The Impact of the Political Conflict on the Oil and Gas Industry in Yemen

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Abstract— Yemen's oil industry faces severe challenges due to ongoing conflict, drastically reduced production, and export blockades, limiting its economic potential. The study aims to assess Yemen's oil sector amid war disruptions, revenue losses, and recovery barriers since 2015, including the sedimentary basins in Yemen, the productive, exploratory, and open oil sectors in Yemen, the most important export ports, oil and gas pipelines, and internal and external operating oil companies, along with development prospects.

Analysis relies on secondary data from industry reports and production statistics spanning 1984–2024, including basin outputs from Masila, Marib, and Shabwa, a non-governmental organization report, government reports, ministry of oil and minerals reports, statistical bulletins, and oil and gas company reports.

Production plummeted due to Houthi attacks on export facilities, with current levels at 7,000–10,000 bpd, all refined locally by firms like Petro Masila. Reserves in major blocks face 70–75% depletion by 2030, with minimal new discoveries; Yemen risks becoming a net fuel importer soon. Without comprehensive peace, foreign investment (e.g., LNG restart) remains stalled, prolonging fiscal crises and hindering diversification.

Keywords: impacts, political, conflict, oil and gas industry, Yemen

I. Introduction

Since the early 2000s, Yemen's oil production has faced a steady decline due to aging fields and limited new discoveries. By 2014, just before the outbreak of the full-scale conflict, oil production had dropped to around 127,000 bpd [1]. The situation further deteriorated after the conflict began in 2015, with production nearly coming to a halt, and in recent years, production has hovered between 30,000 and 50,000 bpd, a fraction of the country's potential output [2].

The conflict has not only led to a collapse in oil production but also severely damaged the infrastructure necessary for oil transportation and export. Yemen's main export pipelines, such as the Marib-Ras Isa pipeline, have been repeatedly targeted, and key oil export facilities have suffered from damage, theft, or neglect. Consequently, Yemen's oil revenues, once the lifeblood of the economy, have plummeted, further exacerbating the country's economic and humanitarian crises [2].

Despite these challenges, Yemen still holds considerable oil reserves, estimated at approximately 3 billion barrels as of 2020. Moreover, Yemen has untapped natural gas resources, particularly in the Shabwah and Marib regions, with gas reserves estimated at 17 trillion cubic feet (Tcf). Before the conflict, Yemen had launched the Yemen Liquefied Natural Gas (LNG) project, which started exporting gas in 2009, but operations were suspended in 2015 due to security concerns [3].

Addressing these issues requires a thorough analysis of the current state of the oil sector in Yemen and identifying the factors influencing its performance. Through this, recommendations can be made to improve oil wealth management and strengthen its role as a fundamental element in economic and social development, contributing to stability and growth in the country [4].

Therefore, this study aims to offer a comprehensive assessment of Yemen's oil sector, detailing the significant impacts of ongoing war disruptions since 2015, including recovery barriers, sedimentary basins, oil sector segments, the productive sector, the exploratory sector, the open sector, major export terminals, oil and gas pipelines, operating companies, an overview of internal and external firms active in the sector, and strategic recommendations for recovery and investment.

II. Literature Review

Currently, there are not enough studies available on the reality of the oil and gas industry in Yemen. There are only limited studies on the properties of oil fluids as well as geological studies as follows: The tectonic implications concerned were studied using aeromagnetic data with the distribution of the sedimentary sequence belts and the related basement complex zones, as well as to differentiate between the causative sources of the

Eastern Yemen region [5]. The Madbi Amran/Qishn total petroleum system was analyzed within Yemen's Ma'Rib–Al Jawf/Shabwah and Masila-Jeza Basins to assess hydrocarbon potential [6]. The aeromagnetic data was used for mapping the basement depth and contact locations at the southern part of the Tihamah region, western Yemen [7]. The tectonostratigraphy of Yemen was demonstrated to have started from the Neoproterozoic time, when West Gondwana and East Gondwana collided ahead of the separation of India from Afro-Arabia, ultimately to the last event represented by the opening of the Gulf of Aden and the Red Sea and subsequent basins formed in or related to these events [8].

