



Yemen's Natural Resources and their Potential for Economic Development

Khaled Ali Saleh Shatef¹ ✉

Youssef Samihi²

^{1,2}National School of Business and Management (ENCG)-University Ibn Tofail Kenitra, Morocco.

Email: khaledalisaleh.shatef@uit.ac.ma

Email: youssef.samihi@uit.ac.ma

(✉ Corresponding Author)

Abstract

This paper aims to analyse Yemen's natural resources and assess their potential for economic development. It highlights key resources, challenges and strategies for sustainable use to promote growth and stability. Yemen is endowed with diverse natural resources, including oil, natural gas, renewable energy, minerals, and fisheries, which are essential for its economic growth and development. Despite these resources, Yemen faces challenges such as political instability, poor infrastructure, and resource mismanagement that hinder sustainable development. This paper explores the key natural resources in Yemen, their economic contributions, and the barriers to their utilization. It highlights the potential of renewable energy and fisheries to diversify the economy and proposes strategies for sustainable development. Through effective governance, investments in infrastructure, and the adoption of renewable energy, Yemen can overcome these challenges and achieve economic stability and growth.

Keywords: Economic development, Natural resources of Yemen, Renewable energy, Resource management, Sustainable development.

1. Introduction

Natural resources are an essential basis for the continuation of life on the planet in all its forms, which determine the economic level of the population and contribute to social well-being (UNDP, 2020). Development plans depend heavily on the size and quality of these resources (World Bank, 2018). The State's strength and political influence depend largely on its natural wealth, as highlighted by the Millennium Ecosystem Assessment (MEA, 2005). The importance of natural resources increases with the substantial increase in the population and the subsequent high demand for such resources, leading specialists to intensify research, study, and authorship efforts to inform society of the importance of these resources, and to clarify their types, characteristics, and spatial distribution (IPCC, 2021). In addition to identifying the problems faced with a view to preserving them, and contributing to supporting the planning of their sustainable investment (Daly & Farley, 2011). Increased awareness of the importance of natural resources among society's members also contributes to enhancing their participation in the sustainable development of these resources, reducing waste, and preventing environmental pollution (Costanza et al., 1997; Rockström et al., 2009). Efforts to manage natural resources sustainably are critical for ensuring food security and addressing global challenges such as climate change and environmental degradation (FAO, 2021; UNEP, 2019). Collective action and effective governance, as discussed by Ostrom (1990), are essential for the sustainable management of shared natural resources, ensuring their availability for future generations.

Yemen is historically known as Happy Arabic, and has acquired this name relative to Yemen in the sense of happiness and prosperity. This name also dates back to the expressions of Ben Qahtan, who is considered the supreme grandfather of the Qahtanite Arabs (Arabs). Yemen has played an important role in many areas such as agriculture, commerce and urbanization throughout history (Kennedy, 1987). Yemen is located in the south of the Arabian Peninsula within the south-west of the Asian continent, bordered by several sides: from the south of the Yemen, located at the southern end of the Arabian Peninsula, is bordered by the Arab Sea and the Gulf of Aden to the south, Saudi Arabia to the north, the Red Sea to the west, and Oman to the east. The country has a rich history and strategic geographical position, making it a hub for trade and cultural exchange over centuries. Sana'a serves as the political capital, while Aden is the economic capital. Administratively, Yemen is divided into 22 governorates, which function as its main administrative units.

