



Analyzing the Algerian LNG Export: Comparative Benchmarking between Key Global Exporters

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Abstract:

In this paper, we focus on a critical concern within Algeria's natural gas sector: the export of Liquefied Natural Gas (LNG). the objective of the study is to effectively manage the country's resources by pinpointing and acknowledging potential areas for enhancement. To achieve this goal, we undertake a comparative analysis and benchmarking exercise involving four LNG exporting countries: Algeria, Qatar, the USA, and Russia. After assessing the current upstream state and downstream challenges, Algeria is compelled to explore avenues and devise solutions for enhancing its LNG exports. This strategic imperative is essential for preserving its market share, necessitating the implementation of new strategies at both the national and international levels.

Key Words: LNG, Strategy, Export, SWOT, markets.

JEL Classification : Q04, Q4, F1

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Introduction:

Algeria's hydrocarbon endowment is dominated by its larger natural gas reserves compared to crude oil. It holds the 10th largest proven gas reserves globally and ranks 3rd in shale gas reserves. Natural gas serves as one of the primary sources of revenue with Algeria being the 7th largest exporter and historically pioneered in Liquefied Natural Gas (LNG). However, in the past two decades, there has been a substantial decline in LNG deliveries, plummeting from 25.68 Billion Cubic Meters (BCM) in 2005(BP, 2006) to 14.4 BCM in 2022(EI, 2023). This decline can be attributed to a myriad of challenges faced by the Algerian gas industry.

In stark contrast, the global LNG trade has been experiencing significant growth, reaching 389.2 million tons in 2022, underscoring its pivotal role as a global energy source. With 45 importing countries and 20 exporting countries (GIIGNL, 2023), the LNG market is evidently diverse. LNG is increasingly recognized as a linchpin of energy security due to its versatility and cost-effectiveness for both exporting and importing nations. However, amid this global surge in LNG trade, Algeria's decline in LNG exports presents a deviation from the prevailing trend.

This research paper delves into the trajectory of Algerian LNG exports aiming to discern the factors and developments influencing this shift in the market landscape. The aim is to identify strategic improvements and potential areas for growth, aligning Algeria's approach with the global energy landscape and ensuring optimal resource



management within the framework of the esteemed SONATRACH Group. the research question is as follow: **“What are the primary factors impacting Algeria's LNG exports, and how can Algeria strategically position itself to sustain its market share and adapt to changing dynamics in the global LNG market?”**

In an attempt to answer the raised question, the following hypothesis is stated:

H01: Algeria possesses significant advantages that it can sustain amidst both internal and external challenges by implementing new strategies in its LNG trade approach.

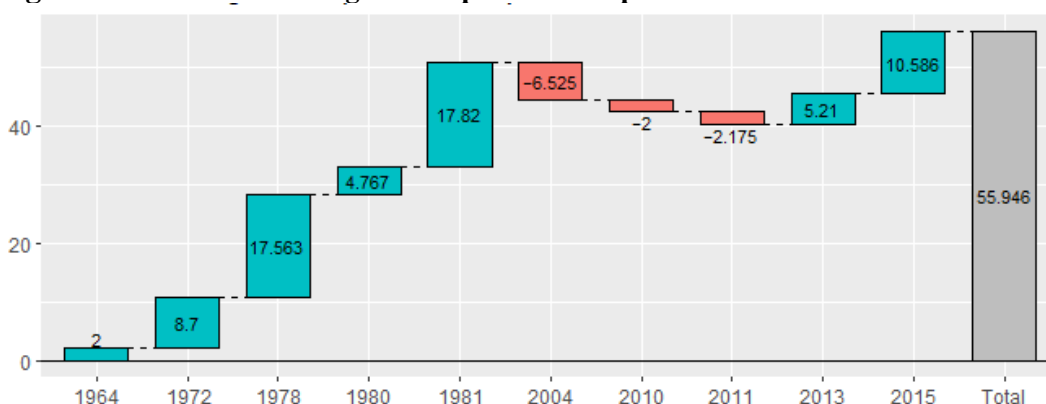
I. Algeria's LNG status:

Algeria's journey into gas production commenced in 1961, initiating with a capacity of 156 million cubic meters (MCM) directed towards domestic consumption. With a substantial surge in global demand for natural gas, Algeria strategically augmented its production, establishing pathways for export through pipelines and vessels in the form of LNG.

The inception of Algerian natural gas exports can be traced back to 1964 when gas was first delivered to the United Kingdom and France, marking the commencement of LNG trade for the nation. The evolution of Algeria's LNG production capabilities is illustrated in the figure below. The initial GL4Z plant was commissioned in 1964 with a capacity of 2 million cubic meters (MCM), paving the way for subsequent plants like GL1K and GL2K, boasting capacities of 4.8 MCM and 4.767 MCM, respectively. Additionally, GL1Z and GL2Z were established with capacities of 17.563 MCM and 17.82 MCM each.

