Randwick International of Social Sciences (RISS) Journal
Vol. 5, No.2, April 2024 | Page: 263-274
ISSN Online: 2722-5674 - **ISSN Print**: 2722-5666
https://www.randwickresearch.com/index.php/rissj

Fundamental Problems of Water Resources Management in the Helmand River Basin, Afghanistan

DOI: *https://doi.org/10.47175/rielsj.v5i2.963*

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ABSTRACT

The closed hydrology and the geopolitical nature of the Helmand River basin in terms of leadership, management, and use of water resources have created serious threats to its integrity, environmental health, and human security in this river basin. The Helmand River basin, where about 8 million people live, includes about 49 percent of the soil and 11 percent of the water flow of this country. Agricultural sectors and related industries are the main drivers of the economy in this basin and due to the increasing need for food in the country and the region, the population shift towards cities, industrialization, and most importantly climate change and water shortage, competition between major water consumers in this basin is increasing. Despite the increasing number of studies on the water management of the Helmand River basin, no practical research carried out to strengthen and summarize the common conclusions and findings related to the fundamental problems facing the water resources management of this river basin. Therefore, in this article, to fill the aforementioned gap, all related documents, studies, and topics have been comprehensively reviewed and analyzed. To achieve this goal, the qualitative-analytical research method was used to analyze and find the key issues raised, and as a result, the basic problems facing the water resources management of this basin were investigated as much as possible. In the following, the necessary suggestions are also presented so that by implementing it, this country would be able to solve the existing problems by using its hydro political capacities and opportunities and it would also be placed at the center of the water interactions in the river basin, to provide a sustainable and all-round development of the country.

KEYWORDS

Afghanistan; climate change; geopolitics; hydrology; water

INTRODUCTION

The Helmand River basin is one of the most important and largest River basin in Afghanistan, which, with its vast and sometimes fertile plains, can accommodate and support a large part of the country's people. Unfortunately, the residents of this River's basin are struggling with many problems due to various factors, including successive droughts and also the lack of properly management of water resources. These problems, with the occurrence of seasonal rains and disastrous floods, cause huge loss of life and financial losses to the people.

Water management in Afghanistan faced with a number of fundamental challenges as a result of persistent instability and wars of the last few decades. For example, its water resource infrastructures such as dams, water reservoirs, irrigation and water supply

networks, water measurement and metrology stations, and water data collection and analysis systems are facing major problems and this causes a lack of management and lack of properly development of water resources and also intensified the migration crisis in the country (for more details, see: Fahim, 2015; Gleick & Iceland, 2018; GAO, 2014; Yildiz, 2015; King & Sturtewagen, 2010). Also, evidence shows that only the average rainfall (between 250 and 310 mm) in this country is much lower than the average global rainfall (it is about one-third of the global average rainfall) (Fahim, 2016), but on the other hand, it also has unequal distribution; Because Amu River Basin covers about 37% of Afghanistan's land, Kabul-Eastern River Basin covers about 12%, and the Helmand Basin covers about 49% of the country's land, while the percentage of water flow in each is about 60%, 12% and 11% respectively (King & Sturtewagen, 2010). In addition, the seasonality of the country's River flow and its excessive dependence on Seasonal rains in the absence of adequate water storage capacity in Afghanistan have doubled water problems (King & Sturtewagen, 2010). For example, during the droughts of 1999 to 2005, a majority of rural residents faced with water shortage problems were forced to migrate to cities (Yildiz, 2015).

In addition, another water management problem in Afghanistan, especially in the Helmand River basin, is the existence of shared transboundary rivers with neighboring countries, including Iran. The studies of Thomas and his colleagues (2016) also show that 90% of Afghanistan's water are shared with downstream neighboring countries, and its management also requires mutual understanding and interaction between the relevant countries, and this is one of the most complicated problems facing water resources management in the Helmand River basin (see, Ullah & Zulfiqar, 2017; King & Sturtewagen, 2010). The evidence shows that the existing treaty between Afghanistan and Iran on the sharing of Helmand River has outdated with misleading concepts and does not respond to the modern need of the two countries (Shroder & Ahmadzai, 2016). In addition, similar studies also show that the scarcity of water resources and the management of transboundary water are fundamental challenges for stability in Afghanistan and in the region (see, Ullah & Zulfiqar, 2017).

