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An Assessment of the Economic Importance of the Shin Dara Coal Mine in Nahrin District, Baghlan Province

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ABSTRACT

The Shindarah coal mine, located in Nahrin District, approximately 87 kilometers northeast of the industrial city of Pul-e-Khumri in Baghlan Province, is considered one of Afghanistan's significant mineral reserves. This mine plays a notable economic and social role in promoting regional economic development. The present study assesses the economic importance of the Shindarah coal mine and its impacts on local livelihoods, employment opportunities, and the development of economic infrastructure in Nahrin District. The research aims to evaluate the economic significance of the mine using a mixed-methods approach that combines desk-based and field research. The findings indicate that coal extraction activities in the Shindarah mine have directly contributed to job creation, increased household income, and the overall growth of the national economy. Indirectly, the mine has fostered the expansion of small businesses, enhanced transportation services, and increased financial circulation in the district. However, challenges such as poor resource management, lack of modern technology, and environmental issues-including soil and water pollution-have hindered the mine's full economic potential. Currently, the Shindarah mine includes over thirty-five community-operated tunnels and four state-operated ones, with a daily extraction capacity ranging from 180 to 200 tons. It is important to note that coal extraction in the mentioned areas continues, and a limited number of local residents rely on these activities as a primary source of income. Therefore, to ensure more effective extraction and utilization of this resource, serious attention must be given to improving extraction techniques, investing in technical sectors, and strengthening monitoring and oversight.

INTRODUCTION

Coal is one of the most valuable fossil energy resources in the world, formed under specific geological conditions from the remains of plants over millions of years under high pressure and temperature. In terms of composition, coal is a complex chemical mixture characterized by a high concentration of carbon. It also contains varying amounts of water and mineral matter. The presence of plant-based (organic) material is essential and necessary for coal formation (Amini, 2017, p. 125).

This mineral resource, due to its high heat content, is widely used in electricity generation, steel production, and various other large-scale industries. In developing countries-particularly Afghanistan-coal plays a vital role in energy supply, employment generation, and economic growth.

With the advancement of techniques and technologies, significant efforts have been made to reduce the environmental impacts of coal and improve its efficiency. Modern technologies such as coal cleaning and the use of carbon capture systems are among the strategies that can help reduce greenhouse gas emissions (Mirfakhruddin, 2011, p. 4).

Afghanistan is among the countries rich in diverse natural resources, including solid fossil fuels, which are found across five distinct basins. These solid combustible materials are the result of the decomposition of plant remains at various depths underground (Rezazadeh, 2018, p. 122).

Extensive scientific studies on coal-bearing areas have not been conducted to a sufficient degree. Therefore, the present research titled "An Assessment of the Economic Importance of the Shindarah Coal Mine in Nahrin District" can be regarded as a valuable contribution in this field.

The main reason for selecting this topic lies in the lack of comprehensive research and reserve estimations of coal deposits in the studied area, as well as the need to highlight the increasing role of coal extraction in both the national economy and the livelihoods of the people in Nahrin District under current circumstances.

Scientific studies conducted by geologists indicate that, in our homeland Afghanistan, coal deposits and other solid fossil fuel occurrences are mostly located within Jurassic sediments of the Mesozoic era, in accordance with the country's paleogeographic conditions. These deposits are widely distributed across regions such as Sabzak, Dara-e-Suf, Saighan-Ashpushta-Pul-e-Khumri, Nahrin-Chal-Namak Ab, primarily situated in the northern and western parts of the country (Sahak, 2012, p. 313).

Coal accumulations in the aforementioned areas are associated stratigraphically with rock complexes of varying compositions, and are related to multiple horizons of different geological ages.

Despite the aforementioned findings, research in this area remains incomplete, and there is a continuous and

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pressing need for more in-depth studies. The main issues and challenges in this regard include the lack of reliable scientific sources, limited access to previous project reports, unavailability of well-equipped laboratories, and the difficult-to-access nature of the region.

Regarding the background of the topic, it should be noted that the earliest geological investigations were conducted in 1837 by Lord, followed by works from 1880 to 1886 by Crispbach, and in 1880 by Bricquet. These early studies provided only limited information on the stratigraphy of the northern Hindu Kush region, identifying coal deposits within Permian and Cretaceous sediments.