A hybrid approach combining artificial neural networks with particle swarm optimization was conducted to enhance the accuracy of gas viscosity predictions in Yemeni oil fields [9]. Tree-based machine learning models were examined for lithology prediction in Yemen's Camal oil field using well-log data [10]. The sedimentary basins of Yemen were analyzed to understand their tectonic development and stratigraphic formations [11]. The application of fuzzy logic was explored for predicting PVT properties in Yemeni reservoirs, specifically focusing on oil viscosity, formation volume factor, and gas solubility [12,13].

A detailed study was performed on fractured basement reservoirs in Yemen's Sab'atayn Basin, focusing on the Habban Field, a prominent oil production site [14]. The evolution of the greater Red Sea–Gulf of Aden rift system was summarized, which includes the Gulfs of Suez and Aqaba, the Red Sea and Gulf of Aden marine basins and their continental margins, and the Afar region [15]. The geological evolution of the Central Marib-Shabwa Basin was studied using well and seismic data gathered by Nimir Petroleum Company between 1992 and 1995 [16]. The neural network was used to predict the inflow performance relationship of producing wells for the Yemeni oil field [17].

An econometric model studied the factors influencing energy demand in Yemen between 1990 and 2012 [18]. The petrology of Rifted-Margin Sand (Red Sea and Gulf of Aden) is summarized using huge data sets [19]. The simulation study was applied to analyze the coal, coaly shale, and shale samples from three wells (Al-Fatak-1, 16/G-1, and 16/E-1) in the offshore Jiza-Qamar Basin [20]. The petrophysical characteristics were analyzed of Cretaceous clastic rocks in the Qishn Formation within the Sharyoof oilfield in Yemen's Masila Basin [21]. The Mukalla source rocks were studied using geochemical analyses, including total organic carbon (TOC) and vitrinite reflectance, along with basin modeling to determine the timing of hydrocarbon generation and expulsion [22]. The characteristics of certain Yemeni crude and fuel oils were evaluated, specifically the Mareb crude oil blend, the Masila crude oil blend, and two samples from the Sounah and Hijah oil fields in the Masila basin [23]. The detailed 3D geological modeling focused on the Lower Cretaceous Sequence conducted through an integrated study for the Lower Cretaceous reservoir in the Masila oilfield [24]. A combined geophysical and geochemical study was performed on Upper Jurassic source rocks in Yemen's Sayun-Masila Basin to examine their suitability for hydrocarbon production [25].

III. Research Methodology and Data Description

To accomplish and complete the study, the analytical methodology was used, which is always used in evaluative, economic, political and social studies. The analytical method can be summarized in detail as shown in **Fig. 1**.

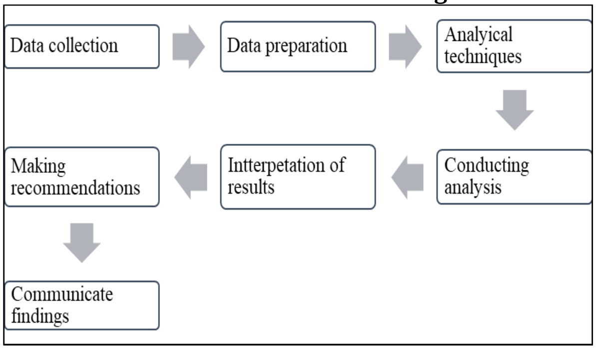

Fig. 1 The schematic structure of research methodology

Totally, huge oil and gas production data records from all production sectors were used in order to achieve the objective of this work. The data were collected from all production sectors located in the different popular Yemeni reservoirs. The sources of this huge information are taken from individual studies, research and academic studies, a non-governmental organization report, government reports, ministry of oil and minerals reports, scientific theses, statistical bulletins, and oil and gas company reports [26-30] as displayed in Fig. 2.

