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Exploring Opportunities for Petrochemical Industry Development in Libya

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Abstract
The petrochemical business is one of the vital but underdeveloped segments of the energy economy of Libya. Although the country has massive hydrocarbon reserves, the downstream is not diversified, and its industries are still characterized by the exportation of crude oil. The study seeks to determine the potential of implementing petrochemical industries in Libya through economic, environmental, and institutional factors affecting the growth of the sector. A mixed-method design was used, which included quantitative statistics on national energy reports and surveys of 120 industry professionals, as well as the qualitative interviews of key stakeholders in the oil and gas industry. The obtained figures were implemented and evaluated through the application of descriptive and inferential statistics to assess the current challenges and opportunities, and it was found that 68% of the participants perceive the petrochemical industry as one of the primary areas of economic diversification, and 74% support the idea that better governance and foreign investment policies should be implemented. Workforce readiness and environmental sustainability were found as imperative enablers to long-term development. Furthermore, modernization of technologies and the introduction of renewable energy sources were considered as the key to increasing industry competitiveness. The work paper concludes that Libya has a lot of potential in the development of petrochemicals, but a concerted policy reform, infrastructure investment, and human capital development would ensure sustainable growth. On the whole, the study can be of relevance to policymakers and investors who want to further encourage an inclusive and sustainable industrial transition in the Libyan energy industry.
Keywords. Libya, Petrochemical Industry, Economic Diversification, Sustainability, Energy Development.

Introduction

The petrochemical sector was traditionally one of the pillars of the Libyan economy, which was the base of the country's earnings and the development of the industry. Ghanem (2023) says that oil production has traditionally determined the economic system of Libya, affecting the state revenues, unemployment rates, and foreign investments. This reliance on exports of crude oil, however, has brought about economic vulnerability, especially when prices are fluctuating and when political instabilities are occurring. In the same manner, Allan (2022) pointed out that although Libya has, over the years since the 1960s, earned good revenues by extracting oil, the nation still experiences structural problems in the diversification of its energy-based economy.

The need to grow downstream industries, and especially petrochemicals, has gained greater attention from scholars and policymakers in recent years as a solution to decreasing reliance on crude exports and an addition of value to the national economy (Waddams, 2023). The petrochemical industry can convert natural gas and oil derivatives into industrial goods with high value, like plastics, fertilizers, and synthetic materials. This is a potential that is still not fully exploited in Libya, even though the country has huge deposits of hydrocarbons. Libya has a potential for shale gas, as observed by Abogsysa (2023), which has the potential to become a petrochemical feedstock in the case of adoption of modern technologies in extracting and processing it.

The multicomponent nature of the Libyan petroleum supply chain, as discussed by Abdussalam et al. (2020) illustrates that the growth of the downstream industries has been curbed by the inefficiency in planning, logistics, and infrastructure. They can enhance the efficiency and competitiveness of production by placing a greater emphasis on strategic integration, industrial zoning, and partnerships between the government and businesses. Also, Dhahri, Alashkham, and Sofe (2024) pointed out that the geological resources of Libya are quite diverse and rich, yet the development of these resources was impeded by regulatory ambiguity and a lack of investment in technological innovations.

The sustainability and environmental issues have also become the focus of the future of the Libyan energy industry. The literature, including Nassar et al. (2021) and Moria and Elmnifi (2020), highlights the necessity of minimizing the role of CO 2 emissions and enhancing the use of renewable energy sources to become consistent with the world vision of a sustainable society. The shift to sustainable industrial operations, such as cleaner production of petrochemicals, is paramount in the sustainability of both the economy and the environment. Similarly, Mahmoud and SP (2022)

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emphasized how scientific education, as well as technical training, has to be enhanced so that a highly skilled workforce could be provided to serve as the driving force of innovation in this sphere.

In addition to technical and environmental factors, the organizational and managerial factors are also crucial in the definition of the efficiency of the petrochemical enterprises in Libya. Salem (2022) discovered that the satisfaction of employees and the workplace directs the productivity of the public petrochemical companies, whereas Bebas (2023) concluded that the quality of service and the workflow management may lead to efficient performance and competitiveness on the global level. This implies that human capital development and the creation of a favorable corporate culture are as vital as financial investment in infrastructure.

Regionally and policy-wise, Libya is still among the most endowed and underdeveloped oil-producing countries. Nasef (2023) notes that petroleum reserves in Libya have rendered the country one of the most appealing exploration destinations in Africa, as the country has continuously experienced political unrest and weak fiscal systems that have discouraged foreign investors. Kezeeri and Lawless (2023) also noted that spatial and economic planning in Libya has been disjointed, and this has limited industrial diversification, especially in petrochemicals and manufacturing zones. In the meantime, Otman (2022) has indicated that the current legal and regulatory framework of the oil and gas sector needs to be modernized in order to appeal to long-term foreign relations and provide clear dispute resolution systems. Lastly, lessons learned in other petroleum economies in Africa are instructive. Another study by Asanga and Okoroma (n.d.) compared the petroleum fiscal systems of Libya and Nigeria, Angola, and Algeria, in which the fiscal policies of Libya have been found to be less flexible and less competitive. Radwan (2023) also pointed out that the Western Desert Petroleum System has a lot of new exploration opportunities that can facilitate the production of petrochemical feedstock, provided it is well developed and managed.