However, from 2004 to 2013, Algeria faced challenges with the performance of its liquefaction plants, primarily GL1K and GL4Z, due to incidents and equipment failures, leading to temporary shutdowns. In 2013, GL1K recommenced operations with a capacity of 5.21 MCM, and by May 2015, another plant, GL3Z, commenced operations with a capacity of 10.586 MCM. This culminated in a total liquefaction capacity of 55.95 MCM.

Figure 1: « Evolution of Algeria's liquefaction capacities in million cubic meters »



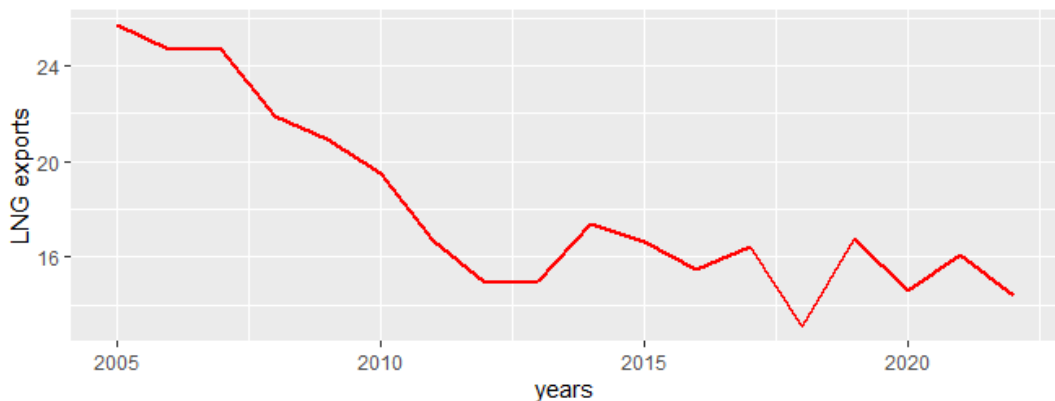
Source: own work based on SONATRACH's data

In this paper, the primary focus is on the LNG sector. In 2003, Algeria held a notable position among the top four LNG exporting nations, trailing behind Indonesia and preceding Malaysia and Qatar (Wood, 2012). Fast forward to 2022, the dynamics have shifted, and the leading LNG exporters are now Australia, the US, Qatar, and



Russia (IGU, 2023) This transformation underscores the evolving landscape of LNG trade, shaped by the success of some players and the challenges faced by others. The Algerian natural gas exports peaked in 2005, since then the total exports experienced downward trend particularly evident in LNG. This decline was due to several challenges that faced the gas sector both on a national as well as the international scale. The following figure shows Algerian LNG exports from 2005-2022.

Figure 2: « Evolution of Algerian LNG exports in Billion Cubic Meters from 2005 to 2022»



source: own work based on BP data

As depicted in the graph, Algerian LNG exports experienced a significant downward trend from 2005 to 2013, plummeting from 25.68 BCM to 15 BCM during this period. Following this decline, there was a partial recovery since 2014, and the export volumes fluctuated within the range of 15-17 BCM per year. The lowest recorded volume was in 2018, with 13.5 BCM. In recent years, exports have stabilized within the range of 14-16 BCM.

II. Methodology

1.The SWOT-AHP method

The approach adopted for the conduct of this paper is SWOT-AHP analysis. The SWOT analysis is a strategic planning and management technique employed by organizations to assess their internal attributes and limitations, in addition to recognizing external prospects and challenges. The term "SWOT" stands for Strengths, Weaknesses, Opportunities, and Threats.

Strengths are the company's internal positives that give it a sustainable advantage while Weaknesses are the internal negative points within the company with substantial margin for improvement. On the other hand, Opportunities encompass external factors or situations that the company can take advantage of and Threats include external challenges, obstacles that may hamper the development of the company (Wheelen & Hunger, 2012).



The Analytic Hierarchy Process (AHP) is a versatile measurement theory. It is utilized to create ratio scales through comparisons, whether discrete or continuous (Saaty, 1987)

The SWOT analysis is combined with a method for multi-criteria decision Analytic Hierarchy Process (AHP). It a hybrid method that produces quantitative values for the SWOT factors and is used to prioritize the SWOT factors to ascertain the relative importance of factors (Oreski, 2012). the factors are compared using the Saaty's scale. This method has been commonly studied and applied in energy sector such as electricity trade (Haque et al., 2020), (Solangi et al., 2019) and (Suriyanti et al., 2020).

One aims to diagnose the LNG sector in Algeria by conducting a comparative benchmark with three other exporting countries: Qatar, USA, and Russia. The factors selected for this benchmark are chosen from Algeria's perspective. The SWOT factors and data have been developed through extensive research, including international reports, articles, policy makers viewpoints, and other credible sources.