Yemen's natural environment comprises land, water, and air, providing essential resources that sustain human life and ecosystems. These natural resources, including minerals, water, and arable land, form the foundation of economic activities, playing a crucial role in agriculture, industry, and trade. Despite its resource wealth, Yemen faces economic challenges. The nation has historically relied on oil revenues, which have proven unsustainable due to depletion and mismanagement (Pugachevsky, 2011). Dependence on oil has contributed to economic instability and underdevelopment, a phenomenon often described as the "resource curse" (Ansari, 2016). Nevertheless, Yemen

possesses significant renewable energy potential, including solar and wind power, which could alleviate its energy crisis and promote sustainable growth (Al-Shetwi et al., 2021). Furthermore, its small-scale fisheries in the Gulf of Aden and Red Sea represent an untapped economic resource, though challenges such as infrastructure and financing need to be addressed (Wagenaar & D'haese, 2007). The country's agricultural and water resources are under pressure due to limited availability and inefficient management. Efforts to improve water resource management and agricultural productivity are vital for economic and social stability (Sieghart & Rogers, 2013). Yemen is rich in natural resources that play an important role in its economy. One of the most important of these resources: Oil is one of Yemen's most important economic resources, accounting for a large portion of government revenues and exports. Oil has been the cornerstone of Yemen's economy since its discovery. Oil contributes significantly to government revenues and GDP (Colton, 2010; Peterson, 2016). Yemen has significant natural gas resources, which are locally used and also exported. Energy in Yemen relies heavily on natural gas, which is used in electricity generation and other industrial purposes (Alkipsy et al., 2020; AL-wesabi et al., 2022). Yemen contains several important minerals such as gold, copper and nickel, along with other minerals such as iron and zinc. These minerals contribute to the economy through export and use in local industries (ALNETHARY et al., 2020; Taib, 2009a)). Yemen owns large quarries that produce building materials such as granite, limestone and marble. These materials are used locally and are also exported, contributing to the national economy (Al Mugahed and Bentayeb, 2018; Al-Kahtani and Al-Darzi, 2007; Almasehali, 2022; Sultan, 2008; Taib, 2009b). Although Yemen suffers from water scarcity, groundwater and surface sources are used for agriculture and drinking. Water is a vital resource for agriculture and the daily needs of the population, but it faces significant challenges due to climate change and poor governance (Debele Negewo, 2011; Talbi, 2014). These natural resources contribute significantly to Yemen's economy and provide employment for many of the population, despite the challenges facing the country.

The objective of this article is to analyze Yemen's natural resources and evaluate their potential for economic development. It aims to identify key resources, assess challenges in their utilization, and propose strategies for sustainable growth and resource management.

2. Energy Sources in Yemen

Since the beginning of the 1990s, Yemen has had a small impact on the development of the energy sector, compared to regional standards, with production peaking at about 350 thousand barrels per day (bpd) in 2000. However, the sector generated about 60% of the state's fiscal revenues and 85% of export revenues. Yemen is a small country in terms of energy production compared to other countries in the region. However, the oil sector played a key role in financing the state's budget, financing development and providing the hard currency needed to cover imports of food and capital commodities from the early 1990s until today.

2.1. First: Oil

Oil is the backbone of Yemen's economy, accounting for a large proportion of government revenues and exports. Since its discovery in the 1980s, oil has become a major source of government revenue and GDP. However, Yemen's economy relies heavily on oil, making it vulnerable to global oil price volatility. Economic analysis shows that Yemen is suffering from a "resource crisis", with heavy dependence on oil neglecting other sectors such as agriculture and industry, which has weakened the economy in general (Al-Iriani, 2012; Ansari, 2016). Yemen has oil reserves estimated at 3 billion barrels, mostly in the areas of Marib, Al-Jawf, Shabwa and Hadramawt. Yemen's oil production depends on international oil companies working in partnership with the Yemeni government. However, production has been significantly affected by ongoing conflicts and political instability in the country. Oil plays a central role in Yemen's economy, accounting for about 70-90% of government revenues and 90% of the country's exports. These revenues are used to finance the general budget and provide basic services such as education, health and infrastructure (Gaghman, 2020).

Despite the decline in oil production and prices, the sector continues to contribute a significant proportion to the national economy, currently contributing 83.4% of total merchandise exports and 48.3% of total state budget revenues in 2014. Yemen's oil and gas production and export revenues have fallen by 90% since 2014, depriving Yemen of its main source of foreign exchange, and depriving the country of 50-80% of its financial revenues (Alomaisi, 2020).