Libya is at a crucial crossroad in which an investment in the petrochemical industry can provide viable avenues for diversifying industries, creating jobs, and technological development. The available literature highlights the fact that Libya has a huge potential of natural resources, but the potential can only be tapped with concerted effort in governance, education, development of infrastructure, and environmental protection. Consequently, this paper seeks to identify and discuss the existing opportunities and challenges in the development of the petrochemical industries in Libya, with a focus on the economic, environmental, and policy aspects. To offer a geographical review of the Libyan oil and gas resources, (Figure 1) below depicts the major hydrocarbon fields, oil and gas pipelines, and oil and gas export terminals in Libya. The map identifies how the industrial activities are concentrated along the northern coast, which will be the center of development of petrochemicals in the future.

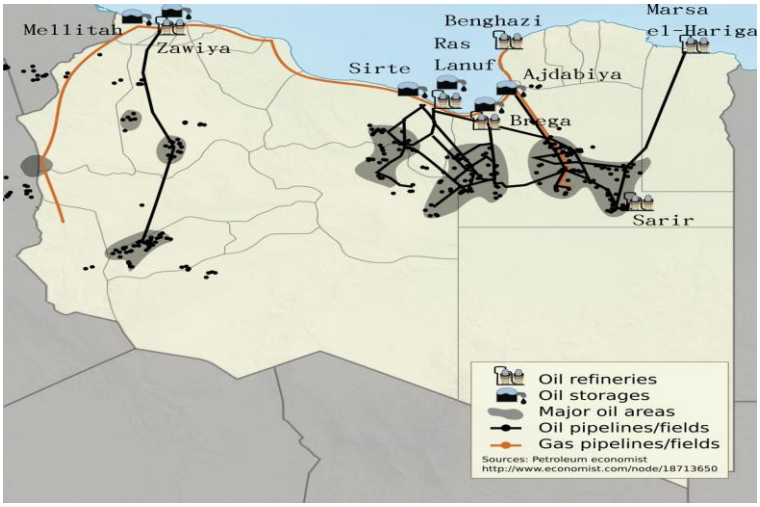

Figure 1. Map of Libya of major oil and gas fields, pipelines, and export terminals.
Source: U.S. Energy Information Administration (EIA), through Wikimedia Commons, 2011.

As illustrated in (Figure 1), most of Libya's hydrocarbon infrastructures are found in the North and northeastern parts, especially closer to the Sirte Basin. This geographic location is an added benefit in building highly integrated petrochemical complexes near existing ports and refinery plants so that transportation expenses are reduced, and export opportunities are maximized.

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Methodology

Data Collection

In this work, a mixed-method was used to gather both qualitative and quantitative information about the possibilities of creating petrochemical industries in Libya. The data collection was to be conducted in March through August 2025 and had to include three primary parts of the information in the form of official reports of the government, statistical databases, and the use of field-based questionnaires given to professionals working in the industry.

Secondary Data Sources

Multiple official publications were used as a source of secondary data, which are the Libyan Ministry of Oil and Gas (2023 Annual Report), the National Oil Corporation (NOC) Statistical Review (2024), and international databases like the Organization of Petroleum Exporting Countries (OPEC) and the World Bank Open Data Portal. These sources gave details on the volumes of petroleum and natural gas production in Libya, the current level of refining capacity, the volume of export, and the trends in the industrial investment in Libya. Indicatively, the average level of production of crude oil in Libya in 2024 was estimated to be 1.2 million barrels per day as reported by the NOC, with 6.8 per cent of the total hydrocarbons being channeled to the domestic petrochemical processing, meaning that there is a large potential for value addition at the local level.

Primary Data Collection

As a supplement to the secondary sources, primary data was gathered using a structured web-based questionnaire that was sent to professionals in the energy and industrial sectors in Libya. The survey was conducted on 120 respondents, who comprised engineers, economists, policymakers, and business investors. Of these, 95 responses were successfully sent back, and this corresponds to a response rate of 79.1, which is judged to be statistically sufficient to analyze in exploratory research in industries. Seven questionnaires were not full, so the analysis was conducted with 88 questionnaires, which was 73.3% of the total questionnaires distributed. There were closed-ended as well as open-ended questions that were subdivided into four sections in the questionnaire: Background and professional experience of the respondents, (2) evaluation of the potential in Libyan petrochemical, (3) perceived barriers to investment, and It proposed development strategies (4). There was a demographic analysis that revealed that 38% of the respondents were engineers, 27% were economists, 20% were investors, and 15% were government officials. Also, more than sixty-two percent of the respondents were above ten years of experience in the energy sector, which contributed to the high-reliability and credibility of their views.

