Foundations for the sustainability of the LNG supply chain in Egypt and the logistics services supporting it.

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ABSTRACT:

Natural gas has recently become the preferred fuel for many countries at the global level, whether rich or poor, due to its relatively low price and the lack of harmful emissions to the environment resulting from it compared to oil and coal, as the proportion of carbon dioxide in natural gas is 30% less than oil and 45% less than Coal and therefore the major countries in Europe and America depend on it in many fields, whether in industry, power generation or heating. The major industrial countries in Europe and America face a major problem in their natural gas reserves due to the Russian-Ukrainian war and the suspension of Russian gas supplies to Europe in Nord Stream pipelines 1 and 2. Accordingly, Egypt seeks to become a regional center for the production, liquefaction and export of gas in the Middle East, especially after the discovery of the Zohr field and the realization of a surplus in natural gas production. the study seeks to demonstrate the foundations for the sustainability of the LNG supply chain in Egypt and the logistics supporting services it, starting from the places where it is extracted to its export or consumption, especially in light of the global trend towards preserving the environment, reducing emissions, using environmentally friendly energy sources and achieving environmental sustainability standards.

Keywords: liquefied natural gas - supply chains – Transportation - sustainable development – logistics services

1. INTRODUCTION:

Recently, natural gas has become of strategic importance in the global political economy and has a strong influence in international relations, as it gives the producing and exporting countries that possess high reserves of natural gas economic and political weight, as natural gas is considered one of the most important sources of energy and is used in many activities such as Industry, heating, etc. Thus, the world is now facing an increasing consumption of natural gas because it is less polluting the environment compared to other sources of energy such as coal and oil, which led to a significant expansion of gas trade worldwide and increased interest in studying the natural gas supply chain and the logistical activities involved

in it, including extraction, storage or Transportation and distribution, whether from producing countries to consumers from neighbouring countries, or to consuming countries far from the sources of production, with the aim of raising the efficiency of these activities and reducing their costs in order to achieve significant economic savings. Sangaiah, et al., (2019)

The capabilities of the countries of the world differ in the production of liquefied natural gas, and the volume of natural gas consumption by the countries of the world differs for several factors, including the population represented in the domestic consumption of natural gas, especially in Europe in very cold regions for heating, in addition to the size of the industry, and the volume of transport activity, and other areas of liquefied natural gas consumption Natural gas production is concentrated globally in several regions, including Asia, the Pacific, the Middle East, and African countries, including Egypt and America, in addition to Russia, Norway, and other sources of LNG production and supply. LNG is stored in floating units, which are LNG vessels of varying tonnage and carrying capacity. Merkulov et al., (2020)

The following figure reviews the volume of natural gas production in Egypt and the volume of domestic consumption of natural gas, as Egypt possesses approximately 65 trillion cubic feet (1.84 trillion cubic meters) of proven natural gas reserves in 2016, thus Egypt ranks fourth in Africa in the level of gas production After Nigeria, Algeria and Mozambique, more natural gas fields are expected to be discovered in the coming years, which will contribute to raising Egypt's production of natural gas and it caused an increase in domestic demand before the discovery of the Zohr and Atoll field. Egypt also seeks to develop the natural gas fields that were discovered, such as the Zohr field, Atoll field, and the West Nile Delta project. The Zohr field is considered the largest marine natural gas field discovered in the Mediterranean, given that it contains reserves estimated at about 30 trillion cubic feet, which contributes to Egypt's aspirations to achieve self-sufficiency. of gas, meet the needs of local demand, and provide a surplus of gas that can be exported to achieve economic returns that contribute to the domestic product, provide job opportunities, and improve the income level of youth, in addition to in addition to Egypt becoming its political, strategic and international weight and its entry into the club of LNG producers and exporters at the global level. Assfour, H.M, et al., (2020)