2.2. Natural Gas

Yemen has substantial reserves of natural gas, which is used to generate electricity and other industrial purposes. Developing this sector can reduce oil dependence and provide new opportunities for economic growth. However, significant investments and infrastructure development are needed to make full use of these resources (Al-Shetwi et al., 2021).

Yemen's natural gas reserves are estimated at 17 trillion cubic feet and are mainly located in the governorates of Marib and Shabwa. The LNG project in Belhav, which began exporting in 2009, is one of the most prominent projects in this sector, where LNG is exported to global markets, especially Asia and Europe (Al-Shetwi et al., 2021).

Natural gas is mainly used to generate electricity in power plants, which helps reduce oil dependence. ISIL is used as fuel in many industries, including the cement and metal industry. Natural gas is also provided for home use, such as cooking and heating.

Despite the great opportunities offered by natural gas, there are several challenges facing this sector, the most important of which are:

1. Infrastructure: Gas infrastructure needs to be developed and improved, especially with regard to gas transportation and storage.

2. Political and security stability: Ongoing conflicts in Yemen affect production and transportation processes, increasing costs and limiting the ability to fully utilize available resources.

3. Investments: There is a need to attract foreign and domestic investment to develop the natural gas sector and its infrastructure.

The oil and gas partnership is a key pivot to developing and exploiting this important resource in Yemen. Through cooperation with foreign companies, Yemen can bring significant economic benefits, transfer technology, and create jobs. However, the success of these partnerships requires political stability, infrastructure development and improved regulatory frameworks, which is the main objective of our study.

2.3. Solar Energy

Due to Yemen's distinct geographical location, the country has high rates of solar radiation, making solar energy a promising option for renewable energy. In recent years, some SMEs have started using solar panels to provide electricity in rural and remote areas, where they lack traditional power infrastructure. These projects contribute to improving the quality of life in these areas by providing the electricity needed for lighting, health and education services. Studies have suggested that solar energy can become a major solution to Yemen's energy problems, especially in areas with severe electricity shortages. Solar panels provide clean and sustainable energy and have proven effective in improving the daily lives of locals in remote areas (Al-Shetwi et al., 2021). In addition, the Yemeni government, in cooperation with international companies, can develop solar infrastructure, enhancing electricity access to disadvantaged areas and contributing to economic development (Baharoon et al., 2016). These studies illustrate the great potential of solar power in Yemen, and the importance of its development as part of a broader strategy to improve the country's energy infrastructure.

2.4. Wind Energy

Although Yemen's wind power has not yet been significantly exploited, there are some locations that have good potential to generate electricity from the wind. According to studies, most of Yemen's regions such as Hodeida, Dhamar, Mekha and Sqtari enjoy climatic conditions favourable to the utilization of wind energy, as data show that average wind speeds in these areas can be sufficient for the efficient operation of wind turbines and the generation of electric power.

A study suggests that Yemen has significant untapped potential in wind energy, and the development of this sector could contribute to diversification of energy sources and reduce dependence on fossil fuels (AL-wesabi et al., 2022). Another study also suggests that the development of wind energy could be an important step towards achieving environmental and economic sustainability in Al-Shetwi et al., 2021. Since many oil and gas installations and electricity systems have deteriorated due to conflicts and poor maintenance, investment in the rehabilitation and development of energy infrastructure to improve the efficiency of the sector and promote economic growth is essential, and work to address challenges that hinder foreign investment, including the deteriorating security and political situation, the investment environment must be improved by providing incentives and guarantees to companies and investors. In addition to the lack of local competencies and modern technology in the field of energy. Working to train and qualify local cadres and transfer modern technology through partnerships with local and international companies is the perfect solution to meet the challenges and achieve sustainable development through the exploitation of renewable sources of energy and natural gas. Thus, investing wind energy in high-potential areas can be an important part of a national strategy to secure sustainable energy and achieve economic diversification. Ongoing conflicts affect energy infrastructure and hinder production and distribution, and working towards peace to attract investment and achieve sustainable development is not very important for the use of Yemen's energy sources.

