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Potentials and challenges for Egypt to achieve blue growth: an SDG 14 perspective

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Potentials and Challenges for Egypt to Achieve Blue Growth: An SDG 14 Perspective

By

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EGYPT

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Dissertation Declaration

I certify that all material in this dissertation that is not my work has been demonstrated, and the contents of this dissertation show my view in analysis and demonstrated issues that discussed in the whole dissertation chapters.

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Abstract

Title of Dissertation: **Potentials and Challenges for Egypt to Achieve Blue Growth: An SDG 14 Perspective.**

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In recent years, climate change is considered a hot spot topic. Because it has severe negative impacts especially on the marine environment where it raises the average temperature of the arctic region which helping on thawing the sea ice, therefore, it opens new navigation lines such as the Northern Sea Route NSR. The NSR decreases navigating time between East Asia countries particularly China and Europe subsequently causes negative impacts on the Suez Canal, which is deemed as the most effective waterway in the globe and one of the main resources of the Egyptian economy. As a result of coming challenges in the near future of climate change and at the same time to achieve the SDGs, the Egyptian government has established the Suez Canal Corridor Project (SCCP). Moreover, development of the SCCP aims to attain economic improvement, social wellbeing, and sustain the marine environment resources. Therefore, the Egyptian government has declared in the Egyptian vision in relation to the UN 2030 Agenda for Sustainable Development (UN 2030 Agenda) that industrial and logistics areas and the port of East Port-Said and Ain Sokhna Port in development the Suez Canal zone will depend on renewable energy to decrease GHGs emissions and replace fossil fuels. Egypt is suffering of poor planning and lack of optimal use of resources overland in the past. Therefore, the Egyptian government is relying on and harnessing its blue economy to face coming challenges such as the NSR, to compete with promising projects in the region, and to attain the SDGs.

Keywords: Climate Change, the SCCP, Suez Canal, NSR, MSP, Blue Growth, SDGs, MPAs, ICZM, Egypt, Greening Port, the port of East Port-Said, GHGs, ISO 14001, EnMS, PERS, SDM, Echo ports, EMAS.

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List of Abbreviations

ABNJ	Areas Beyond National Jurisdiction
AFS	Anti Fouling System
AHD	Aswan High Dam
BWM	Ballast Water Management
CCS	Capture and Sequestrate of Carbone Dioxide
CO2	Carbon Dioxide
EEAA	Egyptian Environmental Affairs Agency
EEDI	Energy Efficiency Design Index
EMAS	Eco-Management and Audit Scheme
EnMS	Environmental Management System
EPS	The port of East Port-Said
ESPO	European Seaports Organization
GDP	Gross Domestic Product
GERD	Grand Ethiopian Renaissance Dam
GHG	Greenhouse Gas
HFO	Heavy Fuel Oil
HPS	High Pressure Sodium
ICZM	Integrated Coastal Zone Management
ILO	International Labour Organization
IMO	International Maritime Organization
IPCC	Intergovernmental Panel on Climate Change
ISO	International Standards Organization
IUCN	International Union for Conservation of Nature
IUU	Illegal, Unregulated and Unreported Fishing
LC	London Dumping Convention
LED	Light Emitting Diode
LNG	Liquefied Natural Gas
LULC	Land Use/ Land Cover
MARPOL	The International Convention for the Prevention of Pollution from ships
MBI	Market-Based Instrument
MEPC	Marine Environmental Protection Committee
MPAs	Marine Protected Areas
MSC	Maritime Safety Committee
MSP	Marine Spatial Planning
NGOs	Non-Governmental Organizations
NIS	Non-Indigenous Species
NSR	Northern Sea Route
OCED	Organization for Economic Co-operation and Development
OPRC	International Convention on Oil Pollution Preparedness, Response and Cooperation
OPS	Onshore Power Supply

PERS	Port Environmental Review System
PM	Particular Matter
PV	Photovoltaics
RCI	Rotterdam Climate Initiative
RTG	Rubber Tired Gantry
SCA	Suez Canal Authority
SCCP	Suez Canal Corridor Project
SCCT	Suez Canal Container Terminal
SCR	Suez Canal Route
SDGs	Sustainable Development Goals
SDM	Self-Diagnosis Method
SEAs	Significant Environmental Aspects
SEEMP	Ship Energy Efficiency Management Plan
SLR	Sea Level Rise
SOLAS	Safety of Life at Sea
SRS	Ship Reporting System
SUMMED	Suez-Mediterranean pipeline
TEU	Twenty-Foot Equivalent Units
U.N	United Nations
ULCC	Ultra Large Crude Carrier
VLCC	Very Large Crude Carrier
VMS	Vessel Monitoring System
VTS	Vessel Traffic Services

Title: Potentials and Challenges for Egypt to Achieve Blue Growth: An SDG 14 Perspective

1.1: Background

In the last three decades, climate change has been deemed as highly topical due to its impact on the ecosystem. According to the latest report by IPCC published on 24/09/2019 established that the globe is on the verge of disaster because ocean temperature and marine heatwaves have increased by more than double since the end of the last century. Moreover, ocean acidification has increased, and the amount of oxygen has decreased from sea surface to different depths as well. Therefore, it causes negative impacts of marine species communities, biodiversity, production, and fisheries catch possibility. In addition, increasing the mean air temperature by 2°C more than preindustrial levels will increase the possibility of the Arctic ice-free in September to approximately 35%. Also, increasing the average air temperature to 1.5°C will cause degradation of seagrass meadows and kelp forests, while 2°C will destroy all coral reefs. Furthermore, ocean warming causes sea level rise, raises permafrost temperature, and salinity intrusion as a result of anthropogenic impact at sea and overland (IPCC, 2019).

There is a persisting argument between ecologists in relation to the origins of climate change, which could either be due to human activity by burning fossil fuel, or due to natural changes in this context. Most ecologists believe that human activity is responsible for climate change, especially after the industrial revolution. The increased reliance on fossil fuel in the industry has generated the growth of carbon dioxide (CO2) and greenhouse gas emissions (GHG) in the air. Moreover, the annual average raise in the Arctic upper latitude 60° N is almost double the Earth's mean which causes the Arctic ice thaw to increase and raise the number of warm days (Overland et al., 2018). Industrial countries rely on burning fossil fuels such as coal, gas and oil in both social and industrial development. As a result, the Arctic is warming quite rapidly, and more spacious areas of the Arctic seas will become areas of navigation (Stevenson, Davies,

Huntington, & Sheard, 2018). On this basis, the United Nations has been trying to solve the global warming issue by holding the first Earth Summit in Rio de Janeiro in June 1992 and adopted the United Nation Framework Convention on Climate Change (UNFCCC) to reduce GHG emissions, and to make the average increase in the air temperature within 2°C by the end of 21st century as compared to pre-industrial levels. In addition, the International Maritime Organization (IMO) has adopted measures to reduce Greenhouse Gas (GHG) emissions in MARPOL Annex VI. Moreover, on January 2020, IMO imposed new rules to prohibit vessels from using fuel with a Sulphur content of more than 0.5 % m/m as compared with 3.5 % m/m in 2012. This will be enforced by the States' governments as paying a tax unless vessels have scrubbers to filter Sulphur emissions (Halff, Younes, & Boersma, 2019).

Motor vessel *Venta Maersk* was the first container ship navigating in the Northern Sea Route (NSR) after it departed from the harbour of Vladivostok in Russia on 22 August 2018 and arrived at the port of Saint Petersburg on 28 September 2018. Moreover, the container ship is deemed as an ice-class type and has a capacity of 3600 TEU (Twenty-Foot Equivalent). Since the company declared the first navigation voyage, all the international media and the shipping companies are dealing with a number of questions: Will the Northern Sea Route become a commercial and navigational alternative to the Suez Canal Route? In short, the world has witnessed the melting of snow at an accelerated pace and a simultaneous decrease in sea ice in the Arctic region in the last years (H. Park, Walsh, Kim, Nakai, & Ohata, 2013).

According to the majority of ecologists, climate change has negative impacts not only in the Arctic Sea but also to the entire globe. Some States in the upper northern latitudes and navigation shipping lines deem it as a "grace" which will erase the sea ice and become a way to increase trade and the economy (Rashid, 2009). Given the fact that the NSR connects the Atlantic and the Pacific Ocean, this will inevitably connect the East (Far East Countries) and the West (Europe Countries) so seaborne trade volume will increase in this region firstly since the distance will be shorter than the Suez Canal Route and, secondly, bunker consumption will reduce. Based on this

presupposition, the voyage costs are likely to decrease. Moreover, with melting the ice, there will be new explorations for gas and oil in the Arctic sea (Ermida, 2014). As a result, the economy and trade will increase in the Arctic area.

The NSR causes negative impacts in Egypt because is create new competition for the Suez Canal Route (SCR) concerning the shortest distance. The majority of vessels which come from the Far East will alter their courses to pass over Russia instead of using the SCR and Russia supports using the NSR (H. Wang, Zhang, & Meng, 2018). In particular, the SCR profits will decrease, so the Egyptian economy will suffer because the Suez Canal revenue is considered to be a vital source for the Egyptian economy. In addition, the Arab Spring Revolution in 2011 generated a negative influence on the tourism sector revenue which was a vital source of foreign exchange earnings in the Egyptian economy (Haddad, Nasr, & Ghida, n.d.).

Egypt is considered one of the highest five states vulnerable to the impact of sea-level rise due to the low-lying level of the Nile Delta (Batisha, 2012). Furthermore, the global warming impact will threaten the coastal states in Egypt, for instance, Alexandria will be exposed to the sea level rise impact (Kamh, Khalifa, & El-Bahrawy, 2016). Moreover, climate change impact will affect fish farms along Egypt's North Coast, where aquaculture is considered an alternative source to fisheries. For example, Egypt's production from aquaculture is more than one million tons annually and first place in Africa (Shaalan, El-Mahdy, Saleh, & El-Matbouli, 2018). Also, agriculture in the Nile Delta will reduce due to the scarcity of fresh water as a result of global warming impacts (Abdelkader et al., 2018).

Furthermore, climate change impacts such as direct impacts of salt water intrusion, sea level rise, marine environment degradation, and land subsidence which causes negative impacts of sustainable development in Egypt (Cramer et al., 2018). In addition, indirect impacts such as the opening of the NSR in coming years. Thus, Egypt will have to increasingly depend on the blue economy to assure the resources are sustainable for coming generations and to achieve the SDGs.

1.2: Aim

The proposed research proceeds with the following aims:

- This research aims to come up with attainable short-term and medium-term development of the New Suez Canal Corridor Project. To become a logistics and industrial area with the target of increasing job opportunities and developing the Egyptian economy in the existence of anticipated competition with the NSR in the near future; and
- Transfer seaports to green ports to attract investors, shipping lines, and mitigate negative climate change.
- Critically analyze the concept of "blue economy" and its role in achieving sustainable development from an Egyptian perspective. To this end, this research aims to tackle environmental and commercial impacts on Egypt, with specific reference to the UN 2030 Agenda for Sustainable Development.

1.3: Objectives

The fundamental objectives of this research are provided in the following:

- To illustrate how transforming the port of East Port Said to green port will attract investors, shipping lines, and mitigate GHGs emissions from the port;
- To examine the positive attributes of the Suez Canal Development Project on the marine environment by relying on renewable energy and cut down emissions;
- To identify the impact of the NSR on the SCR as an alternative route.

1.4: Research Questions

1- What are the expected impacts of the SCCP and how challenging it could be in the coming years when there is increased regional competition, especially climate change?

2- A) How will the optimization of the Suez Canal Zone project; especially by greening the port of East Port-Said can mitigate potential environment degradation?

   B) How can the SCCP megaproject help in achieving SDGs according to the UN agenda 2030 especially increasing economic and save new jobs for people? And protect marine resources - SDG14

3- What are the potentials and challenges for Egypt to achieve sustainable development for its marine resources?

1.5: Methodology

The research methodology comprises both qualitative analysis in the following manner:

Table 1 Research Methodology

Step Number	**Description**	**Research Approaches**	**Data Collection Methods**
1	- Utilizing some statistics from the last few decades to anticipate how many months in the year the NSR will be available to vessels. Gathering and confirmation of data. - Choice of annual reports to the Suez Canal Authority and references of the NSR concerning the quantity and kinds of vessels to assess to what range will there be a competition between the SCR and NSR and when, - The anticipation by inspecting and implementing the statistical way of data gathered.	- Qualitative - Quantitative	- Data given by competent authority - Suez Canal Authority (annual report) - By using trustworthy online references
2	- Determination services of development and optimization	-Comparative study Applied	Case study: for example the harbour of Rotterdam as a green port

1.6: Research Objectives

- To highlight the required steps to transform the Suez Canal Axis into an industrial and logistics region on a global scale.
- To illustrate ways through which the Suez Canal ports can compete with the largest and important hub-ports.
- To distinguish difficulties to attain the UN 2030 Agenda as stated in the Egypt vision.
- To what extend is the accumulative impacts of poor land use plan and past planning affected on the Egyptian economy and marine environment and all ways of life in Egypt.
- To determine the proper use of the blue growth to attain economic developments, job opportunities, and concurrently sustain marine environment resources, either living or non-living, which attain direct or indirect benefits for the coming generation.