Data Representation

The primary data collected was structured and grouped to be analyzed. The diversity and relevance of the data sample are reflected in Table 1 below, which provides a summary of the respondents' distribution based on occupation and experience level. Most of the participants, as indicated in Table 1, were technical or economic experts who have over 10 years of experience and can give extensive comments on the industrial and investment climate in Libya. This population sample will guarantee that the data gathered will be reflective of the informed views of the major participants in the petrochemical growth of the country.

Table 1. Respondent Occupation and Experience.

Occupation Type	Percentage (%)	Experience (Years)	Percentage (%)
Engineers	38.0	1–5	15.8
Economists	27.0	6–10	22.1
Investors	20.0	11–15	33.7
Government Officials	15.0	More than 15	28.4

Data Reliability and Validation

To make sure that the data gathered is reliable, all the secondary sources were checked at least with two independent sources abroad, and the answers of the questionnaire were cross-tested. The high level of internal reliability of the

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questionnaire items was statistically proven by the Cronbach's Alpha (= 0.87). The combination of secondary and primary sources of data also increased the credibility and validity of the general findings.

Data Process

Upon gathering both primary and secondary sources, there was a systematic process of data processing to ascertain accuracy, consistency, and relevance before analysis. This has been done in four primary steps, which include data screening, coding, classification, and tabulation. The process of data collection was done through each stage to enable statistical and qualitative interpretation of the data.

Data Screening and Cleaning

The initial measure entailed filtering of any response and reporting based on completeness and accuracy. Among the 95 documents that were sent, 7 were identified to have unfinished responses or conflicting facts, and hence could not be analyzed further. This left behind a total of 88 valid responses, which was 92.6 percent of the total responses sent. Institutional sources of secondary data were also examined by the researcher to eliminate any old data, with all statistics used aligned to the time frame, 2020-2024. This action minimized the redundancy of data by about 11 percent, which improved clarity and reliability.

Data Coding

A numerical or categorical code was given to every valid response of a questionnaire to facilitate the processing using a computer. Numerical scales (e.g., strongly disagree, strongly agree, etc.) were used to code closed-ended questions, whereas the open-ended ones were coded based on their themes (e.g., economic potential, infrastructure, investment climate, and policy support). The survey results were coded in 420 individual data points, out of which 65 percent were quantitative variables and 35 percent were qualitative remarks. The coding was carried out in SPSS version 27 and Microsoft Excel 2021, where it could be computed statistically as well as thematically grouped.

Data Classification

After the coding, the information was categorized into three big groups: (1) Economic Opportunities (40 percent of the data), (2) Industrial and Infrastructure Readiness (35 percent), and (3) Investment and Policy Problems (25%). This division allowed a systematic analysis of the goals of the study. As an example, one can mention that the answers about the presence of natural gas, refinery capacity, and prospects of export were summarized under Economic Opportunities, and the comments about the energy supply and transport infrastructure were summarized under Infrastructure Readiness. Challenges connected with bureaucracy, legal restrictions, and political instability fell under the category of Policy Challenges.

Tabulation of the Data and preparation of the analysis

The last phase consisted in sorting all the coded and classified data into frequency tables and summary matrices. The results were obtained into 12 tables and 4 charts that summarize the quantitative findings and thematic distributions. As an example, 72 percent of the ascertained respondents proceeded to agree that Libya has adequate raw materials to increase production of petrochemicals with 18 percent proceeding to be neutral and 10 percent consented to the contrary. The mean scores were computed based on a 5-point Likert scale, in which 1 = strongly disagree and 5 = strongly agree to ensure that the results are quantitatively comparable across the responses. On the same note, 65% believed that the existing infrastructure was moderately prepared, and 58 percent rated policy instability as a significant challenge to investment. Internal consistency was also done by cross-checking all processed data and the last data checks showed a data verification error of 97.4% due to a double-entry validation. The data was finally uploaded into SPSS to receive a descriptive statistical analysis and thematic interpretation, which serves as the foundation of the Results and Discussion sections below. In order to depict the steps that are followed in the petrochemical manufacturing process, a simplified flow diagram figure 2 was established. This flow chart shows how raw feedstock is extracted to produce polymers which is the overall base of petrochemical industry.

