



Norwegian University  
of Life Sciences

**Master's Thesis 2017 30 ECTS**

Department of International Environment and Development Studies, Noragric

# **Social impacts of the construction of large dams on upstream livelihood: The case of Khersan-3 dam on Khersan river**

**Mahsa Motevallian**

MSc International Environmental Studies

**Declaration**

I, Mahsa Motevallian, declare that this thesis is a result of my research investigations and findings. Sources of information other than my own have been acknowledged and a reference list has been appended. This work has not been previously submitted to any other university for award of any type of academic degree.

Ås, 15<sup>th</sup>, December 2017

Signature: \_\_\_\_\_

## **Acknowledgements**

First and foremost, I would like to thank my thesis supervisor professor William Derman, for his unreserved support, professional supervision, and useful comments from the proposal stage of the thesis, and to the very last days of the writing process. I am lucky to have him as my supervisor and this thesis would not have been possible without him.

I would like to give a big thanks to all the informants for allowing me to interview them and providing me with valuable information despite their busy daily schedules. Indeed, the fieldwork could not have been successfully conducted without them.

Finally, my warmest thanks must be to my family. Thanks to my parents and my lovely brother, whose love, continuous support and encouragement are with me in whatever I pursue. They are the ultimate role models. Lastly, thanks to my dear husband who has been a huge support throughout my whole master program and makes the completion of this thesis possible.

## **Abstract**

This thesis analyses the social consequences of the construction of large dams on upstream inhabitants. It presents a background about the purposes and the consequences of the large dam constructions in the world as well as investigates on the resettlement issues associated with the large dam constructions. The thesis further illustrates the Iranian water status and water management system and shows the necessity of the dam construction in Iran. The thesis applies a combination of qualitative and quantitative research methodologies as well as literature reviewing method to explore the thesis objectives. Moreover, key informants interview and semi-structured interview methods used during the data collection.

The analysis draws upon the data collected from the Khersan-3 dam located on Khersan river in south-west of Iran. The case study allows me to examine the social impacts of large dam project through time and in details. The thesis focus on and analysis a range of social impacts associated to many large dam projects, including: the migration, population growth and resettlement of people near the dam site; fluctuations in the rural economy and employment status; impacts on infrastructure, communication and housing status; impacts on culture and traditions as non-material parts of life; and impacts tourist attractions and natural scenery of the area; impacts on religious and ancient monuments; and impacts on the industrial development of the region. The thesis concludes that by focusing more on the potential social impacts prior to the dam construction project, involved actors and policy-makers can reach to better decisions about which action should be undertaken and in what way since some of the negative social impacts associated to these kind of projects are permanent and irreversible. In the other word, the decision makers should focus on proactive management system in other to avoid social negative impacts of the construction of large dams rather than reactive management system.

## Table of Contents

<b>Declaration.....</b>	<b>I</b>
<b>Acknowledgements.....</b>	<b>II</b>
<b>Abstract .....</b>	<b>III</b>
<b>1 Introduction and Background .....</b>	<b>3</b>
1-1 The social impacts of construction of large dams on the people’s livelihood and displacement issues .....	4
1-2 Water resource status/management in Iran.....	6
1-3 The necessity of dam construction in Iran .....	10
1-3-1 The impact of climate change on water resources.....	11
1-3-2 The impacts of climate change on water consumption .....	12
1-3-3 The impact of global warming on the energy sector .....	12
1-3-4 Climate change and hydroelectric dams .....	12
1-4 Dams and reservoirs in Iran from past to present .....	14
1-5 Problem statement and Research question .....	14
1-6 Thesis structure.....	15
<b>2 Methods.....</b>	<b>16</b>
2-1 Research strategy: A mixed- methods approach .....	16
2-2 Data collection.....	17
2-3 Challenges and limitations .....	18
2-4 Ethical considerations .....	22
2-5 Data storage and disposal .....	23
<b>3 Results and findings.....</b>	<b>24</b>
3-1 Introduction .....	24
3-2 Overview of a two days’ field visit .....	25
3-3 Social, cultural and economic investigation of Khersan-3 dam’s catchment areas.....	28
3-3-1 Tribes .....	28
3-3-2 Catchment basin’s population .....	29
3-3-3 Literacy and employment status.....	33
3-3-4 Agriculture, animal husbandry, fishery, and beekeeping.....	35
3-3-5 Sanitation and health .....	37
3-3-6 Tourism and sport entertainments .....	38
3-3-7 Communication and road path .....	40
3-3-8 Industries and mines.....	40
3-4 Social, cultural and economic investigation of the villages located in the Khersan-3 Dam’s reservoir .....	42
3-4-1 Introduction.....	42
3-4-2 Description of the villages in Khersan-3 dam reservoir.....	42
3-4-3 Demographic investigation of the villages located in Khersan-3 dam reservoir.....	45
3-4-4 Investigation of the literacy status and housing status.....	47
3-4-5 Facilities and amenities of the villages located in Khersan-3 dam reservoir.....	48
3-4-6 Communication and road path .....	53
3-4-7 Occupational status of the inhabitant of the Khersan-3 dam reservoir .....	55
3-5 Resettlement and compensation issues.....	61
3-5-1 Introduction.....	61
3-5-2 Different types of resettlement investigated for the effected inhabitants .....	62

3-5-3 Works have been done on resettlement issues and suggestions.....	65
<b>4 Discussion .....</b>	<b>71</b>
4-1 Demographic and immigration effects.....	71
4-2 Infrastructure and communications effects .....	73
4-3 Employment and income level effects .....	76
4-4 Effect on animal husbandry .....	79
4-5 Effect on quality of life and literacy .....	80
4-6 Effect on culture and traditions .....	82
4-7 Effect on the tourist attraction points and natural scenery of the area .....	82
4-8 Effect on the religious and ancient monuments .....	83
4-9 Effect on the industrial development .....	84
<b>5 Conclusion.....</b>	<b>86</b>
<b>6 References.....</b>	<b>89</b>

## **1 Introduction and Background**

More than half of the world's major rivers had experience dam construction with some 57,000 large dams by 2015 (International River, 2017). While many people get benefit from the services that large dams provide, the large dams construction and operation phase resulted to many significant, negative and positive social and cultural impacts. Large dam construction adversely affected different categories of people include displaced inhabitant, host societies where inhabitants are resettled, and river area's communities, as well as those downstream of dams, whose access to resources are affected in unpredictable degrees by changed river flows and ecosystem destruction. Generally speaking, the whole communities have lost their access to the region's natural resources and cultural heritage which went underwater by reservoirs' impoundment or rivers transformed by the dams construction. Large dams constructions resulted in to the displacement of 40 to 80 million people in the world (International River, 2016). Many of the displacement inhabitants have not been resettled properly or received a fair amount of compensation. About 4 million people were displaced by constructed of 300 large dams per year in the world between 1986 and 1993 which give an idea of the size of the problem (International river, 2016).

The size and types of social ,cultural and economic issues encountered in the river basins caused by large dam construction are different from region to region. The number of inhabitants deriving their livelihood directly from the river and the river's ecosystem, and the total population mass in the river basin, gives an indication of the potential impacts. China and India (have the most population in the world), have built around 57 percent of the world's large dams and have the largest number of displaced people in this regards. China had about 10.2 million people as "reservoir displaced" people and in India this amount vary from 16 to 38 million people in the late 1980s (International River, 2016).

Resettlement which caused as a result of construction of large dams has been a large part of total resettlement for all developmental public infrastructures. For example in China, 27% of all displaced people by development projects related to the displaced people caused by construction of the large dams. In India 77% of the displacement of people is related to the construction of large dams. Among all the projects funded by World Bank involving displacement, 63% are related to the dams and reservoirs displaced people.

Based on the aforementioned information, this thesis tries to investigate more on the social impacts of construction of large dams on the affected people and specially the “reservoir displaced” people. Khersan-3 dam which is under the construction on Khersan river in southwest of Iran chose as a case study in this regards.

### **1-1 The social impacts of construction of large dams on the people’s livelihood and displacement issues**

Like any development interventions, especially large-scale infrastructural projects, large dam construction involves some form of displaced people from their home and livelihood. The construction of large dams effects not only the ecosystem and the biodiversity of the region but also have serious consequences on people who live both in near and far from the dam site. Changing in the river system (by dam construction) as a multifunctional and most of the times vital resource for the surrounding people can cause the social and cultural impacts. These impacts can be locally disruptive, long-lasting, and irreversible. Displacement is one of the most important impacts of the construction of large dam which can be discussed as physical displacement and livelihood deprivation (World Commission of Dam, 2000).