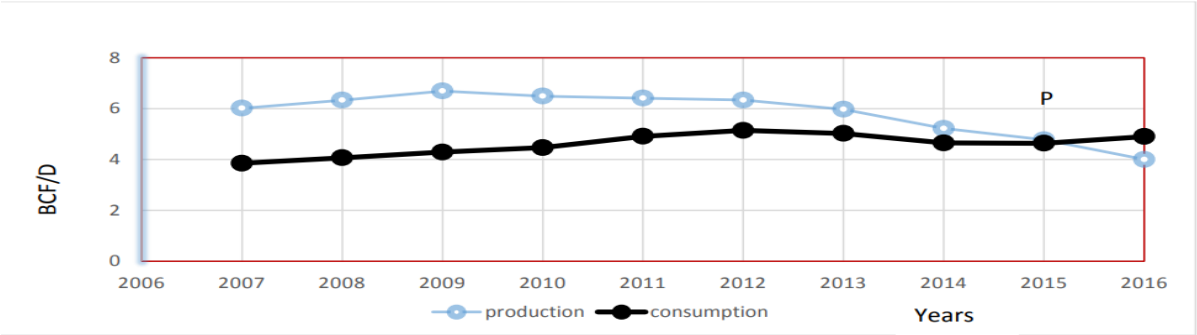

Fig. (1): production and consumption of NG in Egypt.

Resources due to the high global demand for natural gas because of its advantages, including the decrease in carbon dioxide emissions resulting from its combustion compared to other fossil fuels, especially coal and oil, this caused investments in the natural gas market to be huge and require large capital due to the gaseous nature of the fuel. There are various ways to transport natural gas including through pipelines, if the distance between the production fields to the consumption areas is short and does not pass through natural obstacles, including the rugged terrain that prevents the extension of pipelines. The liquefaction stations, where the volume of gas is reduced by 600 times, which makes storing and transporting large quantities of gas easier at a temperature of -162 degrees Celsius, whether in tanks of LNG carriers or inside tanks of land trucks between countries with common land borders. Bittante, et al., (2018)

Natural gas is found in many geographical spots worldwide, whether in America, Asia, Africa, and the Middle East. The world's natural gas reserves are estimated at about 6923 trillion cubic feet, and Egypt ranked 16th in the world in gas reserves in 2017, with reserves estimated at about 77 trillion cubic feet. Especially after the discovery of the Zohr field in the Mediterranean Sea, i.e. about 1% of the world's natural gas reserves. These reserves cover about 37.9% of Egypt's annual consumption of gas. According to the reports of the Ministry of Petroleum and Mineral Resources, Egypt's discovered gas reserves will continue for the next 38 years. Figure 2 shows Egypt's production, consumption, and export rates of liquefied natural gas, as Egypt's exports of liquefied natural gas grew to 4.8 billion cubic meters in 2019 to many Asian and European markets from the liquefaction stations in the cities of Edku and Damietta, which are located on the Mediterranean coast the Edku plant exported about 50 shipments of liquefied natural gas to many Asian and European markets in 2019, compared to 20 shipments in 2018. Egypt plans to make major expansions in logistical activities within it, such as liquefaction, storage, technical and logistical support with the insurer, fuel, and all the necessary requirements for the rigs used in gas exploration operations within the framework of Egypt's plan to become a regional center and a focal point in the global natural gas supply

chain, with Egypt's keenness to implement standards Safety, safety and environmental sustainability in all the aforementioned logistical activities and raising the efficiency of their performance along the supply chain**.**Worldometers**, (**2021)

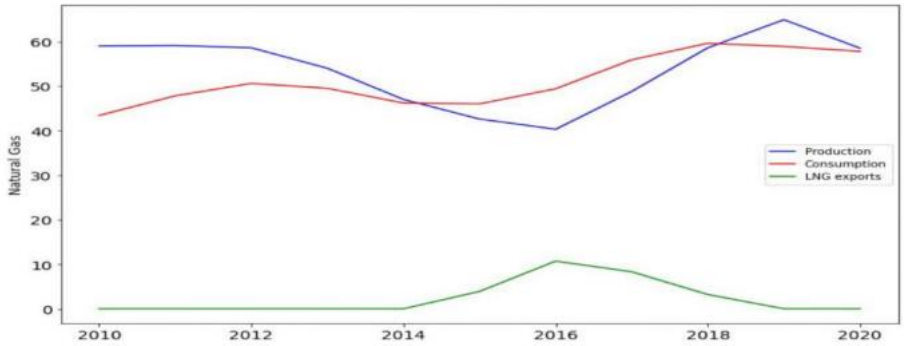

Fig.2. show the production, consumption and LNG exports in Egypt
Source: Data source: BP, 2021

1.1. RESEARCH AIMS AND OBJECTIVES

Research aim:

Studying the LNG supply chain in Egypt and the relevant logistical activities, including exploration, extraction, handling, storage, transportation and distribution from sources of production to places of consumption to achieve large economic returns especially after the discovery of many natural gas fields the most famous of which is the Zohr field.