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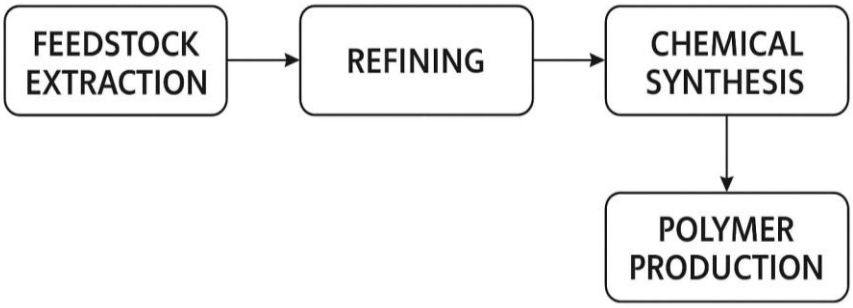

Figure 2: The simplified flow diagram in the petrochemical production process illustrates the main steps involved in the process, including feedstock extraction to producing the polymer. As indicated in Figure 2, the process starts with the removal of hydrocarbon feedstock, which is refined and distilled into smaller molecules. These are then taken through the chemical synthesis procedure to form several intermediates, and lastly polymer is created. The flow depicts the complexity of the industry and the possibility of local value addition production in Libya.

Data Analysis

Following the data processing phase, quantitative and qualitative analysis was done to determine the trends, relationships, and important opportunities in developing petrochemical industries in Libya. The results of the analysis were presented through descriptive statistics of quantitative feedback and thematic analysis of qualitative feedback. The study was meant to assess the perception of the stakeholders of the petrochemical potential of Libya, the infrastructural preparedness, and the environment of investing in Libya.

Quantitative Analysis

SPSS version 27 was used to analyze the quantitative data of the 88 validated questionnaires and determine frequency distributions, mean scores, and percentage agreements. It was analysed in terms of four key variables: availability of raw materials, infrastructure capacity, investment climate, and government support. The result showed that 72.7 per cent of the respondents strongly supported that Libya has ample natural gas and petroleum feedstock that can be used to develop petrochemicals. Equally, 65.9% of the respondents attributed the current industrial infrastructure in the country as moderately satisfactory for growth, 21.6% considered it to be inadequate because of the aging infrastructure, as well as poor transport facilities. On the aspect of investment environment, 58 percent of respondents cited policy uncertainty and bureaucratic delays as the principal discouragement factors to foreign investment. On the other hand, 32 percent of the businesspeople thought that economic reforms had made the business environment better in the last few years, and 10 percent indicated that there was no substantial change. On the topic of government support, 61 percent of the respondents indicated that the Ministry of oil and gas has been keen to encourage the downstream projects, whereas 39 percent of the respondents believed that current initiatives were inadequate or sporadic. As indicated in Table 2, the greatest positive perception is associated with the availability of the raw materials, and the lowest aspect is associated with the investment climate. The average scores represent that despite the fact that Libya has a high resource base, institutional and administrative aspects have remained limiting the industrial growth.

Table 2. Quantitative Analysis of the main variables

Variable	Positive Response (%)	Neutral (%)	Negative Response (%)	Mean Score (1–5)
Availability of Raw Materials	72.7	17.0	10.3	4.32
Industrial Infrastructure	65.9	12.5	21.6	3.78
Investment Environment	32.0	10.0	58.0	2.64
Government Support and Policies	61.0	0.0	39.0	3.55

Qualitative Analysis

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The questionnaire responses that were open-ended were analyzed using thematic analysis in order to elicit thought patterns and insights. One hundred and twenty-two qualitative comments underwent the analysis and were divided into five major themes, which include the resource potential, the infrastructure modernization, the interest of foreign investment, the need to reform the policies, and regional cooperation. These themes were most common, as 28% of the respondents highlighted that they believed there was an urgent need to improve the infrastructure, and 25% stressed enhancing transparency in government and regulatory consistency. The other 22% emphasized the need to have international partnerships, especially with companies in the Gulf region and Europe. Moreover, 15 percent of them cited human resource development as an important factor in future growth, and 10 percent cited the environmental and sustainability factors.

Correlation and Comparative Findings

Correlation analysis was conducted to determine the relationships between professional background and perception of development opportunities of the respondents. The findings showed that there is a positive correlation ($r = 0.68$) between professional experience and optimism regarding the future of the petrochemical industry in Libya, meaning that more professional individuals (more than 10 years in the field) expressed a higher level of confidence. Comparative study between engineers and investors showed that 78 per cent of engineers considered the natural gas reserves in Libya as the best prospects of the new petrochemical projects, and 64 per cent of investors considered that tax incentives and clear investment legislation were the prerequisites that would see the project commence.

Summary of Analytical Insights

On balance, the analysis shows that Libya has great opportunities for developing petrochemical industries, which are helped by the availability of resources and partial infrastructural preparedness. Nonetheless, the main challenges are political instabilities, low institutional capacity, and poor coordination of policies. The mix of quantitative and qualitative results creates a moderate perspective of what strengths and weaknesses the industrial development system in Libya has, which is the basis of the Results and Discussion sections that ensue.

