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**Research Article**

# Future Potential for Infostructure Enhancement of Oil Refining Industry in Iraq

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**ABSTRACT**

The oil refining industry is one of the key sectors in the Iraqi economy, significantly contributing to national revenue and meeting local market demands for petroleum products. Iraq possesses vast oil reserves, with confirmed reserves exceeding 144 billion barrels as of 2022, making it one of the world's largest oil producers. However, this industry faces multiple challenges, most notably aging infrastructure, lack of investment, and limited adoption of modern technologies. Approximately 50% of the refineries in operation were established before the year 2000, highlighting the urgent need to improve refinery infrastructure and upgrade existing technologies. Such advancements would enhance production capacity and operational efficiency. The findings emphasize the importance of attracting local and foreign investments and developing human resources as key factors in strengthening the industry's performance. The development of Iraq's oil refining sector requires a collaborative effort between the government and the private sector, with a focus on innovation and modern technology to achieve the desired economic and social objectives.

**Keywords:** oil refining.

## INTRODUCTION

Oil refining refers to the process of breaking down crude oil into its original components and molecular structures of hydrogen and carbon, then rearranging them to form different groups from those found in crude oil. In other words, refining involves a series of complex physical and chemical processes that treat crude oil, extract various compounds, and convert them into usable products [1]. This process enhances the economic value and usability of crude oil by transforming it into refined products ready for final or intermediate consumption [2]. Refineries vary in size, ranging from small plants that process about 150 barrels of crude oil per day to massive facilities with daily capacities exceeding 600,000 barrels. The primary function of a refinery is to convert crude oil into useful products by separating it into different hydrocarbon fractions, then chemically modifying and treating these components with other substances [3].

There are several types of oil refineries, categorized based on their functions and the objectives behind their establishment. One way to classify refineries is by their proximity to either production centers or consumption centers [4]. During the concession period, companies built oil refineries in or near oil-producing countries, giving rise to the term "production refineries." Examples include refineries in Iraq and Saudi Arabia. Conversely, some refineries are located near consumer markets in countries that do not produce crude oil, such as Japan and Western European nations. Intermediate refineries, on the other hand, are situated between production and consumption centers or in non-oil-producing countries with medium to high crude oil consumption, such as those in Singapore, which were established with foreign expertise and capital to leverage cheap Asian labor [5].

Despite Iraq's vast oil reserves, the country still imports some petroleum products to meet local demand. Therefore, studying the role of oil in Iraq's economy is crucial to understanding its significance in supporting economic

[1]- Hamid Ammar Mahmood, The Role of Modernizing the Oil Refining Industry in Economic Development in Iraq, Master's Thesis, College of Administration and Economics, University of Karbala, 2006.

[2] - Nabil Jaafar Abd al-Ridha, The Oil Encyclopedia, Dar Al-Kutub Wa Al-Watha'iq, Baghdad, 1st edition, 2018.

[3] - Berk Fares Hussein and Muhammad Mousa Khalaf, Investment Contracts in Oil Refining and Their Legal Nature, Tikrit University Journal of Legal and Political Sciences, Vol. 4, No. 14, 2012

[4] - Sara Al-Moussawi, Logistics Challenges in the Iraqi Oil Sector, Logistics Studies Journal, Arab Center for Studies, 2023.

[5] - Nabil Jaafar Abd al-Ridha, Economics of Oil, Dar Ihyā' Al-Turāth Al-'Arabī, Beirut, 1st edition, 2011.

development. Analyzing economic indicators related to the refining industry helps assess the sector's current state and highlight the challenges hindering its progress, while also proposing solutions to improve its efficiency and self-sufficiency [6].

The significance of this research lies in shedding light on the vital role of the oil refining industry in the Iraqi economy, as it remains a major source of national revenue. The findings and recommendations derived from this study can contribute to developing effective strategies for improving performance and promoting environmental sustainability in the oil sector.