Research objectives:

1. Designing, simulating, analysing and optimizing operations in the natural gas supply chain with the aim of improving the performance of the current LNG supply chain in the LNG terminals in Edku and Damietta, in addition to planning storage, transportation and distribution operations along the LNG supply chain in the liquefaction stations in the cities of Edku and Damietta To raise the efficiency of performing logistical activities in the LNG supply chain, and thus achieve significant economic savings.
2. Facing the dual global challenge of producing more energy while reducing waste and emissions to achieve the goals of sustainable development, in addition to the impact of the Russian-Ukrainian war on the supply of natural gas globally
3. Implement effective strategies for optimal planning of LNG storage and sales operations, taking into account global supply and demand to increase revenues

4. Discussing the foundations for developing the necessary infrastructure for the natural gas liquefaction stations in the cities of Edku and Damietta, and raising the efficiency of the supporting logistics services therein.

1.2. LITEREATURE REVIEW:

Due to the decrease in greenhouse gases resulting from the combustion of natural gas, this led to an increase in global demand for natural gas, and this resulted in saving about 24% of global energy reserves. Natural gas is transported by extending pipelines between supplying countries to consumption countries after the gas liquefaction process the pipeline passes either on land borders within the same country or between several countries. The pipeline may also cross the borders of more than one country below sea level, as is the case in Nord Stream one and two pipelines. Najibullah Khan et al., 2016, Arrhenius et al.,**(** 2018**)**

The International Energy Agency has recently predicted future scenarios related to the fact that the demand for natural gas will witness significant growth among fossil fuels because of its advantages, including low carbon dioxide emissions resulting from combustion. The International Energy Agency also predicted a growth in global energy demand, especially gas, by 37%. By the year 2040, therefore, fossil fuels will constitute 55% of the sources of burning shot globally. It is also expected that the demand for natural gas will rise to about 5.4 trillion cubic meters in 2040, in order for it to become the second largest source of energy supplies globally after oil. Bittante, et al., (2018)

As a result of the world's tendency to pay attention to liquefied natural gas as an energy source that is less polluting to the environment and has high commercial and economic returns, there has become a necessary need for exploration, extraction, storage and transportation of liquefied natural gas and organizing its trade according to market mechanisms, supply and demand to achieve a balance between production, consumption and sale, especially in light of political developments In the recent period regarding the Russian-Ukrainian war and the consequent change in Europe's dependence on Russia as a source for the supply of liquefied natural gas, which caused the world's attention to be directed to alternative sources of supply in the Middle East, including Qatar, Egypt, Saudi Arabia, Iran and others. Sangaiah, et al., (2019)

The global LNG supply chain is governed by several factors in order to raise its efficiency and reduce the cost of performing logistical activities along the chain the most important of which is the quality of gas, the cost of production, liquefaction, storage and transportation of gas, flexibility and speed of response by supply sources, and reducing

the time required for delivery from the place of production to the gas consumption market. One of the most important logistical activities in the LNG supply chain is the transportation activity, whether by using pipelines or by using LNG carriers, where we find that the transportation of natural gas using pipelines is limited to a distance not exceeding 2000 km from the country of production to the country of consumption, however, transporting gas in a liquid state using ships can redirect gas shipments to separate regions around the world, and thus quickly respond to regional and international changes in supply and demand Gas is transported in liquefied natural gas tankers in various countries that own natural gas liquefaction stations. Strantzali, et al., (2019)

The latest economic reports indicated that the global liquefaction capacity reached approximately 393 million tons per year (MMTA) in November 2019, and it is expected that the liquefaction capacity will reach about 843 million tons per year in the coming years (IGU 2019), as Qatar announced that it is the largest exporter of gas. Liquefied natural gas in the world has announced an increase in its production by more than 60% during the next five years (John, 2019) to meet the demand for natural gas and implement the sales contracts it has signed with many countries. Many environmental organizations have indicated that this global expansion in gas production Liquefied natural gas causes many growing environmental concerns. Therefore, it is necessary to find opportunities for effective operation and rationalization of global consumption to reduce environmental emissions mitigate global warming and achieve sustainable development**.** Katebah, et al., (2020**)**