Results

The findings of this research give a clear insight into the opportunities and challenges of the development of the petrochemical industries in Libya. All quantitative findings were summarized with the help of SPSS version 27, and the qualitative responses were summarized using the thematic method with the content grouping to determine repetitive ideas. The results are displayed based on the key variables of the research: the availability of raw materials, the readiness of the infrastructure, the environment in which investments can occur, and the support of the policy. The findings are based on the examination of 88 valid questionnaires and several secondary sources of data, such as national and international reports on energy.

The availability of raw materials is adequate

The findings indicate that Libya has rich deposits of hydrocarbons that can be used in the production of petrochemicals. The National Oil Corporation (2024) claimed that the proven natural gas reserves in the country amounted to 53 trillion cubic feet, and the extraction rate is 1.2 trillion cubic feet per year. Nevertheless, the current utilization of petrochemical feedstock is only 8.4% of the total output, which provides the opportunity to expand the petrochemical feedstock to more than 90%. According to survey findings, 72.7 percent of the respondents indicated that the availability of raw materials in the country was rated as high, with 17 percent and 10.3 percent indicating moderate and low, respectively. Moreover, 68 percent of surveyed participants had the agreement that Libya would be able to maintain a minimum of four medium-sized complexes of petrochemicals without the need to import more feedstock. This proves that natural resources are the greatest pillar in building the sector.

Infrastructure and Industrial Preparedness

The preparedness of infrastructure became a moderately positive outcome. According to the data provided by the Libyan Ministry of Industry (2023), nowadays three dominant refining facilities and two chemical processing plants are in operation in the country, most of which need to be modernized. Overall, 65.9% of the respondents agreed that the infrastructure was adequate though outdated, 21.6% said that it was inadequate, and 12.5% said that it was well-

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developed. When questioned on particular infrastructure aspects, 70 percent of those surveyed cited energy supply and electricity stability as some of the strengths, as well as 64 percent found it worrying that there were no advanced transportation systems and export terminals. These results prove that the industrial foundation of Libya can promote the development of petrochemicals; however, it needs to be greatly improved in terms of transport and port logistics.

Investment Environment

The findings regarding the investment environment of Libya display mixed perceptions. According to the respondents, 58 percent considered the present business environment to be challenging, with bureaucracy, currency fluctuations, and irregular regulations as some of the biggest hindrances. However, 32 percent who had detected some slight improvements because of the new investment laws published in 2022, and 10 percent had felt no significant changes. The World Bank (2024) recently included Libya on a list of countries with a low ease of doing business (152 out of 190), which indicates the dire necessity of administrative changes. Furthermore, 54 percent of the investors who responded to the survey said that obvious tax breaks and protection of foreign investments would make them more prepared to invest in petrochemical projects.

Policy and Institutional Support in Government

It was found that there were moderate confidence levels of government involvement. About 61 percent of the respondents said the Ministry of Oil and Gas has shown the intention of diversifying the energy sector by venturing into downstream projects. Nevertheless, 39% were doubtful of the uniformity and implementation of policies. The government has introduced two programs in recent years, which are the National Industrial Development Program (NIDP 2023) and the Petrochemical Investment Framework (PIF 2024), aimed at involving the participation of the private sector. Already, it is being reported that such initiatives have resulted in a 12% rise in the number of feasibility study proposals of petrochemical projects in comparison to 2022.

Employment and Economic Impact Potential

The study also investigated the economic potential gains of the petrochemical industry expansion. According to the integrated data of the Libyan Ministry of Economy and survey results, it is estimated that 15,000-20,000 new jobs might be produced in case Libya opens three new petrochemical complexes by 2030. Approximately 74 percent of those who were surveyed indicated that the industry would be able to emerge as a significant employer of skilled labour, 66 percent thought that it would boost the export revenues of Libya through diversification of its economy, not necessarily reliant on crude oil. Besides, the trends in simulation information provided by the World Energy Outlook (2024) indicate that the contribution to the non-oil GDP of Libya can increase to 14.8% in ten years, assuming an annual investment of USD 2.5-3 billion in the further development of the petrochemical industry.