III. SWOT analysis for the Four Exporting-Countries

One aim to diagnose the LNG sector in Algeria by conducting a comparative benchmark with three other exporting countries: Qatar, USA, and Russia. The factors selected for this benchmark are chosen from Algeria's perspective. The SWOT factors and data have been developed through extensive research, including international reports, articles, policy makers viewpoints, and other credible sources. The SWOT list of factors is:

STRENGTHS	WEKNESSES
<ul style="list-style-type: none"> -Reserves potential -Unitary costs -Geographic location -Availability of skilled labor at low costs 	<ul style="list-style-type: none"> -Rising domestic demand -Aging infrastructure -Market concentration -LNG long-term contracts and spot quantities
OPPORTUNITIES	THREATS
<ul style="list-style-type: none"> -Proximity to the European market -Rising global demand -New import markets Climate change 	<ul style="list-style-type: none"> -Fierce competition from major exporters -Emergence of new players -External and geopolitical trends -Energy transition

1.Strengths

1.1Reserves Potential

According to (BP, 2021) Algeria boasts the second-largest proven natural gas reserves in Africa, after Nigeria. It has the 3rd largest shale gas resources worldwide, 707 trillion cubic feet (International Trade Administration, n.d.). In 2022, SONATRACH, the national oil and gas company of Algeria, made noteworthy announcements regarding three significant oil and gas discoveries in distinct basins within the Algerian Sahara. Notably, one of these discoveries was a substantial gas



find adjacent to the renowned Hassi R'Mel field, marking the most significant discovery for Algeria in the last twenty years (Sonatrach, 2022).

Qatar, on the other hand, holds the position of the world's third-largest country in terms of proven natural gas reserves, with a significant amount of 24.7 trillion cubic meters (TCM). This ranking places Qatar just below Russia and Iran, making it the second-largest natural gas reserve holder in the Middle East. remarkably, Qatar's gas reserves account for approximately 12.4% of the total global reserves, with the majority situated in the extensive Offshore North Field, recognized as the world's largest non-associated gas field.

Natural gas proved reserves in the United States have witnessed a consistent upward trend since 2000, experiencing growth in almost every year. This increase can be attributed to significant advancements in exploration and production technologies for natural gas, particularly the utilization of techniques like horizontal drilling and hydraulic fracturing. These innovative methods have enabled the extraction of natural gas from previously inaccessible reservoirs, including shale formations. Between 2000 and 2019, U.S natural gas reserves grew by more than 148% from 186.51 TCF to 625.37 TCF(EIA, 2023b).

Russia has the world's largest reserves 38 TCM, or 19.1% of global share. Most of its gas reserves are situated in West and East Siberia, there are also several potential areas in the Yamel Peninsula (Locatelli, 2017).

Table 1: « Reserves and production for exporting countries»

	Algeria	Qatar	USA	Russia
Reserves (TCM)	2.3	24.7	37.4	37.4
Production per annum (BCM)	81.5	171.3	914.6	638.5
R/P ratio (years)	28	144	13.8	58.6

Source: BP 2021

1.2Unitary costs

The production costs of natural gas vary from country to country due to numbers of factors, including the cost of labor, the cost of materials and equipment, the cost of complying with environmental regulations, geology, geography and exploitation conditions. Algeria, Qatar, Russia and the United States differ in terms of production cost. In this category, Algeria has one of the lowest production costs after Qatar. The latter benefits from advantageous exploitation conditions: the sea floor is shallow (about 65 m deep) and the natural gas reservoir is only 3 km below the surface (Hafner et al., 2020). Russia's deposits are mostly situated in Siberia and Yamal peninsula making the production cost much higher due to the complexities of geological and hydrological conditions and difficult climate changes. The US has the higher production costs because the shale gas production involves hydraulic fracturing, or fracking, which is a more complex and costly process than conventional gas extraction.

**Table 2: « Unitary costs for exporting countries»**

	Algeria	Qatar	Russia	US
Natural gas	2.1	2	3.2	4
production upstream				
Liquefaction	1.9	1.8	4.2	3.5
capex				
Transport	2.4	1.4	0.3	2.1

1.3 Geographic location

Geographic location plays a significant role in terms of LNG exports. Algeria is strategically situated near to one of the largest natural gas and LNG-consuming regions globally, which is Europe. In 2022, Europe, as the second-largest importing region after Asia Pacific, received approximately 170.2 BCM of LNG (EI, 2023). France, Spain, and Turkey stand out as Algeria's primary clients for LNG and rank among Europe's largest LNG importers. Notably, Qatar, Russia, and the United States hold strategic geographic advantages, being positioned between two major and growing markets, Europe and Asia. Regarding Russia, it too enjoys proximity to key markets, although the location of its gas reserves presents logistical challenges (Gazprom, n.d.).

1.4 Availability of skilled labor at low costs

Algeria has a rich history in the LNG industry, pioneering this technology by inaugurating the world's first plant, "La Camel," in 1964. This placed Algeria at the forefront of LNG technology when it was still in its nascent stage and relatively unknown. Over nearly six decades, Algeria has accumulated valuable experience in the LNG sector, contributing to the country's expertise in the field. Similarly, Qatar boasts extensive experience in LNG, with over 25 years of active involvement in the industry. Qatar has also embraced new technologies, particularly in terms of its LNG fleet. In contrast, Russia and the US are relatively new entrants to the LNG industry, having begun their exports in 2016 and 2009. Respectively. However, both countries benefit from extensive gas pipeline networks, which bolster their energy export capabilities.