1.7: Limitations

- Accessible pertinent data and report regarding to both environmental reports for Egyptian ports, and the NSR and the range of future variables in the Arctic Sea ice.
- The range of progress achieved in the Suez Canal Corridor Project optimization and the extent of new investments and private sector involvement.
- Challenges and obstacles that may hinder required outcomes in the Suez Canal optimization megaproject.
- The response of the EPS authority for inquiry regarding the environmental impact assessment report and port environmental performance.

1.8: Delimitations

- To what extent can the future reading and using IPCC reports and statistic methods to identify how many months per year the Arctic will be ice free then will determine when and how long the Northern Sea Route will be an alternative shipping line to the Suez Canal strait.
- The fundamental focus is on developing the infrastructure in the Sinai Peninsula and the Suez Canal cities.
- This research focuses only on ports optimization and harnessing blue growth, along with how these changes will affect the Egyptian economy.

CH. II: The Suez Canal Corridor Project

2.1: Brief Historical Overview:

The idea of establishing the first Canal on earth goes back to the reign of Egyptian pharaoh Senorist III in 1874 BC, approximately 40 centuries ago when the pharaohs established a Canal connecting the Red Sea with the Mediterranean via the River Nile. The Canal subsequently closed several times as a result of the River Nile alluvium (Hossain, 2018).

In modern times, the idea of constructing a new canal harks back to the leader of the French expedition Napoleon Bonaparte in 1798. When a team of experts tried to address the possibility of constructing a new canal, the explorer's team found that the Red Sea sea-level was higher than the Mediterranean Sea by about ten meters. Therefore, according to their result, if the canal was dredged the Red Sea would drown the River Nile Delta and cause a disaster (Hamza & Abdel-Latif, 2003).

However, after a while and in the era of Said Pasha in 1854, a second team of experts led by Ferdinand de Lesseps, discovered that there was no a big variance between the two seas and the Red Sea was higher by approximately 3 feet. Therefore, the canal construction continued for a decade and it was finally opened for international navigation on November 17, 1869 (See Figure 1).

Figure 1. The Suez Canal opening in 1869

Source: (Hossain, 2018).

Egyptian peasants constructed the artificial Suez Canal (SC), using shovels and picks to dig it out. Furthermore, when the canal was completed, its length was approximately equal to 164 Kilometres with an 8-meter depth, and a width of 53-meters at its narrowest point above the seabed, which starts from Port Tewfik in the Suez terminus in the South to Port Said terminus in the North (SRM & ALexBank, 2018). Moreover, the outbreak of pandemic diseases in that time such as Cholera killed thousands of workers (approximately 120,000 died) because there was not enough food, water or suitable medical attention to accommodate all of the sick people, and they were working for a decade under forced power as well (SCA, n.d).

Foreign ships transited the Canal pursuant to the Constantinople Treaty of the Suez Canal in 1888, where according to article 1, "The Suez Maritime Canal shall always be free and of commerce or war, without distinction of the flag."(Hossain, 2018).
The SC was nationalized in July 1956, and became one hundred percent Egyptian under the reign of the late leader Gamal Abdel Nasser (McDermott, 2001). Moreover, the Canal was closed several times and was the longest running for eight years because of wars in the region until it opened in under era of the late President Sadat in 1975 (Lahav, 2015).
The main objective for digging the SC, known as (Qanat Al-Swiss in Arabic) was to facilitate international trade and connect the West (Canada, Europe, and the USA) and the East, especially China, Japan, and South Korea, according to the trade volume between them. In addition, the SC is considered the link between three continents specifically, Africa, Asia, and Europe. Furthermore, the entire world is benefiting from the SC merits due to its geographical and strategic location. The SC is currently possessed and managed through the Suez Canal Authority (SCA) (SCA, n.d).

2.2: The Importance of the Suez Canal for Seaborne Trade:

The Suez Canal represents a vital role in international seaborne trade. It is considered one of the most significant thoroughfares in the globe where according to the Suez Canal Authorities 2018 report, 18,174 ships have passed through with a daily average

of 50 ships and a total cargo of approximately 1,139,630 thousand tons about (1.14 billion tons), representing about 10 percent of the total globe seaborne trade ("Suez Canal Traffic Statastics," 2018). The SC facilitates transfer cargoes between countries, especially Asian and European countries. Furthermore, the SC reduced the distance between emerging countries in Asia and Europe by providing a surrogate to the route around the Cape of Good Hope at the Southern edge of Africa to arrive in Europe. Moreover, it has reduced voyage cost operations, and the amount of fuel used (See Figure 2).

Figure 2. Suez Canal Vs Cape of Good Hope

Source: (Hossain, 2018).

According to the SC's official web-site, the SC is considered as one of the safest navigation routes, where the rate of accidents is almost negligible in comparison with other routes. Moreover, it does not contain locks or docks, but it is an open waterway, monitored with modern surveillance devices.

The SC accommodates giant containers (gigantism thanks to the economy of scale); therefore, it facilitates transferring goods from Asia, especially China, to Europe with the lowest time and cost. The SC's draft and width can accommodate all container ships, approximately 60% of tankers, and more than 90% of bulk carriers (U.S. Energy Information Administration (EIA), 2017) (See Figure 3).

Figure 3. Bulk Carrier & Giant Container ship passing through the Suez Canal.

Source: (Hossain, 2018).

In addition, The SC is used as a transit to transfer oil and natural gas from the Arabian Peninsula to the Westerns countries through partially loaded oil tankers because fully loaded VLCCs and ULCCs cannot pass through the SC due to their bigger draft. Therefore, they use the SUMED pipelines (Suez and Mediterranean) to offload some of the oil and retake it after transiting the SC in the Mediterranean before proceeding to the Western countries with about 6 million barrels' daily (U.S. Energy Information Administration (EIA), 2017) (See Figure 4).

Figure 3. SUMED Pipelines

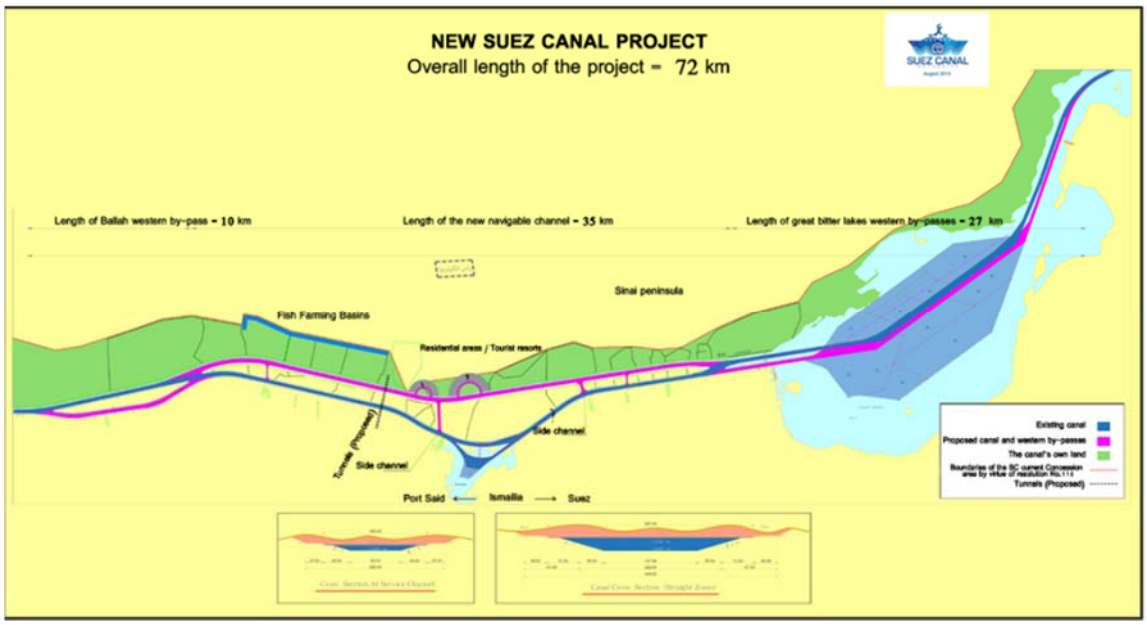
Source: (U.S. Energy Information Administration (EIA), 2017)

The SC plays a crucial role as a focal point in the belt and road initiative (such as the ancient Silk Road) launched by China in 2013, due to its strategic position between Africa, Asia, Middle East, and Europe (L. Wang, Zheng, Ducruet, & Zhang, 2019).

2.3: The Importance of the New Suez Canal for Egypt:

The Egyptian government in August, 2014 announced that the establishment of a parallel canal 37 km and the deepening and widening of the current canal by 35 km (See Figure 5). A year later, in August 2015, the New Suez Canal enlargement project was accomplished with a new depth of 25 m, width of 225m, and length of 194 Km. Therefore, the new expansion in the SC reduced the average transit time from 16 to 11 hours and reduced the waiting time from 18 to 3 hours. In addition, the new expansion allows ships to pass in both directions along most of the canal's length at transit time (Kenawy, 2012).

Figure 4. The New Suez Canal.

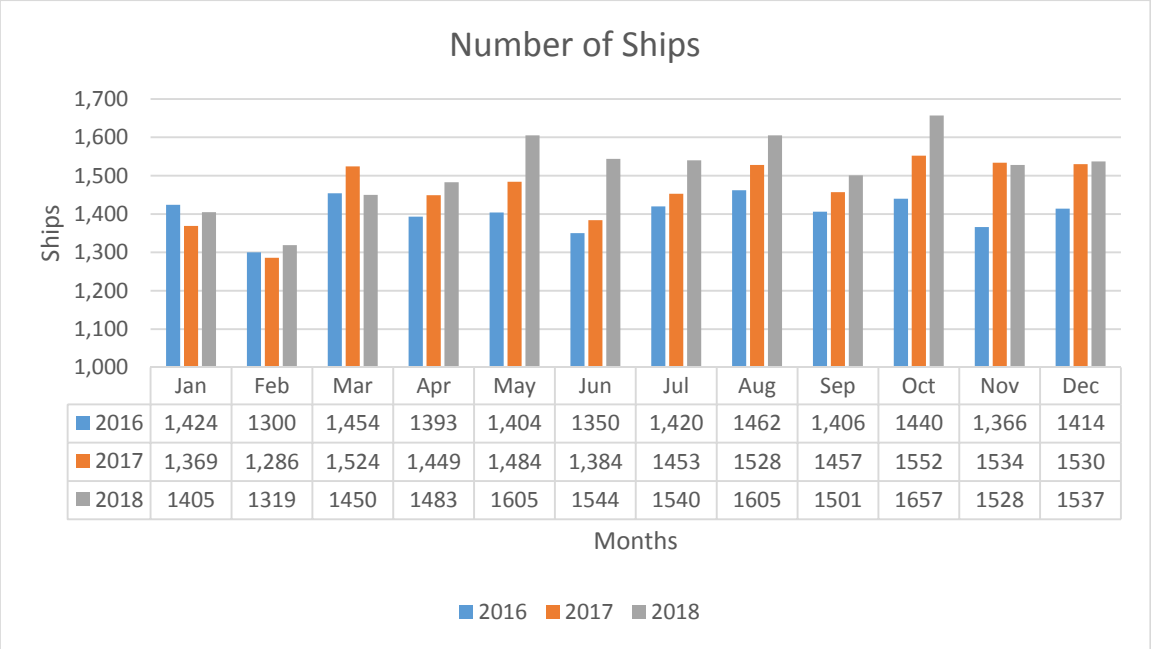


Source: (Atvur, 2019)