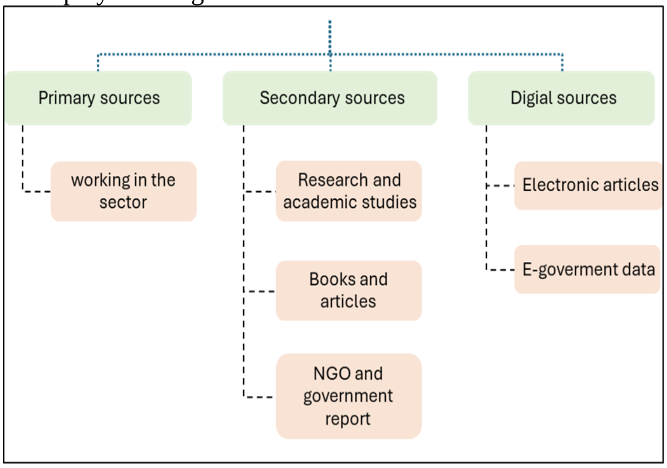

Fig. 2 The schematic of data description

IV. The Ministry of Oil and Minerals in Yemen

The Ministry of Oil and Minerals in Yemen oversees the entire oil and mineral industry, including exploration, production, transportation, and storage. It comprises various affiliated units specialized in different aspects to enhance operational efficiency and regulatory compliance [26], as shown in **Fig. 3**.

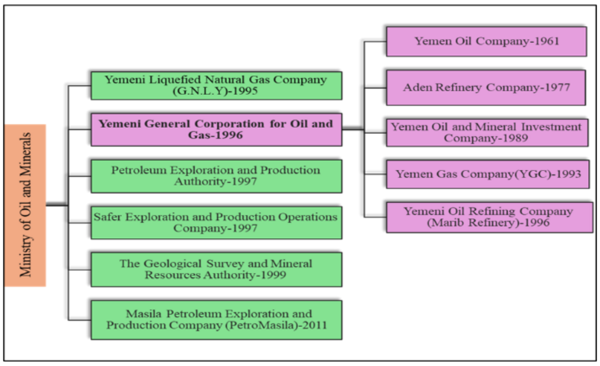

Fig. 3 Units of the ministry of oil and minerals[20]

V. Sedimentary Basins in Yemen

Yemen has thirteen identified sedimentary basins, classified into three geological eras: Paleozoic, Mesozoic, and Cenozoic [11] as shown in **Fig. 4**.

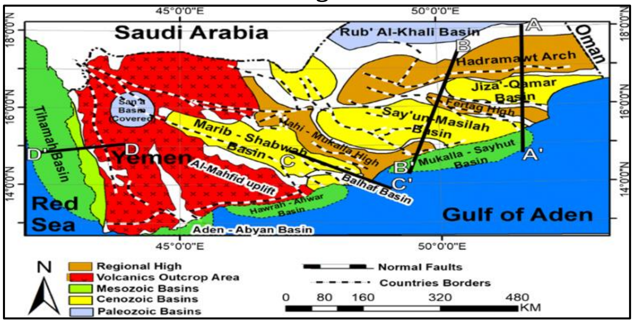

Fig. 4 Sedimentary basins in Yemen[11]

The main Paleozoic basins in Yemen are the Rub' Al-Khali Basin, specifically its southern flank in Yemen; the San'a Basin, located in northwest Yemen around Sadah and Hajjah; and the southern offshore Suqatra Basin [11]. **Fig. 5** displays the main Paleozoic basins and some of their additional information.

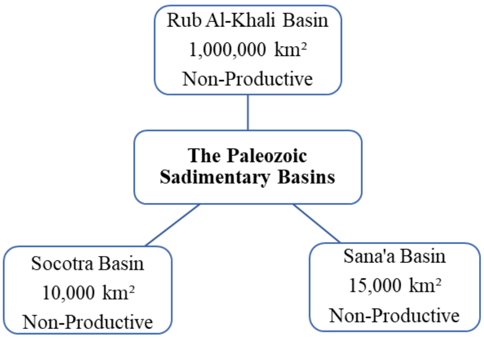

Fig. 5 The Paleozoic sadimentary basins

The five main Mesozoic sedimentary rift basins in Yemen developed mainly during the Late Jurassic to Early Cretaceous period as part of the Gondwana breakup. These basins include Sabatayn Basin, Sayun-Masila Basin, Siham-Aldali Basin, Balhaf Basin, and Jiza Qamar Basin [11], as shown in **Fig. 6**.