3. Minerals and quarries in Yemen

3.1. Minerals in Yemen

The Republic of Yemen is part of the Nubian Arab Shield, a rich geological area containing many important mineral deposits such as gold, lead, silver, copper and zinc. This area is characterized by geological conditions suitable for the formation of these deposits, providing significant opportunities for exploration and investment in the mineral sector. According to some studies, Yemen contains deposits associated with volcanic and magmatic activity, especially in areas such as Sana 'a. Lead and zinc deposits are found in areas such as Mount Solid, which are characterized by geological complexities that make them important sites for exploration. Current mineral excavations in Yemen focus on areas such as Al-Jawf and Shabwa, which are rich in these minerals (Taib, 2009a). Another study also noted the presence of large mineral deposits of zinc, lead and silver in the mountainous region, where these deposits contain resources estimated at 12.6 million tons of ore with high concentrations of zinc, lead and silver (Mondillo et al., 2011). Thus, these mineral resources represent an enormous opportunity to develop Yemen's mining sector and to strengthen the national economy through international and domestic investment in this area.

3.2. Gold in Yemen

Gold deposits are found in various areas of Yemen, most notably in Sana 'a, Hajjah, Mahwit and Jawf governorates. These deposits are associated with volcanic and magmatic activity, making them rich in gold. Sana 'a gold deposits are associated with volcanic and magmatic activity and are part of the Nubian Arab Shield. Studies show that gold in Sana 'a is associated with volcanic and magmatic processes that occurred during a different geological era (Li, 2014).

Research shows that volcanic activity in the areas of Hajjah and Mahwit has contributed to the formation of gold-rich deposits. These deposits are found in basalt and andesite rocks, which date back to periods of intense volcanic activity (Manetti et al., 1991). Al-Jawf is one of the most promising areas for discovering gold deposits. Sediment is found in young volcanic and volcanic rocks formed as a result of magmatic activity (Li, 2014). Intensive volcanic activity in Yemen, especially during geological periods such as myocin, has led to the formation of mineral-rich geological structures, including gold. Volcanic volcanoes and eruptions contributed to the transport and deposition of minerals in different regions. Magmatic activity played a key role in the formation of mineral

deposits. Magmatic movements and fiery interventions contributed to the formation of gold deposits in young volcanic and volcanic rocks.

Gold deposits in Yemen, particularly in the areas of Sana 'a, Hajjah, Mahwit and Jawf, are of great importance and are linked to volcanic and magmatic activity. These deposits provide great opportunities for exploration and investment in mining.

3.3. Lead and zinc in Yemen

Yemen's lead and zinc mineral deposits are geologically complex and mainly concentrated in the Jabal Silb area of Marib governorate, and Shabwa governorate is also a promising area for exploring these minerals.

The largest lead and zinc deposits are found in the Jabal Silk area of Marib governorate. These deposits are found in Jurassic-era Dolomite rocks (Li, 2014). A solid mountain associated with the tectonic and geological activity that occurred during the Jurassic period, resulting in the formation of sedimentary environments suitable for the accumulation of these minerals. Sediment in Mount Solid has been exposed to several stages of geological transformation, including hydrolomite and primary metals to secondary metals due to thermal and hydro activity (Mondillo et al., 2011). Interactions between hydrothermal fluids and host rocks led to the formation of new minerals and increased the complexity of the geological composition of these deposits. Shabwa governorate is a promising area for exploring zinc and lead deposits. These deposits are found in Jurassic-era carbonate rocks and successive sediment layers (Li, 2014). Yemen's lead and zinc mineral deposits are geologically complex and concentrated in the Jabal Silb area of Marib governorate, and Shabwa governorate is a promising area for exploration for these minerals. Geological complexity involves thermal and hydrothermal transformations and chemical interactions between host liquids and rocks, as well as tectonic activity that contributed to the formation of these deposits.