The study aims to examine the reality of oil refining in Iraq, assess the impact of aging refineries on the industry, and provide strategic recommendations to enhance performance and increase production capacity. Additionally, it seeks to explore future opportunities in the sector. The research problem revolves around the challenges facing Iraq's oil refining industry.

## 2- OIL REFINING COMPANIES IN IRAQ

Iraq is one of the first countries in the region to establish crude oil refineries, a development that dates back to the 1925 agreement between the Iraqi government and foreign monopolistic companies. Article 15 of this agreement stipulated the establishment of an oil refining industry in Iraq for export purposes [7].

As of 2022, Iraq has 14 operational refineries, most of which have small production capacities, except for a few large refineries. The Baiji Refinery has a production capacity of 160,000 barrels per day, the Basra Refinery produces 210,000 barrels per day, and the Doura Refinery has a capacity of 140,000 barrels per day. Despite having 14 refineries, Iraq's refining capacity remains low compared to other Gulf countries.

For instance, the United Arab Emirates has only five refineries but boasts a total production capacity of 778,000 barrels per day, while Saudi Arabia operates eight refineries with a total capacity of 2.12 million barrels per day. This significant gap in refining capacity means that Iraq misses out on the economic benefits that could be achieved through economies of scale [8].

**Table (1): The Main Oil Refining Companies in Iraq [9]:**

1 - South Refineries Company

2 - Middle Refineries Company

3 - North Refineries Company

4 - Kurdistan Refineries Company

The South Refineries Company was established in 1969 with the creation of the Basra Refinery, and its actual production began in 1974. It is one of the major refining plants in Iraq, using the latest technology of the time to produce petroleum products of high quality for consumers. Over the years, the company has gone through several name changes. Initially founded as the Basra Refinery Presidency in 1969, it was renamed in 1976 to the Public Establishment for Oil Refining in the Southern Region. In 1987, it merged with the Public Establishment for Gas Industry in the Southern Region, and became known as the Public Establishment for Oil and Gas Manufacturing in the Southern Region. Finally, in 1998, the company was rebranded as the South Refineries Company.

The company operates the following refineries [10]:

**Meftah Refinery**: Established in 1953 in the northern part of Basra, on the banks of the Shatt al-Arab river, this small refinery had a capacity of 5,400 barrels per day (BPD). It consisted of two production units for crude oil refining, and was supplied by the Zubair oil field. The refinery was designed to meet local demand for petroleum products like

6 - Organization of Arab Petroleum Exporting Countries (OAPEC), Monthly Bulletin, Issue 10, 2017.

7 - United Nations, Institute for Advanced Human Studies, February 25, 2009.

8 - Ahmed Malik Abdul Hussein and Mayada Rashid Kamil, Economic and Environmental Impacts of Oil Refining, Journal of Economic Sciences, Issue 34, Vol. 9, College of Administration and Economics, University of Basra, 2013.

9 - Ahmed Jassim Al-Yasiri, et al., Economics of Energy, Dar Al-Nibras, Najaf Al-Ashraf, 1st edition, 2021.

10 - International Monetary Fund (IMF), Iraq, Expert Report on Article IV Consultations for 2013.

gasoline, naphtha, kerosene, fuel oil, and diesel. It was closed in 1973 due to the establishment of the Basra Refinery, which eliminated the need for it [11].

**Maysan Refinery**: Established in 1999 with a production capacity of 10,000 BPD, production began in 2000. In 2010, the refinery was expanded with two new refining units, each with a capacity of 10,000 BPD, raising the total capacity to 30,000 BPD.

**Nasiriyah Refinery**: Established in 1980, it has three distillation units with a capacity of 30,000 BPD, a white oil treatment unit with a capacity of 10,000 BPD, a vacuum distillation unit with a capacity of 10,000 BPD, and a kerosene sweetening unit with a capacity of 10,000 BPD.