Broadly speaking, dam displacement caused the physical displacement of people living in the reservoir or other areas related to the dam construction. Displacement happens not only from the reservoirs impoundment but also from the dam’s installation facilities and dam’s associated



infrastructures. Based on the World Commission of dam's (WCD) report, most of the time the dam related physical displacement is compulsory and happens by force.

On the other hand, the inundation of land and changing of the ecosystem by the dam construction also changes the resources available in terms of land and river based productive activities. In the local communities which dependent on their land and the surrounding natural resources, the dam construction often results in the loss of their access to conventional means of livelihood such as some types of their agricultural production, fishing, livestock grazing, and collection of forest products. Beside the economic effects of this disruptions, the displaced people face to losing their access to a series of natural resources and environmental inputs of their pervious livelihoods. This type of livelihood displacement dispossesses people from their production resource as well as their previous socio-cultural environment.

The time of the social impacts caused by the construction of large dams are varies based on the proximate cause. When the inhabitants loss their home and livelihood because of the impoundment of a reservoir, the social impacts can be seen quite immediate (upstream impacts). The impacts on the downstream livelihood can be seen only after the completion of the dam. The change in fellow and the social impact on the recession of agriculture sector can be seen quickly after the completion of the dam but the physical and chemical changes resulted to the degradation of ecosystem function and loss of biodiversity cannot be seen immediately and need more time to occur (Richter et al.,2010).

Moreover, in most of the cases, resettlement programs have mainly concentrated on the physical relocation processes rather than the economic and social development of the displaced effected people. This gap in the resettlement plan result to impoverishment of a majority of the displaced people in the most of the dam projects in the world (World Commission of Dam, 2000). According to the studies, displacement is a perfect example of the social exclusion of the certain group of people. It leads to the physical exclusion from a geographical zone as well

as social and economic exclusion from a various of social networks. Therefore, affected inhabitants face a broad range of impoverishment risks such as losing their lands, losing their occupations, losing their homes, losing food security, losing of the common resources, facing marginalization, and facing community division. All the mentioned impoverishment risks associated with resettlement may result in a loss of sociocultural resilience (Cernea, 1998).

The main economic risks to the affected inhabitants are related to the loss of their livelihood and income sources including agricultural land, common properties (such as forests, grazing areas, fisheries, wetlands), as well as changed access and control over of the economic resources. The inhabitant's economic power loss can result in short-term or long-term, and in some cases irreversible weakening in their living standards, caused marginalization of this group of people. The more diversity in the loss of the livelihood resources create higher risks and uncertainties for the effected people. Moreover, the loss of agricultural activities can create negative affect on the inhabitant's food security which may cause undernourishment (Cernea, 1998). In addition, worsening of the water quality caused by the dam construction may increase the number of the contaminated water type diseases resulted in increasing morbidity and mortality (Lerer, Scudder, 1999).

All in all, forced displacement caused by the large dam constructions resulted to apart the existing social structure of the inhabitants which may lead to social and cultural disarticulation if the proper resettlement plan is not exist.

## **1-2 Water resource status/management in Iran**

Iran located in west of Asia, and having water boarder with the Caspian Sea in the north and the Persian Gulf and Oman Sea in the south. Iran is the second largest country in the Middle East and the 18<sup>th</sup> largest country in the world. From 7880 km of total boarders of Iran with its neighbors, 2440 km are water borders. Iran has the second place in terms of the population in the Middle East and the 17<sup>th</sup> place in the world with about 77 million people. The country have

a large climatic variability and diverse topography. The country has about 413 billion cubic meters of precipitation per year but the amount of precipitation is very different in different regions of the country, fluctuating from about 50 mm in the central regions to about 1000 mm in the region located on the Caspian coast. However the average precipitation of the country is about 250 mm annually. It should be noted that the 75% of the country's precipitation is off season and in the season when there is no need of water for the agricultural sectors. The significant variability of the time and place of the precipitation in Iran has been one of the main reasons to construct lots of dams and large reservoirs in order to control water flows. 65% of the country is considered as arid areas, 20% is semi-arid areas and the 15% is humid and semi-humid areas. There are lots of rivers in the country. Most of the rivers are flooded in the spring but have little/no water during summer time (Raziei, Arasteh, & Saghafian, 2005).

Iran was a pioneer in terms of sustainable water resource management for thousand years. However, in the recent decades, lots of modern related water issues are associated with this country including, drying lakes and rivers, decreasing the amount of ground water resources, contamination of water, obligatory migration, agricultural losses, and ecosystem destructions (Ahmadi, Samani, & Malekian, 2010). The Iranian people are still proud of developing one of the oldest water regulation, water monitoring, and water market systems in the world as well as constructing the tallest ancient arch dam in the world, one of the largest gravity dams, remarkable flood control infrastructure, weirs, and water transfer channels a long time before most of other countries. However, in the recent decades, rapid social and economic development has caused a serious water crisis for the country. Lots of lakes, rivers and wetlands in Iran (for example, Urmia lake, Hamoun river, and Gavkhoni wetland) were disappeared, dried, and shrunk because of the several reasons including frequent drought, aggressive upstream water use, ever-lasting transboundary conflicts, frequent dust storm, and imposing extensive pressure on the agriculture, industries and urban population (Fathian, Moradi, &

Kahya, 2015) (Madani, Hipel, 2011) (Madani, Marino, 2009). It should be noted that some the mentioned damages to the wetlands had occurred despite the fact that Iran has been committed to preserve its wetlands under the “Ramsar Convention” signed in 1971 which identified the wetland’s essential ecological functions in addition to their economic, cultural and amusing values (Matthews, 1993).

In addition to water resources status mentioned above , rivers have been one of the major victims of human developments in Iran in order to enhance national and regional economies. Lots of dams are built on the rivers to store water in reservoirs with the aim to support agricultural activities, produce electric power, and improve urban water supplies. Iran has the third place in the world in terms of the number of dams which are under construction. In 2014, the country has 316 dams, with the capacity to store 43 billion cubic meters of water as well as 132 dams under construction. Moreover, the country has plan to construct 340 new dams (Madani, 2014). However, the outcomes of this huge dam construction for Iran which needs to be able to have a sustainable development under severe international sanctions are heartbreaking. The tragic out comes of construction of dams in Iran includes, significant damages to the ecosystem, degradation of the quality of water, losing the historic sites by reservoir’s impoundment, changes in the land use types, and increased downstream side development under the shadow of increased water availability (Manouchehri, Mahmoodian, 2002). These outcomes make the Iranian dam construction subject to debate. (Tajziehchi et al., 2013)

Moreover, new water security issues and increased conflict over transboundary water system (both nationally and internationally) caused by the limited water resources and increasing the water demand. At the national level, disagreements continue between different provinces over the national transboundary water such as Urmia lake and Zayandeh-Rud river (Madani, Zarezadeh,2014). These disagreements were strengthened through the reforms which

has been done during the presidential period of Ahmadinejad. Within this reform the watershed boundaries replace by the provincial boundaries in order to give more power to provinces in this regards. Unfortunately, these reforms were resulted in increasing the number of stakeholders and promoting the tragedy of the commons within different watersheds (Zarezadeh, Madani,& Morid, 2013). On the other hand, at the international level, most of the conflicts are regarding the surface waters sharing. For example, the everlasting conflicts about the ownership of the Caspian Sea which is the world's largest lake, one of the main source of the sturgeon in the world, and a key source of oil and gas in the near future in the region. The unsuccessful attempts in reaching an agreements over sharing Caspian sea with its surrounding countries (Russia, Azerbaijan ,Turkmenistan, and Kazakhstan) has caused a transboundary tragedy of the commons, including the massive water pollution and ecosystem damages (Behmanesh, Madani,Geiger, & Bahrini, 2013). Nevertheless, Iran's efforts to increase the use of transboundary surface water resources can lead to increase conflicts with the neighbor countries at the international in the future.

Beside all the human made water issues in Iran mentioned above, the natural disaster should also considered in this regards. Due to the country's geographical location, Iran is a disaster prone country. 11 million people were faced to flood with the average death of 131 people annually during the last two decades (Department of Environment, 2010). Droughts are one of the most common type of natural disaster and happening more frequent in Iran (Abarghouei et al., 2011), which result in major impacts on agriculture sector, urban water supplies, natural ecosystem, and rural areas (Abbaspour, Sabetraftar, 2005). Moreover, studies show that climate change and global warming is apply additional pressure on water resources by making the country warmer and drier (Abbaspour et al. 2009). The impacts of this phenomenon on Iran's water resources and dam constructions will be discussed with more details further in the thesis.