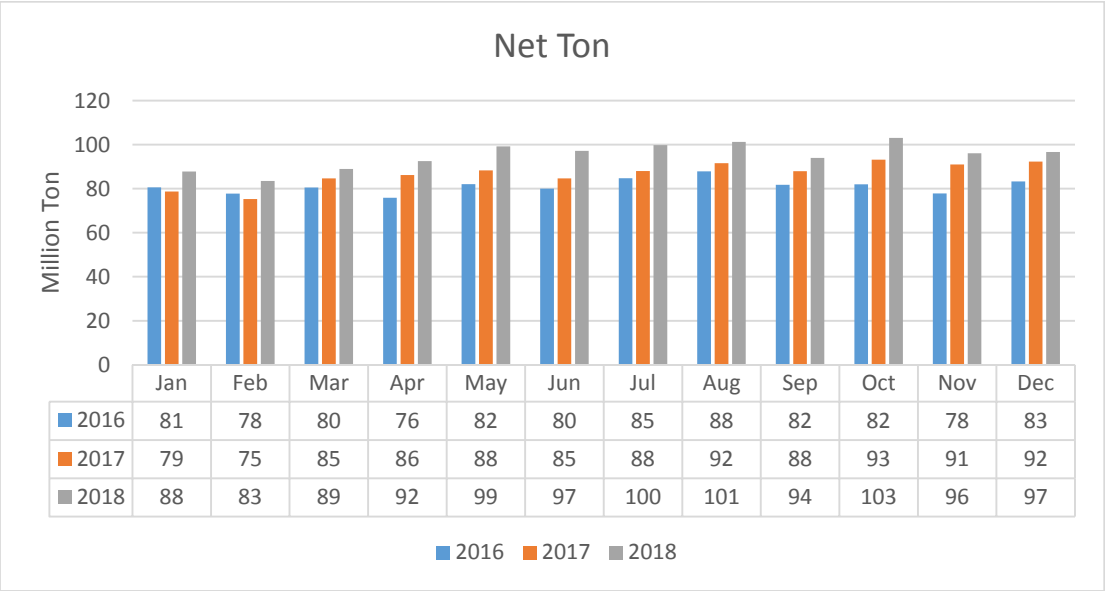
The Suez Canal is a key pillar in the Egyptian economy. The annual revenue of the SC is approximately 6 billion USD, which represents about 5% of the Egyptian GDP, and it is considered a key source of foreign currency. Moreover, it coming in third place after tourism (by approximately 11.4 billion USD which accounts for about 12% of

the Egyptian GDP in 2018) which was affected because of the 2011 revolution, and expatriate labour remittance (approximately 26 billion USD) (Fibich, Bed, Haindorfer, & Wiesböck, 2018). Moreover, the SC revenues are expected to double by 2023. This expectation is linked to the annual growth of world seaborne trade in the last five years (See Table 2).

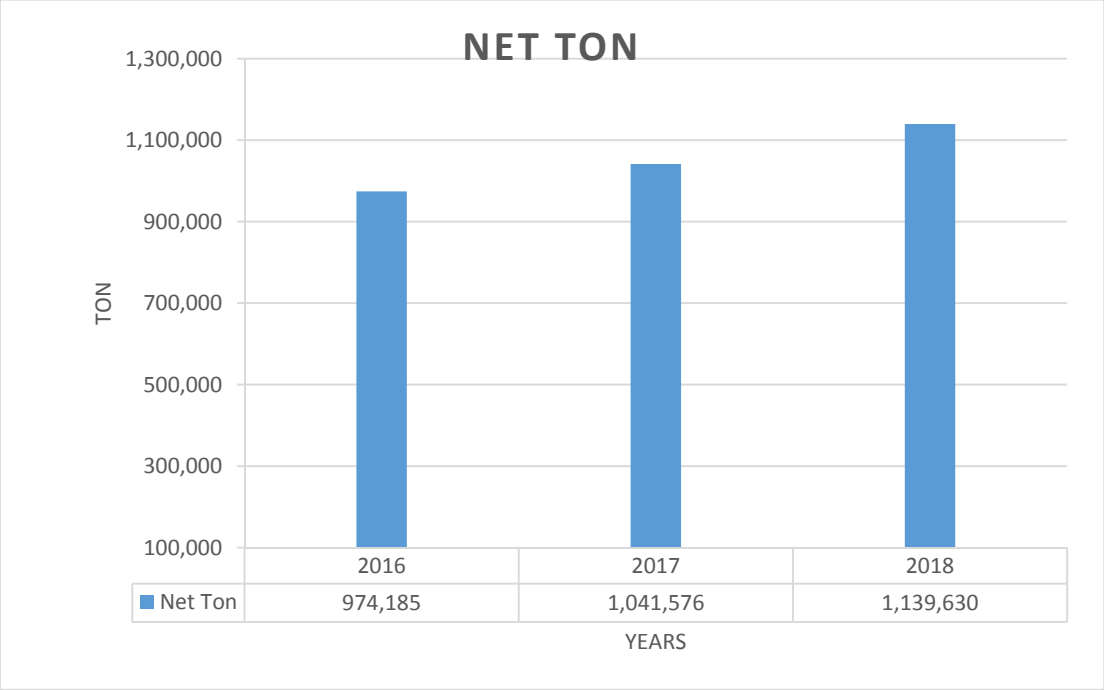
Table 2. Number of Ships Crossing the New Suez Canal.



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2016	1,424	1300	1,454	1393	1,404	1350	1,420	1462	1,406	1440	1,366	1414
2017	1,369	1,286	1,524	1,449	1,484	1,384	1453	1528	1457	1552	1534	1530
2018	1405	1319	1450	1483	1605	1544	1540	1605	1501	1657	1528	1537



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2016	81	78	80	76	82	80	85	88	82	82	78	83
2017	79	75	85	86	88	85	88	92	88	93	91	92
2018	88	83	89	92	99	97	100	101	94	103	96	97



Source:(Suez Canal Traffic Statistics, 2018).

Overall, these bar charts show an upward trend and gradual increase in both the number of ships and quantity of cargo passing through the New Suez Canal after its last expansion in August 2015. Moreover, this increase is due to the increase in the

amount of cargo transported by sea, and the last expansion in the SC, which facilitated the relocation process for cargo.

2.4: Challenges for the New Suez Canal:

The challenges for the New SC as follow:

2.4.1: Cape of Good Hope

Tankers VLCC/ ULCC choose the Cape of Good Hope as a replacement route to the SC when they proceed from the Arabian Peninsula to the USA in back and forth voyages. Even though it is longer than the SC in terms of distance because the SC's narrow width and shallow depth cannot accommodate fully loaded (VLCC/ ULCC) two tankers in both direction, and the maximum permissible load is 240,000 MT. Therefore, fuel consumption and operation voyage costs are higher. If the SC can accommodate tankers with 350,000 MT or approximately eighty percent of fully loaded VLCC, the SC revenues will increase by six times. On the other hand, SCA presents discounts of approximately thirty percent to attract tankers to proceed through the SC instead of the Cape of Good Hope. Furthermore, some ships use the Cape of Good Hope in South-South seaborne trade such as the trade between south Africa-South America- Australia and the SC has no effect on this shipping line (Kenawy, 2012).

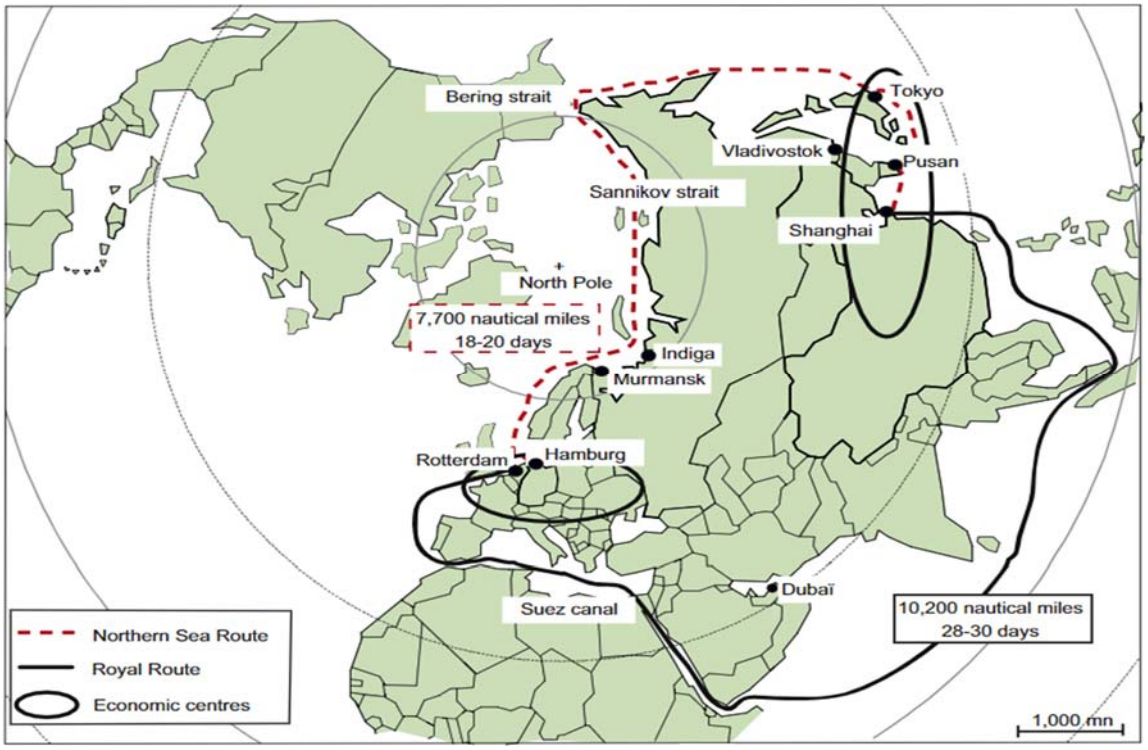
2.4.2: Land-bridge Red-Med Railway

In light of the period of political instability that Egypt witnessed after the uprising events of the 2011 revolution, the Israeli government cooperated with China in 2014 to construct a land-bridge train that would connect the port of Eilat in the Gulf of Aqaba and the harbours of Ashdod and Haifa in the Mediterranean to transfer containers with a length of 350 km as a surrogate route to the Suez Canal, which is considered as the regional competitor (Lakhal & H'Mida, 2017).

2.4.3: The NSR as an Alternative Route to the SCR

The Northern Sea Route (NSR) is deemed to be the quickest link between the Far East (China, South Korea, and Japan) and Europe and the majority of it runs across Russia. The NSR represents a strong competitor to the SCR in the coming years since; the NSR will reduce ships' voyage time (See Figure 6). So that, it will save time, fuel costs, and labourers' salaries. The total distance, for example, from Shanghai, one of the biggest port in China and the world in container handling, to Europe, it will be less than approximately one third of the SCR (Comer, Olmer, Mao, Roy, & Rutherford, 2017).

Figure 5. The NSR Vs SCR



Source: (Verny & Grigentin, 2009)

Shipping in the Arctic sea has increased in the last decade because of the melting of ice, which opens new navigation lines. The NSR is considered the most promising route between the transarctic routes and approximately 252 ships passed through the NSR from 2010 to 2016 with a yearly average of 42 ships (H. Wang et al., 2018).

The importance of time will increase and play a vital role in the seaborne trade industry to compete with other methods of transport such as air and overland transportation, where nowadays approximately 90 percent of the globe trade quantity transfers by sea. The maritime transport is the cheapest means of transportation. It is approximately 50 times less expensive than air transport and 4 to 6 times less than trains. In addition, cargoes that have a high value such as gold, or some kinds of cargoes that are quickly damaged, are not transported by sea. Moreover, according to Kitagawa "Time is the determining factor in advanced relocation processes in shipping" (Kitagawa, 2008).

The NSR is ice-free for two or three months during the summertime and ships can navigate without icebreakers. In addition, the infrastructure in the Arctic area has been improved by Russia and Norway in recent years.

Moreover, this is considered an excellent opportunity for shipping companies, especially containers shipping lines, to use the NSR because container handling has increased in recent years between East Asia and Europe and North America. In addition, using the NSR is important for shipping companies because it will decrease the voyage time; therefore, it will decrease fuel consumption. Furthermore, the NSR will take ships away from any piracy attacks regions. Moreover, ships will avoid likely heavy shipping traffic and extra fees in the Suez Canal (Benedyk & Peeta, 2016).

Finally, ships navigating in the NSR have a large opportunity to supply LNG fuel as an alternative source of energy for HFO. Since constructing a first LNG plant in the Arctic region, ships will be able to supply LNG with costs and emissions less than HFO.

On the other hand, nowadays ships vulnerable to many challenges and challenges during navigating in the NSR because, for instance, ship and cargo damages, insurance premium, costs for accompanying icebreaker and pilot and weather conditions inhospitable waters (Benedyk & Peeta, 2016).

Until now there has been a shortage in infrastructure and a quick response in the case of oil spill operations in the Arctic. Moreover, oil slicks in cold water are difficult to disperse and degrade while the IMO prohibits using HFO on board ships in August 2011 as a fuel, ballast and cargo in the Antarctica continent and in turn did not apply the same condition in the fragile Arctic environment (Roy & Comer, 2017).

Moreover, the safety of navigation in the Arctic Sea still represents an obstacle in the shipping lines and voyage cost is higher than the SCR and not available all year long. Ships must navigate with the assistance of expensive icebreakers and navigation hazards such as drifting icebergs while navigating in remote areas. On the other hand, if the impact of global warming on the Arctic region continues as business as usual (with the same annual rate), the NSR will be ice free and ships could navigate without icebreaker assistance by 2040 (Åtland, 2010).