According to (Oueld Kaddour, 2018) wages for Algerian workers in the oil and gas industry rank among the lowest globally. On a global scale, Australia offers the highest salary levels in the industry. Among the benchmarked countries in this analysis, North America leads in terms of compensation, followed by the Middle East and the CIS region (Statista, 2023)

2 Weaknesses

2.1 Rising domestic demand

Globally, natural gas consumption experienced an upward trajectory over the past few decades, reaching a significant volume of 3,241.3 BCM in 2023. Among exporting countries, Algeria has demonstrated notable growth in gas consumption. From 2012 to 2022, domestic demand in Algeria increased by 4%, surpassing the growth rates of the United States, which experienced a 2.5% increase, and Qatar,



with a growth rate of 0.9%. Russia, on the other hand, recorded a negative growth rate of -0.5% (EI, 2023).

In terms of national market demand for natural gas, excluding LNG self-consumption, it is anticipated to exhibit an annual growth rate of 3.0% from 2019 to 2040 in the base scenario. This growth can be primarily attributed to the evolving demand from the state-owned utility in charge of electricity and natural gas distribution (Sonelgaz), which is projected to increase by 3.3%. This rise is largely due to the implementation of programs within the industrial sector, which is expected to experience a growth rate of 5.1%.

2.2 Aging infrastructure

Algeria's land-based infrastructure in the LNG sector has been in operation for approximately 32 years. However, the current operational capacity falls short of the installed capacity due to failures in certain strategic equipment. These equipment failures have resulted in a decline in production output. Presently, the LNG plants are experiencing a high rate of self-consumption, meaning that LNG production is below the available production capacities. This situation has led to higher self-consumption levels compared to the optimal operation of the facilities.

In contrast, the United States entered the LNG production arena in 2016, and its liquefaction equipments are relatively new. The U.S. boasts the largest liquefaction capacity globally, totaling 91.25 million metric tons per annum (MMTPA) (GIIGNL, 2023). Over the next five years, the United States is poised to significantly expand its gas liquefaction capacity, with plans to more than double its current levels. With three projects expected to receive final investment decisions within the current year, the annual LNG export capacity of the country is projected to reach 169 MMTPA by 2027. This expansion would position the United States ahead of Qatar, which is currently the third-largest LNG exporter globally, and it has the third-largest liquefaction capacity after the United States and Australia. By 2027, Qatar is projected to undergo a substantial increase in its export capacity, reaching 136 MMTPA. Meanwhile, Russia holds the fifth position globally in export capacity, with an anticipated growth of 20 MMTPA, ultimately reaching 49 MMTPA by 2027 (BloombergNEF, 2023).

In terms of liquefaction capacity utilization in 2022, Algeria had the lowest utilization rate, standing at under 40% globally. In contrast, the United States achieved full utilization of its capacities, reaching 100%, while Qatar and Russia exceeded 100%, with utilization rates of 107% and 120%, respectively (IGU, 2023).

2.3 Market concentration

Evaluating market concentration within the context of LNG exports serves as a common analytical approach for gaining insights into the industry's dynamics. Among the different methodologies, the Herfindahl-Hirschman Index (HHI) stands out as a valuable tool. One calculated the HHI index for the four exporting countries from 2018 to 2022.

During the historical period, Algeria's LNG exports demonstrated a higher degree of market concentration, indicating less diversification. The HHI value for Algeria reached 0.261 in 2022.



In contrast, the LNG export scenarios of Qatar, USA and Russia exhibit a distinct pattern of higher diversification. These countries have managed to achieve lower HHI values over the last five years reaching 0.105, 0.109, and 0.144 respectively, in 2022. This suggests that these nations have distributed their LNG exports across a wider range of destinations, showcasing a more dispersed market presence.

Table 2: Herfindahl-Hirschman Index (HHI)

Country	2018	2019	2020	2021	2022	Trend
Algeria	0.232	0.211	0.262	0.249	0.261	
Qatar	0.102	0.086	0.083	0.088	0.105	
USA	0.117	0.077	0.069	0.082	0.109	
Russia	0.187	0.129	0.125	0.129	0.144	

Source: Author calculations based on BP data

2.4 LNG long term contracts and spot quantities

Traditionally, the trade of LNG is dominated by long-term contracts (LTCs, the contract period is more than 20 years), with price linked to oil price. However, the landscape is changing with the rise of spot LNG trade due to the emergence of new suppliers and consumers.

In the medium and long term, a significant shift is evident in the Algerian LNG landscape as three out of five contracts recently reached their expiration, leaving approximately 5.5 million metric tons per annum (MTPA) remaining. In contrast, Qatar stands out as a prominent player, boasting an impressive array of contracts with a total volume of 81.45 MTPA. Following closely, the United States has secured contracts amounting to 68.5 MTPA, while Russia has secured contracts for 14.9 MTPA, as reported by the (GIIGNL, 2023). When it comes to spot and short-term quantities, as of 2022, the lowest amount was exported by Algeria with 4.25MT, while US tops the list with 45.74 MT followed by Qatar 10.25 MT and Russia with 9.67 MT.

