

Institutional Cooperation in Shale Gas: The Role of the Military in Algeria's Development

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Abstract:

This study focuses on the importance of institutional cooperation in the field of shale gas and highlights the prominent role of the military in providing security, stability, and promoting development in this sector. The study concludes that Algeria has all the necessary qualifications to become a leader in shale gas, thanks to its material and human resources, despite lacking exploration technology. This has prompted Algeria to open its doors to specialized international companies for investment, despite potential terrorist threats in the south that put the energy sector at risk. However, the military establishment remains the main guarantor of shale gas investments.

Keywords: Institutional collaboration; shale gas; military institution; development.

INTRODUCTION

Although Algeria is not the only country in Africa with potential shale gas sources, it is the only country that has most of the development prospects. According to the International Energy Agency (IEA), Algeria has about 231 trillion cubic feet of shale gas, enough to meet the demand for natural gas in the 27-member European Union. According to the British "Financial Times," buried shale gas resources in the Algerian desert are worth \$2.6 trillion. Therefore, if Algerian

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Institutional Cooperation in Shale Gas: The Role of the Military in Algeria's Development

shale gas production can match that of the United States, Europe will have the opportunity to dispense with Russian gas imports. Algeria has three major cross-continental pipelines for exporting natural gas to Europe: the Enrico Mattei Pipeline (Transmed), the Medgaz Pipeline, and the Maghreb-Europe Gas Pipeline (MEG). The capacity of the Medgaz pipeline, which transports natural gas to Spain, increased from 283 billion cubic feet per year to 378 billion cubic feet per year by the end of 2021 after the operation of a third turbine compressor. (U.S.EIA, 2023) These gas pipelines can ensure the arrival of gas to Europe, and due to the increasing global demand for gas due to the Russian war on Ukraine, to cover the demand, the Algerian government resorted to considering exploiting shale gas. However, the country's capabilities do not allow for that because shale gas extraction requires a set of specialized skills and resources, including advanced drilling techniques, geological expertise, and environmental management practices. These techniques are lacking. ExxonMobil, a North American oil and gas giant, has negotiated cooperation in the field of shale gas. Before that, Eni, the Italian company, and Royal Dutch Shell and Talisman Energy of Canada signed cooperation agreements with Algeria regarding shale gas exploration. However, the process was halted due to internal pressures.

The military institution is usually tasked with providing security and protection for the mining areas and the surrounding areas. This is due to the strategic importance of these resources, which represent a major source of national income, where the necessary protection is provided for workers, critical facilities, and equipment used in the mining process. The military institution also works to prevent any external attacks or threats that may target those areas, which could disrupt the mining operations and threaten national security. In this article, we will explore the role of the military institution in providing security, stability, and achieving development within the institutional cooperation to study the subject by asking the following question:

Research Question:

- What is the importance of institutional cooperation in extracting shale gas? And how can the military institution contribute to achieving security and stability in Algeria?

Research Hypothesis:

- Institutional cooperation is critical for the responsible and sustainable extraction of shale gas. The military establishment is a key factor in providing security and stability in shale gas mining areas and therefore contributes to development.

research importance: The importance of the topic lies in the fact that institutional collaboration for shale gas extraction is of significant importance due to the country's large reserves. To achieve safe and sustainable extraction, all institutions must collaborate within their areas of expertise in a stable and secure environment. Security and stability cannot be achieved without the military, as their role is crucial in the process of gas extraction and contributing to the country's development.

Search goal: The research aims to highlight the importance of institutional collaboration in shale gas extraction, as well as the importance of the role played by institutions in achieving development and stability and their impact on the development process.

Previous studies:

Study (Tim Boersma & other.2015) "**Shale Gas in Algeria No Quick Fix**": This study concluded that Algerian shale gas is not a quick fix for the EU's alternative energy needs. The country's shale gas extraction is in the early stages, and social unrest is a potential concern. Algeria's natural gas production faces structural challenges, including stagnant production levels, lack of investment, and increasing domestic demand. The country's dependence on hydrocarbon sales is risky given the current market outlook. The lack of reforms inhibits energy policy liberalization and renewable energy

Institutional Cooperation in Shale Gas: The Role of the Military in Algeria's Development

development. Security concerns dominate the country, but avoiding change may jeopardize economic and social development. The Algerian government should engage with local communities and present an economic development plan for southern regions. Attracting foreign investors, market liberalization, subsidy reform, and energy efficiency are necessary for Algeria's economic recovery and energy sector growth. However, the country's long-term prospects and leadership transition may pose risks. The US and EU should engage with Algeria to pursue modest reforms to boost exports and attract foreign investment.

Study (Adjout Abdelkader & Bendib youcef.2021) **"Perspectives du développement du gaz de schiste en Algérie à travers l'expérience américaine"** This study concluded the challenges and limitations of shale gas production in the United States, including rapid decline in well production, high capital costs, and environmental concerns. In Algeria, shale gas reserves are located at significant depths and potential contamination of vital aquifers is a concern. Additionally, the economic viability of shale gas is uncertain given the declining prices of renewable energy sources. The study recommends focusing on the exploration and production of conventional natural gas and investing in solar energy for hybrid electricity production. This will reduce pressure on natural gas production and boost exports, while also supporting the development of electric transportation. The study suggests a complete abstention from shale gas exploitation in the medium term.