2.5: Egypt's Vision to Overcome Challenges

In recent years, SC revenues have decreased by approximately 20 % due to two crises. First, the piracy attacks on ships in the Gulf of Aden forced vessels to change their course to pass via the Cape of Good Hope (Bendall, 2010), and at the same time, the global economic crisis from 2008 to 2010 decreased freight rates for shipping and many ships were sold as scrap (Kalgora & Christian, 2016). The two aforementioned issues reduced the number of ships transiting the SC. This trend was exacerbated by the 2011 uprising, known as the Arab spring revolution, which caused period of unrest that, affected Egypt politically, economically, and socially. The SC route remained safe over this period.

Pursuant to Egypt's vision in 2016 to achieve the UN 2030 Agenda, the Suez Canal Corridor Project (SCCP) considered to perform a vital role in attaining sustainable development goals. The political stabilization in the last years supported the Egyptian government to establish a megaproject such as the SCCP to attract foreign and local investors to invest in Egypt to achieve this megaproject. Moreover, the principal purpose of the fundamental target of the SCCP is for Egypt to benefit economically, but at the same time, this project will be environmentally friendly. Therefore, the Egyptian government should accelerate the completion of the SCCP to turn the SC Zone into a global logistics area, and to act in a vital role in the new Belt and Road project, particularly with the competition from many countries in the region.

The SCCP will cover an area equal to approximately 460 Km² in the governorates bordering the SC namely Sinai, Port-Said, Ismailia, and Suez. Moreover, the project will include the development of six ports, namely East and West Port-Said, Al Arish in North Sinai and Altor in South Sinai and two ports in Suez, Al Adabia and Ain Sokhna. In addition, the project will convert East port-said and Ain Sokhna for hub harbours (State Information Service Egypt, 2016) (See Figure 7).

Figure 6.The SCCP Ports.

Source: (Elsayed, 2018).

Egypt's government is attempting to exploit the strategic position of the SC by establishing the megaproject so it will contain on ships services stations such as bunkering, maintenance, and recycling because approximately 18,000 ships pass through the canal annually. Furthermore, the project depends on renewable energy such as solar panels and power plants from gas and wind farms to generate clean energy and to reduce climate change impacts in the SC Zone, and as a clean source for electricity, which will reduce burdens on conventional electricity sources.

Moreover, the project will include desalination plants to increase the amount of required drinking water due to the expected increase in population and industries in the SCCP area. Furthermore, Egypt's portion from the River Nile water is approximately 56 billion m^3 per year and represents approximately 97% of the water resources in Egypt. To bridge the gap between the available and required water, Egypt is relying on desalination plants, reuse drainage, and ground water. Egypt will suffer in the future from water scarcity because of many reasons, such as the disposing of untreated industrial wastes and agriculture sewage in the River Nile. Moreover, climate change impacts on the rain rate in Ethiopia (upstream country). Furthermore, constructing Ethiopia the Grand Ethiopia Renaissance Dam (GERD) on the River Nile which affects the Egyptian's portion of water. Meanwhile, there is an astounding increase in the Egyptian population and the amount of potable water over time deceases (Yihdego, Khalil, & Salem, 2017).

The SCCP aims to attain fast economic and sustainable development in Egypt. Therefore, the optimal exploitation of land and urbanization (Land use and land cover change LULCC) is essential to attain these goals. Furthermore, more than one hundred million people inhabit in a region that almost equals to six percent of Egypt whole area, and more than ninety percent of the total of Egypt's area is desert (Aliyu, Modu, & Tan, 2018). The project area is divided into four categories desert, water, agriculture, and urban. So, Egypt dredged tunnels under the SC to connect Sinai Peninsula in the East of the SC with Port Said, Ismailia, and Suez cities in the west of the SC and in order to decrease population congestion by the optimal exploiting of the SC Zone.

The SCCP will increase Egypt's GDP by one hundred billion USD and will save a million jobs, which means five million families will benefit from this project since one person can support five. On the other hand, according to the ILO report in 2018, approximately one-third of the young people (15-24 years) in Egypt are unemployed, which equals four times the older adults, and the majority of unemployed are women and educated persons, and the total unemployment persons are 11 percent. So, unemployment is an obstacle to achieving sustainable development (Abdel Ghafar, 2018).

The development of six ports in the SCCP is considered a key factor in implementation of the project because the port is a connection between the international and national economy. In addition, Egypt has fifteen commercial ports, six of which are positioned in the Mediterranean and nine in the Red Sea (Egypt Maritime Transport Sector, n.d.). To make these ports attract shipping companies and, therefore, increase cargo-handling operations transfer, transforming some of them to hub ports is required. As a result, the SCCP will transform East-Port-Said in the Mediterranean and Ain Sokhna in the Red Sea into hub ports.

The next chapter illustrates how the port of East Port-Said as a hub port, will depend on renewable energy to become a green port on the long run, like Rotterdam port as a successful case study. In addition, it will address reasons for choosing the port of EPS as a promising example to help Egypt in achieving sustainable development goals.

Chapter III: The Importance of Green Port

3.1 East Port-Said Port as greening port:

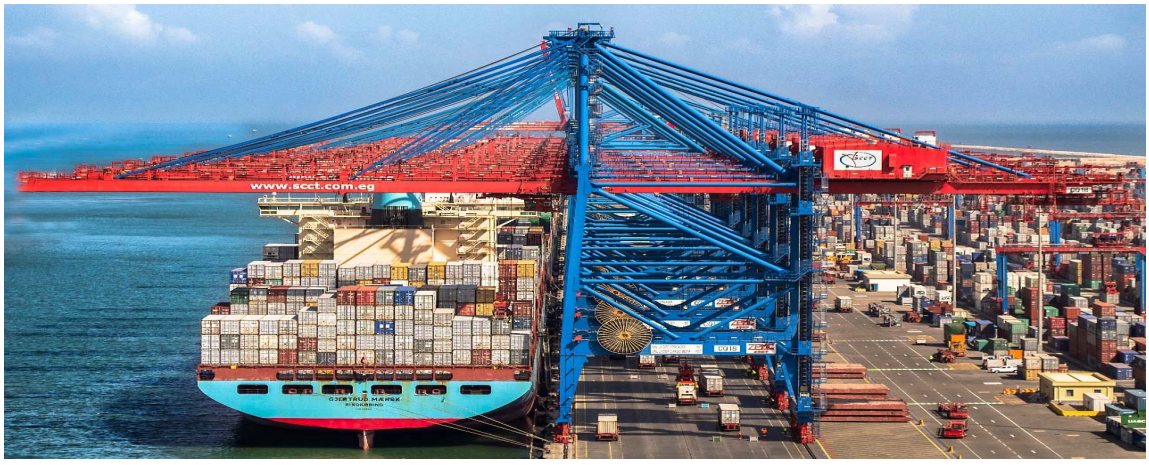
3.1.1: Port specifications:

The Port of East Port-Said (EPS) is 12.4 Km² whereby the maximum draft is 22 meter. EPS is located in the Sinai Peninsula and separated from Port-Said city by the Suez Canal and approximately 185 km Northeast of Cairo. Moreover, the Suez Canal Container Terminal (SCCT) (See Figure 8) in the EPS port is considered the largest terminal in Egypt and Africa and one of the fifty biggest container terminals on the globe.

The main idea of establishing the EPS port is to exploit the merits of SC, where approximately ten percent of the world trade, and a quarter of the globe's containers, transit yearly.

There were two objectives of constructing the EPS port, first to increase containers transhipments because of its strategic locations, so it can compete with Jabil Ali in the UAE and Singapore port, and second to enhance Egyptian economic growth.

Figure 7. SCCT at East Port-Said port

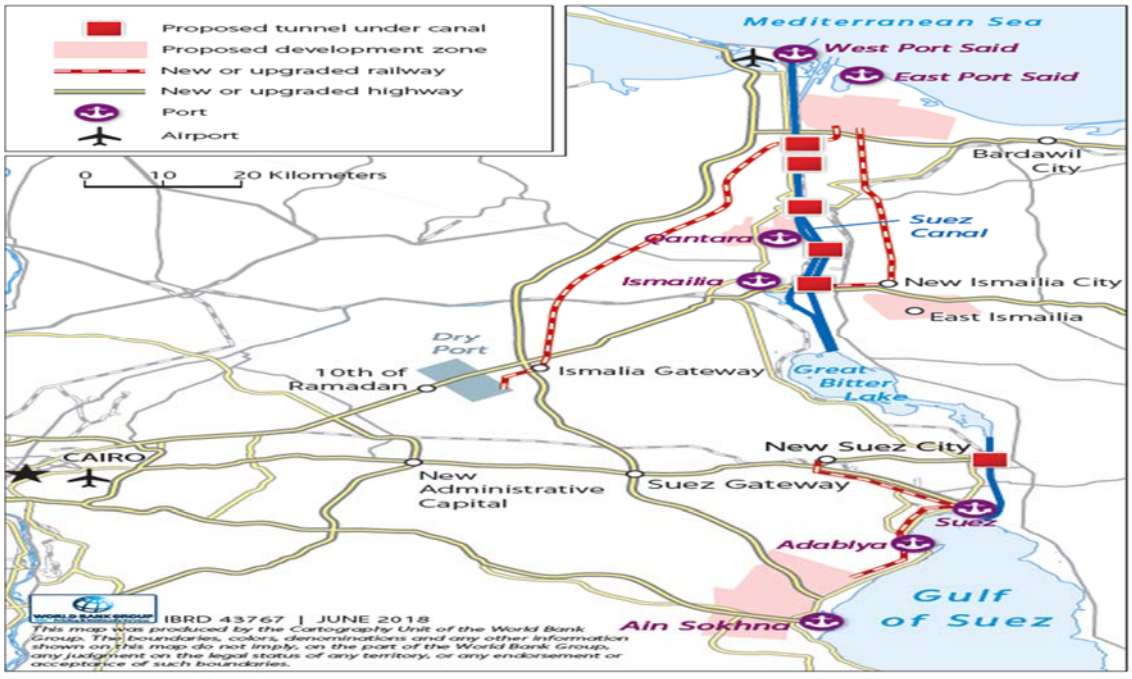


Source: ("Suez Canal Container Terminal Set To Reinstate Connectivity and Competitiveness," n.d.)

However, the objectives of establishing the EPS port were not attained until nearly two decades ago. Operations commenced in 2004, due to the Suez Canal convoy time, which hindered ships from entering and poor hinterland connections by train or container trucks ferries crossing the Suez Canal (poor supply chain) to transfer containers trucks from or to the EPS port.

Eventually, the two barriers were removed by first, establishing a new channel dedicated to ships entering the EPS port in 2016. Second, establishing three tunnels, one for rail and two road tunnels. Therefore, tunnels have facilitated the container transfer process between the SCCT terminal and hinterlands. In addition, tunnels have decreased the dependence on passing over the swing bridge which cross over the SC, and to decrease the use of ferry boats to transfer containers trucks between EPS port and the other side (See Figure 9) (Arvis, Vesin, Carruthers, Ducruet, & de Langen, 2019).

Figure 8. Multi Model Transport



Source: (Arvis et al., 2019).

In recent years, the competition between ports has increased in terms of both deep water and greenness as a result of the vast growth of seaborne trade handled in ports.

According to UNCTAD (2018), seaborne trade was 2.6 billion tonnes in 1970 and has reached 12.1 billion tonnes in 2019 (Clarksons Research, 2019) which means it increased by approximately five times in a half century. Furthermore, container ship capacity is expected to increase to 30,000 TEU after one or 2 decades according to fuel prices and to 50,000 TEU after a half century to gain from low operation cost merits (Saxon & Stone, 2017). Moreover, port policies have changed and ports have become wider and deeper to accommodate Triple E ships (Economies of scale, Environmentally improved and Energy efficient). On that basis, the EPS port has increased its depth to 22 meters to accommodate current and future drafts of container ships. Hence, as long as the port's depth and width have increased, the environmental awareness should increase too. To maintain both the port and its environmental sustainability for years to come, environmentally friendly ports have become unavoidable.

3.1.2: EPS Port SWOT Analysis

The SWOT analysis shows the importance of the port of East Port Said in achieving economic growth which is the main pillar in the SCCP Megaproject.

Table 3. SWOT Analysis for the Port of EPS.