3. Opportunities

3.1 Proximity to the European market

As it is already mentioned above, Algeria is strategically located in close proximity to Europe. The ongoing crisis in Ukraine and the resulting tensions between Russia and Europe have underscored the importance of LNG and the diversification of Europe's sources. LNG became a new baseload supply for the continent and its share increased from 12 % over the 2010s to 35% in 2022 (IEA, 2023a). One of the main options for Europe to diversify its supplies in order to ensure its energy security is the Mediterranean area (European Commission, n.d.). This will create a significant opportunity for Algeria to expand its LNG exports and maintain its market share in



the region. In comparison with other countries, Algeria has a comparative advantage in terms of LNG exports which make it an attractive supplier for Europe.

3.2 Rising global demand

At the global scale, Gas is poised to experience the most robust growth among fossil fuels. The proportion of LNG within the worldwide gas supply is set to rise in order to meet demand growth and replaces decreasing pipeline and domestic gas, a rise of 30% between 2030-2050 is forecasted by (BP, 2023).

3.3 New import markets

Over the past decade, LNG imports in Latin America and the Caribbean have been unpredictable due to their strong dependence on weather conditions. Despite representing less than 5% of global LNG imports, this region holds particular importance for LNG suppliers due to its substantial regasification capacity. Currently, there are 72 million metric tons per annum (Mtpa) of existing LNG regasification capacity, with an additional 15 Mtpa under construction.

Notably, most of the upcoming projects are in new LNG-importing countries in the region, including Antigua and Barbuda, Aruba, Ecuador, and Nicaragua. These countries are aiming to use LNG imports to replace heavy fuel oil and diesel in their electricity sectors. Furthermore, even existing LNG importers like Brazil and Colombia are expanding their facilities or developing new ones, indicating a growing interest and investment in LNG infrastructure throughout the region (GECF, 2022). In Europe, Germany is emerging as a significant new LNG importing market, with a notable increase in infrastructure investments. It is projected that by 2030, Germany's LNG capacity will reach 9 BCM. This presents a promising opportunity for the four exporting countries to enter these expanding markets and capture a larger share of the LNG trade.

3.4 Climate change

The Paris Agreement brought together numerous countries with the shared commitment of establishing ambitious international objectives aimed at stabilizing and decreasing carbon emissions in order to address and alleviate the impacts of climate change (Gürsan & De Gooyert, 2021). Natural gas, often regarded as a transitional energy source, is seen as a means to lower emissions by replacing more environmentally harmful fossil fuels and working in harmony with intermittent renewable energy sources (Szabo, 2022). When comparing emissions from coal and gas, on average, coal-to-gas switching reduces emissions by 50% when producing electricity and by 33% when providing heat. In China, there has been a rapid increase in gas demand in recent years due to significant policy efforts to improve air quality (IEA, 2019). In Europe gas is recognized as essential component against climate change (La tribune, 2022). As a result, there has been a noticeable upward trend in the proportion of natural gas within energy consumption structures in recent years, driving the growth of the global natural gas trade (Xia et al., 2023).

4 Threats

4.1 Fierce competition from major exporters

The global LNG market is currently witnessing intense competition among major exporters, notably Qatar, the USA, Australia, and Russia. This competition has



intensified, particularly in the European market, following the Russia-Ukraine conflict, which elevated Europe as a premium LNG market.

Historically, Algeria has been heavily reliant on the European market, which serves as its traditional client and ranks as the third-largest supplier of gas to Europe in terms of LNG, after the U.S. and Russia. However, Algeria is now facing fierce competition primarily from the United States, Qatar, and Russia.

The United States has emerged as a major LNG exporter and is now the largest supplier of LNG to the continent. In 2022, the United States exported a substantial 72.1 billion cubic meters (BCM) of LNG (EI, 2023), challenging traditional buyers. This significant increase of 141%, as reported by the (EIA, 2023a)), can be attributed to two principal factors. Firstly, it is a response to the decline of Russian pipeline exports, which reached the lowest levels in 40 years. Secondly, favorable pricing conditions in European trading hubs, coupled with U.S.-EU cooperation on energy security, contributed to this surge. Notably, France, the United Kingdom, Spain, and the Netherlands collectively accounted for 74% of U.S. LNG exports to Europe.

Qatar is also a reliable supplier of LNG to Europe, with major customers including Belgium, Italy, the United Kingdom, Turkey, and Spain. Before the significant increase in U.S. LNG exports to Europe, Qatar was Algeria's primary competitor in the European market. In 2022, Qatar exported 28 BCM (EI, 2023) to Europe, marking a 5.5 BCM increase from the previous year (BP, 2022). Other key players are competing with Algeria in the LNG market, such as Nigeria and Egypt, whose exports to Europe accounted for 12 BCM and 6.5 BCM, respectively. Additionally, Azeri gas remains a competitive source of natural gas, with Europe considering it as an alternative source to diversify its imports.