Study (Boualem Ammar CHEBIRA & Lynda AMIRAT .2017) **"Shale Gas Exploitation: Challenges for Development in Algeria"**: Algeria faces a strategic choice in its development model, as hydrocarbons have been the main driver of its economy but have also led to a rentier economy. The decline in hydrocarbon production and reserves is a concern, and while shale gas reserves are available, their potential negative externalities make their exploitation unacceptable.

The country needs to focus on diversifying its economy by generating wealth through the productive sector and managing its resources more rationally. Competitiveness, social sustainability, and environmental sustainability should be the key indicators of prosperity, with a focus on maximizing the potential contribution of all members of society while ensuring the prosperity of present and future generations.

The topic will be discussed through the following axes:

- Conceptual framework of study variables.
- Shale Gas Resources and Infrastructure in Algeria.
- The Mechanisms of Collaboration and environmental risks.
- The role of the military institution in achieving development.

A. Concept of institutional collaboration for shale gas extraction :

1- Collaboration definition :

This is a way of thinking about the relationship between people or institutions that generally differ in their nature and activities. It allows for different contributions to be made towards the implementation of a joint project. The approach and methods of this collaboration are agreed upon, and negotiations take place regarding individual and collective interests. (R N R S M-S, 2010, p. 09) Collaboration also refers to the joint work among many participants who may or may not belong to the same organization. (ARAB, 2014, p. 03)

Institutional collaboration means the relationship between multiple organizations participating in achieving a common project. Collaboration involves the repetitive nature of exchanges and a certain convergence around goals and methods. To varying degrees of intensity, it results in the creation of communication channels, transfer of knowledge and standards, exchange or pooling of resources, and coordinated or jointly executed activities. (Tardy, 2011, p. 09)

2- Institutional collaboration definition:

Institutional collaboration refers to a partnership between two or more organizations working together towards a common goal. This collaboration involves unifying efforts, resources, and knowledge to achieve the shared goal in an effective and sustainable manner. It

Institutional Cooperation in Shale Gas: The Role of the Military in Algeria's Development

requires a clear shared vision and defined goals, which are achieved through the exchange of information, expertise, and resources between the participating organizations. (Godwin & Oluseyi Oyerinde, 2017, p. 80)

Institutional collaboration for shale gas extraction refers to the cooperative efforts between various organizations, government agencies, and stakeholders involved in the process of shale gas extraction. Collaboration takes various forms, including: (Doblingera & Other, 2019, p. 1464)

- ♦ Collaboration between government agencies and energy companies to develop policies and regulations governing shale gas extraction.
- ♦ Collaboration between energy companies to exchange expertise, technology, and resources to efficiently and cost-effectively extract shale gas.
- ♦ Coordination between energy companies and local communities to address concerns related to environmental impacts, public health, and safety.
- ♦ Collaboration between research institutions and energy companies to develop new technologies and methods for shale gas extraction that are more environmentally sustainable and socially responsible.

3- Institutions involved in cooperation :

Institutional collaboration is a matter that requires careful handling. (Mourey & Other, 2016, p. 02) The most important institutions that can participate in institutional collaboration for shale gas extraction are:

- **Energy companies:** are companies that operate in the energy sector and produce and distribute fuel and energy for industrial, commercial, and personal use. Energy companies include various companies that operate in fields such as oil, natural gas, coal, solar energy, wind energy, water energy, nuclear energy, and bioenergy.

♦ **The most important energy companies in the world:**

the names of the energy companies, along with their respective countries of origin:

Country	The Energy Companies
United States	Chesapeake Energy; Range Resources; Devon Energy; EQT Corporation; ConocoPhillips; Anadarko Petroleum Chevron; ExxonMobil.
United Kingdom	BG Group
France	Total
Spain	Repsol
Brazil	Petrobras
China	(CNPC) china national petroleum corporation
Norway	Equinor
Netherlands/United Kingdom	Shell
Italy	Eni
Russia	Gazprom
Australia	BHP Billiton ; Santos

Source: Prepared by the researcher based on the data from the source. (IEA, 2020, p. 45)

♦ **Types of Energy-Sector Companies :** (CHEN, 2022)

Below are some of the types of companies found in the energy industry. Each has a distinct role to play in bringing energy to businesses and consumers :

- **Oil and gas drilling and production:** These are the companies that drill, pump, and produce oil and natural gas. Production typically involves pulling oil out of the ground.
- **Pipeline and refining:** Oil and natural gas must be delivered from the production site to a refinery to be refined into a final product such as gasoline. Companies within this portion of the energy sector are called midstream providers.
- **Mining companies:** Coal companies could be classified as energy companies since coal is used to power plants, including nuclear.