3.4. Copper and Nickel in Yemen

Copper and nickel deposits are found in the governorates of Ta 'izz, Amran, Sa' dah and Ishbuh, where these deposits are associated with volcanic supermarkets. These deposits represent a great opportunity for future exploration and development, especially in the Sa 'ada region, which is promising to explore copper and nickel.

Copper and nickel deposits are found in the areas of Ta 'izz and Amran, and are associated with volcanic superrocks. These rocks formed as a result of intense volcanic activity that led to the formation of complex geological structures containing diverse metals (Li, 2014).

Sa 'ada is a promising area for exploring copper and nickel deposits. Geological studies indicate high concentrations of these minerals in volcanic rocks, making them a potential target for future exploration and development (Li, 2014).

Like this, Shabwa governorate is a promising area for exploring zinc and lead deposits. Mineral deposits in shabwa associated with tectonic and geological activity that led to the formation of depositing environments suitable for the accumulation of these minerals (Li, 2014). Although these promising mineral resources exist in Yemen, the full potential for exploration has not yet been exploited. Analysis of the distribution of mineral resources and the current state of exploration indicates that there are several promising areas where investment can be made in order to contribute significantly to supporting the national economy if optimized. With improved mining policies and the provision of the necessary infrastructure, Yemen can become an attractive destination for investment in the mining sector.

3.5. Quarry in Yemen

Quarry in Yemen form an important part of the national economy by extracting, manufacturing and exporting stone materials such as granite, limestone and marble. These natural materials are mainly used in the construction and construction industry, their applications include building construction, pavements, and many other construction projects (Al-Anweh et al., 2023).

3.6. Granite in Yemen

No granite extracted from Yemeni quarries is mainly used in construction applications due to its strength and durability. It is used in cladding buildings, flooring, and different surfaces. Areas such as Sana 'a, Dhamar and El Bayda are the most important sources of granite in Yemen, with quarries providing high-quality ores for construction use.

According to a study, granite extracted from Yemen's El Bayda region shows distinctive metal and geological properties that make it an excellent material for use in construction industries. Geochemical studies reveal that granite in this region is rich in mineral elements, making it suitable for use in a variety of industrial applications (Sakr et al., 2022). In addition, environmental impacts of extraction and manufacture of granite from Yemeni quarries were studied, as environmental impacts related to emissions from quarrying and manufacturing processes were assessed (Al-Kharraz et al., 2020). These studies highlight the importance of Yemen's granite in the construction and construction sector, with emphasis on the need to develop and improve extraction techniques and address the environmental impacts resulting therefrom.

3.7. Limestone in Yemen

Limestone is an essential material in the cement industry and is also used in construction and covering surfaces. Areas such as Marib, Sa 'ada and Amran are among the most important sources of limestone extraction in Yemen. Limestone quarries are present in these areas and provide raw material that is widely used in different industries.

According to a study, limestone in the Amran region is present in large quantities and is used as an essential material in the cement industry. Chemical analysis shows that this limestone contains a high percentage of calcium carbonate (CaCO₃), making it suitable for use in the cement industry and other industrial products. The study also noted some environmental challenges associated with quarrying processes, such as the emission of dust and gases

during limestone extraction (Al-Kharraz et al., 2020). In addition, another study examined the environmental assessment of raw materials used in Yemen's cement industry, focusing on the impact of quarrying on the environment and recommendations for improving these processes to reduce environmental damage (Al-Anweh et al., 2023). From these studies it is clear that limestone plays an important role in the construction and manufacturing sector in Yemen, and the environmental impacts of this quarrying extraction processes must be carefully considered to ensure the sustainability of these resources.