In 1935, further studies were conducted on the stratigraphy and tectonics of northern Afghanistan, leading to early predictions about the region's potential for oil, gas, and coal resources. That same year, Priouks published findings on the stratigraphy of the Hindu Kush and upper Amu Darya basin.

In 1937, Gibrek investigated the Khanabad-Pul-e-Khumri area in his geological research.

The scientific and practical significance of this research lies in highlighting the geological and geographical characteristics of the study area, identifying the properties of its coal deposits, and revealing the extent to which mining-related activities in various parts of the region impact government revenues and the local economy.

The primary objective of this research is to assess the economic importance of the Shindarah coal mine in Nahrin District. Through this assessment, the characteristics of the coal deposits are identified, and the potential impacts of ongoing mining activities under current conditions on the national economy and local communities can be evaluated.

The central research question is: "What impact does the exploitation of the Shindarah coal mine in Nahrin District have on the local economy and the broader economic development of Afghanistan?"

The main hypothesis of this study is that: Scientific extraction and improved management of coal resources in Afghanistan can pave the way for sustainable economic growth and help reduce the country's economic dependence.

This research addresses the following questions:

1.How does the Shindarah coal mine economically impact the lives of people in Nahrin District?

2.Does coal extraction from the Shindarah mine contribute to national economic growth and improve the livelihoods of the people in Nahrin District?

3.In what ways does the exploitation of the Shindarah coal mine benefit the regional and national economy?

4.Can the Chanarak coal mine be considered a sustainable source of income for the local population?

MATERIALS AND METHODS

This research employs a mixed-methods approach, combining both library-based and fieldwork methodologies. Primary data and information were collected from the study area, journals, reliable domestic and international scientific sources, and scientific research reports from the respected Directorate of Coal Affairs and the Hashemi Group Company.

Geological Characteristics of the Study Area

Physical and Geographical Features of Nahrin District

Nahrin is one of the districts of Baghlan Province, located approximately 75 kilometers northeast of Pul-e-Khumri city, with Nahrin serving as its administrative center. The local population primarily engages in agriculture and animal husbandry. Recently, however, the majority have been sustaining their livelihoods through mining activities. The Shindarah coal mine is also situated within this district, as illustrated in (Figure 1).

The Shindarah mine is located approximately 12 kilometers southeast of Nahrin District. It was discovered by local residents in 2001 (1380 AH). From 2007 to 2012 (1386 to 1391 AH), exploratory and extraction activities were conducted by the Northern Coal Directorate. In recent years, however, the mine has been exploited using unscientific methods. The coal from this area is of high quality, characterized by a shiny black color and a powdered texture.

In addition to local use for heating homes during the winter season, the coal is also transported to other areas such as Barka District, Jilga, Central Baghlan, Pul-e-Khumri city, and even to Kunduz Province for use in brick kiln heating (Anwar, 2015, p. 25).

As Afghanistan is a poor country experiencing economic stagnation, it lacks advanced facilities for the extraction of natural resources, particularly coal. Consequently, mining operations are conducted using unscientific methods. Additionally, the mountainous terrain of most regions in Afghanistan has resulted in all coal mines being exploited through underground mining methods (Schmillen, 2021, p. 36).

Figure 1: Coal-bearing Area of Nahrin District

Baghlan Province consists of 14 districts, with Pul-e-Khumri serving as its capital. The districts of Baghlan include Central Baghlan, Khinjan, Doshi, Banu, Deh Salah, Pul-e-Hisar, Khwost, Farang, Guzargah-e-Noor, Nahrin, Borka, Dahana-e-Ghori, Tala wa Barfak, as illustrated in Figure 2.