4.2 Emergence of new players

The LNG industry is currently experiencing a period of significant growth and opportunity, thanks to its various advantages. While several countries, as mentioned earlier, have ambitious plans in the LNG sector, there are other nations actively working to develop and expand their LNG capabilities. Canada, known as the sixth largest natural gas producer globally, is on the verge of entering the LNG export market. The construction of its first liquefaction facility on the west coast is nearly complete, with a strategic focus on the Asia Pacific region for its initial export endeavors (Ghosh & Islam, 2023). The country's abundant natural gas resources make it a promising player in the LNG sector. In Europe, the European Commission has taken proactive steps by establishing a dedicated working group with Canada. This collaboration aims to explore possibilities for LNG and hydrogen deliveries in the upcoming years, reflecting Europe's commitment to diversify its energy sources and strengthen its energy security (European Commission, 2022) . Meanwhile, in West Africa, the Greater Tortue Ahmeyin project is gaining prominence. This project is a cooperative effort between Senegal and Mauritania and has the potential to emerge as an LNG exporter to Europe. The first LNG shipments from this project are anticipated in the first half of 2024 (Bloomberg, 2022; Mackenzie, 2023). Additionally, other West African nations like Mozambique, the Republic of Congo,



and Tanzania are also positioning themselves as emergent players in the global LNG market, leveraging their considerable natural gas reserves.

4.3 External and Geopolitical trends

Regional volatility and geopolitical tensions, along with trade disputes and maritime chokepoints, pose potential threats to the natural gas and LNG industry globally. Algeria, located in the Maghreb region but with connections to the Middle East, Europe, and sub-Saharan Africa, has experienced challenges due to instability in neighboring nations. These issues have disrupted the smooth flow of gas exports and directly impacted Algeria's critical hydrocarbon industry, primarily concentrated in the south. In 2022, diplomatic tensions with Morocco led to the shutdown of gas supply through the GME pipeline. However, Algeria's LNG exports remained unaffected by this development.

Similarly, Qatar, situated in a region prone to geopolitical tensions like the Gulf Diplomatic crisis and facing challenges related to maritime chokepoints such as the Strait of Hormuz and Suez Canal, remains vigilant to potential disruptions. Any instability in neighboring countries can impact Qatar's LNG exports, given its strategic location.

The United States experienced a significant decline in LNG exports to China during the 2018-2019 US-China trade dispute. This dispute caused a decrease in US LNG exports from 3 BCM in 2018 to 0.4 BCM in 2019 (BP, 2019, 2020). Additionally, the transit of LNG through the Panama Canal, connecting the Gulf of Mexico to the Pacific, can be a concern, although the Panama Canal administration and political situation have remained stable in recent decades.

Russia, a country historically involved in geopolitical conflicts, particularly with Ukraine, has faced sanctions related to its natural gas exports. This has extended to its LNG exports, with the UK and Lithuania banning LNG imports originating from Moscow. Recent reports suggest that Europe is planning to cease Russian fuels by 2027 and recommends EU sanctions on Russian LNG starting now (Bruegel, 2023; Investment Policy Hub, 2022; Janeliūnas, 2023).

4.4 Energy transition

The adoption of renewable energy sources has become imperative not only as a response to climate change but also as a means to diversify energy sources, enhancing energy security by reducing dependency on a single major source. This transition away from fossil fuels to renewables does carry risks for countries heavily reliant on hydrocarbons for their economies. In the next five years, renewables, particularly solar and wind energy are projected to surpass all other sources in terms of installed capacity for global electricity grids, an 85% acceleration from the previous five years mainly driven by China, EU, the US and India. Looking ahead to 2050, these two technologies will emerge as the predominant global electricity sources due to significantly reduced installation and operational costs (IEA, 2022, 2023b).

IV Quantitative matrixes for SWOT analysis

In this approach, referred to as A'SWOT, we integrate the hybrid method to quantify SWOT factors. The matrixes assign a weight factor between 0 to 1 for each analyzed



aspect. The determination of the perceived importance (weight) of these factors for Algeria is based on the AHP method. Rating factors are scored on a scale from 1 (low) to 5 (outstanding), reflecting the performance of the player in each aspect.

Table 3: «Internal factors analysis summary (IFAS) »

	Weight	Rating	Weighted score
Strengths			
Reserves potential	0.282	3.2	0.901
Unitary costs	0.067	4.5	0.300
Geographical location	0.036	3.5	0.127
Availability of skilled labor at low costs	0.115	4	0.461
Weaknesses			
Rising domestic demand	0.304	2	0.608
Aging infrastructure	0.056	1.5	0.084
Market concentration	0.115	1.8	0.207
LNG contracts	0.025	2	0.050
	1		2.739

Source: By Authors

Table 4: «External factors analysis summary (EFAS) »