In addition to the mentioned natural based climatic issues, the country has not have an stable economic situation because of the severe international economic sanctions. These economic pressure result to enhance of the short-term benefits maximizing approaches in the water management sector. Increasing the immediate benefits has been a reaction which can be seen from both consumers and decision-makers to combat sanctions. Thus, the water resources status in Iran has worsened during the past decades due to the absence of proper regulatory institutions and economic motivations for user to cooperate (Madani, Dinar, 2013).

Actually, not considering environmental issues in the developmental activities in massive shortsighted national developmental plans have caused to unintentional hydro-environmental problems. Unfortunately, these kind of problems' long-term costs are much more higher than their short-term benefits. Despite the fact that Iran had advanced water management systems comparing to the other Middle East countries, the country is currently faced to a serious water crisis and unfortunately governments take no success and serious action to combat water crisis in long-term (Foltz, 2002).

### **1-3 The necessity of dam construction in Iran**

For the late 19th, the climate change issue has been raised up globally and the impact of climate change and the gradual evolution of global warming on the development strategies in various fields has become more and more in the focus of attention of government officials and scientific authorities. Water, energy and food sources, agriculture, health, forests and natural events such as floods and storms can influenced by climate change. Therefore, it is essential that the consequences of this phenomenon are taken into account in the long-term planning for the mentioned fields.

What is being explored in this part is an overview of the consequences of the climate change on the water and energy sources. Moreover, explore the adaptation strategies against this phenomenon, especially the necessity to construct large dams for storage of water runoff

from sudden floods (flood is one of the definitive results of climate change) , and providing the opportunity to manage the proper distribution of water, and consequently to control the effects of droughts (drought is another consequence of climate change).

Climate is described as the average of weather conditions in a particular region and climate change is a significant change in the mean of the meteorological data over a period of time. This phenomenon has natural origin and human origins. The natural origin is coming from changes in the sun's energy output (due to solar disruptions) and the human origin is greenhouse gas emissions.

### **1-3-1 The impact of climate change on water resources**

Climate change (global warming) leads to change in the rainfall distribution pattern (both time and place) , in the rainfall amount and types (snow or rain), in flood magnitude, in probable months of maximum flood events , in water quality, in evaporation rates, and in the groundwater levels. Moreover, climate change leads to reduce the amount of snowfall and also changes the snowfall's melted time from spring to winter, which affect the seasonal pattern of river flows. In fact, due to this phenomenon, the natural mechanism that ensures a balanced and gradual distribution of water throughout all the months and seasons of the year will be replaced with heavy rainfall, storms, and sudden flooding. In other words, the volume of runoff water will increase in winter, and in dry seasons such as summer, the groundwater levels will be sharply decrease (Vörösmarty, Green, Salisbury & Lammers, 2000).

Generally, it seems that one of best alternative mechanism that can adjust the imbalance between water resources and water consumption, is the construction of large dams in order to storing water in rainy/monsoon seasons and gradually distributing it in dry seasons (Bates, 2009).

The Intergovernmental Panel on Climate Change (IPCC) analyzes in 2014 indicated that an increase of 1.5 to 4.5 °C in temperature can increase the average global precipitation by 3 to 15

percent. Furthermore, the study of long-term data released by the Iran Meteorological Organization Stations shows that 40 to 50 percent of the annual volume of the rivers' flow of Iran are waste in the shape of flood (Iran Meteorological Organization, 2016) .

### **1-3-2 The impacts of climate change on water consumption**

The results from the study regarding the impacts of temperature rise and annual population growth on water consumption in Tehran county (in Iran) indicate that with assuming of an increase 2 degrees in temperature and the predicted population growth rate by 2030, the annual water demand of this metropolis will be 1.78 billion cubic meters. This amount of consumption will be about twice as more as the current amount.(Iran's Ministry of Energy, 2014)

In addition, the increase in temperature leads to increase in the demand for agricultural water. As the temperature increases, the evaporation is also increase, thus it leads to decreases soil moisture and increases the amount of water required by the plants. Investigations show that a two-degree increase in temperature leads to 30 percent increase in water consumption for irrigation lands which are under cultivation (Iran's Ministry of Agriculture, 2012).

### **1-3-3 The impact of global warming on the energy sector**

Due to the global warming in the recent decades, demand for heating has declined and on the contrary the demand for cooling has risen up. Temperatures rising and population growth have led to increase the demand for energy, and in the future, with the increase in global warming, this trend continues and intensifies. In addition, increased demand for energy will lead to increase the energy production which resulting in increase in greenhouse gas emissions and, consequently, an ever-increasing rise in global warming.

### **1-3-4 Climate change and hydroelectric dams**

Based on the report from Climate Change office of Iran's Department of Environment in 2012, about 78% of the total greenhouse gas emissions in Iran (the main cause of global warming), are from the energy sector, and half of this amount is from thermal powerhouses.



Therefore, One of the alternative plans for adapting and combating the global warming phenomenon is increasing the use of renewable energies, including increasing the use of hydroelectric power which can produced by large dams.

Thus, in the long-term planning regarding Iran's natural resources, and formulate and implement policies to combat the climate change phenomenon, it is important to note that even though the different region of Iran have the same political and geographical boundaries, they do not have the same climate condition. Due to the geographical extent of the country, different climatic condition, and different topography in each region, the severity of the impact of the climate change will be different in every single region in Iran. It is noteworthy that the climate condition in Iran varies very much for example, the temperature varies from less than  $-30\text{ }^{\circ}\text{C}$  (Ardebil county) to more than  $+60\text{ }^{\circ}\text{C}$  (some southern regions). Furthermore, Iran's average annual rainfall varies from less than 50 mm to near 2000 mm in different regions (Iran Meteorological Organization, 2017). Thus, as mentioned before it is impossible to use the same strategies to combat climate change in all the regions of the country as vast as Iran.

Iran is effected negatively by climate change phenomenon in different ways including: increasing the number of floods and droughts, increasing demand for water and energy resources, and losing water distribution balance. Therefore, it is necessary to control the main human made cause of this phenomenon which is greenhouse gases and to find out solutions in order to decrease damages caused by floods, droughts and lack of water resources to combat climate change. According to the researches done by Iran's ministry of energy, it seems that the construction of large dams and hydropower plants, which are multifunctional infrastructures for the purpose of producing clean energy (controlling the main cause of global warming), storing water (to reduce the consequences of drought), and controlling floods (reduction of damages), is one of the most effective tools to reduce, adapt, and control the negative effects of climate change in Iran.

#### **1-4 Dams and reservoirs in Iran from past to present**

Major dam construction in Iran began in the 1950s. In about two decades before the Iran's Islamic revolution, fourteen large dams were built throughout the whole country with the help of foreign designers, engineers, and advisors.

After the revolution in Iran, the dam construction capacity was improved notably. In less than three decades, there are 200 contracting companies, and 70 consultant companies, hundreds of hydroelectric business units have been launched in Iran. Other than the need of generating electricity, the country needs dams to control and manage a growing water scarcity throughout the whole country. Just in 2007, 88 small and large dams were constructed in Iran which had the potential to add close to two billion cubic meters of water annually to the country. Since 2010, Iran has constructed 588 big and small dams and 137 more dams are under construction and 546 dams are in the plane and design phase (Iran Water and Power resource Development company, 2017). According to International Commission on Large Dams (ICOLD)'s report, Iran is the 11th largest dam building country in the world while China and the United States have in the first and second places.

#### **1-5 Problem statement and Research question**

Societies can reach sustainable development and prosperity by utilizing new technologies in constructing their infrastructures. Therefore, inhabitant's real needs and careful consideration of standards must be considered prior to constructing any new infrastructures (such as industrial facilities, big factories, dams and powerhouses), which can lead to reduction and ultimately elimination of negative social and environmental impacts of these kinds of projects.

Constructing large dams as one the developmental tools needs lots of investigations in different field in order to make it sustainable and prevent form its negative impacts. Since, the most vulnerable dam effected people are the people who live upstream side of dam (in reservoir and

river catchment area) thus, investigative of the impacts of constructing large dams on the mentioned people is a great need. Lots of researches and studies have done regarding the technical and environmental aspects of the large dams' construction in Iran however, barely any within social consequences on the effected inhabitants have been carried out so far. In my point of view, it is essential to fill this gap as most of the social impacts of the dam construction are long-lasting and irreversible. Hence, the research question for this thesis will be:

- What are the social impacts of the construction of the Khersan-3 dam on the upstream inhabitants?