This paragraph displays, as shown in figures 3 and 4, the history of the development of liquefied natural gas production, passing through several generations, starting from 1990 to 2019, in addition to the most important areas of liquefied natural gas production in the world, where the produced quantity of liquefied natural gas increased from 52 million tons a year 1990 to about 419 million tons by the end of 2019. The second figure also shows the most important countries producing liquefied natural gas globally, namely Algeria, Australia, the United States of America, the United Arab Emirates, Indonesia, Malaysia and Brunei, in addition to Qatar, which entered the club of liquefied natural gas producers in 2000, reaching Nigeria and the Sultanate of Oman In addition to Egypt, which entered the club of liquefied natural gas producers in 2005, Norway in 2008, and Russia in 2009, which discovered many liquefied natural gas fields in the Arctic, which caused an increase in Russia's exports of liquefied natural gas to Europe, specifically Germany, through the well-known natural gas supply lines. In the name of Nord Stream One and Two, all of this led to an increase in the world's production of liquefied natural gas to about 264 million tons per year end of 2019. Merkulov et al., (2020)

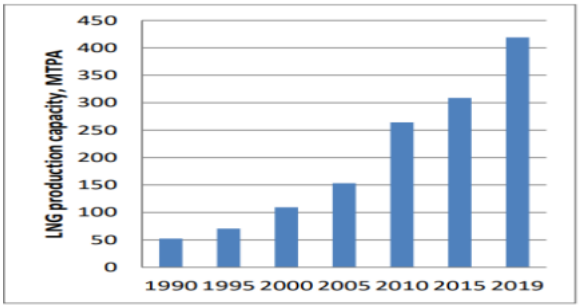

Figure 3.Dynamics of world LNG production Capacities, MTPA

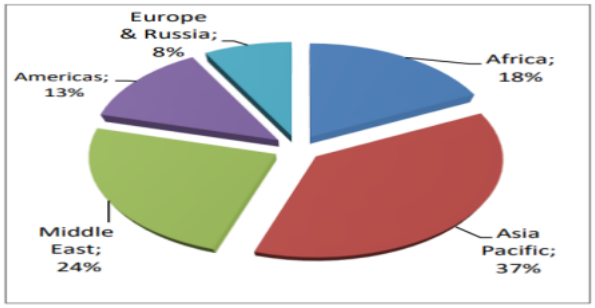

figure 4.shares of regions in the global production capacity of LNG in 2019

Prior to 2018, Egypt was importing a large percentage of its natural gas needs, due to the growth of domestic demand and the increase in gas consumption in various fields, with the annual decrease in natural gas production. This continued until 2018, when many natural gas fields were discovered, such as Zohr, Noor and Atoll. And others, which encouraged Egypt to aspire to be a regional source for the production, liquefaction and export of natural gas, due to what Egypt possesses of a distinguished strategic and geographical location, as it connects three continents, namely Asia, Africa and Europe, and what Egypt also possesses from sea outlets on the White and Red sea its efficiency and conversion into smart ports to raise its productivity and competitiveness regionally and internationally, in addition to Egypt's containment of the most important international waterway, the Suez Canal, in which about 12% of the world's trade passes. All this helps Egypt to be a regional source of liquefied natural gas. Abbas, N.S, et al., (2020)

Figure5. Cheniere Supplier-Specific Supply Chain

The figure5 shows the life cycle of liquefied natural gas and supply chains in one of the companies operating in the natural gas production sector, where the natural gas supply chain starts from the production well until the re-conversion of gas into gas at the port of final destination. Greenhouse gas emissions along this supply chain are estimated at about 30% to 43%. The drawing shows a group of logistical activities that take place across the supply chain, starting from production from the well using drilling rigs, then

purification, treatment, storage, transportation to liquefaction stations, then sea transport across oceans in LNG ships, then re-conversion of liquid gas into gas in a port The final destination is then the use of gas in several areas, including electricity generation, industry, means of transport, heating, etc. Companies working in the field of gas are trying to link all elements of the supply chain together and apply environmental sustainability standards along the life cycle of natural gas and along the supply chain, and reduce emissions as much as possible and raise safety and security rates. Especially in the activities of transporting and storing gas with the aim of ensuring that there is no leakage or explosion of gas and the resulting marine environmental pollution During the transportation process in the oceans, in addition to human and material losses, all this is done with the aim of preserving the environment and achieving sustainable development. Roman-White, et al., (2021)