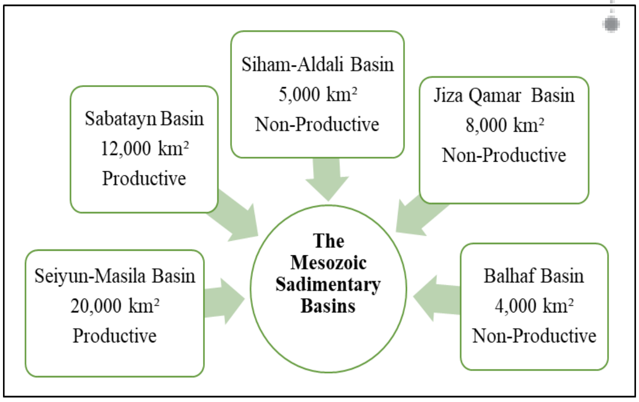

Fig. 6 The Mesozoic sadimentary basins

The Cenozoic rift basins along the Gulf of Aden include the Mukalla–Sayhut, the Aden-Abyan, the Tihamah, the Hawrah–Ahwar, and the Red Sea basins, as shown in **Fig. 7.**

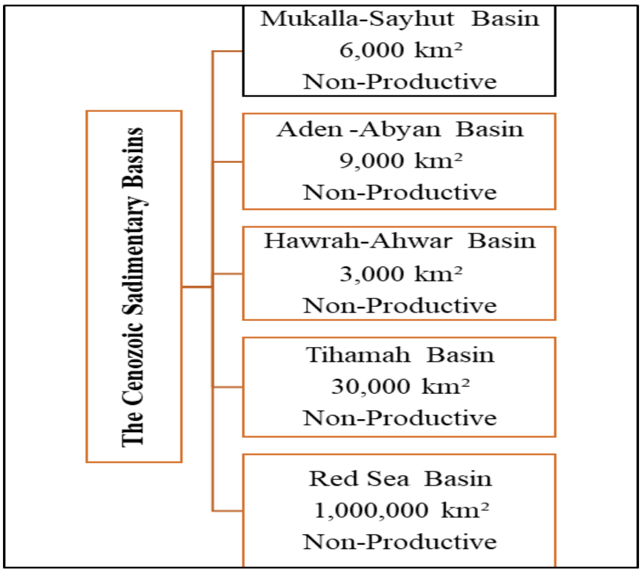

Fig. 7 The Cenozoic sadimentary basins

VI. Oil Blocks in Yemen

According to the oil map of Yemen, Yemen has a total of about 105 oil concession blocks, of which 12 are currently producing and operated by 11 oil companies [26]. There are 21 blocks in exploratory phases with 14 companies involved, and 70 blocks remain open for exploration and 2 sectors pending approval under PSA contracts. The blocks are both onshore and offshore in areas such as the Arabian Sea, Gulf of Aden, and Red Sea [26]. **Fig. 8** demonstrates the oil sectors in Yemen as of the end of 2014, according to the statistics of the Ministry of Oil and Minerals.

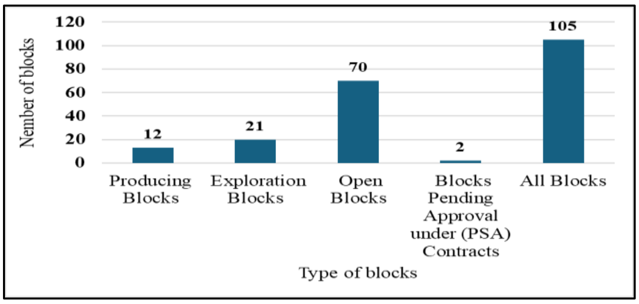

Fig. 8 Oil blocks in Yemen as of the end of 2014

Producing oil blocks

Yemen's oil production is concentrated in three governorates: Hadhramaut, Shabwa, and Marib, and Al Jawf. These areas are considered part of Yemen's "triangle of power" for oil and gas production. Yemen's oil production primarily originates from several key blocks, with Masila (Blocks 10 and 14) being the most significant. Other notable blocks include Marib–Al Jawf (Block 18), East Shabwah (Block 10), and Janah (Block 5) [27]. The number, name, governorate, area, and operating company of each production block are shown in Table 1. Fig. 9 illustrates the producing oil blocks in Yemen as of the end of 2014, according to the statistics of the Ministry of Oil and Minerals.