Furthermore, the inability of Afghanistan due to weak bargaining power against neighboring countries including Iran, has slowed down the sustainable management of the country's water resources (see, Hayat & Elçi, 2017). The recent efforts of Afghanistan to construct water diversion dams and water storage may hurt the quantity of water flow in neighboring countries and force them to prevent Afghanistan in every possible way to manage its water resource (Pervaz & Khan, 2014; Rassul, 2011; Shroder & Ahmadzai, 2016). Because Iran and Pakistan are worried about the infrastructural activities of water resources management in Afghanistan (for further study see, Mouszadeh, & Abbaszadeh, 2015; Mokhtari et al., 2017 and, Hayat & Elçi, 2017).

Water management in the Helmand River basin is considered one of the fundamental issues and problems between Afghanistan and Iran, which has certain complexities. For this reason, this problem has an increasing impact on the economic-political relations of these two countries, and as a result, not only it has seriously challenged the management of water resources in the basin inside Afghanistan, but also it deprives the political stability and economic development in the country. To study the dimensions of this issue, the fundamental problems of water resources management in the Helmand River basin have been investigated.

LITERATURE REVIEW

There is very limited reliable information and scientific publications about Afghanistan's water resources management and related challenges, especially about the Helmand River

basin. However, the results of some of the previous findings show that Afghanistan in general, and the Helmand River basin in particular is facing a shortage and decrease in water resources. In addition to successive droughts and an unprecedented shortage of surface water, the underground water level has been decreasing over time and the water quality in the mentioned area has also worsened. Droughts in the Helmand River basin have led to the replacement of surface water with groundwater resources to support socio-economic development and environmental security. However, due to the low thickness and productivity of underground aquifers, this is not possible. There is also an increasing demand in this watershed due to population growth, agricultural needs, industrialization, and socio-economic improvement (Kohistani, Saf, & Jawid, 2013). Globally, during the last century, the world's population tripled and the use of water increased sixfold, irrigation accounts for 70% of global water withdrawal, industry for 20%, and urban use for 10% (Gourbesville, 2008) and thus the water demand in the Helmand River basin is also decreased.

However, to develop a sustainable water management strategy, we are faced with several challenges in doing so, especially considering the changing and uncertain climate situation in the future, and the rapid population growth that increases social and economic development, globalization. How to best deal with these challenges requires research in all aspects of water management (Cosgrove, & Loucks, 2015). There are a number of methods and policies to manage water resources, among them, integrated water resources management (IWRM) is one of the appropriate solutions and more suitable for sustainable management of water resources that have been considered by many researcher (McDonnell, 2008; Rahaman, & Varis, 2005; Al Radif, 1999; Fulazzaky, 2014; Chikozho, 2014; Mahmoodi, 2008). To implement integrated water management, it is necessary to have a dialogue and understanding with all parties who have shared water resources. Despite efforts at local, national, and international levels to manage water resources, there is still a threat of water shortage and even water crisis in some countries causing irreparable damage to the economy of developing countries (Wolf et al., 2003).

Transboundary water management was understood best, when the reduction of underground and surface water related to food security gets worsen, and as a result, it made the policy makers to take a more comprehensive approach and more effective action to manage the rapid climate changes at the global and national level (see Shroder & Ahmadzai, 2016).

The findings show that transboundary waters have historically caused disputes between neighboring countries, especially between Afghanistan and Iran and Pakistan. The conclusion of the Helmand River Treaty in 1973 between Afghanistan and Iran was a good achievement for the water management of the Helmand River basin. But recently, due to the reduction of groundwater and surface water related to food security, sustainable water management faced more challenged in this area (see Orlović, & Krajnović, 2015).

The findings of Schroeder and his colleagues (2016) about Afghanistan's hydropolitics and its future show that rivers originating from Afghanistan flow to neighboring countries, but this country has not been able to manage its waters due to the instability of the last few decades. It is slow and on the other hand, it has remained far away from the water management structures already stablished by neighboring countries in the absence of Afghanistan. Also, the evidence shows that water management in Afghanistan is not only faced with internal problems and factors but also faced to a number of complicated problems with one or a group of neighboring countries, including the difficulties of negotiating over common water management.

On the other hand, Habib (2014) has investigated water-related problems in Afghanistan. Based on his findings, water management faced with a fundamental problem due to the lack

of and or destroyed water infrastructure systems during long-term civil wars in urban and rural areas. His findings show that as a result of drought in recent years (2003-2019) vast natural resources destroyed in Afghanistan; it lowered the level of water beds, dried up wetlands, caused land erosion, wildlife populations were destroyed and forest areas were left bare. Excessive extraction of underground water along with prolonged drought has led to a severe decrease in water resources and has put Afghanistan's environment under a hazardous pressure.