Institutional Cooperation in Shale Gas: The Role of the Military in Algeria's Development

- Renewable energy: Clean energy has gained traction and investment dollars over the years and is likely to be a growing part of the energy sector in the future. Examples of renewable energy include wind and solar.
 - Chemicals: Some companies specialize in refining oil and gas into specialty chemicals, although many larger oil producers such as Exxon Mobil are integrated energy producers, meaning they produce multiple types of energy and control the entire process.
- **Government agencies**: are departments or organizations responsible for overseeing or managing a specific sector or field. Here, government agencies refer to departments involved in energy production and related areas and any department that has a direct or indirect relationship with this field. (Government Information Help Guide)
- **Local communities and stakeholders**: are individuals, groups, organizations, or companies that have an interest or concern in the community. Stakeholders can be affected by or have an impact on the actions, objectives, and policies of the community. (Mike, 2008)
- **Research institutions**: are organizations that have been established to conduct research. Although the term often refers to natural science research, there are also many research institutes in social sciences. Here, research institutions refer to all organizations interested in energy production, environment preservation, and other related fields.
- **Financial Institutions**: is a company engaged in the business of dealing with financial and monetary transactions such as deposits, loans, investments, and currency exchange? Financial institutions include a broad range of business operations within the financial services sector, including banks, insurance companies, brokerage firms, and investment dealers. (HAYES, 2024)

B. Definition of shale gas :

Shale gas is a form of natural gas (mostly methane), found underground in shale rock. It is classified as 'unconventional' because it is found in shale, a less permeable rock formation than sandstone, siltstone, or limestone in which 'conventional' gas is found, and it is generally distributed over a much larger area. (LSE, 2022)

Shale gas is extracted through hydraulic fracturing, a technique in which water is pumped at high pressure into rocks to create narrow fractures to allow gas to flow into the wellbore for capture.

C. Definition of Military Institution:

- The Military is the force authorized to use lethal force and weapons to support the interests of the state and some or all of its citizens. It typically consists of an Army, Navy, Air Force, and in certain countries the Marines and Coast Guard. The task of the military is usually defined as the defense of the state, and its citizens, and the prosecution of war against another state. (Metumara Duruji & Other, 2018, p. 447)
- Joseph Nye's definition: "The military are the sector responsible for maintaining security and national sovereignty, performing duties of surveillance, reconnaissance, self-defense, and offensive operations in times of war" (Joseph, 2011, p. 46)
- Martin Schwartz's definition: "The military are a part of the state tasked with implementing national defense and security policies." (Schwartz, 2016)
- Stephen Pedersen's definition: "The military are the institutional group that bears the primary responsibility for defending the state." (George & Rishikof, 2010, p. 18)

The military institution is characterized and features that are not found in other social institutions, including:

- Precise organization and possession of the force represented in the weapons and military equipment at their disposal, used according to the law.
- The army is considered the most advanced national institution in terms of integration, where the leadership of the army plays a very important role in achieving integration through the fusion of individual positions, religious, sectarian, and partisan orientations into a higher loyalty to the nation and the people.
- Technological and organizational advancement: The military institution is the most modern, organized, and technologically advanced of all state institutions.
- The military institution does not consist of a single social class. The army, from the highest ranks to its soldiers, represents a truthful reflection of society

Institutional Cooperation in Shale Gas: The Role of the Military in Algeria's Development

with all its different layers, classes, sects, and groups.

- Hierarchical gradation: The military hierarchy is a precisely graduated social structure, with a higher degree of tight divisions than those observed among the layers and groups formed by social and economic

Section II: Shale Gas Resources and Infrastructure in Algeria

Algeria has significant reserves of shale gas, which qualifies it to be one of the largest producers of shale gas in the world. The Algerian government is actively working to develop its shale gas resources to diversify its energy sources and boost its economy. However, this has been met with opposition from concerned environmental groups, and Algerian experts have called for a national discussion on the issue.

A. Shale Gas Resources:

Algeria's total gas exports to Europe reached 55.2 billion cubic meters, (Intissar, 2022) and with increasing demand for this commodity, especially after the Russian war on Ukraine and the suspension of Russian gas supplies to Europe, Algeria faces the challenge of increasing its production capacity to raise exports. This has led Algeria to reopen the issue of shale gas, which had previously caused controversy and opposition from southern residents in 2015.

In a statement to the press, President Abdelmadjid Tebboune said in an interview with a group of national public and private media officials, "Today, we consume 43 percent of our gas production, and with the number of houses being built, as well as projects to supply gas to residents in mountainous and rural areas, our domestic gas consumption will rise to over 60 percent in the short and medium term. We are a gas-producing country more than a petroleum-producing one, and this is a reality that imposes itself, as we have the second or third global reserve of shale gas, and we do not export any agricultural or industrial materials. The door is open to the exploitation of shale gas, and we will open a discussion with influential groups". (ANA, 2020)

B. Shale gas Basins :

There are many shale gas basins in Algeria, and the following table shows us the most important of them. Here are the following data:

Table 1: Algeria's shale basins and technically recoverable oil and gas resources