### **1-6 Thesis structure**

Besides the introduction and background chapter which includes problem statement and research question as well, the thesis includes four chapters. Chapter 2, presents the methodology I have used as well as the thesis limitations and ethical concerns. Chapter 3, provides my finding and the result I got during the field trip and interviews. Chapter 4, illustrate my personal analysis and discussions before the fifth chapter wraps the thesis up with summery and conclusion.

## **2 Methods**

This study is an impact evaluation of social consequences of construction of Khersan-3 dam. In development studies, impact evaluations seek to investigate the impacts produced by an intervention and to learn what had worked or what did not and why to achieve expected results (Garcia 2011). This chapter describes the methodological approach, and data collection methods used for this research. I will also reflect on the research challenges and limitations, ethical considerations, and data storage and disposal methods.

### **2-1 Research strategy: A mixed- methods approach**

Research strategy is a methodology that helps the researcher to explore the research objectives. Bryman (2015) indicated that there are two main research strategies: qualitative research strategy and quantitative research strategy. I have chosen an interdisciplinary approach where different methods have been used in triangulation thus I employ “Methodological triangulation” strategy to investigate the thesis objectives. Methodological triangulation is describing as the use of more than one method to investigating one phenomenon under investigation and is mostly used in social sciences. This thesis applies a combination of qualitative and quantitative research methodologies as well as literature reviewing method to explore the thesis objectives. This kind of triangulation can be done at the level of research design or data collection (Hussein, 2015).

Triangulation methodology has three main advantages. Firstly, the advantages of the qualitative and quantitative strategies are pulled together. Secondly, by using different methods (ensure triangulation), the validity of the research’s results will be strengthening. Thirdly, since the qualitative and quantitative research strategies are complement each other, researcher might be able to do a precise and useful research and increase the credibility of the research results.

## **2-2 Data collection**

I choose Key informant interview (resource person interview) which is a type of qualitative interviews that involve face to face interview with a key person in the village community and official authorities as one of my data collection methods (Bryman 2012). In this research, key informant interviews had an important role because it was mainly through these interviews that I understood the large dam construction process in Iran, at least in theory. Moreover, the key informant interview provided a comprehensive knowledge about the social, cultural and economic situation at the Khersan-3 dam catchment areas level as well as the reservoir area. More importantly, I got most of my second-hand quantitative data from these interviews since the catchment and reservoir areas are very big and I had time and resource constrains in order to do the quantitative investigation by myself (probably more than a year of field works in different cities and villages needed). The resource persons' interview included at least one authorized person in most of the related company and organizations related to the Khersan-3 dam construction project at the national and local levels. (both private and public companies and officials). It should be noted that some interviews were also done at the village representatives level in order to get their view point regarding the thesis objectives as well.

While conducting key informant interviews, I use semi-structured type of questions to interview my informants since it seemed to be the best interview's question type regards to my research. A semi-structured interview is a type of formal interview in which the interviewer has partially structured the interview in advance with preparing an interview-guide including questions to cover the research topic(s), but the questions not necessarily needs to be discussed in a specific order and there is also room for unplanned and related sudden raised up questions. Semi-structured interviews are different from structured interviews, in which structured interview is mostly related to quantitative research and based on a formal questionnaire that is fixed during the interview. Furthermore, semi-structured interviews also differ from

unstructured-interviews in which in un-structured interview there is no need to pre-made interview-guide and interview questions but rather conducts as an informal interview discussing one or more specific topics.

Moreover, the researcher can choose between different ways to conducting interview such as: between face-to-face or by telephone interviews, and between using a recorder or writing notes at the time of the interview (Bryman, 2012). In my case study, I preferred to conduct face-to-face interviews in order to be able to motivate the interviewees to discuss more regarding the topic and questions as well as to do as many as possible interviews by this way. However, I could not manage to do all of the interviews face-to-face so a few of them had to be done by telephone or skype because of the interviewee's time limitation or long distance issue. Nevertheless, I got satisfactory answers to my research questions also by conducting interviews by telephone and Skype. Furthermore, I took notes by using pen and paper most of the time, as I find out that most of the key informants and interviewees were not comfortable with recording.

In terms of document analysis section, in addition to the primary data which I have personally collected from different interviews, I have reviewed all the existing articles, official reports, magazines, and journal for answering the research questions and examine any possible correlation with the objectives of the thesis. In addition, literature in both English and Persian (Farsi) language was examined as the majority of limited achieved social data on Khersan-3 dam is in Persian (Farsi) language. Moreover, for literature review, I used different specialized libraries related to the dam and water management issues in Iran such as the library of the Iranian National Committee on Large Dam, the library of the Iranian Department of Environment, the library of the Iran's Ministry of Energy as well as the Iran's National library.

### **2-3 Challenges and limitations**

Challenges and limitations are inevitable in the most of the field works. Usually researchers complain of time and resource constraints, something that I also experienced during

my field work as well. Besides all the usual constraints, I had a few other challenges and limitations. The most important challenges that I experienced during my two months of field work in Iran was to finalized my case study. Since almost all the large scale dams in Iran construct under the management of the Iran Water and Power Resource Development Company (IWPCO), I had to be authorized by this company to do my field works on any of the large dams in Iran. I choose Gotvand dam and Azad dam prior to Khersan-3 dam to investigate on but both of them have been rejected by IWPCO company. Here I will describe briefly that why I chose these dams prior to Khersan-3 dam and why they were rejected by IWPCO:

Gotvand dam is an embankment dam which is located on the Karoon river in Khuzestan province in southwest of Iran. The main purposes of constructing the dam was generating approximately 4500 GW/h annual hydroelectric energy, controlling seasonal floods of Karoon river, providing downstream water, and creating tourism attractions (Joozi, Seyfosadat, 2013). Unfortunately, choosing the wrong location of this dam has led to salt deposition on the slope of the Aanbal Mountains upstream of the dam (Mansournejad, Kalantari, Mahdavi & Adeli, 2015). Because of this halite layers (sodium chloride/rock salt) which were coming into direct contact with the reservoir after impounding of water, the concentration of salt has been significantly increase during the Gotvand Dam's life cycle. The increasing of the salt concentration in the reservoir lead to increasing the salt concentration in the downstream of Karoon river which is the source of freshwater for both drinking and agricultural purposes in the Khuzestan plain. The salinity of the Karoon river causes major negative environmental and social impact for the villages and towns which are located downstream of the Gotvand Dam. In addition to the aforementioned unique downstream effect, the upstream local residents are also affected by resettlement associated with this dam like any other large dams in the world (Mansournejad, et al., 2007). Thus, based on the unique environmental and social effects that the construction of the Gotvand dam had on both upstream and downstream side, this dam was

my first priority to be the case study for the thesis. However, after a two weeks of doing official paper works to get the permission, my request had been rejected by the IWPCO company. The Gotvand's project manager indicated that since the social, cultural, and environmental information and reports regarding this dam are confidential and they were archived a long time ago so it is impossible for me to get them.

Therefore, I forced to change my case study to another dam and the IWPCO's officials suggested Azad dam as a suitable case study to me.

Azad dam is an embankment dam which is located on the Gura river in Kordestan province in west of Iran. The main purposes of constructing this dam is generating approximately 500 MW/h annual hydroelectric energy with pumped storage powerhouse, and to provide water supplies for the Kordestan province (Iran Water and Power Resource Development Co, 2017). Azad dam have a unique resettlement plan and process. This dam has the most successful resettlement plan among all the large dams in Iran and become a role-model in this regards (based on my interview with different official bodies of IWPCO company). Thus, I find this dam as an interesting case study to investigate more regarding the social, and cultural impacts of construction of a successful dam. Finally, after a ten days of the paper works and official works I got the permit to start my field work on this dam. At the first step, I had the opportunity to have an interview with the Azad dam's project manager at IWPCO company. He was very interested to the topic and objectives of my thesis however, he told me that lots of the social, cultural and economic data and information of this dam is confidential and I cannot use them in the thesis due to the sensitive location of the dam. (Azad dam located near to the border of Iran with Iraq). Moreover, I was not allowed to go to the dam site for the field visit and I was not allowed to use any figures from any parts of the dam in the thesis (roads, villages, and infrastructures). Thus, according to these constrains, I found the Azad dam impossible for more investigations.



Finally, after lots of meetings and discussions with the authorities of the IWPCO company, based on my own investigations, and the IWPCO's authority's suggestions, I choose Khersan-3 dam as my case study which seems to have a normal constrains and also interesting case study for the further investigations.