According to Goes et al. (2016), the only water treaty between Afghanistan and Iran regarding the use of water in the Helmand River Basin is facing serious implementation challenges. He emphasizes that water management in Afghanistan, which has a strong exploitation potential, needs cross-border and regional understanding and measures. Also, Partmore and Rogers (2010) have highlighted the environmental and economic consequences of not managing water in Afghanistan. He shows that the existence of consecutive droughts as well as deforestation and unsustainable land use have caused about 75% of the country's soil to be exposed to the severe risk of desertification and create environmental problems.

Atef et al. (2019) have investigated the cooperation and resolution of water conflicts between Afghanistan and Pakistan. They show that Kabul River, which flows between Afghanistan and Pakistan, provides the capacity and conditions for bilateral dialogue and understanding on the water management of this River basin, and in case of excesses of one side, there will be major problems for water management and will deprive both countries of the benefits of water management in this area.

Itaat and Warzish, (1390) thinks that various factors such as the presence of influential regional powers, such as England with its judgments, ideological differences, facilities built on the River, and periodic droughts, play a role in the hydropolitical problems of Helmand River basin. Also, Yazdani (2016) has investigated the role of morphological changes in the diplomatic relations between Iran and Afghanistan on the transboundary river of Helmand. According to him, one of the effective factors between the two countries is the morphology of the Helmand River and its permanent change in short periods, which has created numerous and complex issues in the legal system. He shows that the morphology of the Helmand River, especially the Arterial Pattern of the border, faces the biggest change compared to other models. And the border is totally located in the most vulnerable parts of the Riverbed. This issue has recently become the most important issue causing tension between Iran and Afghanistan, and it will probably remain so in the future. The difference of opinion about the determined border that follows the current of the River and also from the unstable distribution of water and water rights between the two countries has been formed and ultimately causes a wide range of disputes.

Hafeznia and Alizade, (2007) has studied the hydropolitics of Helmand and its effect on the political relations between Iran and Afghanistan. His findings show that the fluctuation of the Hilmand water flow and the decrease of water flowing towards Sistan in Iran in the last hundred years have always caused problems in the political relations between Iran and Afghanistan at the local and national levels. The occurrence of drought and the reduction of water flow has aggravated the water shortage in Sistan in times of drought in the upper part of the River.

Mouszadeh and Abbaszadeh, (2015) analyzed the mechanisms leading to the harvesting of Helmand River water in Afghanistan with emphasis on the government building project in Afghanistan. Many regional, developmental, and international factors affect the water withdrawal in Afghanistan and consequently the reduction of the flow of the Helmand River toward Iran. In this regard, several studies have been conducted on the role of regional

factors and international relations in the form of hydropolitical studies on the Helmand River (see, Dalutyar & Gray, 2003; Dehghan et al., 2014; Hafiznia et al., 2007). Dehghan et al., (2014) considered the withdrawal of Helmand River water by Afghanistan as a lever for the balance of power in the region, and Badiei et al., (1390) have taken into account the balance of power in the entire region of Southwest Asia. Also, Mousazadeh and Abbaszadeh (2015) shows that the Afghan government's superiority over the Helmand River has caused Iran's influence to be more exploited and overlooked, and Mokhtari and Mustafa (2008) also called the hydro politics of the Helmand River basin as a crisis.

Taking into account the mentioned studies, it became clear that the studies are scattered and numerous in terms of content and nature and do not comprehensively clarify the problems facing the water management in the Helmand River basin. This has caused the Afghanistan government not to have a basic assessment of the fundamental problems of water resources management in the River basin. Therefore, despite the increasing number of studies on the management of water resources in the Helmand River Basin, a comprehensive review has not been done to strengthen and summarize the common conclusions and findings related to the fundamental problems of water resources management in the Helmand River Basin. To fill this gap, this study has comprehensively reviewed, discussed, and concluded related studies and topics.

RESEARCH METHODS

Recently, the problems of drought and lack of water, as an adverse effects of climate change, have become one of the fundamental problems in Afghanistan and faced economic-political and environmental development with serious risks in this country. And thus, investigating the fundamental problems of sustainable water management in dry areas like Afghanistan, especially the water basin of the Helmand River, is a priority that should be comprehensively studied. In this article, the relevant literature is reviewed using the pertinent websites Science Direct - Elsevier Journals, Springer Nature, and Google Scholar and using the keywords like "water management in Afghanistan", "fundamental problems of Helmand River basin management", "water management problems of the basin", "Water crisis in dry region", "Water crisis in Afghanistan", and "Adverse impact of climate change on water resources in Afghanistan". Also, the reference list of each article was checked to find other relevant articles, we obtained more than 40 articles, mostly published after 2001.