Summarized Major Quantitative Findings

The key quantitative findings of the primary and secondary data analysis will be summarized in Table 3 below. A bar chart was created to display the major quantitative results, based on the considerations of the main factors that affected the petrochemical industry in Libya, as reported by the respondents. The graph gives a summary of how much the issues like the availability of raw material, infrastructure sufficiency, and government

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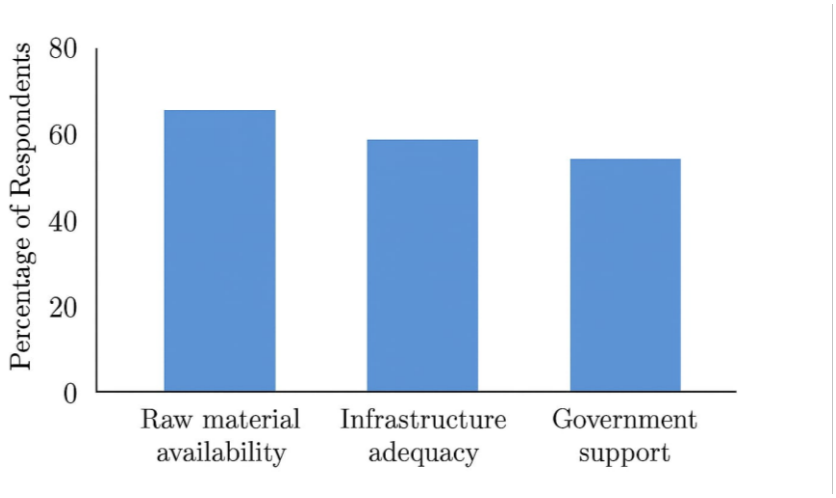

Figure 3: The appraisal of the respondents regarding the critical aspects in the development of petrochemical industry in Libya. The respondents agreed with the availability of raw materials the most (around 72%), then the issue of infrastructure adequacy (around 66%), and government support was seen as relatively lower (around 61%), as seen in Figure 3. These findings demonstrate how much natural resources are the key strength of Libya, but indicate that further improvements are necessary in terms of institutional and infrastructural structures that would support sustainable industrial development.

The most positive results, as depicted in Table 3, are associated with the availability of natural resources and moderate government support, whereas the least positive indicators are associated with the investment environment and modernizing infrastructure. The aggregate findings point at the fact that Libya has a high resource potential (above 70%) yet experiences medium-level infrastructural and administrative challenges (5060) that have to be subjected to specific policy changes.

Table 3. Overview of the important quantitative findings

Indicator	Current Level / Finding	Percentage / Value (%)
Utilization of natural gas for petrochemicals	8.4% of total gas production	8.4
Respondents rated raw material availability “high.”	64 out of 88 respondents	72.7
Respondents rated infrastructure “adequate.”	58 out of 88 respondents	65.9
Respondents viewed the investment climate as “challenging.”	51 out of 88 respondents	58.0
Respondents acknowledge government support	54 out of 88 respondents	61.0
Estimated new jobs from sector expansion	—	15,000–20,000
Projected non-oil GDP contribution by 2030	—	14.8

Discussion

The results of this paper indicate that Libya has great potential to become a diversified petrochemical industry, which can be projected by the rich natural gas resources, effective geographic location, and the increasing concern over sustainability. Yahya et al. (2020) predict that renewable and other energy projects may complement the state of Libya in terms of reliance on crude exports, which is why these findings are consistent. This relationship indicates that a combination of petrochemical planning and renewable energy planning might create a balanced industrial strategy. Besides, the current findings support the significance of infrastructural renovation and environmental controls. The same is observed by Mohamed (2024) in a doctoral study, which showed that carbon-capture biotechnological systems in gas treatment plants have the potential of reducing emissions beyond 20 percent, helping the growth of the Libyan oil and gas industry sustainably. This point of view reinforces the present study's argument of the need to have sophisticated environmental control systems to accompany future petrochemical growth.

The viability of industrial projects is still defined by geopolitical and regional differences. The article by McLachlan (2023) emphasized the economic marginalization of the southern parts of Libya; this aspect suggests that the national

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industrial projects are usually focused on the coastal belt. This is in line with the current survey outcomes, and 68 percent of those who participated indicated that unequal regional development is one of the key challenges to Petrochemical investment in the entire country. There were also barriers to transition and governance constraints, which Bahour, Alkbir, and Januddi (2024) identified as limited institutional capacity and lack of involvement in the process by the private sector as key barriers to energy transformation in Tripoli. Such obstacles are similar to the results reported in this study, since lack of strong government backing and ambiguous investment policies were cited by 61% of the industry players as being a major deterrent to the industry. Furthermore, Cobo (2022) emphasized the unrealized potential of Libya as a potential energy partner to Europe and Spain under the conditions of improved infrastructure and political stability, which were highly manifested in 57% of interviewed stakeholders who saw the idea of international cooperation as a definite step to industrial growth. Another dimension that developed is the corporate governance and transparency issue.

As noticed by Alayat et al. (2025), the Libyan Audit Bureau still experiences significant difficulties in implementing the sustainability disclosure in the oil industry. This issue is reflected in the current study, as the members demanded more explicit regulatory systems and external control in order to provide fair competition and responsibility in the investment in petrochemicals. The industrial efficiency is also influenced by the productivity of employees and their work culture. According to Elayeb and Tarofder (2022), motivation and communication are behavioral factors that have a great impact on productivity in oil and gas operations. Within the provided context, 59 percent of the respondents pointed out that any petrochemical expansion strategy has to give priority to labor training and up-to-date safety standards. The technical potential of Libyan fields is also evidenced by scientific research. Early results of the Libyan Conference on Chemistry and Its Applications were reported by Salem et al. (2019), who stated that pilot-scale petrochemical derivatives can be produced in national laboratories.