Basin - formation	Depth of shale gas reservoirs (ft)	Risked, technically recoverable shale gas resources (tcf)	Risked, technically recoverable shale oil resources (bn barrels)	Organic-rich average net thickness for shale reservoirs (ft)
Ghadames - Silurian Tannezuft	10000-16000	176	0.5	104
Ghadames - Devonian Frasnian	8000-16000	106	3.9	248
<i>Ghadames, total</i>		282	4.4	
Illizi - Devonian Frasnian	3300-8000	56	0.5	162
Illizi, total		56	0.5	
Timimoun - Silurian Tannezuft	5000-15000	59	/	90
Timimoun - Devonian Frasnian	3300-9000	93	/	180
<i>Timimoun, total</i>		152	/	
Ahnet - Silurian Tannezuft	6000-10500	51	/	297
Ahnet - Devonian Frasnian	3300-9500	9	0.2	54 (dry gas) -248 (wet gas/ condensate)
<i>Ahnet, total</i>		60	0.2	
Mouydir - Silurian Tannezuft	5000-10000	10	/	54
Reganne - Silurian Tannezuft	5000-16000	105	0.3	117(wetgas/condensate) -207 (dry gas)
Reganne - Devonian Frasnian	5500-16000	16	0.2	234 (dry gas) -297 (wet gas/ condensate)
<i>Reganne, total</i>		131	0.5	
- Silurian Tannezuft (uncertainty due to limited good penetrations)	6600-14000	26	0.1	54
<i>Tindouf, total</i>		26	0.1	
<i>Algeria, total</i>		707	5.7	

Source : Tim Boersma & Other, Shale Gas in Algeria, P12 , See the link: https://www.brookings.edu/wp-content/uploads/2016/07/no_quick_fix_final-2.pdf .

Institutional Cooperation in Shale Gas: The Role of the Military in Algeria's Development

Through the data presented in the table, it is evident that the Ghadames, Timimoun, and Reganne basins have the largest shale gas resources due to a lack of exploration and assessment of the basin, with these basins containing varying amounts of technically recoverable shale gas resources. The Ghadames basin has the largest estimated technically recoverable shale gas resources at 282 trillion cubic feet, while the Tindouf basin's shale gas resource quantity was not estimated. The estimated technically recoverable shale gas resources in the other basins range from 26 trillion cubic feet to 152 trillion cubic feet. Here is a detailed breakdown of each basin: (ROBEI, 2014, pp. 72-75)

- **Ahnet Basin:** Located in the southwest of Algeria, the Ahnet Basin is one of the most promising shale gas basins in the country. It covers an area of approximately 180,000 square kilometers and is estimated to contain significant shale gas reserves. This basin has an estimated technically recoverable shale gas resource of 60 trillion cubic feet. It is located in a relatively remote area, which may present logistical challenges for exploration and production.
- **Timimoun Basin:** The Timimoun Basin is located in southwestern Algeria and covers an area of about 22,000 square kilometers. It is estimated to contain substantial shale gas reserves and has been the focus of several exploration projects. This basin has an estimated technically recoverable shale gas resource of 152 trillion cubic feet. It is believed to contain high-quality shale formations with good permeability and porosity. The basin also features a thick shale section.
- **Reggane Basin:** The Reggane Basin is located in the southwest of Algeria and covers an area of approximately 30,000 square kilometers. It is also considered a promising shale gas basin and has been the site of several exploration projects. This basin has an estimated technically recoverable shale gas resource of 131 trillion cubic feet, which could make it an attractive target for exploration and production.
- **Illizi Basin:** The Illizi Basin is located in southeastern Algeria and covers an area of about 150,000 square kilometers. It is home to several shale gas plays, including the Tassili n'Ajjer and the Tinrhert plays. This basin has estimated technically recoverable

shale gas resources of 56 trillion cubic feet. The shale formations in this basin are believed to be of good quality and have high organic content and permeability.

- **Ghadames Basin:** The Berkine Basin is located in the southeast of Algeria and covers an area of approximately 140,000 square kilometers. It is a prolific oil and gas basin, but also contains significant shale gas resources in the In Salah and Gourara plays. This basin has the largest estimated shale gas resources in Algeria, at 282 trillion cubic feet. The basin is characterized by a thick shale formation believed to contain a high percentage of gas.
- **Tindouf Basin:** The Tindouf Basin is located in the far southwestern portion of Algeria, bordered on the west by Morocco and the south by Mauritania. the least explored basin in the Sahara Derst platform covers an area of over 116,000 square kilometers. Due to a lack of exploration and assessment, the amount of shale gas resources in this basin is unknown, but it is believed to have a significant amount that would qualify it for investment operations.
- **Mouydir Basin:** The Mouydir Basin is located in central Algeria, west of the Illizi Basin and east of the Timimoun and Ahnet Basins. A variety of upthrust structural ridges separated these basins. covers an area of over 33,000 square kilometers. This basin has an estimated technically recoverable shale gas resource of 26 trillion cubic feet.