	Strengths		**Weaknesses**
S1	Strategic location	**WI**	Environmental impacts due to heavy shipping traffic
S2	Adjacent to logistics and industrial areas	**W2**	Suez Canal strait as a water barrier and poor supply chain
S3	Government and Suez Canal port authority interests and support to achieve the SDGs	**W3**	Absent state of art technology in monitoring process
S4	Zero tax and customs	**W4**	Applying and implementing environmental laws and regulations
S5	The maximum draft is 22 meter		
	Opportunities		**Threats**
O1	Improvement of the Egyptian economy	**T1**	Piracy attacks in the Gulf of Aden

O2	Foreign and national investors	**T2**	Competition from other ports in the East of the Mediterranean region
O3	Greening port	**T3**	International economic crises
O4	The Chinese Belt and Road Initiative (BRI)		

Source: (Based on data collected by the author).

3.2: Green Port Policy

The EPS port aims to decrease the adverse impacts of harbour operations via this green port policy. So, the Green Port Policy adoption serves as a guide for environmentally friendly harbour operations. Meanwhile, the EPS port in the SC Zone has assigned contract in December 2018, with SISCO Saudi industrial company to transfer the EPS port to become the first green port in Egypt and Africa ("Egypt, SISCO ink 1st green port contract - Egypt Today," n.d.). Moreover, the competent authority tries to improve the environmental performance for all ports ("Egypt government calls for port development – PortSEurope," n.d.).

The ESP port is experiencing expansion and development operations to achieve the economic growth. Therefore, an increase in activities and operations can be found inside the port. As a result, environmental and climate pollution are increasing in the port region. Subsequently, sustainable development and greening of ports is required. The greening of the port is considered an optimal solution to attract both foreign and local investors, shipping lines, and to mitigate climate change impacts by reducing GHGs emissions. Therefore, the port should evaluate and determine the environmental aspects and should be supported by the civil society (KAYA, Bitiktaş, & Çelik, 2018). A port with an excellent environmental performance also with public support, is highly recommended (Lam & Notteboom, 2014).

3.2.1: The IMO's role in decreasing GHGs emissions

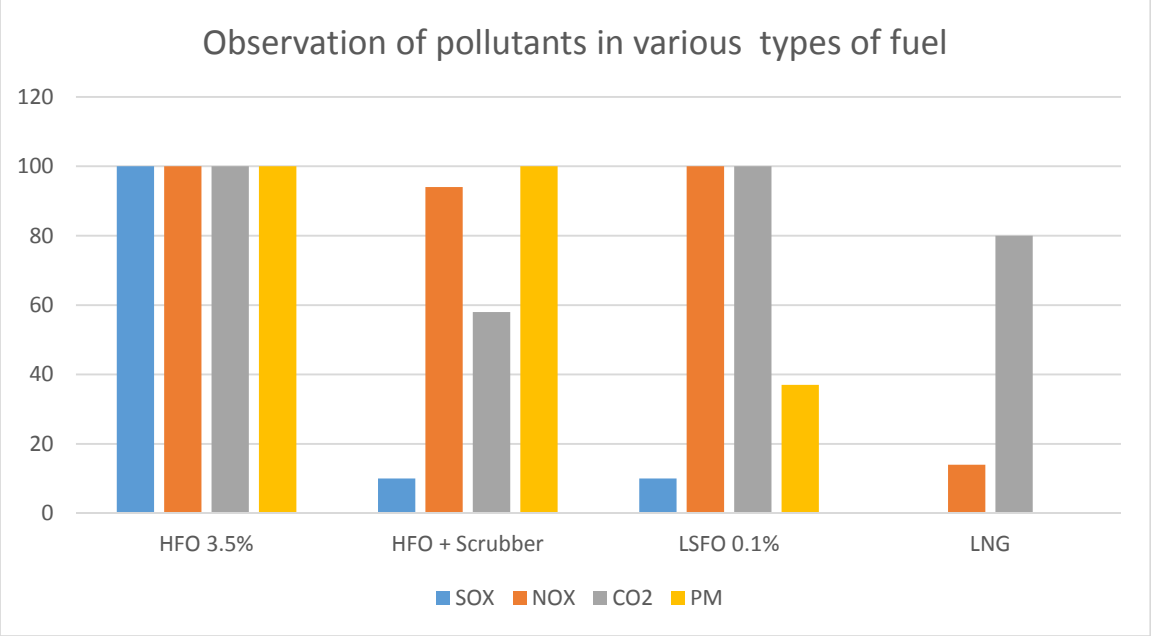
The transportation of international commodities by sea is the most efficient means of transport in comparison with air and land (trucks and trains) in terms of GHG

emissions and prices (Bouman, Lindstad, Rialland, & Strømman, 2017). However, the UN assigned the IMO to deal with environmental protection such as GHG emissions, due to the absence of the port authorities' role in enforcing the applicable law and environmental regulations in ports. This because the need for port activities and operations to continue and to satisfy the shipping lines visits (Romero, Asmus, Milanelli, Buruaem, & Abessa, 2014).

The IMO is responsible for approximately fifty global conventions and agreements and some of them deal with environmental issues, such as the London Convention (LC) 1972, MARPOL 73/78, OPRC 1990, AFS 2001, BWM 2004, and the HONG KONG convention 2009 (Duran Puig, 2016). Furthermore, the IMO applied a Market-Based Instrument (MBI) to mitigate and reduce GHGs emission in international seaborne trade and to become more energy-efficient consumption. (KAYA et al., 2018).

In addition, the IMO has focused on improving energy efficiency on board vessels to decrease climate change impacts through MARPOL Annex 6 resolution MEPC.203(62), making EEDI obligatory for new vessels and SEEMP mandatory for all vessels. Furthermore, the IMO imposed a sulphur cap 0.5% m/m from January 2020 to decrease GHGs emissions like Sox, NOx, CO2 and PM, by improving the quality of fuel used on board ships, to decrease climate change impacts, and to lower the impacts on human health especially near to ports (See Table 4).

Table 4. Comparisons on the Quality of Fuel Onboard Ships.



Source: (BRS, 2019).

The Egyptian government is said to increase the dependence on renewable energy in the coming years as a primary source of electricity in ports to decrease negative environmental impacts in order to keep up with increasing port operations, development, and new requirements for international and national regulations. In addition, to increase the dependence on Onshore Power Supply (OPS) (electricity from port's berth to ships instead of using auxiliary ships' engine which is considered as a main source for air pollution) (Doudounakis & Kanellos, 2014) will help to decrease climate change impacts. The goal is to reach 20 percent renewable energy by 2022 in the order of 6% hydropower, 12% wind, 2% solar, and 80 % fossil fuel. It is further expected that renewable energy use will reach 42% by 2035 as compared to 2014 when 2% of energy came from renewable sources, 8% from Aswan High Dam, and 90% from fossil fuel (Investment & Financing, n.d.).

3.3: The Objectives of Transfer EPS from Seaport to Green Port

The importance of transferring the EPS port to green port is to enable the EPS to compete with other ports in the region, decrease GHG emissions, to assist Egypt in achieving sustainable development goals, improve the Egyptian GDP via attracting investors and shipping companies, and to face the challenges of the NSR.

3.3.1: Steps to Transfer EPS to become a Green Port

There are 5 pillars in relation to the development of a "Green Port"

1- Technology;
2- Policy;
3- Standardized EnMS (PERS, ISO, and EMAS);
4- Awareness; and
5- The circular economy approach i.e. for instance how to reuse (emissions, garbage and wastes)

The port occupies a critical location, and to attain this, the sustainable development for ports through stabilization between social and economic interests, the environmental impacts are required (Zdravev, 2017). On the other hand, port operations cause adverse consequences on the environment and local community, such as air and water pollution, which affects the health of people who are working in or living close to the port.

Water pollution in the port can be generated from:

- Ballast water
- Sewage
- Sludge and bilge wastes
- Oil spill accidentally or deliberately
- Dredging activities

Air pollution in the port can be generated from:

- Cargo dust from bulk carriers' ships
- GHGs emissions from trucks, ships
- Shore cranes
- Fumigation gases

3.4: Environmental Performance for Seaports Assessment Methods

To transform the EPS port into a green port, the port authority, or an environmental manager, must focus on cutting down energy consumptions, either from the port facilities or from ships, thereby, decreasing emissions. Moreover, decreasing energy consumption is considered a key element in greening the port (Wan, Zhang, Yan, & Yang, 2018). Thereafter, the port authority, or the environmental manager, will assess all activities and operations inside the port to detect important environmental aspects which cause contradictory influences in the atmosphere, and will detect the baseline and the goals, finally allocate finance to improve and develop the environmental performances of the port (Elzarka & Elgazzar, 2015). However, the greening port analysis is considered an unclear, complicated, and vague process (J. Y. Park & Yeo, 2012).

3.4.1: SDM

SDM (Self-Diagnosis Method) is the first step for ports to become green ports and it is prepared by ECOPORTS as the lead of European Seaports Organization (ESPO), which tries to combine the economic and environmental necessities. SDM is a simple checklist produced by an environmental manager or port authority, where the environmental manager defines all the environmental aspects for the port during construction and operation conditions such as activities that cause negative impacts on the water, air, and soil. After this the significant environmental aspects (SEAs) that have great influence on the environment are determined and the port authority focuses their efforts on mitigating and reducing these impacts on the environment. Therefore, this review can detect both supporting agents and obstacles to implementing a

satisfactory EnMS. Furthermore, SDM is adaptable to special port conditions and quite important in environmental planning (Romero et al., 2014).

After the port manager completes the checklist, then the port can join the ECOPORTS networks and get access to ESPO services.
The steps to attain an efficient EnMS are as follows:

- Comparison between port environmental performance and the European benchmark according to ISO 14001 or PERS requirements.
- Gap analysis between ESPO benchmark requirement and the port checklist.
- SWOT analysis for the port by an expert,
- Advice and recommendations to fill the gaps (ESPO Green Guide, 2012).

3.4.2: EnMS

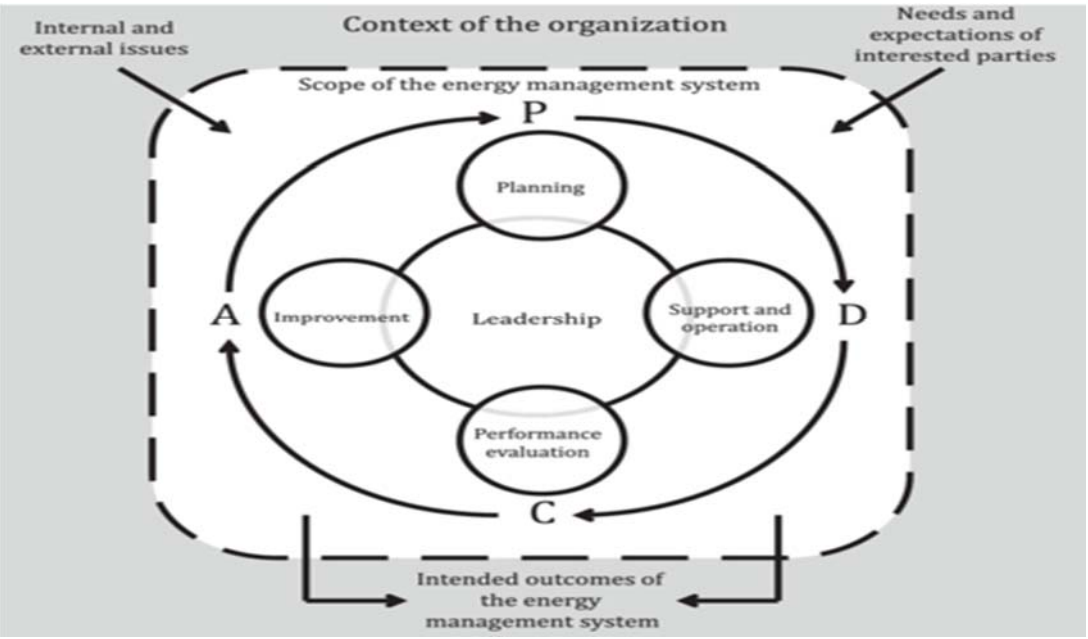
The Environmental Management System (EnMS) is a tool for port managers to decrease and mitigate environmental impacts of the port operations and to protect both the environment (marine and terrestrial) and the people who work or live near the port (Romero et al., 2014).
Even though the important role of EnMS, the Egyptian ESP, Alexandria, and Ain Sokhna ports, according to a study carried out to assess and improve green ports performance indicators, were found to lack efficient and proper energy and management systems. The significant externalities causing negative impacts were:

1- Air pollution;
2- CO2 emission;
3- Oil spill emergency plan;
4- Dangerous cargo management.

EnMS involves ongoing development of the environmental performance through a circle of Plan-Do-Check-Act and the process that builds up the EnMS and to maintain ongoing developments (See Figure 10). Therefore, the main objective of the management cycle is the proper use of own resources in an effective way and a

development of an energy policy through ongoing the enhancement of environmental performance and continuous review of these stages. This will produce new corrections and views and update the managements commitments.

Figure 9. PDCA Management Cycle



Source: (ISO 50001 EnMS, 2018).

