Impacts of the Construction and Operation of Kamal Khan Dam on the Lives of Nimroz Residents

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Abstract: The vital importance and scarcity of water have compelled people worldwide to adopt more responsible and efficient approaches to its utilization and management. This includes ensuring that every drop is used wisely while minimizing wastage through containment, control, and storage in reservoirs, retention basins, and dams. The construction of the Kamal Khan Dam in Nimroz province is a preventive measure aligned with these efforts. Studies on the construction and operation of this dam indicate that it facilitates the storage of excess water from the Helmand River during periods of high flow, making it available for drinking and agricultural use during times of water scarcity. Additionally, the establishment of a hydroelectric power plant on this dam enables the conversion of water's potential energy into electricity, addressing local energy needs, particularly in the city of Zaranj. This project is expected to play a crucial role in fostering long-term development and improving various aspects of life for local communities.

Keywords: Dam, Ecosystem, Hydroelectric Energy, Surface Water.

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I. INTRODUCTION

Much has been said, heard, and written about water. However, only a small fraction of its immense, fundamental, and decisive role in the lives of humans, animals, and plants has been articulated and documented. Scientific evaluations regarding water affirm that, to date, the various lifesustaining impacts of water on human existence, interconnected natural phenomena, and ecosystems have been studied in conjunction with one another, highlighting that no other element can replace water in society.

The history of human civilizations has repeatedly demonstrated that water is the foundation and origin of life, constituting one of the most essential and urgent needs of humankind. The increasing recognition of water's critical importance has been particularly intensified by the rapid growth of the global population, which has necessitated the expansion of agriculture and industry—sectors heavily reliant on water resources that remain finite and limited.

Hydrologists predict that the escalating and excessive consumption of water will, in the near future, lead to a catastrophic crisis of water scarcity, disproportionately affecting arid and semi-arid regions. The movement of water, like other natural phenomena, is not confined by artificial territorial boundaries established by nations and peoples. Instead, it follows its intrinsic natural laws and governing factors, originating from one geographical region, traversing through others, and ultimately reaching its natural endpoint.

The vital significance and growing scarcity of water have compelled global communities to reconsider their consumption patterns and adopt a more cautious and strategic approach to its utilization. Ensuring the rational and economic use of every drop of water, while scientifically and technically preventing unnecessary wastage, has become an imperative. Researchers and experts emphasize that storing excess water during periods of abundance-when river and stream flows are at their peak-can address water shortages during times of scarcity. Additionally, harnessing the potential energy of water to generate hydroelectric power presents a viable solution to meeting human needs. In this context, the planning, design, and construction of water regulation structures, particularly the Kamal Khan Dam in Nimroz, play a crucial and decisive role in managing water resources effectively.

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II. THE SIGNIFICANCE OF THE CONSTRUCTION AND UTILIZATION OF THE KAMAL KHAN DAM FOR LOCAL COMMUNITIES

The Kamal Khan Dam is one of the most significant, fundamental, and impactful projects for the planned and economic storage, regulation, and distribution of water at the national level, particularly in Nimroz province. Located approximately seven kilometers south of Zaranj city, in the Chahar Burjak district along the Helmand River, the dam has now reached the final stage of completion and is ready for operation following the third phase of its construction.

As a multipurpose infrastructure project, the Kamal Khan Dam not only stores and distributes water but also irrigates 80,000 hectares (equivalent to 400,000 jeribs) of

land and generates nine megawatts of hydroelectric power. With a height of 16 meters, the dam has a storage capacity of 52 million cubic meters of water and has been constructed with a total length of 17 meters.

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The construction of this dam is part of a strategic and effective government initiative aimed at controlling surface water resources and preventing their uncontrolled flow into neighboring countries. The operationalization of the Kamal Khan Dam is expected to bring about transformative and systematic changes in various aspects of local, regional, and national life and economic development. This paper investigates the most significant consequences of the dam's construction and utilization, presenting well-founded analyses of its impact, which will be examined in the following sections.



Fig 1 Location of the Kamal Khan Dam

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Fig 2 the Kamal Khan Dam, its Tributaries and Reservoirs

> Social Impacts

Humans are inherently social beings who live in communities. For the survival and continuity of human generations, societies require well-being, and social welfare has always been dependent on the proper utilization of water, particularly in the modern era. Alongside food and shelter, water plays a crucial and decisive role in human life. Human communities cannot thrive without water, and in essence, the absence of water equates to the extinction of humankind (Sadat, Seyed Mojtaba, 1389).