**Shuaybah Refinery**: Built in 1969 and starting production in 1974, it is located in Basra and is one of the key refineries in southern Iraq, serving local demand for petroleum products. It initially had a refining capacity of 70,000 BPD, and later an additional refining unit was built with a capacity of 70,000 BPD. In 1977, an Italian company constructed a fat refinery with a capacity of 100,000 tons per year, which was later integrated with the Basra Refinery, bringing the total capacity to 150,000 BPD. During the 1990s, the refinery was severely impacted by international sanctions and became inactive for some time. It was later sabotaged, reducing its refining capacity to 98,000 BPD. Today, it produces approximately 210,000 BPD [12].

**Table (1): Oil Refinery Companies in Iraq and Their Capacity**

| Owning Company | Refinery Name | Location | Year Established | Refinery Capacity (thousands of BPD) |
|---|---|---|---|---|
| Middle Refineries Company | Dora Refinery | Baghdad | 1955 | 140 |
| | Najaf Refinery | Najaf | 2008 | 30 |
| | Samawah Refinery | Samawah | 1989 | 30 |
| | Diwaniyah Refinery | Diwaniyah | 2009 | 20 |
| | Karbala Refinery | Karbala | 2019 | 140 |
| South Refineries Company | Shuaybah Refinery | Basra | 1974 | 210 |
| | Maysan Refinery | Maysan | 1999 | 30 |
| | Dhi Qar Refinery | Dhi Qar | 1980 | 30 |
| North Refineries Company | Beiji Refinery (Al-Samoud) | Salah al-Din | 1978 | 310 |
| | Kirkuk Refinery | Kirkuk | 1973 | 30 |

[11] - Hussein Latif Al-Zubaidi, The Oil Industry in Iraq: Prospects and Challenges, Center for Iraq Studies, Baghdad, 2015.

[12] - Imad Maki, Developing the Oil Refining Industry in Arab Countries: Present and Future, Journal of Oil and Arab Cooperation, OAPEC, Kuwait, Issue 40, 2014.

| Owning Company | Refinery Name | Location | Year Established | Refinery Capacity (thousands of BPD) |
|---|---|---|---|---|
| | Al-Kusk Refinery | Nineveh | 1983 | 10 |
| | Chinese Refinery | Salah al-Din | 2009 | 20 |
| | Haditha Refinery | Anbar | 1949 | 16 |
| | Qayyarah Refinery | Nineveh | 1956 | 16 |
| Kurdistan Refineries Company | Khormala Refinery | Erbil | 2009 | 30 |
| | Koba Refinery | Sulaymaniyah | - | 70 |
| | Bazian Refinery | Sulaymaniyah | 2017 | 20 |

The table is prepared by the researcher based on data from the Organization of Arab Petroleum Exporting Countries (OAPEC), "Oil Refining Industry Worldwide 2019.

It is evident from Chart (1) that there is a significant disparity in refining capacities across Iraq's refineries. High production capacities are concentrated in a few refineries such as Karbala and Beiji, while most of the other refineries have small to medium capacities. These smaller refineries may play a complementary role in supporting domestic production, but they are not the primary source.

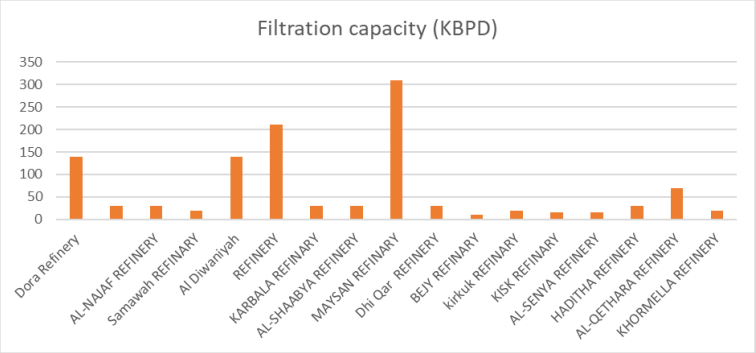


Chart (1) illustrates the refining capacities of Iraqi refinery companies.