The increase in global energy demand in recent decades has caused a significant increase in carbon emissions, causing climate changes and raising the global temperature, which encouraged the world to promote the use of natural gas as an alternative to fossil fuels such as coal and petroleum due to the low carbon dioxide emissions resulting from its combustion, especially in light of The world moved towards protecting the environment through the use of clean energy sources, which made natural gas a major contribution to the global energy sector, as the demand for natural gas reached 24.2% in 2019. The liberalization of the energy market, climate change and the challenges of the global environment also had a major role in the search for energy sources. Esily, et al., (2022)

2. International experiences in the liquefaction of natural gas in specialized liquefaction stations.

Building liquefied natural gas liquefaction stations requires a very large capital amounting to a few billion dollars. A group of countries in the Middle East and the world have liquefied natural gas liquefaction stations, including Egypt, Libya, Oman, Qatar, the Emirates, globally, Norway, Greece, Russia and other countries in the world.

3. GAP ANALYSIS

The decrease in research papers that contributed to analysing the current situation of the global natural gas markets from the perspective of logistics and logistics services along the supply chains of liquefied natural gas, by focusing on natural gas importers in the world as target markets that Egypt will target in the coming period, whether it is European or Asian markets, and specifying paths Optimum capacity and increased ability to predict regional and global demand for lliquefied natural gas, as well as measuring the impact of recent events such as the Russian-Ukrainian war on the global LNG supply chain, and presenting

the changes that occurred in the elements of the supply chain, such as changing sources of supply, transportation and storage methods, and changing gas distribution networks and centers as well, especially after Russia stopped exporting LNG to Europe and stopped Pipelines Nord Stream 1 and 2**.**

4. CONTRIBUTION

The study's contribution appears in examining, analyzing and studying a chain of supply for liquefied natural gas in Egypt through interest in raising the efficiency of the performance of logistical, operational, technical and tactical activities along the chain, with a focus on the maritime transport operations of liquefied natural gas from the gas producing countries to the countries consuming the gas.
The study also seeks to raise the efficiency of liquefied natural gas storage activities in Edku and Damietta cities in specialized warehouses that apply environmental safety standards.
The study also seeks to develop effective plans for natural gas distribution operations and measure the impact of the Russian -Ukrainian war on global gas supply sources. All of this aims to design the supply chain structure that reduces the costs of performing logistical activities and helps support decision -making processes with regard to the storage of gas that has been produced or its distribution in order to achieve a balance between production (supply) and demand, taking into account the needs of local consumption in Egypt.

5. RESEACH PROBLEM

The high cost of performing logistical activities along the LNG supply chain in the study area, and at the top of these activities are handling, transportation, liquefaction and storage due to the weakness of the existing infrastructure, whether liquefaction stations, storage tanks, or methods of transporting LNG from the source to consumers, whether by pipelines or natural gas ships liquefied or land trucks, which makes these logistical activities require huge financial investments that are not available, which weakens Egypt's competitiveness among the countries exporting liquefied natural gas regionally and internationally.

6. RESEACH AREA

According to the reports of the Egyptian Ministry of Petroleum and Mineral Resources, Egypt produced about 53 million tons of natural gas in 2021, an increase of about 17.2% compared to 2020, and Egypt's gas exports reached about one million tons in 2021. It also owns two natural gas liquefaction stations in the cities of Etko and Damietta. . Each of them has a distinct strategic location on the Mediterranean coast to facilitate the export of

liquefied gas to Europe and the world, and the cost of each station is a few billion dollars, which helps Egypt to become a regional center for liquefaction and trading of natural gas. The production capacity of the liquefaction plant in the city of Edku is about 7.2 million tons annually, and it contains two gas storage warehouses, the capacity of each warehouse is 140,000 cubic meters, and the station is attached to a sea port to receive giant natural gas carriers. The cost of the station is about two billion dollars. The production capacity of the Damietta plant is about 4.8 million tons annually, and the liquefaction plant in Damietta accommodates about 750 million cubic feet per day. The investment cost of the Damietta plant is about $1.3 billion. Egypt is also considered a central point in the gas supply chain of its production. Regions to consuming regions, as liquefied gas is exported to about 20 countries around the world, including Japan, France, Pakistan, India, Greece, Belgium, South Korea, Panama, the Emirates and others. Egypt was able to achieve self-sufficiency in natural gas in 2018 thanks to what was discovered in the Mediterranean gas fields such as the Zohr and Nour fields and other fields. 4 billion cubic meters, and thus Egypt ranks 14th globally, fifth regionally, and second in Africa in natural gas production in 2021, according to what was announced by the International Energy Agency. Egypt ranks second in the world in terms of contributing to the growth of LNG exports worldwide.