Therefore, it can be stated with certainty that the construction of the Kamal Khan Dam and the provision of adequate water for the people of Nimroz have significantly contributed to social development. With a strengthened belief in the future, individuals confidently engage in social transformations. Conversely, water scarcity leads to the fragmentation of human settlements, damages the environment, and has negative repercussions on various aspects of life. The lack of water hampers societal growth and forces communities to migrate, resulting in the destruction of local civilizations and achievements, sometimes even erasing historical legacies. This phenomenon applies unequivocally to the villages surrounding and benefiting from the irrigation system of the Kamal Khan Dam.

- From a Social Perspective, the Construction of the Kamal Khan Dam has the Following Impacts:
- **Employment opportunities** for local residents have increased, reducing labor migration both to other regions and abroad.
- **Population retention and attraction**—instead of declining, the population of the area is expected to grow

as labor forces from nearby towns and provinces migrate to seek work opportunities.

- **Reduction in social conflicts**—as water availability improves, disputes related to resource scarcity gradually diminish.
- Enhanced social welfare—the well-being of local communities improves, contributing to the systematic development of human settlements.
- **Increased financial self-sufficiency**—local residents gain greater financial stability, leading to stronger social relationships both within the community and with neighboring villages.

➢ Economic Impacts

The economy serves as the foundation of social life, influencing all other changes and transformations in human society. Economic developments directly affect various aspects of human life, and higher income levels correlate with greater social welfare. The people of Nimroz province are no exception to this principle. With the expansion of agricultural land and improved irrigation systems, the productivity of existing farmlands increases, enabling local farmers to produce higher agricultural yields.

As a result, local residents generate more income by selling their agricultural products, which allows them to improve other aspects of their lives. Additionally, increased revenue fosters the expansion of agriculture, horticulture, and livestock farming, encouraging investment in various sectors and creating employment opportunities for thousands of people. Given that the rural economy of Nimroz is almost entirely dependent on agriculture and animal husbandry, the development of these sectors instills hope for improved living conditions. It enables the local population to live in greater comfort and stability (Abrishami, Jalil, 1380).

The construction of this dam is expected to lift the local population out of poverty and economic hardship, gradually paving the way for a more prosperous and modern lifestyle. Thus, the completion and operation of the Kamal Khan Dam will bring about significant economic transformations for the local community.

> Cultural Impacts

As is widely known, rural life in remote areas of the country relies heavily on agriculture and livestock farming, with the livelihoods of the population dependent on human labor. In the villages of Nimroz, much like other regions of the country, nearly all family members—both men and women—are engaged in agricultural and livestock-related activities. Due to economic hardship, many families prioritize immediate income over education, often choosing to have their children work in these traditional income-generating sectors rather than attend school.

However, if Afghanistan's rightful share of water from the Helmand River is stored in the Kamal Khan Dam and subsequently utilized effectively, significant economic and social improvements will emerge, leading to greater prosperity for local residents. With a relatively stable economy, families will be able to send their children to school without financial worries and even provide educational opportunities for adults, particularly women.

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Such progress fosters a growing awareness among the local population, encouraging them to actively participate in the social and economic transformation of their villages and, consequently, contribute to the overall development of the country. Increased interest in education leads to the establishment of more educational institutions, as well as literacy courses for out-of-school youth, particularly for women. Additionally, sports teams and cultural groups begin to form, and facilities such as community halls and cultural clubs emerge. Ultimately, as a result of the economic and social prosperity facilitated by the construction of the Kamal Khan Dam, the cultural and intellectual standards of the population will rise, empowering individuals to actively and consciously contribute to the nation's development.

Health and Hygiene Impacts

Ensuring the health and well-being of local populations is a strong driver of social and economic changes, particularly in rural areas. As experience has shown, the responsibility for health primarily lies within the family, and within the family, women and mothers play a central and crucial role in social life. Women are responsible for reproduction, preparing food and clothing for the family, and have a decisive and fundamental role in raising children. Therefore, most healthrelated issues in communities are addressed within the family setting.

With the proper knowledge and understanding, women can maintain better hygiene and health conditions within the family and the broader community, thereby preventing the spread of various diseases (Sadat, Seyed Mojtaba, 1396). The availability of clean and safe drinking water in rural families in Nimroz enhances the cleanliness and hygiene of households, promoting better health conditions. The more that health and hygiene resources are made available to families, the more effectively the spread of diseases can be prevented.