RESULTS AND DISCUSSION

Fundamental problems of water resources management in Helmand River basin, Afghanistan

Afghanistan as a whole is facing many problems, such as economic, political, and social problems, drought problems, and endless poverty. This country lacks political frameworks to be able to manage its waters and use these relatively abundant resources for the sustainable economic and social development of the country. Also, there are many problems in the implementation of existing policies and the implementation of water management laws, such as the weak infrastructure, which affects the management, exploitation, and conservation of water resources. The problems related to the management of water resources in the Helmand River basin are explained and analyzed in detail below:

A. **Lack of reliable data:** due to the lack of hydrological measurement stations and their destruction during the war years, the monitoring system, the central information system and management tools, specific and reliable quantitative information about the

water resources of Afghanistan, especially about the water resources of the Darya basin. Helmand does not exist (Saffi & Kohistani, 2013). If so, the current policies and programs related to the management and use of water resources in the country are not up-to-date, and are mainly based on historical information, which has many limitations (Beekma & Fiddes, 2011). In addition, the relevant information that is currently collected in Afghanistan is much less than what is required for water resources planning and management (Gareth, 2014). In this context, there are some different views. For example, the view of some other experts is that the importance of information and research in Afghanistan is less than the budget and political will for those ambitious water management programs, including related infrastructure (Gareth, 2014).

B. The problem of implementation of the Helmand River agreement between Afghanistan and Iran: After the problem of lack of accurate information in this context, one of the most fundamental problems challenging water management in the Helmand River basin is the non-implementation of the existing treaty between the two countries of Afghanistan and Iran. For the implementation of the treaty for effective use of water, mutual cooperation is needed, something that still does not exist honestly between these two countries, and in addition to that, the existing water treaty between Afghanistan and Iran is also, is so old and misleading in terms of modern concepts and it needs new and comprehensive negotiations (Shroder & Ahmadzai, 2016). Even though about 90% of Afghanistan's running water is shared with its neighboring countries, so far, there is no formal dialogue process or bilateral or multilateral agreements on water with neighboring countries, except for the Iran-Afghanistan treaty on the Helmand River (Ullah & Zulfiqar, 2017) and in this context, Afghanistan should think of fundamental solutions and implement them to provide the country's growth and stability with the management of the country's waters, especially the waters of the Helmand River Basin.

C. Economic problems: The main problem of investing in water resource management infrastructure projects in the country, especially in the Helmand River basin, is lack of adequate funds (World Bank Group, 2018). In addition, corruption and negligence in the water management sector of this basin have caused the available funds not to be used effectively, which is an important problem in the management, development, and preservation of water resources in this river basin.

D. Problems of political instability: Political instability is considered a serious long-term risk (Beekma & Fiddes, 2011). The current security situation in Afghanistan is clear to everyone, especially in the field of management, exploitation, and preservation of water resources of the Helmand River basin, the security risks are still uncertain. The current government should pay serious attention to maintaining the stability of the country and ensuring the security of this river basin. Because insecurity had severely limited the formulation and implementation of development projects in previous years.

E. Lack of human resources capacity: The lack of specialized and experimental capacity in the country's energy and water sector, including its inability to attract foreign aid and create national and regional coordination, is a major obstacle in the development of comprehensive water management systems (Beekma & Fiddes, 2011). If, due to the lack of local capacity, the wide presence of foreign consultants and experts, who worked in the relevant ministries and other departments related to water issues in previous years, was evident. On the other hand, government employees are almost generally poorly qualified, poorly rewarded, and unmotivated. These employees at the provincial and district levels are usually infected with corruption and