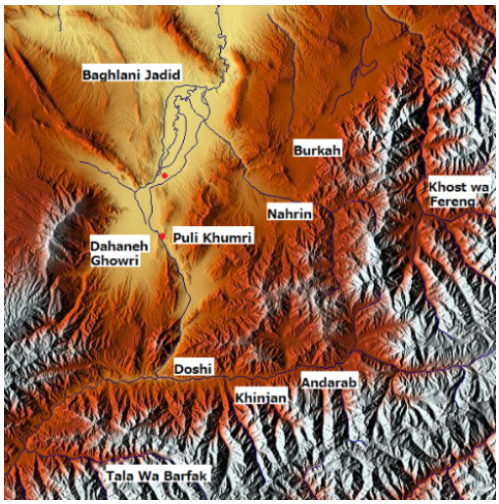

Figure 2: Observational Map of Nahrin District

Various ethnic groups such as Tajiks, Pashtuns, Hazaras, Uzbeks, Gujars, Kazakhs, Mongols, and Pashai live together in this province in a brotherly and harmonious manner.

The population of Nahrin District is estimated at 78,437, comprising 129 villages. The district covers an area of 1,043 square kilometers, and its elevation reaches up to 1,073 meters above sea level. Nahrin shares borders with Jilga District to the east, Central Baghlan and Pul-e-Khumri to the west, Burka District to the north, and Doshi and Andarab districts to the south (Osmani, 2015, p. 29).

Stratigraphy

In the geological territory of Afghanistan, Jurassic deposits have played a more significant role in the formation of coal mines compared to rocks from other geological systems, as conditions during this period were favorable for their development.

Jurassic formations have been identified in many regions of Afghanistan and are generally composed of marine sediments. These formations are stratigraphically divided into Lower-Middle and Middle-Upper Jurassic units.

Since ancient times, specialists have focused on the coal-bearing potential of Lower-Middle Jurassic deposits. Some researchers have identified these coal-rich layers-and in some cases even the Upper Jurassic formations-as significant coal-bearing strata.

Lower Jurassic Deposits

These formations, known as the Sighan Series, are primarily composed of Lias-age strata with a thickness ranging from 83 to 100 meters. This section consists of arenaceous rocks, olistostromes, argillites, fine- to medium-grained coal-bearing clays, along with interbedded coal seams and lenticular coal layers.

Middle Jurassic Deposits

(Excluding the uppermost Yaros-Bath layers)-The bulk of the Sighan Series belongs to the Middle Jurassic. Notable coal occurrences such as Lailah, Shabashak, Dara-e-Suf, Sar Asia, Ashpushta, Nahrin, and others are associated with these Middle Jurassic sediments. These formations predominantly consist of terrigenous rocks with varying amounts of arenaceous rocks, olistostromes, clays, conglomerates, gravellites, and coal. Their thickness ranges from a minimum of 458 meters to a maximum of 1,748 meters (Sahak & Rezazada, 2012, p. 22).

Tectonics

Based on the lithofacies and geotectonic conditions, the coal accumulation zone in the Nahrin coal-bearing region is part of the Northern Afghanistan Coal Basin. This area experienced subsidence during the Lower Jurassic period, and the formation of foreland structures began, extending as far as the southwestern part of the Pul-e-Khumri region.

The modern tectonic structure of this area has been influenced by active volcanic processes, which disrupted the coal accumulation sequences. As a result, the Lower Jurassic coal-bearing strata are interbedded with terrigenous materials containing tuffs, tuffaceous sandstones, and tuff lavas. These layers are intruded by basic and intermediate igneous rocks in the form of dikes and stocks (Sahak, 2015, p. 15).

Coal occurrences in the Nahrin region are characterized by intense folding, complicated by numerous faults and fractures. The coal seams exhibit steep dip angles ranging from 60 to 80 degrees. The layers are often accompanied by small-scale folds, with amplitudes ranging from tens to, in some cases, hundreds of meters (Rezazada, 2012, p. 23).

Figure 3: Coal Occurrences in the Shindarah Area

RESULTS AND DISCUSSIONS

Based on comprehensive studies, the coal mine in Nahrin District holds significant economic importance for the region.

The Shindarah mine is located 12 kilometers southeast of Nahrin District. It was discovered by local residents in 2001 (1380 AH), and exploratory and extraction activities were carried out by the Northern Coal Directorate between 2007 and 2012 (1386-1391 AH). In recent years, however, the mine has been exploited through unscientific and informal methods. The coal found in

this area is of high quality, with a shiny black color and a powdery texture. Besides being used locally for heating homes during winter, it is also transported to other areas such as Burka, Jilga, Central Baghlan, Pul-e-Khumri, and Kunduz Province for fueling brick kilns.