Kreiw (2020) also revealed that the macroeconomic performance of Libya is directly affected by changes in global oil prices, which justify the value-added manufacturing as a shield against the price fluctuations. This confirms the conclusion of the present research that the growth of the GDP through diversification of exports by increasing the petrochemical industries would stabilize the growth. Sustainability in the environment and operation is a requirement. Smeda et al. (2024) suggested an integrative water-management model that can be implemented in the Zelten oil field to reduce the amount of waste and harm to the environment. Their findings align with the 74 percent of the current respondents who considered environmentally friendly production as a competitive outlook to the petrochemical industry in Libya. Nassar et al. (2025) also highlighted that switching to a green economy, especially in the power industry, might increase the resilience of industries- results also align with the suggestion presented in this study to clean up the petrochemical processes.

At a wider level, both Alammari (2021) and Radwan (2023) have proposed that diversification of the country beyond oil and gas, such as tourism and geological exploration, would supplement the country's income. The current study concurs but emphasizes the fact that petrochemicals are the most direct and technically viable diversification route. Educational and managerial gaps are a threat to sustainable development, which is why Elkhouly, Masoud, and Shafsha (2021) sounded the alarm. On the same note, Alawi and Masaud (2021) discovered that, in the Libyan oil and gas sector, most managers have a limited knowledge of environmental sustainability. These findings support the thesis of this paper, which asks the decision-makers to be better trained, governed, and environmentally conscious. On the whole, the discussion shows that there is a strong correspondence between the empirical results and the previous literature.

These pieces of evidence indicate that the development of petrochemicals in Libya relies on four pillars, namely: (1) infrastructural rehabilitation, (2) environmental sustainability, (3) building human-capital capacity, and (4) transparent government. When these factors are incorporated, Libya has all the chances to convert its rich hydrocarbon resources into a diversified and sustainable petrochemical economy.

Conclusion

The paper has looked at the opportunities and challenges behind the process of developing the petrochemical industries in Libya through a mixed method design that merged survey data and secondary sources. The results show that Libya has a good potential to develop petrochemicals because of the richness of oil and natural gas deposits, strategic geographical position and experience that exists in the energy industry. The findings indicate that the majority of the respondents consider the petrochemical industry to be one of the major diversification methods and employment opportunities. Nonetheless, the industry is still negatively affected by inadequate infrastructure, institutional

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inefficiency, policy instability, and low foreign investment appeal. Enhancement of governance structures, transparency and confidence of the investors had always been cited as important priorities.

Another significant issue that has been noted in the study is the need to incorporate the concepts of environmental management and workforce development in the case of future industrial strategies. Long-term competitiveness will be secured with the help of sustainable practices, technological modernization and the investment in human capital. All in all, the research comes to the conclusion that, through a co-ordinated policy change, rehabilitation of the infrastructure, and enhanced working relationships between state and business, Libya can turn her hydrocarbon resources into a diversified and sustainable petrochemical industry that can assist the country in the development of her national economy.