Table 1 Producing oil blocks as of the end of 2014 [27]

No	Block / Sector		Governorate	Area Km^2	Operating company
	Number	Name			
1	18	Marib – Al-Jawf	Marib – Al-Jawf	8,479	Safer
2	14	Al-Masila	Hadhramaut	1,275	Petro Masila
3	10	East Shabwah	Hadhramaut	953	Total Yemen
4	32	Hawarim	Hadhramaut	592	DNO
5	53	East Saar	Hadhramaut	474	Dove Energy Limited
6	5	Jannah	Shabwah	280	Janna Hunt
7	4	West Ayad	Shabwah	1,998	KNOC
8	51	East Al-Hajar	Hadhramaut	2,042	Canadian Nixon
9	S1	Damis	Shabwah	1,156	Occidental
10	43	South Hawarim	Hadhramaut	2,026	DON
11	9	Malek	Hadhramaut	2,227	Calvalley
12	S2	Al-Uqla	Shabwah	904	OMV

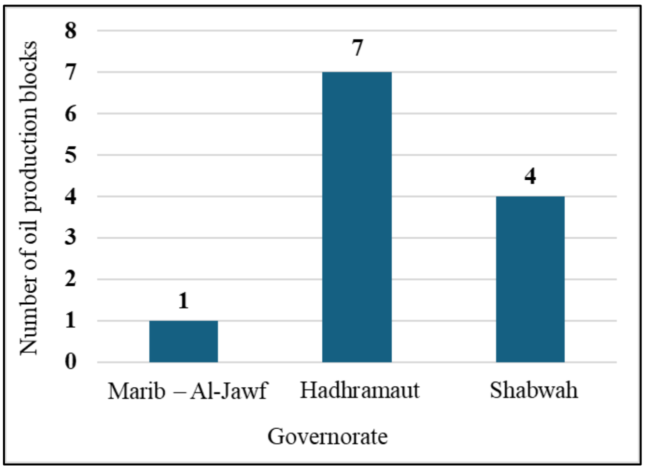

Fig. 9 Oil production blocks as of the end of 2014

Exploration oil blocks

Yemen's oil exploration is concentrated in several key sedimentary basins with significant oil potential. The Ministry of Oil and Minerals oversees the process, currently managing around 21 exploration blocks worked on by 13 international oil companies. The main basins attracting exploration activities include the Sayun-Masila Basin, Shabwa Basin, and the Jiza-Qamar Basin, among others such as Marib-Jawf, Mukalla-Sihout, and Tihama. The Petroleum Exploration and Production Authority (PEPA) plays a central role in managing and promoting oil and gas exploration and production in Yemen [26, 27]. The number, name, governorate, and area of each exploration sector are shown in **Table 2**. **Fig. 10** explains the exploration oil blocks in Yemen as of the end of 2014 according to the statistics of the Ministry of Oil and Minerals.

Table 2 Exploration oil blocks as of the end of 2014 [27]

NO	sector		Governorate	Area (Km^2)
	It's number	It's name		
1	2	Al-Mabar	Shabwa Hadramout	3,012
2	3	Jardan	Shabwa	2,950
3	7	Al-Burqa	Shabwa	4,939
4	13	Al-Arma	Al-Mahra	5,516
5	20	Al-Sabatin	Marib-Shabwa	2,049
6	29	South Sanaa	Al Mahrah	9,237
7	33	Al-Furt	Hadramout	4,482
8	34	Gheiz	Al Mahrah	7.016
9	37	Mareit	Hadramout-Al Mahrah	6.894
10	45	South Al-Furt	Hadramout-Al Mahrah	6.627
11	49	Southeast Al-Mabar	Hadramout	2,700
12	68	Ghayl Bin Yamin	Hadramout	679
13	70	Autq	Shabwa	1,367
14	71	Al-Qarn	Hadramout	1,801
15	72	Al Ain	Hadramout	1,821
16	75	Merkhah	Marib-Shabwa	1,050
17	82	Wadi Amad	Hadramout	1,853
18	83	Wadi Arat	Hadramout	364
19	86	South Al-Oqla	Shabwa	652
20	2R	East Al-Mabar	Hadramout	2,850