3.8. Marble in Yemen

Yemeni marble is a high quality material and is widely used in the interior and exterior decorations of buildings, exported to many countries. The most important marble quarries are located in areas such as Ta'izz, Marib, Saada and Sana'a. Different types of marble are extracted that meet the needs of the world class construction and decoration industry. Studies show that marble extracted from these areas has metallic and geological properties that make it suitable for use in a variety of architectural applications. This marble is characterized by its colour and quality that meets the required standards in the world markets. The export of Yemeni marble also plays an important role in the domestic economy by providing foreign currencies and enhancing Yemen's position in international markets.

Yemeni marble is widely used in cladding floors and walls, and in making surfaces for kitchens and bathrooms. Also, this marble is exported to many countries, where it is used in major construction projects due to its high quality and diversity of colors. The use of Yemeni marble is not limited to Yemen, but extends to Gulf and international markets, enhancing the value of Yemen's exports.

Although studies with a particular focus on Yemeni marble may be limited, some research on the use of decorative stones in Yemen suggests that extracted materials, such as marble, are widely used in Yemen's ancient and modern culture for decorative and structural purposes

(Weiss et al., 2009). Exporting marble from Yemen is an important source of hard currency and contributes to supporting the local economy. Quarries in Marib, Ta'izz and other areas provide jobs for communities and contribute to infrastructure development. Despite Yemen's economic and political challenges, the marble extraction and manufacturing sector remains a vital part of the economy.

Yemeni marble is one of Yemen's most important natural resources and offers great opportunities for economic expansion and improved living standards in areas around quarry sites. Developing this sector sustainably can contribute to strengthening Yemen's economy and make it a strong competitor in international markets.

4. Water sources in Yemen

Yemen is facing a severe water crisis that is exacerbated over time by, inter alia, excessive use of groundwater resources, climate changes and poor sustainable management of these resources. According to the World Bank, a 2010 report showed that Yemen's groundwater reserves had dwindled significantly, with the amount of water available falling from 71 billion cubic metres in 1990 to just 5 billion cubic metres in 2010 (World Bank, 2010).

Yemen's main problem relates to rates of replenishment of surface and groundwater resources. Yemen's average per capita renewable water resources is about 130 cubic meters per year, a figure that is among the lowest globally, well below the internationally recognized water poverty threshold of 1,000 cubic meters per capita per year. Although Yemen relies on agriculture as a major sector, this intensive water use in agriculture is a major challenge. Agriculture uses approximately 3 billion cubic meters per year, which is equivalent to about 90% of the country's total water use. Evaporation and leakage in the old irrigation system also increase water loss. As the population grows and temperatures rise as a result of climate change, Yemen's groundwater is threatened by depletion in the coming decades, placing the country facing significant challenges in securing water for human and agricultural needs (Al-Saidi, 2020). Water scarcity in Yemen is one of the major challenges facing agriculture and human consumption. The country relies mainly on Yemen's groundwater, which is threatened by climate changes and poor governance. There is an urgent need to develop water management strategies and improve use efficiency to ensure the sustainability of these vital resources.