The following map shows the distribution of shale gas basins in Algeria :

Figure 1: The most important shale gas basins in Algeria



Source: (Zahraoui & Other, 2021, p. 06), See the link :

<https://www.mdpi.com/1996-1073/14/9/2354>

C. Distribution of gas transmission pipelines :

The following map is related to gas pipelines in Algeria and their distribution from production centers in the country to local markets and exports to other countries:

Figure 2: Gas pipeline distribution map of Algeria



Source : (Ouki, 2019, p. 04)

According to the map, Algeria has a wide network of gas pipelines, which are used to transport natural gas from the country's production centers to domestic markets and for export to other countries. The country is one of the largest gas producers in the world, and gas pipelines are a vital part of its energy infrastructure. Here are some of the most important gas pipelines: (Butt, 2023)

- 1- **The Medgaz Pipeline:** A subsea pipeline that transports natural gas from Algeria to Spain. The pipeline is around 210 kilometers long and has a capacity of 8 billion cubic meters per year. The Medgaz Pipeline is owned by a consortium of companies, including Sonatrach, the Algerian state-owned oil and gas company.
- 2- **The Hassi R'Mel-Biskra Pipeline:** This pipeline transports natural gas from Algeria's Hassi R'Mel gas field to Biskra, a city in eastern Algeria. The pipeline is around 560 kilometers long and has a capacity of 4.5 billion cubic meters per year.

- 3- **The GR5 Pipeline:** This pipeline transports natural gas from Hassi R'Mel to Skikda, a coastal city in northeastern Algeria. The pipeline is around 670 kilometers long and has a capacity of 10 billion cubic meters per year.
- 4- **The Algeria-Sardinia-Italy Gas Pipeline:** This is a proposed pipeline that would transport natural gas from Algeria to Italy via a subsea route across the Mediterranean Sea. The pipeline would be around 1,500 kilometers long and would have a capacity of up to 8 billion cubic meters per year. The project has faced several delays and challenges, including financing and regulatory issues.
- 5- **The In Salah Gas Pipeline:** This pipeline transports natural gas from the In Salah gas field in central Algeria to Hassi R'Mel. The pipeline is around 860 kilometers long and has a capacity of 8.1 billion cubic meters per year. The In Salah Gas Pipeline is owned by a consortium of companies, including BP and Sonatrach.

Algeria is also seeking to establish the Trans-Saharan Gas Pipeline, which is a proposed project to transport natural gas from the country's southern gas fields to Europe via a route through Niger and into Nigeria. The pipeline would be over 4,000 kilometers long and would have a capacity of up to 30 billion cubic meters per year. However, the project has faced several delays and challenges, including security concerns in the region. Despite Algeria's infrastructure for exporting gas via pipelines, it faces a challenge due to population growth in the country. The biggest challenge for gas in Algeria is domestic consumption, leaving little room for exportation. It is possible to increase gas exports to the maximum. With the government's efforts to deliver global gas, the country may need to produce up to 100 billion cubic meters of gas annually to meet the expected demand. (oxford business group, 2020)

Section III: The Mechanisms of Collaboration and environmental risks

A. collaboration mechanisms:

The cooperation mechanisms for the extraction of shale gas in Algeria include various approaches and frameworks to facilitate cooperation between different stakeholders. The following are some of the key cooperation mechanisms:

- **Legal and regulatory frameworks:** This mechanism involves developing laws and regulations that govern shale gas activities and provide a basis for institutional cooperation. This includes legislation related to exploration, production, environmental protection, safety standards, and licensing procedures. These frameworks ensure all stakeholders work within a clear legal framework and facilitate cooperation in compliance and enforcement.
- **Coordination between institutions:** Cooperation between state institutions is necessary to ensure effective management of shale gas activities. Coordination mechanisms, such as joint committees between ministries or working groups, can facilitate information sharing, policy development, decision-making, and coordination of efforts related to shale gas extraction. Regular meetings, joint planning, and collaboration platforms align the activities and responsibilities of different institutions.
- **Cooperation in research and development:** Cooperation between research institutions, academia, and industry plays a crucial role in developing knowledge and technology in shale gas extraction. Collaborative research projects, joint studies, and the exchange of research results facilitate innovation, improvement of extraction and processing techniques, and addressing environmental and social concerns. Creating knowledge exchange platforms, workshops, and conferences that promote cooperation in research and development activities.
- **International cooperation and technology transfer:** Algeria may engage in international cooperation and seek partnerships with countries and companies that have advanced expertise in shale gas extraction. This cooperation can include knowledge sharing, technology transfer, and capacity-building initiatives. International partnerships provide access to best practices,

advanced technologies, and technical expertise, which can be adapted and applied in the Algerian context.

- **Stakeholder engagement:** Cooperation with local communities, civil society organizations, and other stakeholders is of paramount importance to achieve sustainable development of shale gas resources. Regular consultations, dialogue platforms, and community participation mechanisms facilitate cooperation, address concerns, and ensure fair participation in the benefits and impacts of shale gas extraction.