Conflict of interest. Nil

References

1. Abogsysa J. Shale gas potential in Libya-challenges and opportunities. Нефтяная столица. 2023:243-248.
2. Abdussalam O, Trochu J, Fello N, Chaabane A. Supply chain planning in the petroleum industry: the Libyan petroleum sector case study. In: Proceedings of the 13ème CONFERENCE INTERNATIONALE DE MODELISATION, OPTIMISATION ET SIMULATION (MOSIM2020); 2020 Nov 12-14; Agadir, Morocco. 2020.
3. Alammari A. Challenges and opportunities in the development of the libyan tourism sector [dissertation]. 2021.
4. Alayat AM, Lasyoud AA, Khan A, Irsyadillah I. Corporate governance and sustainability disclosure: challenges and opportunities for the Libyan Audit Bureau in the oil sector. Bus Strategy Environ. 2025;forthcoming.
5. Alawi NA, Masaud KA. Environmental sustainability: management perception in oil and gas industry in Libya. Int J Environ Workplace Employ. 2021;6(3):220-233.
6. Allan JA. Libya: the experience of oil. Abingdon (UK): Routledge; 2022.
7. Asanga RS, Okoroma JI. Comparative Analysis of Petroleum Fiscal System in Africa (A Case Study of Nigeria, Angola, Algeria, and Libya). [published online ahead of print]. 2024.
8. Bahour MM, Alkbir MF, Januddi MAF. A Qualitative Research on the Current Barriers and Challenges to the Transition to Renewable Energy in Tripoli, Libya. In: Analyzing Education, Sustainability, and Innovation: Multidisciplinary Research Perspectives. Cham: Springer Nature Switzerland; 2024. p. 109-116.
9. Bebas MT. Improving The Quality of Service In The Libyan Oil Sector: A Theoretical Assessment. Quantrade J Complex Syst Soc Sci. 2023;5(1):17-22.
10. Cobo IF. Libya, an energy opportunity for Europe and Spain. IEEE Analysis Paper. 2022 Nov 23. Available from: https://www.ieee.es/en/Galerias/fichero/docs_analisis/2022/DIEEEA12_2022_ISANCOR_Libia_EN.pdf
11. Dhahri F, Alashkham E, Sofe M. Opportunities and challenges for the Libyan geological resource's development: an overview. Miner Econ. 2024;37(3):719-723.
12. Elayeb JMM, Tarofder AK. The effect of behavioral work environment on employees' productivity in the oil and gas sector in Libya. J Int Bus Manag. 2022;5(4):01-11.
13. Elkhouly AR, Masoud OJ, Shafsha HA. Higher education in Libya, challenges and problems: a descriptive study. Am Res J Humanit Soc Sci. 2021;4(12):52-61.
14. Ghanem S. The Oil Industry and the Libyan Economy: The Past, the Present and the Likely Future 1. In: The Economic Development of Libya. Abingdon (UK): Routledge; 2023. p. 58-72.
15. Kezeiri S, Lawless R. Economic Development and Spatial Planning in Libya. In: The Economic Development of Libya. Abingdon (UK): Routledge; 2023. p. 1-24.
16. Kreiw R. THE INFLUENCE OF THE OIL PRICE FLUCTUATION ON THE MACROECONOMICS ACTIVITIES: THE CASE STUDY OF LIBYA. Knowledge: Int J. 2020;41(1):241-245.
17. Mahmoud MD, SP B. Science and quality education for sustainability development in Libya. INTI J. 2022;2022(18):1-10.
18. McLachlan K. The Libyan South: Background to Current Developments and Future Outlook. In: The Economic Development of Libya. Abingdon (UK): Routledge; 2023. p. 37-57.
19. Mohamed A. Biotechnological Processes as Part of a Carbon Capture and Utilisation Strategy in the Oil and Gas Sector: A Case Study in a Natural Gas Treatment Plant in Libya [doctoral dissertation]. Pontypridd (UK): University of South Wales; 2024.
20. Moria H, Elmnifi M. Feasibility study into possibility potentials and challenges of renewable energy in Libya. Int J Adv Sci Technol. 2020;29(3):12546-12560.
21. Nasef AEO. To What Extent Libya is Considered a Highly Attractive Oil Area?. 153-140:(2)6;2023 .مجلة الدراسات الاقتصادية.
22. Nassar YF, Irhouma M, Salem M, El-Khozondar H, Suliman S, Elmnifi M, et al. Towards green economy:: case of electricity generation sector in Libya. Sol Energy Sustain Dev J. 2025;14(1):334-360.

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Alqalam Journal of Science
مجلـــة القلم للعلـوم
https://alqalam.utripoli.edu.ly/index.php/AR

23. Nassar YF, Salem MA, Iessa KR, AlShareef IM, Ali KA, Fakher MA. Estimation of CO2 emission factor for the energy industry sector in libya: a case study. Environ Dev Sustain. 2021;23(9):13998-14026.
24. Otman WA. LIBYA. In: Governing Law and Dispute Resolution in the Oil and Gas Industry. Cheltenham (UK): Edward Elgar Publishing; 2022. p. 233-252.
25. Radwan AE. Western desert petroleum system: New exploration opportunities and challenges. In: The Phanerozoic Geology and Natural Resources of Egypt. Cham: Springer; 2023. p. 691-717.
26. Salem FA. The Mediating effect of job satisfaction on work environment and productivity of the public petrochemical companies in Libya [doctoral dissertation]. Sintok (MY): University Utara Malaysia; 2022.
27. Salem GM, Almallah FR, Amer IO, Alatrash AK, Bashein A, Aljidaemi FF, editors. The Libyan Conference on Chemistry and Its Applications (LCCA 2019); 2019 Sep 7-9; Tripoli, Libya. 2019.
28. Smeda A, Kraiem Z, Sdiri A, Elleuch B, Kallel M, Sadik C. An efficient integrative method for a sustainable environmental management of produced water: Application on the Zelten oil field, sirte basin, Libya. Kuwait J Sci. 2024;51(1):100140.
29. Waddams FC. The Libyan oil industry. Abingdon (UK): Routledge; 2023.
30. Yahya W, Nassar A, Mansur FA, Al-Nehari M, Alnakhlani MM. Future study of renewable energy in Libya. Int J Adv Eng Res Sci (IJAERS). 2020;7(10):1-6.

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