As previously noted, this research evaluates the economic significance of the Shindarah coal mine in Nahrin District of Baghlan Province. The name Shindarah translates to "Green Valley," referring to the area under investigation. The mine is located approximately 3 kilometers from the Coal Directorate's local office. The number of informal mine shafts (locally known as "sofs") is constantly changing, as some are closed due to safety incidents. Currently, the mine hosts over 40 informal shafts and 4 state-operated shafts. More than 150 to 200 workers are engaged in coal extraction activities. The daily coal output from the mine exceeds 200 metric tons (Irfan, 2024, p. 5).

Figure 4: Primitive Transportation of Coal from Informal Shafts in the Shindarah Coal-Bearing Area

It should be noted that the number of informal shafts is continuously changing, with some becoming hazardous and consequently being closed. The number of workers engaged in coal extraction in these informal shafts varies between 4 to 10 individuals. It is also worth mentioning that the coal extraction volume from these shafts is variable (Irfan, 2018, p. 14).

Figure 5: Unloading of Coal Transported by Miners

It is noteworthy that mineral occurrences, indicating promising coal-bearing strata, have been observed at various locations, suggesting a favorable outlook for coal reserves in the area. The excavation of new government shafts would provide employment opportunities for a significant number of local residents in Nahriyn district. Moreover, it would prevent destruction and unscientific extraction of shafts, while potentially increasing coal production. This, in turn, would generate substantial revenue for the government and income for the local community.

The daily, monthly, and annual coal extraction from informal shafts, operated by approximately 180 workers, is summarized in Table 1.

As shown in Table 1, the government earns AFN 1,500 in tax revenue for each ton of coal extracted from informal shafts operated by local residents.

As previously mentioned, the study area indicates a promising potential for coal resources. If the Islamic Emirate of Afghanistan takes concrete steps toward developing new government-operated shafts, the state's revenues could increase significantly. Moreover, a large number of unemployed residents of Nahrin District in Baghlan Province could gain employment, thereby improving both their livelihoods and the national economy (See Table 2).

Table 1: Extraction of Informal Coal Mines in Shindara and Government Revenues

Daily Extraction (tons)	**Monthly Extraction (tons)**	**Annual Extraction (tons)**	**Tax per Ton Collected by Government (AFN)**	**Market Price per Ton (AFN)**
200	5200	62400	1500	6000
Daily Revenue (AFN)	Monthly Revenue (AFN)	Annual Revenue (AFN)		
300000	7800000	93600000		

Table 2: Revenue from Government- Operated Coal Shafts in the Shindarah Mine

Daily Extraction (tons)	**Monthly Extraction (tons)**	**Annual Extraction (tons)**	**The price per ton of coal in the Shindarah area**
200	5200	62400	4600
Daily Revenue (AFN)	Monthly Revenue(AFN)	Annual Revenue (AFN)	
920000	23920000	287040000	

As shown in Table 2, if the Islamic Emirate of Afghanistan proceeds with the development of state-operated coal shafts, the resulting revenues would be significantly higher compared to those generated from informal shafts. Additionally, by employing qualified professionals under government supervision, unregulated and non-technical extraction of coal in the Shindarah area of Nahrin District can be prevented.

As is well known, mining operations require a labor force and involve various operational expenses. All associated costs have been outlined in Table 3.

Table 3: Annual Salary and Operational Costs of Shindarah Coal Mine (Government- Operated Shafts)

No	Category	Number of Personnel	Monthly Salary per Person (AFN)	Total Monthly Salary (AFN)	Annual Salary (AFN)
1	Geological Engineer	4	16,000	64,000	768,000
2	Technical Worker	8	10,500	84,000	1,008,000
3	Security Guard	4	10,000	40,000	480,000
4	Extraction Worker	184	10,000	1,840,000	22,080,000
5	Miscellaneous Expenses	–	–	–	13,104,000
6	Total Expenses	200	–	–	37,440,000
7	Annual Revenue from the Mine	-	–	–	287,040,000
	Government Net Profit (1 Year)	-	–	–	249,600,000

Table 4: Comparison of Revenues from Government vs. Community-Operated Coal Shafts in Shindarah

Daily Production (tons)		Monthly Production (tons)		Annual Production (tons)		Market Price per Ton (AFN)
Government	Community	Government	Community	Government	Community	4600
200	200	5200	5200	62400	62400	Tax imposed by the government per ton
Revenue		Revenue		Revenue		
Government	Community	Government	Community	Government	Community	1500
920000	300000	23920000	7800000	287040000	93600000	

Based on the above data, a comparison of the revenues from community-operated and government-operated coal shafts is presented in Table 4.