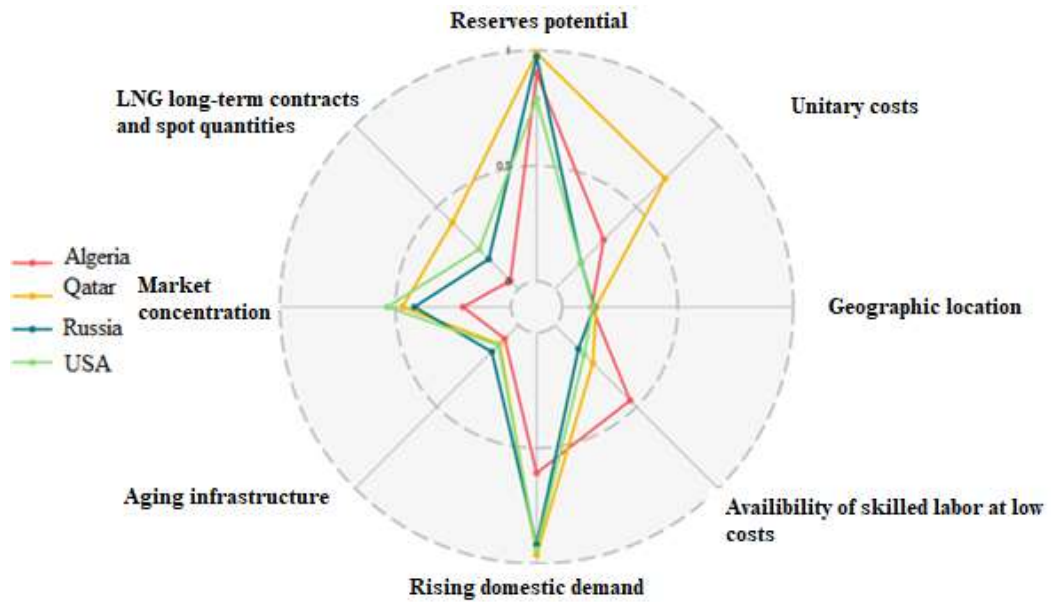
	Weight	Rating	Weighted score
Opportunities			
Proximity to the European market	0.268	3	0.804
Rising global demand	0.127	4	0.507
New import markets	0.037	4.2	0.156
Climate change	0.068	3	0.206
Threats			
Fierce competition among exporters	0.301	1.5	0.451
Emergence of new players	0.029	3	0.087
External and geopolitical trends	0.109	3	0.185
Energy transition	0.062	2	0.218
	1		2.612

Source: By Authors

Conducting a similar analysis for other exporting countries concerning both internal and external factors, one presents Fig. 3 and Fig. 4 comparing Algeria, Qatar, the USA, and Russia. Following the Radar charts, a comprehensive comparison of the final total scores for internal and external aspects of each player is provided.

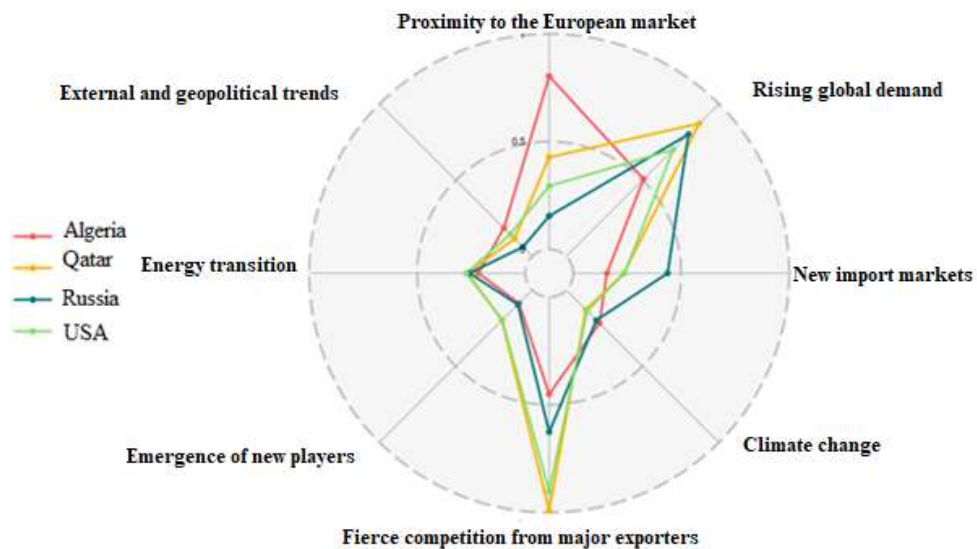


Figure 3: «Comparison of Internal Factors across exporting countries »



Source: By Authors

Figure 4: «Comparison of External Factors across exporting countries»



Source: By Authors



V. SWOT strategies

1. Strengths- Opportunities strategies

Algeria possesses a significant competitive advantage in the global LNG market, thanks to its low production costs for natural gas and ample reserves. To harness this advantage, the country should strategically increase LNG exports to Europe by positioning itself as a reliable supplier, especially given the heightened demand resulting from the Russia-Ukraine conflict. In addition, offering competitive LNG pricing and focusing on cost-efficiency improvements can help Algeria expand its market share in high-growth regions like Asia and Latin America. Further optimizing the operational processing costs of natural gas, particularly at the liquefaction plants within the LQS Activity, can unlock new commercialization opportunities for SONATRACH. As an example, by reducing the LNG processing cost by approximately 1.3\$/MMBTU, SONATRACH could become more competitive in the Asian market with an estimated breakeven cost of 5.5\$/MMBTU. The country, drawing upon its extensive LNG expertise, should play a pivotal role in serving international demand and promoting natural gas as a cleaner alternative to coal, it should emphasize the environmental advantages of transporting LNG from Algeria to Europe, highlighting the reduced carbon footprint compared to sourcing from distant regions. By enhancing the technical capacity and skills of its workforce, SONATRACH can prepare for future ventures such as shale gas production. Leveraging its experience and skilled workforce, Algeria can also embark on new LNG projects to cater to emerging importers in Asia and Latin America, further solidifying its position in the global LNG market.