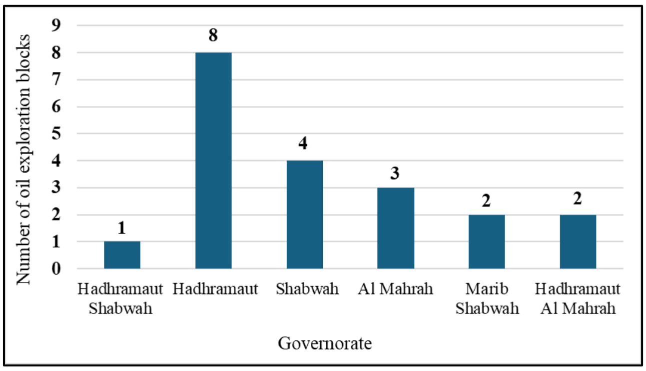

Fig. 10 Exploration oil blocks up to the end of 2014

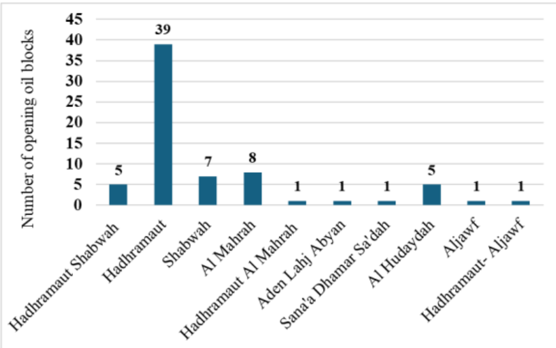

Fig. 11 Opening oil blocks up to the end of 2014

Opening oil blocks

The geological information suggests petroleum potential due to their number and the presence of other favorable indicators. There are about 70 open oil sectors, including a number of offshore sectors. show promise for petroleum accumulations, but they haven't been adequately studied. As a result of the political crisis and the flight of many companies outside Yemen [26, 27]. **Fig. 11** explains the opening oil blocks in Yemen as of the end of 2014 according to the statistics of the Ministry of Oil and Minerals.

VII. Oil and Gas Pipelines and Terminals

Three major oil pipelines in Yemen carry most of the country's crude oil production to terminals along the Gulf of Aden and the Red Sea. Additionally, a significant gas pipeline transports the majority of Yemen's gas to a single terminal [26, 27]. The major oil and gas pipelines and some of their additional information are shown in **Fig. 12.**

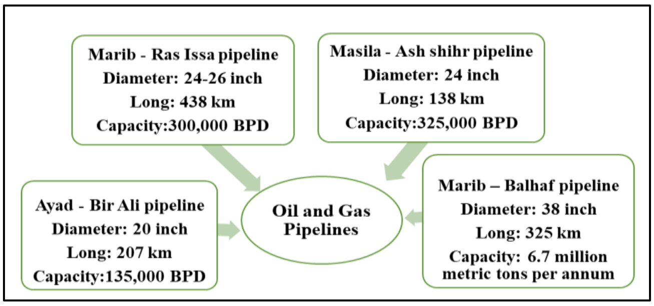

Fig. 12 Oil and gas pipelines

The oil and gas pipelines and terminals are illustrated in Table 3. The main oil and gas terminals with producing oil and gas blocks are presented in Fig. 13. The main oil and gas pipelines and terminals are displayed in **Fig. 14**.

Table 3 The Main oil and gas transportation pipelines[27]

Terminal	No. of Tanks	Tank Capacity bbl	Total Capacity bbl
Ash Shihr	5	500,000 bbl	3,500,000
	1	1,000,000 bbl	
Bir Ali	5	126,000 bbl	630,000
Ras Issa	1	3,000,000 bbl	3,000,000
		LNG Terminal	
Balhaf	2	140,000 m^3	280,000 m^3

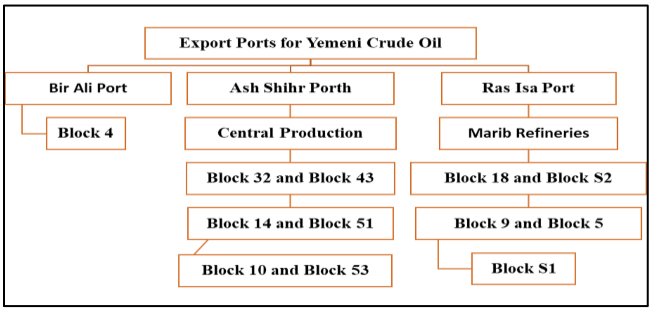

Fig. 13 Export ports for Yemeni oil[23]