Discussion

Considering the current economic conditions of the country, the Chenarak coal mine located in Nahrin district, Baghlan province, is regarded as one of the significant economic resources in the region. The extraction activities of this mine provide employment opportunities for the local population and contribute to a relative improvement in their economic status. However, alongside these benefits, challenges such as inadequate equipment, harsh working conditions, and insufficient regulatory oversight adversely affect the livelihoods of the miners.

CONCLUSION

Upon completion of this scientific-research study, the following conclusions can be drawn:

1. The Shin Dara coal mine was discovered by local residents in the year 1380 AH (2001-2002 CE).
2. From 1386 to 1391 AH (2007-2012 CE), exploratory and extraction activities were conducted by the Northern Coal Authority; however, in recent years, the mine has been exploited through non-technical methods.
3. The number of operational shafts managed by local communities exceeds 40, highlighting the need for technical enhancement and the employment of skilled personnel. Additionally, it is necessary to initiate new mining operations across various locations within the Shin Dara coal field.
4. There are currently four government-operated shafts in the Shin Dara mines with relatively low daily extraction rates. These require expansion through the excavation of additional shafts, technical strengthening, and recruitment of engineers and professional staff.
5. The coal from these deposits is characterized by excellent quality, exhibiting a shiny black color and a powdery texture.

Recommendations

Based on the findings of this study, the following recommendations are proposed to achieve sustainable development in the Shin Dara coal mine sector of Nahrin district, Baghlan province:

1. The Shin Dara mine contains a considerable amount of coal; therefore, its extraction can increase the revenues of the Islamic Emirate of Afghanistan and improve the economy of the people of Nahrin district.
2. In the Shin Dara mine, more than ten community-operated mining shafts are active, but the number of government-operated shafts is limited; therefore, it is recommended that the number of government shafts for extraction be increased.
3. In addition to extraction activities at the government shafts, dozens of local shafts in the area are currently being exploited in a non-technical manner, with little attention paid to their structural reinforcement.
4. n various parts of the coal-bearing area of Shin Dara, numerous mineral indications can be observed, suggesting the presence of large coal deposits. Therefore, it is recommended that new shafts be excavated to create job opportunities for the people of Nahrin district and increase government revenues.
5. Construction of proper roads, electricity lines, processing facilities, and the development of modern technologies are essential for optimal exploitation of the coal mine.

Novelty Of Research

It is noteworthy that mineral occurrences, indicating promising coal-bearing strata, have been observed at various locations, suggesting a favorable outlook for coal reserves in the area. The excavation of new government shafts would provide employment opportunities for a significant number of local residents in Nahriyn district. Moreover, it would prevent destruction and unscientific extraction of shafts, while potentially increasing coal production. This, in turn, would generate substantial revenue for the government and income for the local community.

Contribution Of Knowledge

The mine has fostered the expansion of small businesses, enhanced transportation services, and increased financial circulation in the district. However, challenges such as poor resource management, lack of modern technology, and environmental issues including soil and water pollution have hindered the mine's full economic potential. Currently, the Shindarah mine includes over thirty-five community-operated tunnels and four state-operated ones, with a daily extraction capacity ranging from 180 to 200 tons. It is important to note that coal extraction in the mentioned areas continues, and a limited number of local residents rely on these activities as a primary source of income. Therefore, to ensure more effective extraction and utilization of this resource, serious attention must be given to improving extraction techniques, investing in technical sectors, and strengthening monitoring and oversight.

Fulfillment Of Research Gap

For writing this article, the researchers faced some challenges such as; in our University we do not have standard library in Geology and Mine field, as well as we do not have developed laboratory. And it is mentionable that, in our university as a researcher we do not have financial independence. Besides this, in this research the researchers used library method, we utilized books, reports, and magazines available in the libraries of Jawzjan University.

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