2. Strengths -Threats strategies

Algeria should leverage its abundant natural gas reserves and cost-efficiency to offer competitive pricing, ensuring stable supplies for long-term contracts while remaining competitive even as new market entrants emerge. Long term contracts provide stability amidst uncertainties in demand. Furthermore, Algeria can maximize its skilled workforce by investing in research and development for cleaner energy solutions, thereby diversifying its energy portfolio and aligning with the global transition towards sustainability. By implementing these strategies, Algeria can effectively transform its strengths into potent tools for addressing the challenges it encounters in the LNG export market.

3. Weaknesses -Opportunities strategies

Algeria should proactively leverage market concentration to drive diversification into new geographic regions, reducing its reliance on a single market and thereby mitigating risks associated with market fluctuations. The growing global demand for LNG provides a favorable backdrop for such diversification efforts. Algeria's focus should be on securing contracts in emerging import markets across Asia, Latin America, and nascent European markets like Germany, where demand for alternatives to Russian pipeline gas is on the rise. Early entry into these markets positions Algeria as a reliable supplier, potentially enabling favorable terms in long-term contracts. Additionally, offering flexible LNG delivery terms to cater to diverse buyer needs, including the spot market, can foster partnerships and attract foreign



expertise and investment for the development of LNG facilities. These strategic moves will enhance Algeria's resilience and competitiveness in the evolving LNG landscape.

Algeria should look to partner with international oil companies to gain capital, technical expertise and access to new technologies that can help upgrade its aging liquefaction infrastructure. For investments: Sonatrach has Set a target for optimizing Capex at \$1.7/MMBTU instead of \$1.9/MMBTU, a reduction of \$0.2/MMBTU. Fortunately, a reliability improvement project is in progress at the GL1Z and GL2Z.

This can improve efficiency and help Algeria maintain its cost competitiveness. Strategic partnerships can also provide knowledge transfer to further develop the capabilities of Sonatrach's personnel.

4. Weaknesses-Threats strategies

To address weaknesses and mitigate threats in Algeria's LNG industry, the country should pursue several strategic initiatives. First, investing in cleaner energy alternatives for domestic consumption can reduce reliance on traditional fuels, freeing up more natural gas for export to tap into higher-demand markets and compete effectively against other LNG exporters.

Second, modernizing infrastructure is crucial. Upgraded facilities can match or surpass the capabilities of new entrants, enhancing efficiency, reliability, and safety, making Algeria an attractive choice for LNG buyers.

Third, Algeria should capitalize on market concentration by targeting emerging markets with less competition. Focusing on regions with growing energy demands and less established LNG supply networks can create new opportunities and secure long-term contracts.

Lastly, Algeria should leverage its unique strengths, such as low unitary costs, to offer competitive pricing and attract buyers seeking reliable and cost-effective LNG supply. These strategic actions will help Algeria navigate challenges and strengthen its position in the LNG industry.

Conclusion

The paper analysed the current energy situation for the commercialization of Algerian LNG through a benchmark with other exporting countries namely: Qatar, the US and Russia. The evaluation uses the SWOT methodology. The analysis has provided valuable insights into the dynamics of Algeria's natural gas market, particularly focusing on its LNG export capabilities. This study took into account the global energy landscape, marked notably by the surging consumption in Asia and Europe and the stiff competition posed by global leaders Qatar, the US and Russia. Algeria, endowed with significant reserves potential, advantageous geographic location, and the availability of skilled labor at lower costs, stands as a prospective player in the LNG market. The low unitary costs further enhance its competitiveness. However, certain weaknesses need to be acknowledged and addressed, including the challenge of balancing global domestic demand for natural gas, managing high



market concentration of LNG, addressing expired LNG contracts, and modernizing aging liquefaction infrastructure.

Opportunities abound, especially considering Algeria's proximity to the EU, where the demand for LNG is on the rise. The global shift towards natural gas due to climate change concerns provides an optimistic outlook. However, Algeria needs to navigate threats such as fierce competition among exporters, the emergence of new LNG exporters, and the ongoing energy transition favoring renewable alternatives.

In light of these factors, it is crucial for Algeria to leverage its strengths, address its weaknesses, and seize the identified opportunities. Strategic collaboration with international partners, investment in modernizing infrastructure, and diversification of its customer base could help mitigate threats, expanding the maritime fleet, investing in regasification terminals in key markets. Additionally, promoting sustainable practices and exploring innovative technologies will position Algeria favorably in the evolving global energy landscape.

Ultimately, with a strategic and forward-thinking approach, Algeria can optimize its LNG exports, solidify its position in the global market, and contribute significantly to the sustainable energy future while aligning with the strategic objectives of the SONATRACH Group.

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