Beside the major challenge that I faced to finalizing the case study, I had the following challenges and limitations during my research on Khersan-3 dam as well:

Firstly, I had time limitation in my dam site visit trip. The trip was organized by the IWPCO company and the dam consulting company (Aban-Pazhouh company) however, it was just a two days' trip and I was not able to visit some parts of the catchment areas. This is closely related to the issue of time constraint because if I would have had more time in the field, I might have been able to conduct more interviews, which would have increased the reliability of my findings.

Secondly, the dam site interviews were planned and organized by the IWPCO company and most of them were with the villages representatives, whom I think were selected intentionally according to their agreements to the Khersan-3 dam construction project. Thus, the findings would have been different if I was able to interviewed someone else or more inhabitants individually.

Thirdly, the Khersan-3 dam is still under the constructions (the construction supposed to be finish in 2015). As some of the promised infrastructures, roads, welfare services, and other facilities are also under the construction, it was hard to get the definite answer from local inhabitant about the changes they face by the project's progress, thus their answers to these kind of questions are accurate within the current situation, these answers might be different in future.

Notwithstanding the above mentioned limitations and challenges, I feel that the data which are collected for this thesis have a high quality for the following reasons:

First, all the interviews were translated exactly after the interview time and within the same day in order to avoid missing data and information. Second, I did not have any language barrier since I know the respondents' language and I can be sure that I do not miss any data and information and I avoid misinterpretation in this regards. Third, I made sure to ask the interviewees follow-up and probing questions during the interview whenever I thought that their answer was not clear. Fourth, I prepared and changed the interview guide based on each interview some days prior to the interview day along with the thesis's objectives. Fifth, I was interviewed at least one person in all the relevant officials and companies related to the thesis objectives at the national and local levels in order to increase the credibility of the thesis. Lastly, I used triangulation methodology in order to verifying the data gathered and data sources to increase the level of credibility and validity of my results.

#### **2-4 Ethical considerations**

To ensure to have an ethical sound research Bryman (2015) indicates that the researchers have to be ensure that the research did not result in (i) harm to the respondents, (ii) lack of prior and informed consent, (iii) invasion of the respondents' privacy, and (iv) deceive the respondents.

Doing harm to the respondents can happen directly or indirectly. Direct harm contains physical injuries to the respondents while indirect harms contains psychological injuries such as causing stress at the time of the interview. During this study, I tried my best to cause no harm to anyone participated in the research process, or affected the research's results (for example: all interviewees' names are anonymized through the entire of the thesis). Moreover, I did not want the participants to feel forced to participating in the interviews. Thus, I made sure that I had their oral consent prior to conducting the interviews which was a very time consuming process as most of my interviewees are official bodies and get their consent required lots of paper works. In addition, I started all the interviews with a brief presentation of myself and my research

objectives and explain that what the information gathered from the interview would be used for. Furthermore, I asked for participants' permission in order to use a tape recorder and letting them know the purpose of it and explain that I would be the only person to have access to these recordings. However, most of the participants rejected my request to record the interview. Finally, at the end of the interview, I allowed the participants to add any additional comments or asked me questions that they may have.

## **2-5 Data storage and disposal**

Data storage required filing the information and data manually or electronically in order to make it unreachable to unauthorized person. During my research process, I chose both manual and electronic data storage. In addition to data storage, data should be disposed in a proper way after the completion of the research work or in future. Proper disposal is also essential in order to prevent information leakages to an unauthorized person the same as data storage (Berg & Lune 2012; Bryman 2015).

As the proper storage and disposal are important for ethical reasons, during my field work, data storage was done according to the rules and regulations given to me by the IWPCO company and data disposal will be done in this way also after the completion of my research work.

### **3 Results and findings**

This section is divided into five main subsections. First, introductory note on Khersan-3 dam and its construction goals. Second, a short overview of my field visit to the dam site. Subsequently, the social, cultural, and economic investigation on the Khersan-3 dam catchment areas. Following the social, cultural, and economic investigation on villages which were located in the dam reservoir prior to the construction of the dam and then move on to the investigation on the resettlement processes and suggestions regarding the resettlement process.

#### **3-1 Introduction**

Construction of Khersan-3 dam on the Khersan river in the south of Lordegan city is one of the largest national projects and infrastructures in Iran with the goal of economic growth, poverty eradication, job creation and sustainable development for local people. The construction of the dam began in 2007 and supposed to be operational in 2015 but it's still under the construction. Total number of 28 villages were impacted directly by Khersan-3 dam construction with 24 villages affected because of locating on the reservoir part of the dam and 4 villages affected due to road and communication constructions. All these villages belong to two provinces named "Kohgiluyeh and Boyer-Ahmad" and "Chaharmahal and Bakhtiari".

The catchment of the Khersan river indirectly impacted Hana and Semrom cities (located in Esfahan province) and Sisakht and Yasuj cities (located in Kohgiluyeh and Boyer-Ahmad province), as well as 430 villages and hamlets. These areas are influenced culturally and traditionally by Qashqai, Bakhtiari, and Boyer-Ahmad nomads' culture and life style (IWPCO, n.d.).

I had the opportunity to have an interview with the project manager of the Khersan-3 dam to inquire about the objectives of Khersan-3 dam constructions. Based on the project manager input, the primary goal of Khersan-3 dam construction was to generate over 1.1 megawatt hour of hydroelectric energy per year and the secondary objectives are as follows:

- Regulate of the release of Khersan River flow to optimize energy generation by downstream dams
- Flood controlling over the Khersan river
- Increase the variety of different aquatic and facilitate their breeding
- Recreation purposes and tourism attraction
- Reduce carbon dioxide emissions compared to thermal power plants

### **3-2 Overview of a two days' field visit**

I had a chance to visit Khersan-3 dam and its surrounding areas in a short two days' trip to the dam site. This trip was organized and planned with the Iran Water and Power Resource Company (IWPCO). The company's authorities warned me in advance to not organizing any meetings and interview without their permission due to my own security as well as the confidentiality of some of the information. Thus, I was accompanying by two of the dam specialists from IWPCO company in the entire trip. Beside these constrains, being with these two dam specialists was a great opportunity for me because they have been working with dam related issues for several years and they are familiar with the Khersan-3 dam project as well as the inhabitant's culture and social concerns.

The Khersan-3 dam is located in Chahar Mahal and Bakhtiari province in south-west of Iran. We use Lordegan- Sardaht- Atashgah road to get to the dam site. This road is a paved road up to the Talaeih bridge and the rest of the road up to the dam site is also paved but with low quality asphalt. (this part was unpaved before the Khersan-3 dam construction project).

Through our way to the dam site I saw lots of livestock which were grazing in different villages near to the dam site. As the trip was in summer time and summer consider as Yeylak time for nomads, seeing this amount of livestock in the villages can indicate that the nomads of these areas (or at least a large number of them) don't have a real nomadic lifestyle. I could see sheep, goat, cattle, and cow on the way. In terms of vegetation, the oak, almond, and olive trees were

dominant in the area. Moreover, crop lands with wheat, rice and sugar beet cultivation were visible. In addition to the crop lands, grape and apple orchards could be seen in some parts. In our way to the dam site, we passed from Atashgah village and visited the Atashgah waterfall (one of the most important tourist points of the area). The access road to the Atashgah waterfall is a new paved road which was unpaved before the initiation of the dam construction. The waterfall was very beautiful itself but still suffer from lack of tourist services such as camping areas, toilets, and proper car parking.

We reached to the dam site in the working hours, since the dam is under the construction lots of people working in the area. As I asked from the dam specialists who accompany me, 90% of the workers were from local inhabitants. More than people, lots of industrial vehicles were also worked at the dam site. The construction of the dam's powerhouse was finished and the dam reservoir was ready for impoundment but the dam' wall was still under the construction. The dam supposed to become operational by 2015. In my point of view, the Khersan-3 dam construction project is weakening the beauty scenery of the area and the Khersan river in the construction period.

I interviewed two of the local workers who works on the dam site (from Sarsour and Gholchehreh villages), they were working for the dam project in the past five years and were very happy regarding their incomes as well as their occupation type comparing their pervious occupation which were animal husbandry. Moreover, they told that the local worker learnt lots of industrial technics form the dam project such as welding and piping. However, they mention that some of the elder inhabitant who lost their job as a result of the dam project and could not employ in the dam related jobs because of their age are jobless now and not received a proper compensation in this regards up to now.