3.4.2.2: Benefits of EnMS

Benefits of EnMS include:

- Reducing the environmental impacts.
- Optimizing compliance with legal requirements
- Dealing with uncertainties such as new regulations, substances scarcity, and local community claims
- Optimizing the use of natural resources according to government policy
- Decreasing environmental hazards.
- Decreasing the operations costs due to decreasing in garbage production, water and energy consumption

- Implementing formal EnMS which are attractive and increase the confidence of banks and insurance companies
- The environmental performance indicator pointing at the efficiency of EnMS.
- Creating optimum communication between the local community, stakeholders, and port authorities
- Granting market and competitive power for the port (Duran Puig, 2016).

3.4.3: EnMS Standards

There are three standards of EnMS that ports can use to manage sustainability measures in the particular ports:

1- ISO 14001 the International Organization for Standardization by:
   - Creating a self-measurement and self-notification,
   - Requesting approval from consumers and stakeholders,
   - Demanding recognition of its self-declaration by an external organization
   - Asking certification/recording of its EnMS by an outer organization.

2- EMAS the Eco-Management and Audit Scheme: It is an optional environmental management tool and is a sort of ISO 14001; the organizations must meet with the provisions of the EU EMAS Regulation.

3- PERS (the Port Environmental Review System) recently developed specific for ports Once the port becomes an Eco-port it can obtain on PERS and the port can take 3 or 4 years to ensure the EnMS is running and been reviewed several times. The certificate includes the principal provisions of identified environmental management standards, which are produced and specified by the ports to assist in achieving their targets in regarding sustainability developments (Duran Puig, 2016).

The port should follow these steps to obtain the PERS certificate:

1- connect the network
2- Create an own SDM

3- Get on the Eco-Port Status
4- Match the port's SDM score with the average European benchmark of environmental performance
5- Evaluate the port's SDM score
6- Receive expert advice and SWOT analysis for the port.
7- Get on the PERS certification.

3.4.4: The European Code of Action to Achieve PERS Certification

The port of EPS to get the PERS certificate should follow the five Es:

1. Exemplifying: Choosing a perfect model in achieving efficient environmental performance in all port operation for civil society.
2. Enabling: Provide good potential in the port facilities to gain the confidence of stakeholders.
3. Encouraging: Give rewards for port users, for example, discounts from port dues, to boost them to enhance their environmental performance.
4. Engaging: Train the people in the port and users to achieve the aim of improving the particular environmental performance in the harbour, logistics building, and industrial area.
5. Enforcing: Assure a proper implementation for environmental requirements by the harbour users to maintain an excellent environmental performance (ESPO Green Guide, 2012)

3.4.5: Indicators for a Green Port

The primary purpose of using the Environmental Performance Indicators (EnPIs) is to evaluate and determine the status of the environment in the port for the port authority, to know whether it is satisfactory or unsatisfactory, which is important for port stakeholders in developing and supporting port operations and activities in order to ensure sustainable developments for the port due to the expansion of port operations (Puig, Wooldridge, & Darbra, 2014).

According to ISO 14031 there are three classifications of EnPIs management and operational performance indicator and environmental condition indicator.

The environmental indicators are categorized for lagging and leading indicators in civil society and where the regulators generally prefer lagging indicators. Examples of lagging indicators are fines or complaints such as the amount of toxic gases emitted in the port.

A leading indicator deal with uncertainties issues such as environmental agenda or policy.

The balance between lagging and leading indicators is required to a proper measurement for port indicators. In addition , OCED divided indicators to state, pressure and response indicators (Duran Puig, 2016).

3.4.5.1: Mapping the port of EPS

Mapping the port of EPS as a proposal enabling the port authority to transfer the port to become a green port.

Table 5. East Port-Said Port Environmental Management Checklist

Item		
	YES	**NO**
Environmental Policy?	✓	
If so, is the environmental policy accessible on the port's website?		**x**
List of Significant Environmental Aspects (SEAs)?		**x**
List of concerning environmental law?	✓	
Environmental aims and objectives?		**x**
Environmental Program?		**x**
Environmental Training Program?		**x**
Annual Environmental Report?		**x**

Contingency Response Plan?	✓	
Environmental Monitoring Program?		x
Internal environmental review?	✓	
External environmental review?		x
Environmental Management System (EnMS)?		x

Source: (Duran Puig, 2016) and the assessment based on data collected from different resources.

According to the data collected related to environmental performance, the port of EPS has a good opportunity to become a green port when attaining major nonconformity measures.

3.5: Specific Recommendations

In order to transfer the port of EPS to an environmental friendly port, the port authority should depend on renewable energy (wind turbines, PV, and biofuel) as the primary source for energy-generating to reduce GHGs emissions in the port area from ships, trucks, light masts, and cranes. Furthermore, this select ISO 14001 as an EnMS standard.

Moreover, transfer diesel -RTG (Rubber Tired Gantry) to fully Electric RTG and afforestation in the port area, are all mentioned solutions, which will reduce depending on fossil fuel consumption and GHGs emissions. Therefore, the air, water, noise pollution and the impact of dredging operation impacts, will decrease in the port region (Yahya, 2019).

3.5.1: Reduction of GHG Emissions

Ships can achieve through this first via, technical standards, optimization in ship construction such as hull, machinery and propulsion systems, and using non-conventional

fuels such as bio-diesel, batteries, Bio-alcohol, fuel cells, and scrubbers, all to mitigate exhaust emissions from ships engines, and using an onshore power supply or cold ironing.

Secondly, MBI could present incentives for ships to decrease GHG emissions such as decreasing port dues. MBI is divided into two types, price instruments such as a carbon tax, and quantity instruments, for example, government permits. Therefore, ship owners should invest in more modern technological ships.

Lastly, operational options, for example, ships with a Master choosing a proper ship route, low steaming, and optimizing logistics services (KAYA et al., 2018).

3.5.2: LED Light

LED lamps are one more easy effective measure to put in place on the light mast in the port of EPS because it has a low cost and low maintenance, with a long lifespan average of approximately 15 years. It has reduction consumed energy in the harbour, and a low carbon footprint compared to High Pressure Sodium (HPS) lamps and working in several weather conditions with high durability (Iris & Lam, 2019). In addition, energy effective measure can apply through depending on an automatic ventilation system in summer and winter and automatic a lighting system that can save the energy by approximately two-thirds, therefore, reducing the emissions in the port of EPS building (Popa & Popa, 2018).

3.6: Case study: Port of Rotterdam in the Netherlands

The port of Rotterdam won the European Seaports Organization award (ESPO) as a clean and proper working environment port in the world in 2018. Rotterdam port is the pioneer in terms of dealing with decreasing the climate change impacts and using

renewable energy (wind turbines, solar panels (photovoltaics PV), and biofuel) as alternative source for fossil fuel (See Figure 11).

Figure 10. Port of Rotterdam

Source: (GIZ, 2018).

Table 6. Overview of the Port of Rotterdam

The port of Rotterdam	
Ranking of the port in terms of productivity	
Total Cargo by million tons	469.0 million tons and the tenth on the world and the largest in Europe
Handled Container (million TEU)	14.5 million TEU and eleventh on the world
Maximum depth	24 meters
Port Area	12,713 Hectare
Number of ships visited the port	Seagoing 29,476 ships. Inland 123,859 ships.
Number of Employees	385,000 people direct and indirect jobs
Dominant Goods	Liquid and dry bulk 211.8, 77.6 million tons respectively with total 289.4 million tons represents approximately 62% of the total cargo handled.
GDP	45.6 billion Euro which represent 6.2 percent of the Dutch GDP

Source: (Port of Rotterdam, 2018).

The Rotterdam Climate Initiative (RCI) is the world's pioneer in the biofuel initiative. The objective of the port of Rotterdam strategy is to decrease the carbon dioxide emission to half in 2025 as compared with 1990. The intension is to reduce the dependence on fossil fuels as a prime source for energy and to decrease climate change impacts. Through improving both transport and energy efficiency in the port by using clean energy.

So trucks, cranes, and ships with use clean energy with low sulphur emissions. Eventually, all vehicles in the cities will use low polluting engines and service stations will provide biofuels for all vehicles.

In addition, it will capture and sequestrate carbon dioxide (CCS) under the North Sea (Samadi, Schneider, & Lechtenböhmer, 2018). Furthermore, reuse of carbon dioxide, steam, and heat from the factories and decrease in carbon dioxide footprint by relying on Natural liquefied gas, and establishing the expert centre in the harbour for energy efficiency technology (Bosman, Loorbach, Rotmans, & van Raak, 2018). The International Maritime Organization (IMO) intends to decrease

the emissions by 2050 to 50% as compared to 2008 while the Rotterdam port target is 90% ("Zero carbon at sea? Rotterdam port eyes a greener future - Environment - The Jakarta Post," n.d.).

The port of Rotterdam has approved the ISO 14001 as the standard for their EnMS. Moreover, air and water quality, energy consumption, and waste management have been involved in the EnMS. Furthermore, by monitoring and controlling water and air conditions and improving polices, the port can maintain a suitable performance indicator and can modify aims and objectives and measure environmental impacts such as shipping traffic, dredging operations, and port expansion on wetlands and migratory birds (Lam & Notteboom, 2014).

Chapter IV: Untapped Blue Growth in Egypt

4.1: The SCCP Mega Project

Egypt is aiming to renovate its depleted and exhausted economy through establishing mega projects such as the SCCP in order to achieve (SDG 9) and to attain economic growth (SDG 8) and at the same time, protect the marine environment and its resources according to (SDG 14) perspective. Therefore, the SCCP enables Egypt to compete with expected projects in the region, coming challenges from the NSR, and overcome the impact of climate change.

The SCCP aims to support establishing industrial areas in the Suez Canal Zone, to enhance the supply chain, to establish renewable energy projects, and to decrease the impact on the environment of establishing industrial areas (Ezzat, 2018).
Furthermore, there is a strong link between achieving the SDGs and the blue economy, which indicates the importance of proper usage of marine resources in the present and in years to come. The achievement of SDGs will result in economic growth, and wellbeing, as well as reducing impacts on the environment. Without a blooming, clean and healthy environment no SDGs can be attained (Rickels, Weigand, Grasse, Schmidt, & Voss, 2019).

Oceans play an important role in countries' economic strategies. In recent years, countries' claims over sea zones have increased in order to benefit from resources such as seabed mining, fishing, hydrocarbons materials, and marine biotechnology. This is why UNCLOS plays a focal role in protecting developing countries' rights over their continental shelves, exclusive economic zones, and contiguous zones, especially after increasing claims on maritime zones among states because the dependence on the state-of-art technology has increased to benefiting from ocean resources, both living and non-living resources, in the water column and under the seabed.

Blue growth includes both living resources such as blue biotechnology, aquaculture and fisheries and non-living resources such as clean energy (wind farms, tide, and wave), shipping lines, oil and gas and indirect benefits services such as marine species biodiversity, coastal erosion protection, fresh water, and carbon sequestration through which oceans absorb approximately one-third of CO2 emissions.

4.2: Challenges for the Blue Growth in Egypt:

4.2.1: Marine pollution:

In the past, ocean onboard some ships were dubbed by "the big store" which is considered as a place to dispose wastes. Nowadays, the pollution sources are many and varied such as oil spills from ships either accidently or deliberate inside ports or on shorelines, untreated sewage from ships and recreation facilities, agriculture, chemical wastes from chemical tankers or from chemical industries, garbage, dredging, and port development. All of these cause negative impacts on marine ecosystem services, biodiversity, and sustainable developments for ocean resources.