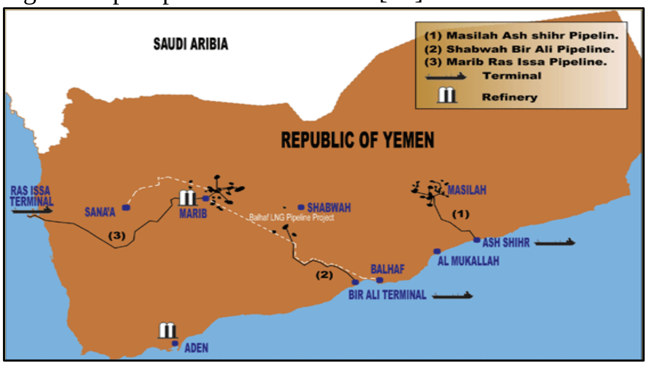

Fig. 14 The oil and gas pipelines and terminals[27]

VIII. Discussions

Although the ministry includes important and diverse units in exploration, production, transportation, storage, and others, these units are ineffective, and the ministry currently is grappling with several critical challenges that severely impact its effectiveness as follows:

- . Houthi Blockades: Since 2022, blockades have halted oil exports from key government-controlled terminals (e.g., Bir Ali, Ash Shihr), leading to a substantial fiscal revenue loss of up to 42%.
- . Infrastructure attacks: Regular assaults on critical infrastructure, such as pipelines and ports, have slashed production figures to approximately 7,000-10,000 barrels per day from major basins like Masila and Shabwa.
- . Currency depreciation and inflation: The economic landscape is characterized by currency devaluation and rising inflation, exacerbating fuel shortages. This situation has triggered public protests due to electricity outages and supply disruptions expected to continue into 2025.
- . Declining aid: Reduced foreign aid and dwindling foreign exchange reserves impede the Internationally Recognized Government's (IRG) ability to import necessary fuel derivatives.
- . Fragile revenue-sharing agreements: Political fragmentation results in unstable agreements over revenue-sharing in oil-rich regions like Shabwa, creating delays in project approvals and discouraging foreign investment.
- . Undeveloped reserves: Significant untapped resources (3 billion barrels of oil and 17 trillion cubic feet of gas) remain inaccessible due to ongoing security concerns.
- . Refinery damage: Critical refineries, like those in Aden, have suffered extensive damage, leading to reliance on local refining processes that are inefficient.
- . Pipeline sabotage: Continuous sabotage of key pipelines (e.g., Safer-Ras Isa) requires costly workarounds, significantly impacting operational efficiency.

Yemen's commercial oil production remains concentrated in the Sabatayn and Seiyun-Masila basins, which together account for virtually all current output from the country's 13 identified sedimentary basins. These two Jurassic rift basins, formed during the Mesozoic breakup of Gondwana, host the majority of Yemen's proved reserves and active fields, with Masila holding over 80% of reserves. Sabatayn features key fields like Marib-Jawf, while Masila drives production via Qishn sandstones and basement plays.

Output has declined sharply since peaking near 450,000 bpd in 2001 due to conflict, maturing fields, and underinvestment, now at 7,000–10,000 bpd refined locally. State firms like Petro Masila dominate, with limited foreign involvement. All commercial oil derives from these Mesozoic systems' source rocks, like Madbi shales. Yemen's sedimentary basins face significant challenges that hinder hydrocarbon exploration and production. These stem from a mix of geological, political, and infrastructure factors as follows:

- Ongoing civil war and Houthi control disrupt operations in key basins like Sabatayn and Masila, causing field shutdowns, pipeline sabotage, and expatriate evacuations since 2015. Bombings and neglect have crippled export terminals, roads, and processing facilities, slashing output from 450,000 bpd peaks to under 50,000 bpd recently.
- ü On the other hand, complex tectonics lead to fault seal failures, rapid reservoir depletion, and high-water cuts in mature fields; frontier basins like Tihamah suffer poor seismic data and deep targets. Sanctions, legal disputes over blocks, and corruption deter IOCs, leaving Yemen reliant on limited NOC efforts amid global energy shifts.