## 3-DETERIORATION OF REFINING UNITS IN THE SOUTH REFINERIES COMPANY

The refining units of the South Refineries Company were established between 1927 and 2014. These refineries have processed crude oil to meet Iraq's demand for various petroleum products such as gasoline, kerosene, gas oil, diesel, solid lubricants, and liquid lubricants. However, some of these units have ceased operations due to wars, economic sanctions, outdated equipment, and lack of modern technology. Meanwhile, the newer equipment operates at only half of its production capacity [13].

Currently, Iraqi refineries are not utilizing their full production potential. However, this should not prevent the establishment of new refineries under the assumption that available capacity is underutilized. This situation indicates

[13] - Ahmed Al-Moussawi, Economic Challenges in the Iraqi Oil Sector, Middle East Studies Journal, Arab Center for Studies, 2022.

that Iraq remains a crude oil-exporting country. At the same time, efforts should focus on optimizing the performance of existing refineries to maximize their available capacity [14].

Since Iraq, like other developing countries, lacks skilled labor, particularly technical expertise in refining, it is crucial to encourage workers in this sector to acquire the necessary experience. This could involve sending them to technologically advanced countries for training or leveraging the expertise of friendly nations to qualify local staff [15].

To illustrate the nature of refineries in Iraq, the South Refineries Company has been taken as a case study. It is a state-owned company located in Al-Zubair, Basra province, and is responsible for refineries in three provinces: Basra, Maysan, and Dhi Qar. Table (2) presents the refineries under the company's management, categorized by province, unit capacities, and establishment dates.

Table (2): Status of Refineries Under the South Refineries Company

| No. | Site Name | Branches (Refineries & Plants) | Operation Status | Unit Capacity | Unit Establishment Date | Executing Company |
|---|---|---|---|---|---|---|
| 1 | Basra | Basra Refinery (Three Refining Units) | Operating | 70,000 barrels/day per refining unit | 1974, 1979, 2014 | Technoexport (Czech Company), Ministry of Oil, Prokop (Czech Company) |
| | | Fat Oils Refinery | Operating (Asphalt Production Only) | 1,000 tons/year | 1996 | Snamprogetti (Italian Company) |
| | | Barrel Manufacturing Plant | Non-operational | 400 barrels/hour | 1978 | Snamprogetti (Italian Company) |
| | | Plastic Container Plant | Non-operational | 1,100 cans/hour | 1992 | Snamprogetti (Italian Company) |
| 2 | Dhi Qar | Dhi Qar Refinery (Three Refining Units) | Operating | 10,000 barrels/hour, Asphalt Unit: 500 tons/day | 1997, 1987, 2005 | Two units transferred from Northern Refineries, One unit established by Saad General Company, Hy Baker (American Company) |
| 3 | Maysan | Maysan Refinery (Three Refining Units) | Operating | 10,000 barrels/day per refining unit | 1999 | Three mobile units transferred from Shuaiba Refinery |

[14] - Arkan Risan Abbas, Geographic Analysis of Small Oil Refining Units in Iraq and Their Impact on Achieving Sustainable Development, College of Basic Education, Al-Mustansiriya University, Madad Al-Adab Journal, 2020.

[15] - Ihab Abbas Mohammed Al-Faisal, Analytical Study of the Reality and Prospects of the Refining Industry in Iraq for the Period 2004-2016, Karbala University, Journal of Administration and Economics, Vol. (special issue), 2019.

**Table (2): Status of Refineries Under the South Refineries Company**

Production capacity represents the company's ability to produce outputs over a specific period. The criteria used to determine available capacities include the efficiency of operational unit equipment and the availability of spare materials. The reasons for deviations from design capacities include the lack of rehabilitation of production units, insufficient spare materials, frequent power outages, inadequate maintenance periods, high salinity levels, and mechanical failures [16].