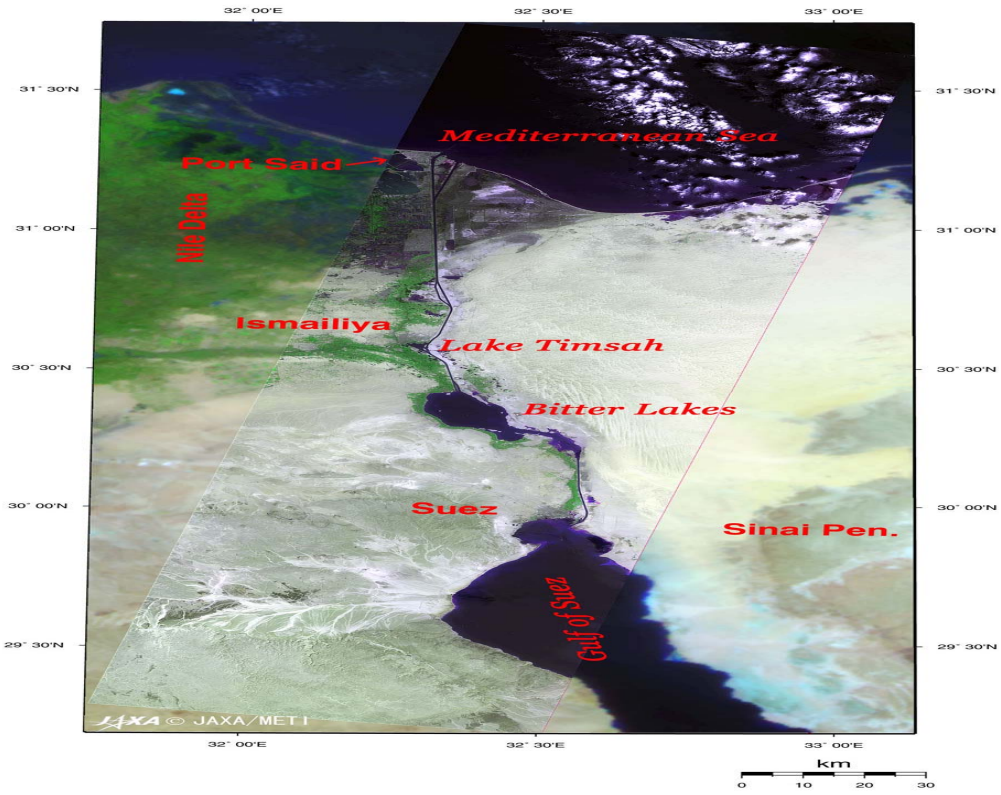
4.2.2: Non-Indigenous Species:

There are approximately one thousand NIS in the Mediterranean. Furthermore, there are three main sources of invasive species in Egypt. First, non-indigenous species that travel from the Indian Ocean to the East Mediterranean through the Suez Canal. Second, invasive species coming from ballast water operations, bilge water, and ships' hulls. Third, NIS generated from fish farms. The invasive species cause negative impacts on the fisheries sector, habitat loss and biodiversity, recreation facilities, and human health (Katsanevakis et al., 2014).

The increase in NIS in the Mediterranean from the Red Sea is due to the reduction in salinity of the Bitter Lakes (See Figure 12) which are located in the Suez Canal and serve as a barrier between the Mediterranean and Red Sea.

However, as a result of the extensive agricultural drainage in the Bitter Lakes' over years, the water has diluted and it was permitted for NIS to invade the Mediterranean. and another indirect impact helped on increasing invasive species due to establishing the Aswan High Dam in the 1960s reduced the amount of both the flow of fresh water and alluvium in the Eastern Mediterranean. Subsequently, the Mediterranean water salinity increased and became similar to the Red Sea salinity (Zakaria, 2015).

Figure 11. NIS invade the Mediterranean via the Suez Canal



Source: (Zakaria, 2015)

4.2.3 IUU Fishing:

In recent years, fisheries stocks have depleted due to fishers using illegal methods for fishing, such as mesh nets and poisons and due to the absence of continual surveillance and fishing during prohibited times. Moreover, there is no Vessel Monitoring System (VMS). Climate change is also a factor. In addition, fishers are targeting some kind of marine species such as sharks fins,

shrimps, and sea turtles and according to a IUCN report those are the 3 most endangered marine species (Öztürk, 2015).

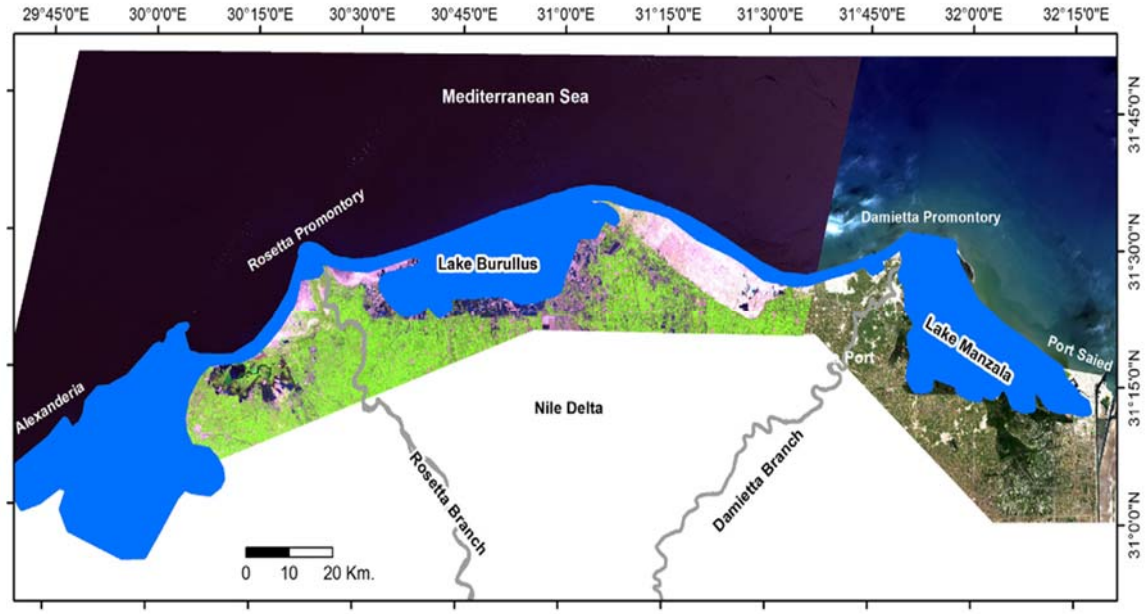
4.2.4 Climate Change:

Egypt is one of the states most exposed to global warming impacts (Brown, Kebede, & Nicholls, 2011).

4.2.4.1 Sea Level Rise (SLR)

Climate change increases seawater temperature and changes water salinity. Therefore, the sea level has increased, causing gust surges, heavy precipitation rate and severe heavy weather on the Egyptian North coast. According to an IPCC report the sea level is anticipated to increase by approximately 60 CM by 2100 (See Figure 13) (Ali & El-Magd, 2016).

Figure 12. SLR in Egypt North Coast as IPCC report



Source : (Ali & El-Magd, 2016)

Moreover, the sea level is increasing by approximately three centimetres every decade (Frihy & El-Sayed, 2013) and at the same time land subsidence changes by 2.5 centimetres (Raey, Dewidar, & Hattab, 1999), which doubles the negative impacts of

SLR. Subsequently, if the sea level increases by 0.5 meters, it is expected to ruin and damage one third of Alexandria and Port Said's governorates, which are located in the Egyptian North coast, and approximately six million people will be displaced. The Egyptian GDP will decrease by approximately six percent and many people will lose their jobs (Abubakr et al., 2018). Moreover, the SLR will cause negative impacts on the agriculture sector and fisheries stocks will decrease from the Egyptian North coastal lakes, namely Edku, Marriott, El Brulus, Al Manzalah, El Mallaha, and El Bardwell lakes, which will be inundated by sea water (Ali & El-Magd, 2016).

4.2.4.2: Coastal Erosion

Coastal erosion on the Egyptian North coast was first caused by the establishment of the Aswan High Dam just over half century ago. The dam construction prevented drought and was a main source for electricity generation; however, the dam also reduced the quantity of fresh water in the Mediterranean, which decreased fisheries stocks and the amount of alluvium, which was protecting the shoreline from erosion (Abd-El Monsef, Smith, & Darwish, 2015).

In addition, coastal erosion causes mixed seawater with groundwater sources along the Egyptian North coast, and when seawater inundates the River Nile delta, it may lead to a disaster. Subsequently, coastal erosion will cause negative impacts on agriculture, tourism, and the fisheries sectors and many more (Ali & El-Magd, 2016).

4.2.4.3 Ocean Acidification

Climate change and ocean acidification are two sides of the same coin. Ocean acidification takes place as a result of increased burning of fossil fuel, and oceans soaking up about one-third of CO2. Subsequently, the dissolved CO2 in the water increases water acidity (Anthony, Kline, & Dove, 2008). In addition to the global warming impact, which increases in the Red Sea's, average temperature, which causes the bleaching of coral reefs. Therefore, it creates adverse impacts on marine ecosystem services and biodiversity. Coral reefs represent economic, bioprospecting, and environmental values for Egypt because they protect the coasts of the Red Sea from erosion, storm waves, and tourism activities such as snorkelling and diving. Egypt has

one of the most impressive coral reefs which attracts millions of tourists annually from all over the world (Hilmi, Safa, Reynaud, & Allemand, 2018).

4.3: Techniques for the Achievement of Blue Growth

The blue economy concept has grown quickly since the United Nations Conference on Sustainable Development in Rio De Janiero, 2012, and has become essential in marine sustainable development in many states. Moreover, the blue economy concept has been backed by the FAO and completed for MDGs (Maria et al., 2018).

4.3.1: Integrated Coastal Zone Management (ICZM**)**

ICZM was established under the declaration of Rio 1992 in the Earth Summit, which encouraged Egypt to issue environmental law number 4 and ICZM in 1994. Moreover, ICZM is considered as a tool in decision-making and an ongoing process to manage the interaction between land and sea, to decrease cumulative impacts, and to ensure resources remain for future generations (Forrest, 2006).

Implementing the ICZM in Egypt is essential because of the paucity of marine resources and the increasing pressure on coasts because of climate change impacts, which increases the sea level and causes coastal erosion on the Mediterranean coast by bleaching coral reefs and mangrove retreats in the Red Sea. Furthermore, for the ICZM it is more important to decrease the cumulative impacts of marine pollution from recreation facilities along the Egyptian coast, where shipping has increased exploration for oil and gas is excavating in both the Red Sea and the Mediterranean and the poor land-use planning, along Egyptian coasts which expand to more than 3200 km totally both the Red Sea and the Mediterranean (Abdul-Azm, Abdel-Gelil, & Trumbic, 2003).

The objectives of ICZM are to maintain marine resources for the long term to achieve economic growth, people's wellbeing, and to protect the environment through

appropriate use of marine resources (sustainable development). However, in Egypt, there are some deficiencies in implementing a proper ICZM. The role of the Egyptian Environmental Affair Agency (EEAA) is absent for two reasons: first, there is a conflict with the Ministry of Tourism regarding the establishment projects along the coasts without an Environmental Impact Assessment (EIA) process for recreation facilities and urban development, which attain economic benefits at the expense of damage to the marine environment; second the participation of stakeholders and civil society in the ICZM are limited (Tabet & Fanning, 2012).

Moreover, the implementation of ICZM in Egypt is suffering from the lack of capacity improvement and trained persons to execute the ICZM initiatives (Ibrahim & Hegazy, 2015). The two most significant failures of applying the ICZM in Egypt are, first, Bardwell Lake, which is located between Al Arish and Port Said in the North part of the Sinai Peninsula (See Figure 14). Bardwell Lake is one of the most significant wetlands in Egypt and a suitable place for migratory birds. In addition, it also produces high quality fish, which are exported to the European market. However, anthropogenic impacts from recreation facilities, agriculture sewage, and fresh water leakage from El Salaam canal, are all a result of the low-lying level of the lake which helps on changing its water density and quality, all because of negative impacts on fisheries, biodiversity, and migratory birds because there is no ICZM technique or proper land use plan (Clark, 2018).

Figure 13. El Bardwell Lake

Source (El-aiatt, Shalloof, & Saber, 2019).

Second, the Gulf of Suez in the Northern Red Sea is one of the most important pillars that Egypt depends on to achieve sustainable development goals. The gulf produces approximately 85 percent of the total petroleum products in Egypt (Alsharhan, 2003) and provides a suitable region for continuous and renewable energy (EL-Shimy, 2010). However, the Gulf of Suez suffers from high condensation of heavy metals such as lead, nickel, zinc, and cadmium due to intensive recreation facilities, oil spills, desalination plants, phosphate factories, shipping lines, untreated sewage, ports, mining, and fishing harbours all of which produce negative impacts on marine species, people health, and the marine environment. So, there is no a high integral level between the shore and ocean to mitigate adverse impacts (Abouhend & El-moselhy, 2015).

4.3.2: Marine Protected Areas (MPAs)

Egypt has 6 MPAs; only one of them is in the Mediterranean and the rest are in the Red Sea. Among these, one of the remarkable MPAs in the world is Ras-Mohamed, a protected area in the south Sinai Peninsula, which was established in 1983 and is dedicated for tourists' activities, scientific research and no take zone. Moreover, there are three proposed MPAs, 2 in the Mediterranean and one in the

Red Sea, to become in total 9, which will exceed the 10 percent recommended (Samy, Sánchez Lizaso, & Forcada, 2011).

MPAs in Egypt play a vital role in protecting approximately five thousand marine species that are vulnerable because of human impacts such as sewage, eutrophication, oil and plastic pollution from ships, recreation facilities, and tourist' activities. In addition, MPAs protect mangroves and coral reefs in the Red Sea from global warming impacts. Moreover, according to the IUCN report, there are many endangered marine species in Egypt such as sea turtles, and sharks because of bycatch from fishers and marine pollution and underwater noise pollution, which obliges marine mammals to migrate or become stranded on the beach (Mahrous et al., 2019). Therefore, the effective MPAs are important to protect endangered species, biodiversity, and enhance livelihood and attain wellbeing for Egyptians in the long-run. So, making MPAs no take zones, increasing surveillance, increasing government funding, increasing awareness, and implementing the environmental law No 4/94 are required (Samy et al., 2011).