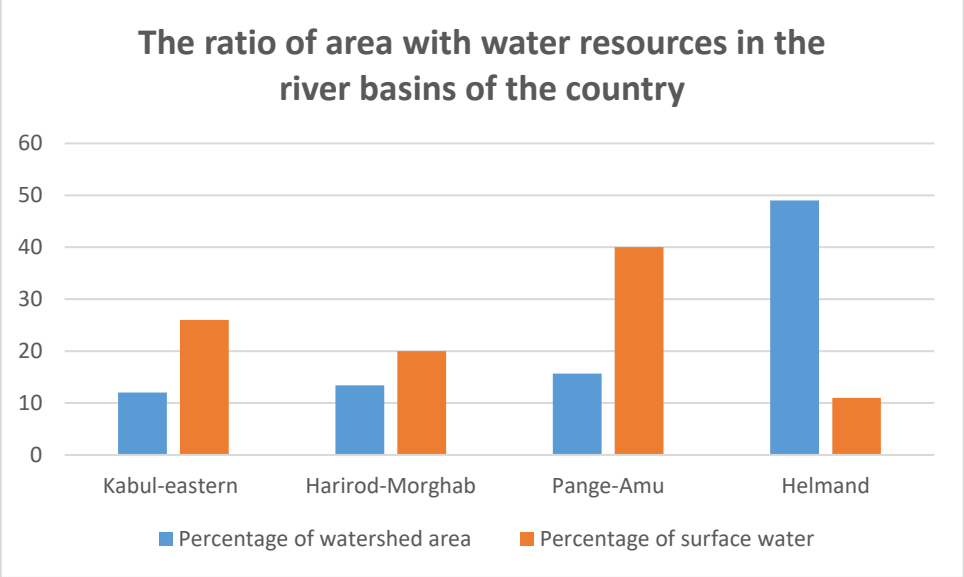
are known as obstacles to the development of effective water management systems (Gareth, 2014).

F. Climatic change problems: Climate Change Problems: One of the important problems facing water management in Afghanistan, particularly in the Helmand River basin is climate change. For example, between 1960 and 2008, the average annual temperature increased by about 0.6°C, at an average rate of 0.13°C per decade, as a result of which the rainfall in Afghanistan decreased sharply (World Bank Group, 2018). This issue is important because water resource in this country is completely dependent on rainfall, which takes place in the form of snow and rain. Studies show that the annual temperature will increase by about 1.4 and 4 degrees Celsius until the 2060s, and with time, these changes will increase, and by the 2090s, the temperature will increase between 2 and 6.2 degrees Celsius. A decrease in rainfall and an increase in temperature in this country will cause all regions of Afghanistan to experience the fastest warming rate in spring and summer at the same time, causing serious droughts and devastating floods (Savage, Dougherty, Hamza, Butterfield, & Bharwani, 2009).\

Studies, as mentioned above, indicate that Afghanistan will experience more severe droughts as a result of a decrease in average annual rainfall in the 2090s, as a decrease in average rainfall of 10 to 40 mm will negatively impact Afghanistan's water resources and especially the southern and southwestern regions of the country will become drier (Hayat & Elçi, 2017). In addition, (Vining & Vecchia, 2007) predict that the annual rainfall in Afghanistan will decrease by about 10% in the next 50 years. Also, snowmelt will occur early in the year (Hayat & Elçi, 2017). This is also one of the major obstacles to water management in the Helmand River Basin.

According to the objectives of this study to examine the fundamental problems of water resources management in the Helmand River basin, it became clear that so far many research and studies have been carried out by individuals, national and international organizations various aspects and issues of water resources in the Helmand River basin, each is of special importance, but these studies and research are very numerous and limited both in terms of nature and scope and in terms of practical goals, and none of these studies, have inaccurate picture, and thus, cannot be comprehensive and practical based on the goals of this study. As a result, the water and water resources management of the Helmand River basin is neglected and does not become a national discourse.

The first discussion in the field of water resource management problems in the country is the uneven distribution of water resources in Afghanistan. For example, the Helmand Basin covers about 49% of the country's land and only 11% of the water flow (King & Sturtewagen, 2010). The inadequacy of the area and water resources, especially in the Helmand the River basin, has caused serious problems in this area and has caused people to face with shortage of water consecutively, and these problems also increase during severe droughts in the River basin, see chart (1):



Source: Nabavi and Mohammadi (2024).

The second issue is climate change, drought, and devastating floods in Afghanistan, which has caused a serious challenge to the management of water resources, especially in the Helmand River basin. People living in this River basin feel this problem seriously in their daily lives. UNEP and NEPA have stated that "drought caused by reduced rainfall and reduced river flow due to reduced spring snowmelt in the highlands are the greatest climatic risks to Afghanistan's livelihoods in the Helmand River basin" (Akhtar, & Shah, 2020).