**Table (3): Daily Shutdowns of South Oil Company – Basra for the Period from 2015 to 2022.**

| Section | Operational Unit | Shutdown Days 2015 | Shutdown Days 2016 | Shutdown Days 2017 | Shutdown Days 2018 | Shutdown Days 2019 | Shutdown Days 2020 | Shutdown Days 2021 | Shutdown Days 2022 | Total Downtime |
|---|---|---|---|---|---|---|---|---|---|---|
| Basra Refinery / 1 | Refining / 1 | 33 | 33 | 33 | 33 | 33 | 33 | 33 | 33 | 264 |
| | Hydrogenation / 1 | 136 | 43 | 18 | 28 | 47 | 58 | 25 | 84 | 439 |
| | Gasoline Improvement / 1 | 89 | 107 | 58 | 85 | 155 | 135 | 40 | 140 | 809 |
| Basra Refinery / 2 | Refining / 2 | 30 | 22 | 12 | 7 | 63 | 16 | 46 | 15 | 211 |
| | Hydrogenation / 2 | 70 | 58 | 55 | 25 | 42 | 53 | 132 | 39 | 474 |
| | Gasoline Improvement / 2 | 73 | 59 | 65 | 86 | 36 | 75 | 186 | 87 | 667 |
| Basra Refinery / 3 | Refining / 3 | 85 | 43 | 13 | 7 | 3 | 41 | 12 | 11 | 215 |
| | Hydrogenation / 3 | Not Established | Not Established | 12 | 26 | 17 | 41 | 24 | 10 | 130 |
| | Gasoline Improvement / 3 | Not Established | Not Established | 28 | 33 | 12 | 48 | 29 | 18 | 168 |
| Fat Oils | Vacuum Distillation Division | 169 | 312 | 323 | 360 | 360 | 338 | 156 | 164 | 2182 |
| | Wax Removal Division | 365 | 365 | 365 | 365 | 358 | 366 | 172 | 176 | 2532 |
| | Furfural Division | 365 | 360 | 348 | 365 | 365 | 366 | Removed | Removed | 2169 |
| | Asphalt Removal Division | 152 | 317 | 334 | 365 | 365 | 332 | Removed | Removed | 1865 |

16 - Ministry of Oil, South Oil Company, Annual Administrative Report, 2016.

| Section | Operational Unit | Shutdown Days 2015 | Shutdown Days 2016 | Shutdown Days 2017 | Shutdown Days 2018 | Shutdown Days 2019 | Shutdown Days 2020 | Shutdown Days 2021 | Shutdown Days 2022 | Total Downtime |
|---|---|---|---|---|---|---|---|---|---|---|
| | Blending Division | 337 | 215 | Removed | Removed | Removed | Removed | Removed | Removed | 552 |
| LPG Division | Gas / 1 | Not Established | Not Established | Not Established | 24 | 21 | 68 | 18 | 85 | 216 |
| | Gas / 2 | 66 | 58 | 73 | 29 | 40 | 54 | 151 | 46 | 517 |
| | Gas / 3 | 110 | 43 | 12 | 9 | 2 | 39 | 18 | 15 | 248 |
| Dhi Qar Refinery | Unit 1 | 52 | 36 | 31 | 17 | 31 | 17 | 82 | 14 | 280 |
| | Unit 2 | 33 | 24 | 15 | 22 | 24 | 17 | 73 | 10 | 218 |
| | Unit 3 | 15 | 18 | 43 | 21 | 9 | 13 | 84 | 10 | 213 |
| | Asphalt Unit | 235 | 306 | 197 | 153 | 82 | 82 | 105 | 29 | 1189 |
| Maysan Refinery | Refining Unit 1 | 35 | 52 | 14 | 21 | 31 | 292 | 133 | 46 | 624 |
| | Refining Unit 2 | 58 | 28 | 7 | 11 | 41 | 84 | 40 | 28 | 297 |
| | Refining Unit 3 | 102 | 36 | 1 | 19 | 42 | 159 | 135 | 52 | 546 |
| | Refining Unit 4 | Not Established | Not Established | Not Established | Not Established | Not Established | 154 | 123 | 54 | 331 |

The table is prepared by the researcher based on data from the Ministry of Oil - South Oil Company - Annual Management Report for the years 2015-2022.