Yemen's oil output plummeted due to repeated strikes on pipelines, terminals (e.g., Ras Isa, Bir Ali), and fields in the

Marib-Jawf and Shabwah basins. Blocks like S1 saw suspensions (e.g., An Nagyah field), while Al-Masila's exports stopped in 2022 after Houthi drone attacks, shifting to local refining. In contrast, Western firms like OMV exited amid security risks and payment delays; Calvalley resumed limited Block 9 output of about 3,000 bpd post-2019 but faces ongoing threats. State operators like Petro Masila persist in Hadramout but under fragmented governance.

Yemen's oil infrastructure exhibits multiple strategic weaknesses, including linear pipelines traversing contested areas, coastal terminals vulnerable to attacks, and aging refineries with limited redundancy. The primary Marib-Ras Isa pipeline spans 440 km through Houthi territory, suffering repeated sabotage over 100 attacks by 2013 alone, halting flows, and forcing reliance on trucking. Coastal export points like Ras Isa face drone missile strikes and blockades near Bab El-Mandeb, while Bir Ali and Ash Shihr have been hit, limiting exports to under 10% capacity.

IX. Conclusion

The main conclusions of this study are as follows:

- Yemen's oil sector has faced severe disruptions from the civil war starting in 2015, leading to sharp production declines and massive revenue losses, while key sedimentary basins and infrastructure remain critical yet damaged assets.
- Oil accounted for over 60% of fiscal revenues pre-war, but revenues crashed to 3% of GDP in 2015 from 13% in 2013, equating to a $4 billion loss in a $38 billion economy.
- Exports halted due to pipeline sabotage and port disruptions, exacerbating fiscal deficits to 11.4% of GDP.
- Yemen hosts several basins, with the Marib-Jawf Basin in central Yemen holding over 1 billion barrels of oil and 9 trillion cubic feet of gas, a pre-war production hub now conflict-ravaged. Other key areas include the Masila Basin (productive in the east) and the Sabatayn Basin.
- Of 21 production sectors, many ceased operations post-2015 due to halted maintenance; six newer exploration sectors briefly produced before war impacts. Productive fields cluster in Marib-Jawf and Hadramaut; exploratory efforts target untapped reserves estimated at 3 billion barrels total.
- Export ports include Ras Isa (main crude terminal on the Red Sea) and Ash Shihr (for Balhaf LNG), both repeatedly attacked. Major pipelines, like Marib-Ras Isa (destroyed multiple times), link fields to ports but remain vulnerable to sabotage.
- External firms like Total Energies and OMV evacuated post-2015; Yemen's state firm YPC and smaller locals manage limited output.
- There are many barriers, including infrastructure damage, factional control, and insecurity, stalling investment despite untapped reserves. For the prospects involve modernizing facilities, security pacts, and diversification, potentially reviving output with strategic funding.

X. Recommendations:

The main recommendations of this study are as follows:

- By addressing governance, security, economic diversification, and social stability, Yemen can gradually neutralize its economy from the effects of conflict and build a resilient, stable society with the cooperation of all stakeholders, including the government, civil society, and international partners.
- By partnering with a specialized global company for oil exploration and reserve studies, Yemen can unlock significant potential in its oil sector. This initiative requires careful planning, investment in infrastructure and workforce, and adherence to sustainable practices to ensure the long-term benefits of oil exploration while supporting national development goals.
- Supporting the Oil Exploration and Production Authority is essential for the effective supervision of oil activities in Yemen. By enhancing the OEPA's capabilities through training, technology, stakeholder engagement, and regulatory frameworks, the oversight of both foreign and national oil companies can be significantly improved, contributing to the sustainable development of Yemen's oil sector.
- By expanding oil exploration in the submerged areas of the Red Sea and Gulf of Aden, significant opportunities for Yemen's energy sector are presented. By developing a structured approach that includes geological studies, regulatory frameworks, technological investment, and community engagement, Yemen can optimize its oil exploration efforts while ensuring environmental protection and local benefits.
- By improving and developing oil agreements with these considerations in mind, Yemen can ensure that its national sovereignty is protected while maximizing the benefits from its oil wealth. A balanced approach that emphasizes transparency, accountability, local development, and environmental stewardship will create a framework conducive to sustainable growth and investment in the oil sector.

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Data availability

The data that support the findings of this study are available from the corresponding author upon reasonable request.

Declarations

Ethics approval and consent to participate: This article does not contain any studies with human participants or animals performed by any of the authors.

Competing interests

The authors declare that they have no conflict of interest in the publication of this article.

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