In this way, the Kamal Khan Dam plays a significant role in improving the health and well-being of rural populations, serving as an essential preventive measure against various diseases.

Development of Agriculture, Livestock Self-Sufficiency, and Food Security

The provision of water to the residents of Nimroz province enables the cultivation of barren, water-scarce, and under-irrigated lands, leading to a significant increase in annual agricultural yields in these areas. This development has two crucial and vital outcomes: first, it creates employment opportunities for the unemployed rural population, and second, it enhances the overall quality of life, bringing noticeable improvements in social well-being and facilitating access to education.

The inclination of people toward education forms the foundation for social transformation and the enhancement of cultural and intellectual levels. As the cultural awareness of

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the population rises, they become more conscious participants in driving social and economic changes within their villages, thereby contributing actively to the development of the country. This growing awareness fosters an increased interest in establishing educational institutions, leading to the creation of additional learning centers, school support programs, and literacy courses, particularly for illiterate youth and women.

Furthermore, sports teams and organizations begin to operate, and cultural halls and clubs emerge as platforms for community engagement. Ultimately, through the economic and social well-being brought about by the Kamal Khan Dam, people attain higher cultural and intellectual standards, enabling them to participate actively and conscientiously in the nation's development.

> Environmental Impacts

As is well known, the rural areas of Nimroz province are classified as arid regions due to the absence of flowing surface water. The scarcity of water, particularly surface water, has resulted in severe environmental challenges for the region. Due to poverty and economic hardship, local residents have been compelled to cut down trees and forest vegetation for firewood and fuel, leading to the destruction of the region's natural plant cover. This, in turn, has caused significant environmental damage.

However, if water resources are made available in the region, the local population will be able to improve their livelihoods through agriculture and livestock farming, reducing their dependence on deforestation. Consequently, the natural vegetation cover of the area can be restored, and the responsible utilization of water from the Kamal Khan Dam by the local community will contribute to the preservation and sustainable development of the environment. This will have long-term beneficial effects on both the present and future generations of Nimroz province.

> Impacts on Springs, Qanats, and Groundwater

The construction of dams and water management structures has a significant impact on groundwater levels, not only within the immediate area but also in surrounding regions. The regulation and storage of water in reservoirs lead to a rise in groundwater levels, increasing the discharge of existing springs and qanats. Additionally, dried-up, abandoned, or inactive springs and qanats can be restored and reactivated, thereby enhancing access to clean drinking water for local communities.

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Furthermore, with the availability of stored water, residents can engage in fish farming by establishing aquaculture farms. This initiative provides both a stable source of food and an economic opportunity, allowing families to improve their financial conditions through fish sales. Additionally, promoting fish farming reduces the need for excessive hunting of wild animals and birds for food, contributing to the conservation of local biodiversity.

Consequences of Electricity Utilization and Its Impact on Urban and Rural Life

Across the world, including in Afghanistan, people reside in areas where rivers serve as a source of energy generation, particularly for lighting, communication, and industrial processes (Payman, Ali Asghar, 1393). The provision of energy in general, and electricity production in particular, is a fundamental requirement for the progress of any country. Consequently, there is a growing global inclination toward electricity generation, with a special focus on hydropower plants.

Hydroelectric energy is recognized as a clean and renewable energy source, playing a crucial role in sustainable development. As an inexhaustible energy resource, it has gained increasing significance in modern times (Bajouri, Mohammad-ud-Din, 1395).



Fig 3 Location of Kamal Khan Dam

One of the most significant and beneficial outcomes of the construction of the Kamal Khan Dam is its potential to supply electricity to the local population. The stored water of the Helmand River possesses substantial hydropower potential for electricity generation. If these resources are utilized effectively and in a timely manner, up to **9** **megawatts** of hydropower—considered the most economical form of energy globally—can be generated for the residents of Nimroz. The provision of hydropower will bring significant changes and improvements in various aspects of life in the region, including the following:

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- The vegetation and plant cover of the area will be preserved, preventing environmental degradation.
- All residents of the region will have equal and simultaneous access to electricity at a lower cost compared to other fuel and lighting sources.
- Access to electricity will transform rural family life, as people will be able to connect with mass communication tools such as **television**, **radio**, **computers**, **and the internet**, leading to increased social and cultural awareness and the modernization of their lifestyles.
- School students and literacy course participants will be able to study comfortably under electric lighting, enhancing their learning experience.