Addition to the dam site, I had a chance to visit one of the towns which was constructed for resettlement of the dam effected inhabitants. The town residential units were built similar to the

other houses in the near villages in terms of their shapes but they built according to more updated technology and with industrial materials (stone, cement, iron and steel doors). All the houses in this new town have water pipeline, electricity, and telephone line. This new town also has different welfare services such as primary, middle and high school, one health center with a small pharmacy, and a mosque. A general practitioner visits the patients two days per week at the health center however the inhabitant should go to the cities nearby in order to visit the specialist if needed. Moreover, the small pharmacy located in the health center just have very basic medicines so inhabitants need to go to the nearby cities in order to get advanced medicines. In regards to schools, there is a problem of lacking the middle and high school's teachers. The students face to absence of the teachers and changing a few numbers of teachers during one school year.

Furthermore, I had the opportunity to interviewed with two of the villages representative (from Bizhgan and Benva villages) which resettled in this new town. Both of them were generally satisfied by the dam construction project in the region. They told that the inhabitants' quality of life was increasing because of the new infrastructures and facilities came by the dam construction. They were also happy with the new occupations created by the dam construction both in terms of their types and incomes despite the fact that some of the conventional occupations were missed and some of the elders leave jobless. They were also pleased with the industrial developments which came by the dam construction projects. The only thing that they were missed and unhappy about it was the relocation of their cemetery and Imamzadeh's holy shrine. Although these religious places moved to a new place in coordination with the competent authorities and in accordance with the existing religious laws and regulations but the inhabitants are miss them and unhappy with the relocation processes.

I should mention that the interviewees from my field visit were selected by the IWPCO's authorities and they were present at the time of interview as well. Thus, the result of my interviews would have been change if I randomly selected my interviewees.

I provided the brief report from my short field visit to the dam site and dam reservoir here but I will explain my finding and results from the several interviews with inhabitant, different official actors, and different project's authorities in detail in the following sections.

### **3-3 Social, cultural and economic investigation of Khersan-3 dam's catchment areas**

The Khersan-3 dam catchment areas consist of four main cities (Yasuj, Sisakht, Semirom, and Hana) and 430 villages. In this part different cultural, social and economic investigation is done regards to these areas.

#### **3-3-1 Tribes**

As mentioned before villages and communities which are located in the dam's catchment areas have tribal structure and consist of 3 different main tribes named Qashqai, Bakhtiari, and Kohkiloye and Boyer-Ahmad which have different cultures and social structures.

*Kohkiloye and Boye-Aahmad tribes (nomads):*

Based on the evidence these tribes have an Iranian race. They speak Luri language which is understandable by Persian speaking people. They are Muslims and Shia. They are nomads and camping when they are in Yeylak time during spring and summer. However, they have small and simple settlement and houses when they are in Kishlak periods.

*Bakhtiyari tribes (nomads):*

Based on historical evidence these tribes have a Persian race. They speak Bakhtiyari language which is one of the Persian dialect with the Pahlavi language routs. They are Muslims and Shia. They are camping when they are in Yeylak time. However, they have also small and simple settlement when they are in Kishlak periods.

*Qashqai tribes (nomads):*



Based on historical evidence these tribes have also Persian race. They speak in both Turkish and Persian languages. Most of them are Muslims and Shia. They are camping when they are in Yeylak time. However, they have also small and simple settlement when they are in Kishlak periods.

### **3-3-2 Catchment basin's population**

#### ***3-3-2-1 Urban areas***

Four towns are located within the catchment area of Khersam 3 dam with the following demographic characteristics (Statistical center of Iran, 2011).

##### *Yasuj:*

In 1996, this city had 11813 households and 66776 inhabitant with 34825 men and 31951 women population. Moreover, 1461 individuals were infants under one years old, 9467 individuals were between 1-5 years old, 12177 individuals were between 6-10 years old, 8367 individuals were between 11-14 years old, 13455 individuals were between 15-24 years old, 20762 individuals were between 25-64, and 1087 individuals were 65 years old and above. Statistical data also indicate positive population growth rate which can be due to high migration rate from the villages into to this city in recent years.

In the latest census in 2011, this city had 26304 households with 108505 inhabitant (54825 men and 53680 women).

##### *Sisakht:*

In 1996, this city had 1176 households which was 5979 inhabitant. Among 5979 inhabitant, 3078 were men and 2901 were women population. Moreover, 79 individuals were infants under one years old, 608 individuals were between 1-5 years old, 946 individuals were between 6-10 years old, 746 individuals were between 11-14 years old, 1175 individuals were between 15-24 years old, 2157 individuals were between 25-64, and 268 individuals were 65 years old and above.

In the latest census which was held in 2011, this city had 1852 households which was 7389 inhabitant (3800 men and 3589 women).

*Semirom:*

In 1996 this city had 4823 households and 23867 inhabitant. Among 23867 inhabitant, 12035 were men and 11832 were women. Moreover, 353 individuals were infants under one years old, 2597 individuals were between 1-5 years old, 3884 individuals were between 6-10 years old, 3166 individuals were between 11-14 years old, 4719 individuals were between 15-24 years old, 8059 individuals were between 25-64, and 1089 individuals were 65 years old and above.

Based on the latest census in 2011, this city had 7036 households which was 25122 inhabitant (12653 men and 12469 women).

*Hana:*

In 2011, this city had 1507 households which was 5354 inhabitant (2687 men and 2667 women). However there is no data available in Statistic Center of Iran regarding Hana's population before 2011.

*Lordegan:*

In addition to above aforementioned major cities, some villages from Lordegan city were also located in the catchment areas. Therefore, although Lordegan is not directly affected by dam construction, several of its villages are impacted due to dam construction. The demographic characteristics are as follows:

In 1996 this town had 2830 households which was 16266 inhabitant. Among 16266 inhabitant, 8286 were men and 7980 were women population. Moreover, 355 individuals were infants under one years old, 2880 individuals were between 1-5 years old, 3065 individuals were between 6-10 years old, 1993 individuals were between 11-14 years old, 2885 individuals

were between 15-24 years old, 4697 individuals were between 25-64, and 390 individuals were 65 years old and above.

In 2006, this city had 4459 households with 22728 inhabitant (11522 men and 11206 women) and in the latest census in 2011 this city had 35276 inhabitant.

Table 1 shows the population changes over years in the cities located in the catchment area of Khersan-3 dam. The data indicates that from 1966 to 2011, the population of Yasuj, Sisakht, Semirom, and Lordegan have increase by 11600 %, 3848%, 250% and 10344% respectively. Also the overall population has increased by about 1400%. Overall, Yasuj had experienced the highest growth rate among all other cities.

**Table 1** - Demographic changes of cities within the catchment area of the Khersam 3 dam

City	Year					
	1966	1976	1986	1996	2006	2011
<b>Yasuj</b>	931	4524	29991	66776	96786	108505
<b>Sisakht</b>	192	936	4697	5979	6342	7389
<b>Semirom</b>	10016	13490	20260	23867	26260	25122
<b>Hana</b>	–	–	–	–	–	5354
<b>Lordegan</b>	341	1660	8331	16266	22728	35276
<b>Total</b>	<b>12982</b>	<b>20593</b>	<b>58685</b>	<b>100775</b>	<b>134746</b>	<b>181646</b>

### **3-3-2-2 Rural areas**

According to the available data from “Statistical Center of Iran”, a total number of 430 villages are located in the catchment area of Khersan-3 dam with some villages being empty and lack any inhabitant. This is mainly due to migration to the larger villages or cities in order to get more facilities and amenities. Table 2 shows the number of villages belong to each provinces that located in the catchment area. Data indicates that Kohgiluyeh and Boye-Ahmad province has the largest number of villages in the catchment area among all the four provinces with 271 villages.

Table 3, shows the village demographic changes in the four main cities of the Khersan-3 dam catchment areas. The data indicates that from 1966 to 2011, the rural population of Semirom, Boyer-Ahmad, Lordegan, and Sepidan counties have increase by 129%, 229%, 365% and 189% respectively. Although, the overall rural population has increased in all the counties in the catchment area but the growth rate is significantly low compare to the growth rate of the cities located in the catchment area (Table 1). However, the most rural growth rate among all the counties belongs to Boyer-Ahmad county by 356% growth rate.