B. environmental risks:

In 2014, four contracts were awarded, including a license for shale gas exploration won by Norwegian company Statoil in partnership with Anglo-Dutch multinational Royal Dutch Shell. In addition, two licenses were granted to a team from Italian company Enel and Dragon Oil - based in the United Arab Emirates and the only new entrant to Algeria - and another license was granted to Spanish Repsol and Shell. Although the results of the licensing round were described as disappointing and concerning, the participation of major oil companies such as Shell and Statoil is seen as a boost that could bring valuable additional capital and expertise. (Nakhle, 2015)

At the beginning of the exploration and drilling process, many protests erupted against shale gas in the southern region of the country. Due to concerns about the economic and environmental impact of shale gas projects, protesters fear the impact of shale gas activities on water supplies and the environment because hydraulic fracturing, the drilling technique used to extract shale gas, requires the use of large quantities of water, which are scarce in Algeria. Some experts also doubt the profitability of this investment in Algeria due to the scarcity of water and lack of local expertise in this field. The following are some of the potential environmental impacts:

- 1- **Environmental impact on water resources:** More than 87% of the weight of the hydraulic fracturing fluid is comprised of water. The hydraulic fracturing process requires injecting a large volume of water into the formation in a short period. Water primarily comes from surface water and groundwater resources, and sometimes from municipal and recycled water sources. In shale

gas extraction areas, the large volume of water required for hydraulic fracturing competes with other water uses, putting water habitats at risk. (X N Li & Other, 2018, p. 91)

- 2- **Air pollution:** There is an environmental concern related to gas emissions into the atmosphere and air quality and their impact on regional populations, the ecological system, and global climate change. Most shale gas platforms contain a proportion of carbon dioxide emissions, similar to conventional gas production, and shale gas has slightly higher emissions than traditional natural gas (up to 4%), but much lower emissions (29% to 38% less) than petroleum or coal products (Natural Resources Canada)
- 3- **Induced earthquakes:** The earthquakes caused by hydraulic fracturing are small, non-destructive earthquakes less than 2 in magnitude, with the vast majority being less than 1 in magnitude. Current evidence suggests that earthquakes occurring during hydraulic fracturing are small in size and below the damage threshold. However, it is still difficult to predict the development of fractures. Fracturing mechanisms and their effects, as well as seismic events, require further investigation. (ZHANG & YANG, 2015, p. 881)

Section IV: The role of the military institution in achieving development

The military institution has various jobs, including security, economic, and social roles, and the traditional security duties remain the primary responsibilities as defined by the constitution. Therefore, the most important job duties are to achieve security and stability.

A. security threats to Algerian national security:

Before addressing the institution's role in development, security threats to Algerian national security must be identified, mainly represented in: (TANDOĞAN & BOUACHA, 2017, p. 313)

- The challenge of the Tuareg issue, Algeria worries about the rise of some extremist groups in Tuareg ethnicity who may call for separation.

- The rise of organized crime such as drug trafficking, arms trafficking, and illegal immigration.
- Foreign intervention under the reason of humanitarian reasons.
- The rivalry among the world's major powers on the natural resources of the Sahel such as petrol, gas, and uranium.
- The military projects proposed in the African continent to build military bases like AFRICOM proposed by the USA. The idea has been refused by many Sahelian countries

B. The Security Role of the Military Institution

The security role is one of the most prominent tasks that distinguishes the military institution from other state institutions. The following are the forms of security that the military institution works to achieve:

- 1- **Border Security:** Securing the borders against illegal activities, illegal immigration, smuggling, human trafficking, arms, and drug trafficking, is a significant challenge, especially in vast and difficult terrains such as the southern borders. (Querine & Matthew, 2015, p. 18) The military plays a crucial role in monitoring and preventing cross-border threats in cooperation with other security agencies such as customs and border police. There are shale gas reserves in areas close to the borders, which may pose an additional security challenge due to illegal activities or regional conflicts. Therefore, the military institution is obliged to ensure the safety of these sites from any potential attacks. Maintaining and controlling borders requires advanced monitoring systems, border patrols, and coordination with neighboring countries. In the context of border protection and combating smuggling and organized crime, the army's accomplishments for the year 2022 included arresting 11,050 people and seizing 2,543 tons of foodstuffs intended for smuggling and speculation, in addition to 1,961,624 liters of fuel intended for smuggling, 1,165 vehicles, 5,912 pneumatic hammers, 9,381 generators, 273 metal detectors, 973.4 tons of raw gold and stone mixture, 104.8 tons of copper and aluminum, 1,733 quintals of tobacco, in addition to 302,064 units of drinks and 310,452 units of fireworks. (mdn, 2023)
- 2- **Internal Security:** Dealing with internal security threats such as terrorism, rebellion, and organized crime is a significant

challenge. Preventing terrorism, enhancing security and securing borders, managing and protecting cyberspace, and ensuring national and economic security are crucial aspects of internal security. (RAND, 2011, p. 27) The military institution, represented by the National Gendarmerie, works to maintain internal security, law, and order, especially during times of civil unrest, social protests, or political instability. Protecting critical infrastructure, and public safety, and responding to emergencies are important aspects of ensuring internal security.