Multi-Purpose Benefits of Kamal Khan Dam

Studies and experiences from dam construction projects worldwide indicate that dams can be built for a single objective or a combination of multiple purposes. The Kamal Khan Dam, in particular, serves the following purposes:

- Water storage and prevention of water wastage, especially during periods of high water availability.
- Increasing water levels to facilitate drinking water supply and irrigation for cities, towns, and villages.
- Flood control and prevention of potential financial and human losses caused by floods.
- Irrigation of agricultural lands, reclamation of barren and uncultivated lands, and revival of semi-arid and abandoned farmlands.
- Providing water for industrial and production facilities to support manufacturing and related activities.
- Regulating river flow, particularly during rainy seasons and periods of excessive water availability.
- Redirecting river water flow by increasing its elevation for various beneficial uses.
- Construction of hydropower plants to supply electricity to cities, villages, and industrial facilities.
- Creating recreational opportunities such as boating in the dam's reservoir, as well as establishing restaurants, cafés, and rest areas in nearby locations for visitors.
- Preservation and development of wildlife habitats to support biodiversity.
- Ensuring sufficient water supply for livestock farming and promoting animal husbandry in the surrounding areas. (*Abrishami, Jalil, 1380*)

III. CONCLUSION

- The construction of the Kamal Khan Dam was undertaken as a historical necessity and is regarded as one of the significant landmarks of our civilization.
- The construction of the Kamal Khan Dam is not solely an agricultural necessity; rather, it serves multiple critical functions, including the provision of drinking water, as well as fulfilling agricultural and industrial demands.
- The construction of this dam has had positive impacts on various aspects of local life, with its economic significance being the most prominent.
- The Kamal Khan Dam has enabled the utilization of Afghanistan's water rights from the Helmand River,

which originates from the country's valleys and highlands, preventing its wastage into neighboring countries.

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- The stored water in the dam enhances soil fertility and facilitates the cultivation of previously uncultivated lands, thereby boosting agricultural productivity.
- The construction of the dam has positively impacted the climate of the region and neighboring areas, as well as groundwater levels, springs, and qanats, contributing to a moderate temperature in the affected regions.
- The dam provides an opportunity for aquaculture development, particularly fish farming, which serves as a reliable source of protein for the local population.
- The construction of the Kamal Khan Dam has a direct impact on employment opportunities in surrounding areas, helping to reduce labor migration, particularly agricultural workforce displacement from villages to cities or even to foreign countries, especially neighboring nations.
- The vital significance of this dam lies in its ability to generate hydropower, ensuring electricity supply not only to adjacent rural areas but also to urban centers, supporting industrial projects and facilitating the establishment of industrial parks.
- The availability of electricity in villages, towns, and cities fosters rapid cultural development, leading to a higher level of social awareness among the population.

RECOMMENDATION

- Given that our country possesses abundant water resources, a significant portion of which is either wasted domestically or exploited by neighboring countries without exception, the construction of dams is considered a serious scientific, social, economic, and ethical necessity for the government.
- To properly collect excess water from rivers and atmospheric waters, especially during the rainy season, which annually amounts to millions of cubic meters, the construction of dams is vital. Therefore, serious and responsible attention must be paid to the surveying and project development of such infrastructure across various regions of the country as a national project.
- A large portion of the country's water resources can be utilized as primary sources of drinking water and, alongside that, as reliable sources for agricultural and industrial water. To meet the water needs of the population, especially for drinking and agricultural purposes, investments—particularly in attracting foreign capital and the private sector—could play a decisive role in fulfilling these needs.
- The creation of a national committee for the survey, research, organization, and oversight of water resources, as well as the construction of water reservoirs and the provision of hydropower, agricultural, and drinking water, is an urgent necessity for our society.
- It is essential to forecast investments from both domestic and foreign financial resources within the country's budget to ensure the effective utilization of water resources through the construction of dams, which is considered a major national undertaking.
- There is a need to utilize the expertise of experienced domestic specialists and similar countries in the field of

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water resource management, dam construction, and its various applications. Additionally, creating opportunities for training national professionals, both within the country and particularly abroad, at a high academic and technical level, is crucial.

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