4.1. Groundwater

Yemen's mountainous regions rely heavily on groundwater to meet their water needs, especially in view of the lack of natural groundwater recharge. Although monsoon rains are the main source of underground nutrition, they are often inadequate, especially in recent years due to climate changes. The amount of groundwater used annually in Yemen is estimated to be about 2-3 billion cubic metres, however, most of this amount is not compensated by natural feeding from rainfall. This gap between consumption and recharge leads to a steady decline in groundwater levels, raising the risk of long-term depletion. The valleys and oases on which Yemen's rural communities were dependent have dried up or become extremely poor flows, increasing people's reliance on drilling deep wells to exploit groundwater. With increasing water use in the agricultural, municipal and industrial sectors, these resources are under enormous pressure. Factors contributing to the degradation of groundwater resources include excessive well drilling, inefficient traditional irrigation systems, as well as unregulated water use in agriculture and industry (Al-Sakkaf, 2020). All these factors combined lead to lower groundwater levels, posing a significant threat to the sustainability of these resources in the near future. There is a correlation between the geological formations of groundwater in Yemen, reflecting the diversity of aquifers and the different impacts on groundwater availability. The diverse geological formations, coupled with climatic conditions, contribute to the formation of Yemen's groundwater stockpile, which is mainly concentrated in valleys affected by sediment and flood fans, formed by floods and resulting deposits. Yemen's main aquifers are located in several areas, including the Tahama Plain, the Tibn-Abyan Basin and the Ahur-Mefeh Basin in the south, as well as Ramla-Shibeen in the west and Hadramawt Valley in the east. These areas contain vital aquifers that support the water needs of the surrounding communities. In addition, some areas such as the basins of Sa'ada, Amran and Maareb-Damar-White contain high permeability underground layers and favourable recharge conditions, making them important underground water resources. It is also the most important (Al-Weshali, 2018).

4.2. Surface Water

Surface water is an important source of irrigation in Yemen, consisting mainly of persistent floods and springs, with different quantities and quality depending on the region. Yemen's surface water resources are estimated at about 1000 million cubic meters per year, making it a vital component to support agricultural activities and household needs. Yemen is divided into four main drainage basins according to geographical location and water distribution: the Red Sea Basin, the Gulf of Aden Basin, the Arabian Sea Basin and the current grazing basin. These basins receive rainwater and are spread over various geographical areas of the country. Water resources management is influenced by several factors, including geological and hydrological transactions, which include the construction of mountain stands and the use of rain harvesting techniques (Hariri et al., 2000). These practices help improve water retention in the soil and reduce its loss, contributing to increased groundwater nutrition, both for domestic use and irrigation. In addition, the relationship between the construction of mountain stands and the use of rain harvesting techniques is closely linked, as these structures help to effectively collect and store surface water. This integration of agricultural activities and water resources is an essential part of water conservation strategies in Yemen's mountainous regions. Yemen's surface water includes canyons and dams, which are an important part of the country's water system. However, these resources are limited and face significant challenges due to climate change and recurrent drought. This particularly affects the storage capacity of dams and other water bodies, reducing their effectiveness in meeting the population's water needs. Climate changes decreased precipitation rates and increased evaporation, increasing surface water scarcity (Al-Hamdi, 2015). Dams in Yemen play a vital role in recharging groundwater, and are also used in irrigation and municipal uses, such as supplying water to drinking wells, especially in areas such as the Sana'a Basin. However, data indicate that the construction of dams has not fully achieved the desired results with regard to halting the continuing decline in groundwater levels or improving conditions for degraded aquifers in many basins.

4.3. Fisheries in Yemen

Yemen, with its unique geographical location overlooking the Red Sea, the Arab Sea and the Indian Ocean, has a long coastal boundary of about 2,000 kilometres. This coastal stretch provides Yemen with an enormous marine wealth of fishery resources, making the fish sector a vital part of the country's economy and a major source of food for coastal populations. Yemen also has about 200 islands, the most famous of which is Socotra Island because of its unique biodiversity and diverse fish wealth (Hariri et al., 2000).

4.4. The Importance of Fisheries in Yemen

Yemen's fisheries are among the most important natural resources that support the local economy, with many coastal residents dependent on fishing as the main source of income, providing daily food and employment opportunities for many. Fish is one of the main nutritional sources in the diet of the inhabitants of these regions, containing high-quality proteins as well as essential vitamins and minerals (Zajonz et al., 2016).

5. The Role of Energy Sources and Fisheries in Yemen's Economy

Yemen is endowed with a variety of natural resources, including oil, natural gas, renewable energy potential, minerals, and rich fisheries. These resources have the capacity to transform the nation's economy and provide sustainable development opportunities. However, Yemen faces significant challenges such as political instability, poor governance, and underdeveloped infrastructure, which hinder effective resource utilization.