The third discussion is the hydroponics and the conflict over the Helmand River water sharing between Iran and Afghanistan; one of the main problems of Afghanistan's hydroponics is the country's isolation from the benefits of the water management structures established by its neighbors (Horsman, 2008; Shroder & Ahmadzai, 2016). This problem, especially in the Helmand River basin, has challenged Afghanistan's efforts to sustainably manage the water resource in the basin (Shroder & Ahmadzai, 2016; Khan & Pervaz, 2014), because with this problem the concern of Iran has increased and forced this country to prevent water management in Afghanistan in every possible way. Iran, which has been controlling and using more water in this basin for a long time, this time is trying more than ever to prevent Afghanistan's water management activities in this River basin. The studies showed that the Iranian government is strongly suspected of attacks or covert actions on both Kamal Khan and Bakhsh Abad dams, including in April 2009 and in March 2012. As in the case of Harryrood, these convert actions slowed down the Salma Dam project (Thomas et al., 2016).

Furthermore, another issue is the lasting political, economic, and social instability in Afghanistan, which has made the Afghanistan’s people incapable of managing its water resources in a sustainable way. The findings show that one of the bitter realities in this country is that, due to its geographical location, which has strategic importance in the region, over many years, Afghanistan has become the battlefield of political, strategic, and economic battles between Empires have transformed and made countless sacrifices (Ahmadzai & McKinna, 2018). The management of water resources in this country, especially in the water area of the Helmand River, has faced problems mainly due to the above reasons, and no effective measures have been taken in the field of management, use, and preservation of its water resources (see, Fahim, 2015; Gleick & Iceland, 2018; GAO, 2014; Yildiz, 2015; King & Sturtewagen, 2010).

It should be noted that the issues discussed in this study are faced with many limitations, because this study was done based on previous findings and a review of past works, and there is a need to understand the problems of water resources management in the Helmand River basin and its effective factors scientifically and practically to develop a proper policy for management, use, and conservation of water resources of the Helmand River basin.

CONCLUSION

In this article, the fundamental problems of water resources management in the Helmand River Basin were investigated. The evidence shows that due to the pressure of population increase, climate change devastating floods, drought, and environmental problems, there is a serious need to manage water resources in this river basin. Discussions over the fundamental problems faced by water management, in the Helmand River basin include the uneven distribution of water in the country, which suffers from floods and droughts due to the very uneven distribution of rainfall in space and time. Also, the issue of hydroponics and the conflict over water sharing between Iran and Afghanistan is one of the basic problems in the sustainable management of water resources in this field. In addition to the problems of lasting political, economic, and social instability in Afghanistan, which has made the Afghan people incapable of managing the water resources of the Helmand River Basin in every way. To avoid the catastrophic consequences of hydrological events-floods and droughts now and in the future - it is necessary to study the sustainable development of water resources in this area. Based on the results of such studies, the obstacles and fundamental problems in the way of managing the sustainable development of water resources in the Helmand River Basin, which covers almost half of the country's area, must be resolved. Several practical measures to be adapted to the specific conditions of this river basin have been suggested.

Recummendations

According to the new water law in Afghanistan, which focuses on the participation of stakeholders in water management, the equitable allocation of water, and the division of tasks at the national, basin, and sub-basin levels, including the participation of all stakeholders in decision-making, it should be based on Integrated Water Resources Management (IWRM). The water resources of the Helmand River basin should be managed sustainably. The goal of integrated management is the gradual decentralization of activities to the rivers and sub-basins and the significant use of water resources (Mahmoudi, 2015). Therefore, to achieve the integrated management of water resources in this area, the following should be considered:

To the government: The following actions must be taken by the government:

- In the field of human resources, the energy and water sector, especially in the Helmand River Basin, should build capacity and also fill the related information gap;
- By understanding and using the hydro political capacities of the Helmand River Basin, the government should provide a framework for understanding and mutual cooperation with Iran and the implementation of the Helmand River Water Agreement of 1351;
- Development and integrated management of water resources should be done comprehensively and sustainably;
- The management and development of water resources should be with the participation methods of the stakeholders.
- Planning and development of water resources should be decentralized according to the boundaries of the natural river basin.
- Water sector development activities should be collaborative and consultative at every level by all stakeholders.

To the researchers: Interested researchers should investigate the various aspects of water resource management problems in the Helmand River Basin scientifically and practically.
By implementing the above key activities, we may achieve our goals, which are the sustainable management of water resources in the Helmand River basin, poverty alleviation and unemployment reduction, social economic growth, and public welfare, and this will lead to the improvement of rural development and sustainable environmental protection.

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