7. RESEARCH METHODOLGY AND ANALYSIS

The research paper relied on a methodology based on a review that highlights the strengths on which Egypt is based in its aspirations to be a regional center for the production, liquefaction and export Egypt for its goal to be a regional gas center in North Africa in addition to reviewing the most important gas production markets in Asia and Africa and the most important gas consumption markets in Europe and America**.**

- **Strength points**

1. What distinguishes Egypt and makes it qualified to be a regional source for the production, liquefaction and export of natural gas is its distinguished geographical location, as it connects three continents, namely Africa, Asia and Europe, and Egypt is considered a gateway to all African countries
2. The sea ports that Egypt owns, Egypt has started to raise their efficiency, develop them, and turn them into smart, controlled and green ports that apply environmental sustainability standards.
3. Egypt contains the most important international waterway through which about 12% of the world's trade passes, which is the Suez Canal and the green hydrogen projects that are taking place in the economic zone of the Suez Canal, in addition to that Egypt

plans to establish some natural gas liquefaction stations discovered in the Red Sea in the economic zone to the Suez Canal.

- **Weak points**

1. Gas exploration projects require a long time and huge financial investments that may not be available to Egypt at the present time.
2. LNG production areas are exposed to geopolitical risks due to the political instability of some producing countries and the emergence of civil or internal wars, or perhaps wars between LNG producing countries and their neighbours, as is the case in the Russian-Ukrainian war, which caused a disruption in global LNG supplies.
3. LNG exports and its extraction, production, transportation, liquefaction and storage operations are greatly affected by fluctuations in the global oil production market, and are also affected by stages or periods of decline in energy consumption globally, as happened during the Corona virus period in 2020, which caused many countries to stop production, which caused a significant decrease in energy consumption. The profitability of LNG production projects globally.
4. The intensity of competition between gas producers, especially in the regions of Asia and the Pacific, where these regions are considered pioneers in the production and export of liquefied natural gas, and among these countries are Australia, Malaysia, Indonesia, Japan, China and Qatar, because these countries have high capabilities in infrastructure along the LNG supply chain and the availability of huge funds have necessary.

- **Opportunities**

1. The Russian-Ukrainian war and the consequent suspension of natural gas supplies from Russia to Europe within the pipelines Nord Stream 1 and 2, which encourages Egypt to be a regional center for importing gas from Russia, then liquefying it in the Edku and Damietta stations, and then re-exporting it again to Europe
2. Egypt's endeavours to discover natural gas in countries that have large reserves of gas, such as Libya, which can be extracted from Libya and then transported to be liquefied at the liquefaction stations in Etko and Damietta, and then exported to southern European countries using the pipeline to be established that connects Egypt with Cyprus and Greece under the depth of the waters of the Mediterranean Sea.
3. Egypt's membership in the Eastern Mediterranean Gas Forum enables it to play a pivotal role in trading natural gas trade in the eastern Mediterranean region as a central point in the global natural gas supply chain linking the three major continents of the world Asia, Africa and Europe, in addition to achieving cooperation between member states and optimal utilization of the infrastructure of each country to achieve maximum benefit from the natural gas wealth in the eastern Mediterranean region.

4. Egypt's membership in an Arab cooperation project that includes Iraq, Jordan and Egypt and is called the New Levant, with the aim of linking these gas-producing countries with a pipeline to transport gas from them as a production area to Egypt as a liquefaction area in the Atco and Damietta stations, and then export the liquefied gas to Europe, whether through pipelines or LNG vessels.

- **Threats**

1. The emergence of green hydrogen as a source of energy generation, as it has become a competitor to natural gas because of its advantages, including that it is more environmentally sustainable than natural gas and does not emit any exhaust polluting the environment.
2. The emergence of shale gas in the United States of America caused a major shift in supply lines, import and export of natural gas worldwide, and as a result of the increased production of shale gas in the United States, this caused a decline in natural gas prices globally.
3. A group of the largest natural gas producing countries, Russia and China, have established pipelines linking their natural gas production areas with gas consumption areas in Europe, including Nord Stream pipelines 1 and 2.