**Table 2** - The number and percentage of villages of each province

<b>Province</b>	<b>Number of Villages</b>	<b>Percentage</b>
<b>Chaharmahal and Bakhtiari</b>	79	18.4
<b>Kohgiluyeh and Boyer-Ahmad</b>	271	63
<b>Isfahan</b>	70	16.3
<b>Fars</b>	10	2.3
<b>Total</b>	430	100

**Table 3** - The rural population of the major counties in the catchment area of the Khersan-3 dam

<b>Province</b>	<b>County</b>	<b>Year</b>					
		<b>1966</b>	<b>1976</b>	<b>1986</b>	<b>1996</b>	<b>2006</b>	<b>2011</b>
<b>Isfahan</b>	<b>Semirom</b>	23479	33990	40486	40381	34303	30367
<b>Kohgiluyeh and Boyer-Ahmad</b>	<b>Boyer-Ahmad</b>	52873	76542	109028	136587	113893	121236
<b>Chaharmahal and Bakhtiari</b>	<b>Lordegan</b>	41120	59527	97221	126592	147886	150229
<b>Fars</b>	<b>Sepidan</b>	34400	49800	61176	65798	68324	65080

### 3-3-2-3 Nomadic areas

As mentioned earlier, majority of the rural communities in the catchment area have tribal structures with nomadic society's culture. The main nomad tribes in the catchment area are Boyer-Ahmad, Bakhtiari, and Qashqai.

Table 4 shows the nomad's population in Yeylak and Kishlak areas in the two main provinces of the catchment area according to the socioeconomic census in 1998 which was held by "Statistical Center of Iran".

Table 4 - The nomadic population based on census in 1998

Province	Settlement Period	Household	Total population	Men	Women
Chaharmahal and Bakhtiari	Yeylak	14657	90014	47020	42994
	Kishlak	6032	36025	18658	17367
Kohgiluyeh and Boyer-Ahmad	Yeylak	11120	70775	36777	33998
	Kishlak	10088	63225	32881	30344

### 3-3-3 Literacy and employment status

#### 3-3-3-1 Urban areas:

All the data gathered from the archived reports (Education and research Census) from Statistical Center of Iran (2011).

#### *Semirom:*

Based on the latest census which was done in 2011, 19575 people in this city were literate<sup>1</sup>. From this population 3869, 3891, and 9548 people have finished primary, middle, and

---

<sup>1</sup> Literate person: based on the definition of the Iran Statistic Center is a person with the ability to read and write.

high school, respectively. The remainder of the total population (4503 people) had some colleague-related education.

Active population in Semirom in 2011 were 8909 people with 7571 people employed and 1338 people were unemployed.

*Hana:*

Based on the latest census in 2011, 3821 people were literate which is about 80 % of the whole population. From the entire literate population in this city, 54 % were men and 46 % were women.

Active population in Hana in 2011 were 1880 people with 1716 people employed and only 164 people unemployed.

*Yasuj:*

The latest census in this city was conducted in 2006. Based on this census, 79720 people were literate. Among literate people 53.83 % were men and 46.17 % were women. Moreover, from 7.74 % illiterate people, 2.41 were men and 5.33 were women.

Active population in Yasuj in 2006 were 46145 people with 30 % employed, and 28 % unemployed, and 42 % were school and university students.

*Sisakht:*

Based on the latest census which was done in 2006, 4927 people were literate in Sisakht. Among literate people 53.89 % were men and 46.11 % were women. Moreover, among 835 illiterate people, 42.24 % were men, and 59.76 % were women.

Active population in Sisakht in 2006 were 4576 people, 29 percent were employed, 34 percent were unemployed, and 37 percent were school and university students.

*Lordegan:*

The latest census in this city was also done in 2006. Based on this census 16658 people were literate. Among literate people 9044 were men (about 54 %) and 7614 were women (about

46 %). Moreover, 3276 people were illiterate which 1084 (about 33 %) of them were men and 2192 (about 66 %) of them were women.

However, there is no data available regarding the employment status in Lordegan.

### **3-3-3-2 Rural areas**

According to the census from Statistical Center of Iran in 2011, from the total literate people in “Kohkiluyeh and Boyer-Ahmad” and “Chahrmahal and Bakhtiari” province 38.9 % were living in rural areas and 61.1 % were in urban areas. In addition, from the total literate men in this province 48.15 % were in the rural areas and 51.58 % were in the urban areas. However, from the total literate women 47.61 % were in the rural areas and 52.39 % were in the urban areas.

Moreover, from the total illiterate population in these two provinces 72.84 % were in the rural areas and 27.16 % were in the urban areas (Statistical center of Iran, 2011).

All in all the literacy rate in rural areas are less than literacy rate in urban areas of the Khersan-3 dam catchment areas.

### **3-3-4 Agriculture, animal husbandry, fishery, and beekeeping**

Agricultural lands in the catchment area include wet lands, dry lands, and orchards or in some parts a combination of these types landmarks. Based on the map made from satellite images in 2002, the status of agricultural lands, their types and percentages in the Khersan-3 dam’s catchment areas are summarized in the Table 5. (Ministry of Agriculture Jihad, n.d.)

According to the Table 5, croplands are the most dominant types of lands in these area.

Generally, The cultivation pattern in the catchment area is more focused on the crops such as wheat, barley, rice, and sugar beet. Moreover, other agricultural productions including different types of beans, lentils, sunflowers, tomato, cucumber, watermelon, strawberry also exist in the catchment region. In addition, the orchards products in the catchment areas are: grape, walnut, hazelnut, apple, pear, cherry, cherry, apricot, peach, nectarine, plum, and almond.

**Table 5** - Specifications and types of agricultural land within the Khersan-3 catchment area (square kilometer)

<b>Land Types</b>	<b>Area</b>	<b>Percentage</b>
Cropland	537.74	46.89
Fallow	2.84	0.25
Mix(Cropland- other types)	1.27	0.1
Mix(Cropland-Dry farming)	316.5	27.59
Mix(Cropland-Fallow)	–	–
Mix(Cropland-Orchard)	13.13	1.15
Mix(Dry farming- other types)	238.13	20.76
Orchard	37.22	3.25
Total	1146.83	100

Different types and quantities of livestock in the most important cities of the Khersan-3 dam catchment areas (based on the statistics released by Iran's Statistics Center and Iranian Farmer's Union in 2003) is shown in Table 6. According to this data, sheep, goat, and cow are the major types of livestock in the catchment areas. However, the dominant type of livestock in these areas is goat. Moreover, Boyer-Ahmad city have the most number of livestock (254994) among all the major cities located in the catchment areas.

**Table 6** - Types and quantity of livestock in the main cities of Khersan-3's catchment area.

	<b>Number of Sheep and Lamb</b>	<b>Number of Goat and Kid</b>	<b>Number of Cow and calf</b>
<b>Boyer-Ahmad</b>	92524	146149	16321
<b>Semirom</b>	82216	24500	7654
<b>Sepidan</b>	50185	37790	17845
<b>Lordegan</b>	43283	83372	15628



Additionally, the status of the traditional poultry in Khersan-3's catchment areas based on statistic from 2003 is shown in Table 7 (Iranian Farmer Union, 2003 )

**Table 7-** Traditional poultry's status in Khersan-3's catchment areas.

	<b>Number of Chicken, Rooster, Broiler</b>	<b>Number of Goose, Duck and Turkey</b>
<b>Boyer-Ahmad</b>	127000	4000
<b>Semirom</b>	54000	2000
<b>Sepidan</b>	83000	4000
<b>Lordegan</b>	111000	6000

Moreover, quantity of fish harvested in “Kohkiluyeh and Boyer-Ahmad” province in 2003 was 2,430,000 kg within 240000 square meters area. However, there is no data available regarding the quantity of fish harvested from “Chaharmahal and Bakhtiari” province and other cities of the catchment areas.

In addition, “Kohgiluyeh and Boyer-Ahmad” province had 32,288 new beehives and 1248 old beehives in 2003, these beehives produced 274948 and 1248 kg honey per year, respectively. Nevertheless, there is no data available regarding the amount of honey production from “Chaharmahal and Bakhtiari” province and other cities of the catchment areas.

### **3-3-5 Sanitation and health**

The health system network including hospitals, health clinics, and health centers are expanded in the villages and cities located in the Khersan-3 dam's catchment areas. Health system network is better equipped and more specialized in big cities of catchment areas. For example, Yasuj city has three hospitals (Shahid-Rajaei, Shahid-Beheshti, and Emam-Sajad) which have different specialized department. Lordegan city has also three hospitals (Shahid-beheshti, Chamran, Tamin-Ejtemaei) that also have specialized departments.