- 3- **Infrastructure Security:** Identifying risks is the first step towards developing risk management strategies and mitigating them. (Baartz & Other, 2003, p. 02) The military institution works to provide security and protection for shale gas infrastructure and facilities. This includes protecting drilling sites, pipelines, processing facilities, and transportation routes against potential threats such as terrorist attacks, sabotage, or illegal activities. The military presence near these sites ensures a safe environment for shale gas extraction activities.
- 4- **Security and Stability:** The absence of security fuels a phenomenon, as the absence of security and terrorism are two inseparable phenomena. Domestic terrorism and all other social crimes are committed in the absence of a strong security structure. (Iregbenu & Uzonwanne, 2015, p. 170) Ensuring security and stability are of utmost importance for the success of cooperation in shale gas extraction. Addressing the security challenges facing the military institution, including the risks of terrorism, social unrest, and border monitoring, is essential to protecting infrastructure, ensuring employee safety, and maintaining uninterrupted operations. In the field of counterterrorism, the military institution has neutralized 39 terrorists according to the 2022 report, where 20 terrorists were eliminated, 5 surrendered, and 14 were arrested, in addition to "arresting 371 support elements for terrorist groups, uncovering and destroying 64 terrorist hideouts, and 97 homemade bombs". (Radio Algérienne, 2023)
- 5- **Cybersecurity:** With the proliferation of the internet and the expansion of electronic governance, e-commerce, healthcare, banking services, energy distribution, and more, cyber threats

such as hacking, data theft, account hijacking, and so on have emerged. (Pande, 2017, p. 40) Protecting military networks, information systems, and critical infrastructure from cyber threats, hacking attempts, and information warfare poses significant challenges. Building strong cybersecurity capabilities, conducting regular assessments, and staying constantly updated on emerging cyber threats is crucial. The military institution must recognize the importance of this and work to ensure that energy extraction sites are secure from any potential cyber threats that could disrupt or damage these facilities.

C. The role of the military institution in providing security and achieving stability

Algeria shares borders with several countries, including Tunisia, Libya, Niger, Mali, Mauritania, Western Sahara, and Morocco. These borders, which span over 6343 km, are difficult to control due to their vastness. Algeria shares 982 km of its border with Libya, 1376 km with Mali, 463 km with Mauritania, 1559 km with Morocco, 956 km with Niger, 965 km with Tunisia, and 42 km with Western Sahara. The southern border, which includes the Sahara, presents a major challenge for security forces. The coastal region has become a source of security threats for Algeria. Algerian leaders recognize that their country is located in a region experiencing many internal crises, such as rising ethnic conflicts, weak economies, and fragility. Terrorist groups with links to Libya carried out attacks on oil and natural gas facilities in Algeria in 2012 and 2013. Algeria wants to prevent jihadists from using Libya as a base to launch further attacks in the region. The last major attack in Algeria was in 2013 against the In Amenas gas plant. According to Algerian officials, Al Qaeda in the Islamic Maghreb and other terrorist groups no longer pose a significant threat inside Algeria. The southern border remains a source of concern for security forces, as the situation in neighboring countries affected by conflict has prompted Algeria to devote significant resources to control its southern borders. The Algerian army patrols and monitors the borders, which are, at least in theory, closed as much as possible, although the vastness of the area and the length of the

Institutional Cooperation in Shale Gas: The Role of the Military in Algeria's Development

borders make it difficult. Around 70% of the Algerian army is deployed to control the territory, most of it on the borders. Algeria maintains small military sites and uses aircraft, as well as satellites and unmanned aerial vehicles, to gather intelligence and monitor the borders. (Hallqvist & Hammargren, 2020, pp. 27-33)

Through deterrence, risk mitigation, coordination, and counterterrorism, the Algerian military protects the shale gas industry from potential destabilizing threats. Its role is considered vital to attract foreign companies to invest in the Algerian shale gas resources. Here are some of its tasks:

- ***Physical Protection:*** The military protects shale gas sites such as drilling platforms, fracking operations, pipelines, storage facilities, etc. from terrorist attacks. Armed forces are deployed to guard these sites and escort convoys. This deters terrorists from targeting shale gas infrastructure because of the risks of confrontation with the army. (William Bill, 2008, p. 16)
- ***Coordination with foreign companies:*** International oil companies have their security measures but still need to coordinate with the Algerian military. The military shares intelligence on potential threats and advises companies on security risks in various locations. The companies are also counting on the military to respond in the event of any attacks on shale gas facilities.
- ***Securing Transport Routes:*** The Army secures major transport corridors and access roads to shale gas sites to enable the safe movement of supplies, equipment, and personnel. It spreads its forces along the roads, especially in remote desert areas.