Table (3) shows the number of long downtime days due to the deterioration of units inside the refinery, which require days or even months for maintenance and restoration to service. This results in work stoppages and consequently a reduction in the production of petroleum products, which negatively affects the refining process as a whole. The production operations have been accompanied by a loss percentage in output due to the aging of the production units. From the table, we can observe planned downtime, actual downtime, and emergency downtime, where actual downtime is for maintenance procedures.

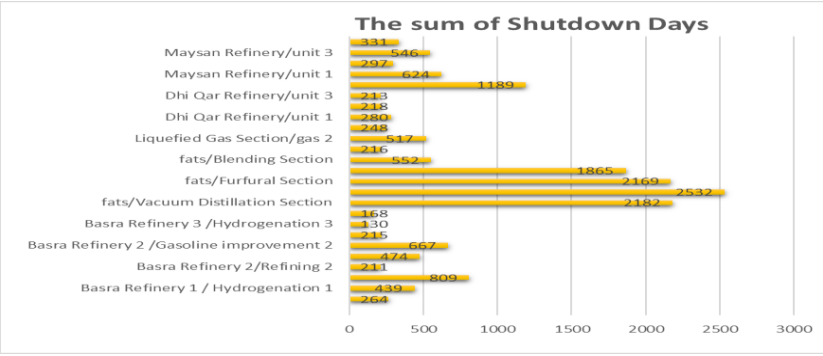


Figure (2) shows the total downtime of the refining units at South Oil Refining Company for the period (2015-2022).

The number of downtime days in the operational units reflects inefficiency in production operations, which impacts the overall refinery performance. Figure (2) reveals a large number of downtime days across several units, indicating recurring issues or the need for routine maintenance. For example, the Wax Removal Section (part of the fats section) recorded the highest downtime at 2532 days, followed by the Vacuum Distillation Section (2182 days) and the Fractionation Section (2169 days).

## RESULTS AND DISCUSSION

Data from the South Oil Company shows that the refining units are outdated, as they were established back in 1974, with additional refining units added up until 2014. After that, no new units were added, and the existing ones have not been expanded. The downtime table reveals unplanned stoppages, likely due to the aging and deteriorating condition of the refining units.

## CONCLUSIONS

1. The oil refining industry in Iraq is crucial for the national economy, contributing to the local market's petroleum product needs and reducing dependence on imports.
2. Iraq's oil refineries suffer from outdated equipment and technology, leading to low operational efficiency and high production loss rates.
3. Iraq has immense potential to develop its refining industry, given the abundance of crude oil, strategic location near global markets, and the potential for foreign investment.

## RECOMMENDATIONS

1. Update Existing Refineries: Iraqi refineries need significant upgrades as many are still operating with outdated technologies, which negatively affect production efficiency and product quality. Modern technologies should be utilized to improve operational efficiency, reduce harmful emissions, and increase production rates.
2. Build New Refineries: Iraq needs to expand its refining capacity to match the growth in crude oil production by constructing new refineries with global standards, including advanced refining technologies (e.g., hydrocracking), which will provide high-quality products for both domestic consumption and export.
3. Focus on Clean Products: Given the global shift towards clean energy and reducing carbon emissions, Iraq's refining industry should focus on producing clean fuels like low-sulfur diesel and gasoline, adhering to international environmental standards.
4. Enhance Transport and Storage Infrastructure: Iraq should develop its pipeline systems, land, and marine transport networks to facilitate crude oil and refined product movement. Expanding storage capacities will also help stabilize both local and international markets.
5. Collaborate with Global Technology Companies: Iraq can form strategic partnerships with global companies specializing in refining and petrochemical industries to enhance sector competitiveness and improve local capabilities.
6. Improve Regulatory and Investment Frameworks: A stable and transparent legal environment must be created to attract local and foreign investments, enhancing investor confidence and increasing capital inflow.
7. Train Workforce: Investing in education and specialized vocational training to improve the technical and managerial skills in the refining sector is vital for improving operational efficiency and product quality.
8. Shift to Sustainable Energy: Iraq can integrate renewable energy projects, such as solar and wind power, with its oil and gas projects to reduce dependence on fossil fuels and lower the carbon footprint of its industry.

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