8. CONCLUSION AND RECOMMENDATIONS

The study presented the most important logistics activities along the LNG supply chain. Demonstrate the foundations of sustainability that must be applied in all logistics activities along the chain and supporting logistics along the LNG supply chain. The study showed that the global LNG supply chain is subject to many factors in order to raise its efficiency and reduce the cost of performing logistical activities along the chain, the most important of which are the quality of gas and the cost of production, filtering, storing and transporting gas, flexibility and speed of response from supply sources, and reducing the time required for delivery from one place to another Production to the gas consumption market. The study also referred to the environmental importance of using natural liquefied gas as a fuel instead of oil and coal. The study also showed the impact of the Russian-Ukrainian war on the fields of natural gas supply at the global level and its impact on supply and demand for LNG globally. The paper presents several recommendations to show the foundations for the sustainability of liquefied natural gas in Egypt and the most important services and logistical activities supporting it.

1. Increasing production capacity by discovering more gas fields by increasing gas exploration operations in order to achieve tangible economic returns and trying to achieve

a measure of balance between demand for gas and supply and providing the necessary gas needs for local consumption.

2. Egypt's entry into the field of building liquefied natural gas carriers to cope with the increase in the volume of gas production and the increase in global demand for gas.
3. The use of floating liquefied natural gas units that are installed on marine barges and that have the ability to withdraw and liquefy gas directly in the sea from the fields and store it directly in ships.
4. Increasing the number and capacity of liquefied natural gas receiving stations, paying attention to improving the efficiency of the infrastructure inside them, providing the necessary tanks for storage, and paying attention to raising the safety rates in the stations to ensure that no dangers occur and reduce damages to the maximum extent possible.
5. Improving the design of the structure of the LNG supply chain, identifying the factors affecting it, identifying the most important risks facing the activities of the LNG supply chain, and trying to address these risks and limit their negative effects**.**
6. Facilitating the construction of the planned project, which is a pipeline between Egypt, Greece and Cyprus, so that Egypt will be a regional center in North Africa to liquefy gas and export it to southern European countries, which is what Egypt aims to achieve, especially after the economic sanctions imposed by the United States on Russia to prevent it from exporting gas from it directly to Europe, especially after the suspension of Nord Stream lines one and two, which are used to export natural gas from Russia to Europe, specifically to Germany, which relies mainly on liquefied natural gas in industry, heating, electricity generation, nuclear power stations, and others.
7. Achieving the maximum benefit by increasing investment in gas exploration projects in the coming years in Lebanon, Jordan and Iraq and linking them to Egypt, as is the case in the new Levant project that connects Iraq, Jordan and Egypt with a pipeline to transport natural gas**.**
8. Exporting the gas produced from the Egyptian fields Noor and Zohr using the planned pipelines or LNG ships to Cyprus and Greece as receiving points to supply consumption markets in Europe**.**
9. Egypt playing the role of the central point in the natural gas supply chain in Africa and the Middle East by receiving natural gas from other countries such as Qatar, Iraq, Jordan, Lebanon and Israel, then liquefying it and exporting it to gas consumption markets such as Europe and America**.**
10. Rationalizing the domestic consumption of natural gas in Egypt, using alternative energy sources such as nuclear energy, solar energy, wind energy and electricity instead of gas to provide the largest possible amount of gas produced from the Egyptian fields to export it and provide hard currency.
11. The speedy completion of international arbitration cases related to the Damietta station so that the station can resume its activities again, as the cost of establishing a new station currently may reach 7 billion dollars, and there are no gas liquefaction stations in any

eastern Mediterranean country, and this is considered a competitive advantage for Egypt Helping it to become a regional center for natural gas liquefaction**.**

12. Because of the discovery of shale gas in America, natural gas prices decreased globally, and therefore Egypt must search for alternative markets to export the gas produced from the Egyptian fields while providing more facilities, including long-term gas sales contracts and entering into partnerships to produce and export gas with neighbouring countries such as Libya.
13. Providing appropriate government support and gas exploration companies and providing technical and logistical support for these projects**.**
14. Paying attention to the infrastructure in the regions of Edku and Damietta with regard to the areas of gas extraction, storage and logistical supply in terms of insurance, fuel and all needs and services in the fields of production, liquefaction and storage of gas**.**
15. Allowing the private sector in the field of gas exploration and taking care of industries based on gas and petrochemicals and exporting them to Arab and African markets to save hard currency.
16. The government must work to facilitate the issuance of gas exploration licenses and to pay all arrears to Egyptian and international gas companies.
17. Achieve integration and linkage between all elements of the LNG supply chain, starting from producers, then suppliers, then manufacturers, all the way to final consumers.

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