D. The support of the military establishment for the process of extracting shale gas

The military establishment can provide support for the process of extracting shale gas in several ways, including:

- 1- ***Infrastructure development:*** The military has significant experience in building and maintaining infrastructure in remote and challenging environments. This expertise can be leveraged to support the development of infrastructure necessary for shale gas

extraction. The assistance provided by the military establishment for infrastructure development includes roads, bridges, airports, communication networks, and other public structures, and can take the form of funding, technical expertise, and other necessary resources for infrastructure construction and maintenance. There are many examples of the military establishment's capabilities, such as in Pakistan, where the army played a significant role in building dams, highways, and other infrastructure projects, such as the China-Pakistan Economic Corridor (CPEC), which is expected to boost the region's economy by enhancing connectivity and creating new job opportunities (CPEC, 2022). In India, the Border Roads Organisation (BRO) is a wing of the Indian Army responsible for building and maintaining roads and bridges in border areas. The aim is to support transportation networks with all neighboring regions to facilitate movement and enhance trade. (GlobalSecurity, 2021)

- 2- **Emergency response:** The military can provide support for emergency response and disaster relief efforts in the event of accidents or natural disasters that could affect shale gas extraction operations.
- 3- **Security consulting:** The military can provide expert advice and consulting services on security risks and vulnerabilities related to shale gas extraction, as well as on strategies to mitigate these risks and enhance the security of operations.
- 4- **Technology transfer:** The military has access to advanced technologies and equipment that could be useful in shale gas extraction operations, such as unmanned aerial vehicles (UAVs), advanced sensors, and communication equipment. The military can facilitate the transfer of these technologies to the private sector for use in shale gas extraction.

E. The importance of the role of the military institution in ensuring security and stability :

The primary role of the military institution is to ensure security and stability, which is important for several reasons. We can summarize these reasons as follows:

- 1- **Protecting national sovereignty:** There is a claim that states are vulnerable to violating their national sovereignty under the guise of human rights, which may amount to military intervention in some cases. This claim is based on the fact that the international

community has become increasingly intrusive into what was once under the domain of the domestic affairs of the state. (Irina, 2013, p. 26) The military institution is responsible for protecting a country's borders and territorial integrity, which is essential for maintaining national sovereignty and independence.

- 2- ***Combating external threats:*** Combating external threats it's to the actions taken by a country, organization, or group to defend itself against threats that originate from outside its borders. These threats can come in many forms, including military attacks, terrorism, cyber-attacks, economic warfare, and espionage. External threat means an external force that threatens some or all of those in relation or structure, and military force has been developed to confront these threats. (Emanuelson & Willer, 2015, p. 02) Preparation for internal and external security threats that could manifest, in the near and distant future, is an investment that a nation must make. A nation that is at the cusp of economic and regional power status cannot afford to be defensive and reactive in its response to internal and external threats. (Iasscore, 2018) The military institution plays a crucial role in defending the country against external threats, such as terrorism, aggression, and invasion.
- 3- ***Maintaining internal security:*** The military institution helps to maintain internal security by supporting law enforcement agencies in maintaining law and order and responding to emergencies and disasters. The military may sometimes be required to assist the civilian authorities in dealing with levels of internal tension, violence, or unrest, for example assisting the police in maintaining or restoring law and order. Armed forces are increasingly involved in such operations in their national circumstances. (icrc, 2002, p. 02)
- 4- ***Supporting economic development:*** The military institution can play a role in supporting economic development by providing security for businesses and infrastructure projects, as well as contributing to the development of the defense industry. An example of this is what the Algerian army did during the hostage crisis in Ain Amenas in 2013. Armed militants affiliated with Al-Qaeda attacked a gas facility operated by a joint venture between British Petroleum (BP), Statoil, and Sonatrach. In response, the

Algerian army launched a military operation to rescue the hostages, which resulted in a violent confrontation with the militants. While the operation was criticized for its harsh tactics, it emphasized the Algerian state's commitment to protecting foreign investors and ensuring the security of the vital economic infrastructure. Following the attack, the government increased security measures and deployed additional forces to protect other vital sites, such as oil and gas facilities, to prevent similar incidents from happening in the future. (Union Africaine, 2013, pp. 01-03)

CONCLUSION

In Algeria, institutional cooperation plays a crucial role in the country's development and in achieving security and stability. Collaboration between various institutions is necessary to address the challenges associated with shale gas extraction. This collaboration includes the development of regulatory frameworks, infrastructure, technological expertise, environmental considerations, mitigation of environmental impacts, and maximizing economic potential. Alongside other state institutions, the military also contributes to maintaining security and stability, playing a crucial role in addressing various security threats. This role is essential for achieving economic development and attracting foreign investment. The following are the most important recommendations that can be made to achieve the goals of cooperation for shale gas extraction:

- 1) Enhancing coordination between various institutions related to shale gas.
- 2) Developing specialized expertise through training and capacity building.
- 3) Enhancing regulatory frameworks specific to shale gas extraction.
- 4) Improving public awareness and participation, including local communities and stakeholders.
- 5) Facilitating partnerships with national and international companies.
- 6) Prioritizing environmental protection and compliance with strict standards.
- 7) Implementing monitoring and evaluation mechanisms to track progress and adjust strategies accordingly

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