On the other hand, there are some pitfalls and shortcomings in applying MPAs in the countries' territorial waters. Specifically, the MPA size is more important because small areas will not protect ecosystem services, biodiversity, and are environmentally inadequate. In addition, establishing MPAs will force fishers to fish out the protected area; therefore, conflicts among fishers will increase over scarce and limited resources. Thus, they will fish far away and will try to compensate the extra time and money by using illegal methods and techniques such as poisons, explosive substances, and mesh nets in fishing, destroying ecosystem services and decreasing ocean health and biodiversity outside the MPAs.

Moreover, establishing a MPA does not mean that it is an isolated island, but is inevitably affected by the degradation in adjacent marine areas, so planning and managing the MPA is quite important to decrease negative impacts from the surrounding areas and because there is no link between MPAs and coastal and

offshore locations. Hence, the MSP is the proper solution to excellent management and enhanced sustainable development, and maintains marine resources. To improve MPAs is the marine spatial planning where it depends on ICZM and the ecosystem based management and more comprehensive processes (Agardy, Notarbartolo, & Christie, 2011).

4.3.3: Marine spatial planning (MSP)

MSP is deemed as a means for the government to accomplish a balance between attaining people's wellbeing, economic growth, and concurrently protecting the sustainability of the marine environment resources. Moreover, MSP is used as a remedy for depleted marine ecosystem services through solving the chronic issues between stakeholders and users from different sectors such as fishers, fish farms, institutions, institutes, scientists, shipping lines, renewable energy, tourism development, military, and industrial activities such as oil and gas explorations in the specific marine areas (Law, Law, & Young, 2015).

Egypt has very sensitive marine locations such as the Gulf of Suez and the North coast. Moreover, there are many blue economy resources in Egypt such as fisheries, fish farms, renewable energy, oil and gas exploration, sea bed mining, coastal development, shipping, and recreation facilities. Therefore, applying effective MSP to make a reform for poor planning and integration between ocean maritime zones and to achieve sustainable development are required.

4.4: The Blue Economy Role in Achieving the SDG 14 in Egypt:

The blue economy is a critical factor to achieving the sustainable development of Egypt. This is because of the following reasons: the poor land use plan in the past, the limited resources over land, the astonishing increase in population yearly, and the drainage of coastal lakes wetlands of coastal development. Thus, Egypt is searching for new resources to attain the economic development and people wellbeing. The blue growth resources such as:

- **Ocean biotechnology:** as a result of increasing the dependence on modern technology in the coming years as a tool to harness and exploit untapped resources by using marine species in biofuels and pharmaceuticals, and to improve the GDP.
- **Aquaculture:**

  Aquaculture uses an alternative resource for the fisheries sector which decreases the pressure and sustains the fish stock.
- **Renewable energy:**

Renewable energy uses an alternative and clean resource for fossil fuel and at the same time decreases GHG emissions.

- **Recreation facilities and activities**:

Recreation facilities save millions of jobs and develop the GDP of the tourism sector.

- **Deep sea mining resources:**

  In recent years, the dependence on deep sea mining resources has increased because of the limited resources of raw materials on land and the increasing demand of emerging countries of raw materials (European Commission., 2017).

4.5: challenges for Egypt in Achieving the SDGs: A Summary Overview

The following is a summary of challenges identified by the author:

1- Education and capacity improvement are considered the main pillars to achieve sustainable development and strategic plans, where there are approximately seventeen million illiterate persons in Egypt and the majority of them are women. This increasing illiteracy of women in rural regions is because their parents prefer them to get married rather than educated; extra money burdens poor people, and there are low job opportunities in rural areas as compared to cities. Subsequently, illiteracy represents a great barrier to achieve sustainable development goals (Sywelem, 2015).

2- High unemployment, especially among educated people, is because there is no link between education system and market requirements, which causes negative impacts on economic growth and human wellbeing.
3- Water scarcity is considered a great barrier in Egypt to achieve sustainable development goals. There are many reasons which cause water scarcity crises in Egypt such as global warming, staggering annual increases in population, disposal of wastes in the River Nile, establishing the Grand Ethiopia Renaissance Dam (GERD), and the limited depending on aquifers to bridge the shortage between the growing water demand in industries and the available natural water resources (Abubakr et al., 2018)
4- Improper infrastructure in the petroleum sector is considered as a barrier to import and export hydrocarbons because there are no adequate pipelines nets. Moreover, the tourism sector has a poor means of transport in connecting tourist spots and places, and in the education sector, the schools need maintenance and refurbishment.
5- There are quite poor land use plans where approximately 90 percent of the total Egypt land areas are desert and people crammed into 8 percent of the total area and the River Nile accounts for approximately two percent.

   The inflation rate in banks has increased because of the pound's devaluation or liberalization as a result of decreasing the production rate, and the political unrest especially after the Arab spring revolution in 2011. (Ministry of Planning, 2015)

4.6: Egypt's Potentials to Achieve the SDGs

Based on the challenges, the author has identified potential areas for improvement, which will in turn help Egypt attain its vision with respect to the SDG:

1- Egypt has a strategic location between three continents Africa, Asia, and Europe. In addition, the Suez Canal connects the entire world and facilitates international trade.

2- Egypt is considered as a young state where more than sixty percent of the population is in the under thirty years' age group. Moreover, Egypt is one of the largest population States in the Middle East, which is deemed to have untapped and unexploited wealth.
3- Egypt has a variety of economic source such as tourism, the Suez Canal, and agriculture.
4- Egypt has oil and gas fields, which is considered low if compared with the other States in the Middle East; however, by depending on the modern technology there will be explorations in oil and gas in the near future.
5- Egypt has many kinds of tourism activities, where Luxor city has one third of the total world monuments, and has monuments from the stone age in addition to remedial, cultural, and maritime tourism.
6- Egypt has a lot of unexploited places such as the coasts of the gulf of Aqaba and the North Sinai Peninsula.
7- Egypt has deserts accounting for approximately 90% of the total area which includes all the unexploited raw materials from different kinds of minerals such as steel, phosphate, uranium, and zinc. Nowadays, the Egyptian government is establishing new cities to decrease population congestion and to achieve sustainable development.
8- Egypt has a gradual increase in aquaculture production and comes in the sixth place globally and first place in Africa (FAO, 2018).
9- Egypt has moderate weather. Therefore, Egypt can generate clean energy from solar panels where the sun radiation average rate is more than 2500 kilowatt hour/m2. Moreover, the Gulf of Suez is a suitable place for generating renewable energy where the wind speed average rate is ten meters per second. The new SCCP megaproject will save one million job opportunities and attain an annual revenue of approximately one hundred billion USD for the Egypt GDP (Ministry of Planning, 2015).

Chapter V: Conclusion and Recommendations

5.1: Conclusion

Egypt is making a great effort to attain fast economic development through megaprojects to meet the Egyptian needs and to attain the UN agenda 2030 for the sustainable development goals. Therefore, the SCCP is a promising project as Egypt's vision 2030 where the SCCP transforms the Suez Canal area from just a waterway to an industrial and economic zone to face current and upcoming challenges such as climate change impacts and expected competition from other countries in the region, and the NSR.

In this regard, there is an argument between economists and scientists regarding mega projects as to whether economic growth comes first or mitigating climate change impacts and marine environment degradation. Economists insist that economic growth enables Egypt to invest in education and health to attain wellbeing for its citizens. Scientists, on the other hand, focus on coming challenges from climate change, which will cause negative impacts on marine resources, coastal Eco services, and sustainable development. Furthermore, these challenges incur Egypt's budget extra wages such as coastal nourishment, and seawalls constructions to prevent the marine environment degradations.

Egypt has suffered from poor land use planning in the past as a result of establishing projects without proper environmental impact assessments incurring Egypt heavy GDP losses. Moreover, the country suffers from the improper use of its resources in the sea and on land such as deep-sea mining, and oil and gas explorations, and raw materials.

Nowadays, as a result of the annual increase in population, and poor planning in the past, and the coming challenges in the near future, the Egyptian government plans to explore and exploit new projects and resources such as renewable energy, building new cities in the desert, modern technology, and ocean resources.

The seaport is one of the most vital indicators on renaissance of countries and is a link between supply and demand or import and export and the location where land, sea, and air meet. Therefore, maintaining air and water status is essential in the harbor area. To this end, Egypt's government concentrates on port developments and expansions such as the ports of East Port-Said in the Mediterranean and Ain Sokhna in the Red Sea.

Moreover, Egypt tries to transform its ports to green ports to decrease negative impacts from GHG emissions on the environment and human's health, and to attract foreign and local investors. Furthermore, by converting seaports to green ports, Egypt will compete with ports in the Middle East and will become ports on a global scale. While decreasing its dependence on fossil fuels by using clean energy is an optimal alternative. Also, decreasing GHG emissions and their negative influences on the marine environment and the populations' health. Moreover, energy is considered as a burden on Egyptian government's annual budget because the government pays for both subsidiaries, the difference between national and international fuel prices, and for hydrocarbons negative impacts on the environment as well.

In recent years, Egypt has witnessed political and economic stabilization, which helping on improvement in all walks of life, through a comprehensive economic reform, and education and healthcare optimization. Thus, a proper participation, and awareness of the community and civil society in decision-making and long-term and mid-term strategic plans is required. Therefore, in this case, to attain Egypt SDGs will become attainable.

To sum up, Egypt is trying to harness its blue economy to achieve SDGs and improve its GDP. So, Egypt would overcome on poor planning in the past and coming challenges of climate change through depending on the state of art technology in monitoring megaprojects and renewable energy.

5.2: Recommendations

For a better method to achieve the SDGs and to face future impacts of climate change the author wishes to put forward the following recommendations:

Recommendation 1: To achieve sustainable development goals and strategic plans, the Egyptian government should improve the education system, especially for women in remote areas and capacity development both are the main pillars to achieving desirable outcomes.

Recommendation 2: To achieve cooperation between EEAA, tourism, and industry ministries to decrease GHG emissions and mitigate the cumulative impacts of coastal urban development, climate change and ocean acidification. Moreover, assure the value of marine environment resources to attain economic growth and human wellbeing.

Recommendation 3: To achieve proper planning for land-use where the Ministry of Planning should construct new cities and use solar panels to generate electricity for new factories and residential buildings because achieving sustainable development requires the exploitation of every land span just like developed countries (e.g. the USA and Japan).

Recommendation 4: To transform all Egyptian ports to green ports and determine targets to reduce GHG emissions. For example, by 2030 reduce the CO2 percentage by 50% and improve the quality of the fuel used. Hence, it will decrease diseases such as asthma and lung cancer, especially for people living or working in the port areas, and to attract and acquire shipping lines confidence and compete with other harbors in the region.

Recommendation 5: The SCCP is an important megaproject, so people, civil societies, and stakeholders' participation with decision makers should be on a high level because this project will save more than one million jobs, increase the GDP by 100 billion USD annually, and reconstruct the Sinai Peninsula and the Suez Canal cities namely Port-Said, Ismailia, and Suez.

Recommendation 6: To apply the practice in Egypt of sustaining marine resources, as a comprehensive approach to improve MPAs. This since the

SCCP is located in susceptible marine areas where climate change impacts, shipping lines, renewable energy, fish farms, and hydrocarbons explorations.

Recommendation 7: To importance of two ports, East Port-Said in the Mediterranean and Ain Sokhna in the Red Sea. These ports are located strategically and should be oriented to become environmentally friendly ports to attract customers and to support global competition, and not only among the Middle East ports.

Recommendation 8: Water scarcity in Egypt is a life or death issue where water plays an essential role in achieving the SDGs. Subsequently, Egypt should find optimum solutions to complete the shortage between available resources and the increasing need for water as a result of population increase, mega projects, and global warming. Therefore, the Egyptian government should reuse agriculture and sewage after treatment in farm land irrigation. Moreover, using the state of art technology to search for water in the deep land. In addition, establishing new desalination plants especially for water used in industry, after taking into consideration its environmental impacts. Furthermore, the cooperation between Egypt and the Nile Basin countries to solve the scarcity of water issue.

Recommendation 9: To play an essential role in achieving SDGs and the people's wellbeing in ocean resources. The scarcity of resources and poor uses of available resources on land have resulted in the decision makers to choose the ocean resources as a proper alternative such as the Suez Canal, aquaculture, oil and gas explorations at the maritime zones. Subsequently, the proper governance and management of marine resources is required to achieve sustainable development.

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