5.1. Energy Resources in Yemen

Yemen's economy has been heavily reliant on oil and gas revenues, accounting for a large portion of its GDP and exports. The discovery of oil in the 1980s brought economic growth, but poor management and depletion of reserves have led to declining revenues (Al-Fakih & Li, 2018). The gas sector, with its potential for liquefied natural gas (LNG) exports, remains underdeveloped. Yemen's reliance on fossil fuels has made its economy vulnerable to fluctuations in global oil prices and the risks of resource depletion.

5.2. Renewable Energy Potential

Yemen is rich in renewable energy resources, particularly solar and wind power. Studies indicate that the country receives high levels of solar radiation throughout the year, making it ideal for solar energy development. Additionally, coastal areas experience strong and consistent winds, suitable for wind power generation (Al-Shetwi et al., 2021). Renewable energy offers a sustainable alternative to address Yemen's energy crisis, which has been exacerbated by conflict and damaged infrastructure.

5.3. Mineral Resources

Yemen possesses significant mineral deposits, including gold, silver, copper, and limestone. These resources remain largely untapped due to limited investment and infrastructure. With proper exploration and regulatory frameworks, the mining sector could diversify Yemen's economy and reduce dependency on oil (Taib, 2009).

5.4. Fisheries in Yemen's Economy

Yemen's extensive coastline along the Red Sea and Arabian Sea provides abundant fishing resources. Fisheries play a vital role in employment, food security, and foreign exchange earnings. The fisheries sector has the potential to drive economic growth if properly developed and managed (Humran, 2024).

5.5. Current State of Fisheries

Despite its potential, the fisheries sector faces challenges including poor infrastructure, limited market access, and lack of modern fishing technologies. Additionally, overfishing and environmental degradation threaten sustainability.

5.6. Challenges in Resource Development

1. Inadequate Infrastructure: Poor transportation and storage facilities hinder market access and export capabilities.
2. Over-Dependence on Oil: Reliance on oil revenues makes the economy vulnerable to price fluctuations.
3. Environmental Stress: Limited water resources and land degradation pose challenges to sustainable agriculture and resource utilization.
4. Governance Issues: Weak institutions and corruption hinder effective resource management and development (Al-Iriani, 2012).
5. Political Instability: Conflicts and security concerns obstruct development efforts and discourage foreign investment.

5.7. Strategies for Sustainable Development

1. Renewable Energy Expansion: Promoting solar and wind projects to address energy shortages and reduce reliance on fossil fuels (Al-Shetwi et al., 2021).
2. Mining Sector Development: Attracting foreign investment to explore untapped resources and establish efficient regulatory frameworks.
3. Fisheries Modernization: Investing in infrastructure, sustainable practices, and training programs to boost productivity (Wagenaar & D'haese, 2007).
4. Institutional Reforms: Strengthening governance, improving transparency, and enforcing regulations to ensure sustainable resource management (Al-Iriani, 2012).
5. Infrastructure Improvement: Upgrading transportation, energy, and water systems to support economic growth.

5.8. Economic Impact of Natural Resources

Natural resources contribute significantly to Yemen's economy, providing revenues, employment opportunities, and foreign exchange earnings. Developing these sectors can stimulate economic diversification, reduce poverty, and promote stability.

Yemen's natural resources possess immense potential to drive economic growth and development. Overcoming challenges related to governance, infrastructure, and sustainability requires strategic investments, policy reforms, and international collaboration. With proper management, these resources can transform Yemen into a more resilient and prosperous economy.

6. Conclusion

Yemen's natural resources possess immense potential to drive economic growth and development. Overcoming challenges related to governance, infrastructure, and sustainability requires strategic investments, policy reforms, and international collaboration. By leveraging renewable energy, modernizing the fisheries sector, and improving governance, Yemen can achieve sustainable economic stability. Effective management and investments in these resources are crucial to transforming Yemen into a more resilient and prosperous economy.

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