According to the statistics and the information from the Yasuj “Health and Medical Education Office”, gastrointestinal parasitic diseases are the most common diseases in “Kohgiluyeh and Boyer-Ahmad” province as well as the Khersan-3 catchment area. Gastrointestinal parasitic diseases are mostly associated with contaminated water and food (Yasuj Health and Medical Education Office, n.d.). The entrance of sewage to drinking water plays a major role in the distribution and prevalence of this disease. In the catchment area, in both urban and rural parts, the sewage and waste water collection and treatment system is not fully integrated. Most of the villages in this region have sewage wells which have only about 4-5 meters depth due to rocky nature of the area, and high cost of wells digging. Therefore, a massive amount of wastewater from the village is entering the river. Yasuj, Sisakht, Semirom and Henna cities, which are also located in the Khersan-3 catchment area, do not have a proper sewage system. Unfortunately, an average of 50-60% of the waste water from these cities is also going back into the rivers.

In addition to the Gastrointestinal parasitic, Leishmaniasis is another common disease in the catchment area. This disease caused by parasites of the Leishmania type. It spreads through bite of special mosquito located in stagnant water which causes skin lesions called Cutaneous leishmaniasis (Yasuj Health and Medical Education Office, n.d.).

Hepatitis-A is another disease which exist in the catchment area. It is an infectious disease of the liver caused by the hepatitis-A virus and it spreads through eating and drinking infected food and water (Yasuj Health and Medical Education Office, n.d.).

### **3-3-6 Tourism and sport entertainments**

As mentioned before, the catchment basin of Khersan-3 dam is a part of Fars, Isfahan, “Chaharmahal and Bakhtiari”, and “Kohgiluyeh and Boyer-Ahmad” provinces. Therefore, the catchment areas depend on these four provinces in terms of economic, social and cultural conditions. Yasuj city (the capital of Kohgiluyeh and Boyer-Ahmad province), and three cities

of Sisakht, Semirom, and Henna are main cities in the catchment area. Tourists who travel to this area are faced with a very beautiful scenery and nature, especially in springs. This area is a very suitable for tourism due to having humid cold to moderate climate. However, so far the tourism potential of this area has not been fully explored and remains unknown to lots of domestic and foreign tourists. The catchment area has plenty of recreational areas and tourism attraction sites and pilgrimage facilities. With planning and encouragement of the investors, it is possible to use the existing potential for job creation for local people. The job potentials can be in the field of building hotels, establishing tourist areas, constructing more travel agencies and building centers for the production and supply of local clothing and handicrafts in order to help the local people and develop the area.

Construction of the Khersan-3 dam was thought not only help cultural growth and job creation, but also increase tourism potential and increase the beautiful scenery of the area. Moreover, it will also possible to develop amusement sports such as climbing, rock climbing, fishing, boating, water skiing, and caving by constructing this dam.

The tourism and recreational spots of the catchment areas are :Murzard wetland, Alamoone wetland, Yasuj waterfall, Bonrood waterfall, Semirom waterfall, Shah-Ghasem dam, Mishi river, Kull mountain, Kare castle, Takhte-Soleiman river, Keykhosroo cave, and Kakan ski resort. In addition to the tourism and recreational spots mentioned above, Dena mountain range is also one the most famous mountain range in Iran which is located in the “Kohkiluyeh and Boyer-Ahmad” province. This mountain range is very effective at attracting sports tourists at the province and national levels.

In addition to the recreational places and tourism attraction, the catchment area has also some holy shrines such as: Emamzadeh Shah-Mokhtar, Emamzadeh Shah-Abdollah, Emamzadeh Sadat-Mahmoodi, and Emamzadeh Shah-Ghasem (From interview).

### **3-3-7 Communication and road path**

The catchment basin of Khersan-3 Dam is connected by the following paved roads to the main roads of the country (Ministry of Road and Urban Development, n.d.):

- 1- The asphalt road of Shiraz-Yasuj, with about 150 km length
- 2- The asphalt road of Semrom-Yasuj with about 168 km length
- 3- The asphalt road of Kazeroon -Shiraz with about 168 km length

### **3-3-8 Industries and mines**

There is a little industrial development in the Khersan-3 dam catchment area prior to the dam construction. However, the most important industries are Yasuj Sugar factory and Yasuj Flour and Starch factory (Ministry of Industry, Mines and Trade, n.d.).

There are also a number of small scale authorized and unauthorized gravel and fine sand production factories in the Khersan-3 dam catchment areas which are mostly located at the riverside. The production of these factories are mostly used for the small scale construction works in the area. Massive irregular extraction of the fine sand and gravel will damage the surrounding environment in two ways. First, fine sand and gravel extraction resulted in increasing the concentration of solid particles and turbidity of water, making it difficult for aquatic animals to live. Second, fine sand and gravel extraction caused damage to the river bed and river lateral walls and change the slope of the river, which potentially can increase the severity of the damage caused by flood. Beside the environmental effects of these types of extractions, due to the non-standard extraction of the fine sand and gravel, the topography of the area has changed noticeably, and after a while small and large pits appear and these pits are suitable places for the growth of insects and diseases vectors.

In addition to fine sand and gravel, there are other small scale mines such as phosphate, bauxite, dolomite, malachite, silicon dioxide, and strontium sulfate mines which are located in the catchment area. The specifications of these mines are presented in Table 8.

**Table 8-** Specifications, location, and names of the mines located in the catchment of Khersan-3 dam.

Mine Name	Mineral Types	Chemical Formula	Mine Storage	Mine Location	Annual Extraction (tons)
<b>Gachkob</b>	Gypsum	CaSO <sub>4</sub> 2H <sub>2</sub> O	3·000·000	80km west of Yasuj	5000
<b>Firooz Abad</b>	Limestone	CaCO <sub>3</sub>	1·000·000	20 km north-west of Yasuj	12000
<b>Doposhte-Dashtroom</b>	Limestone	CaCO <sub>3</sub>	1·500·000	17 km south of Yasuj	12000
<b>Cheshme-Garaznegloo</b>	Gypsum	CaSO <sub>4</sub> 2H <sub>2</sub> O	2·000·000	165 km north-west of Yasuj	5000
<b>Bonzard</b>	Gypsum	CaSO <sub>4</sub> 2H <sub>2</sub> O	1·000·000	78 km north-west of Yasuj	5000
<b>Sarbishe-chenarestan</b>	Limestone	CaCO <sub>3</sub>	3·000·000	12 km west of Yasuj	1000
<b>Salehan</b>	Limestone	CaCO <sub>3</sub>	10·000·000	46 km west of Yasuj	9000
<b>Sang-Najir-Sisakht</b>	Limestone	CaCO <sub>3</sub>	1·750·000	1 km north-west of Sisakht	20000
<b>melleshoor</b>	Sandstone	SiO <sub>2</sub>	1·500·000	27 km south-east of Yasuj	10000
<b>Sarab-Khenzoom</b>	Gypsum	CaSO <sub>4</sub> 2H <sub>2</sub> O	600·000	31 km north-west of Yasuj	25000
<b>Dolomite-Mimand</b>	Dolomite	CaSO <sub>4</sub> 2H <sub>2</sub> O		90 km north-west of Yasuj	—
<b>Silic-Mimand</b>	silicon dioxide	CaCO <sub>3</sub>		80 km north-west of Yasuj	—
<b>Namak-Abi-Sisakht</b>	Salt	CaCO <sub>3</sub>		3 km north-east of Sisakht	—
<b>Ghalat</b>	Gypsum	CaSO <sub>4</sub> 2H <sub>2</sub> O	270·000	23 km south-east of Yasuj	—
<b>Dilgoon</b>	Salt	SiO <sub>2</sub>		60 km west of Yasuj	—
<b>Sar-Gachine</b>	Gypsum	CaSO <sub>4</sub> 2H <sub>2</sub> O	300·000	30 km south of Yasuj	—

Shah-Mokhtar	Limestone	CaCO <sub>3</sub>	500.000	14 m west of Yasuj	—
--------------	-----------	-------------------	---------	--------------------	---

### **3-4 Social, cultural and economic investigation of the villages located in the Khersan-3 Dam's reservoir**

#### **3-4-1 Introduction**

By constructing the Khersan-3 dam on the Khersan river and near to the Talaeih village, the reservoir of the dam is located in a narrow and deep valley with the 40 km length and 400 m width. The most part of the dam's reservoir is rocky with a steep slope, but the slope is lower in a short area from the right end of the dam (IWPCO, n.d.).

Throughout the reservoir of the Khersan-3 dam at the edge of the river, different types of oak tree species are visible. In addition, at the higher levels, which are completely outside the reservoir of the Khersan-3 dam, in the soil fields almonds and olive trees and in the stone field oak-pistachio and pistachio trees are visible. (Field observations)

Over the past few decades, the growth of villages and self-unplanned or obligatory settlements of nomads in the forest area of the Khersan valley, led to the destruction of forest areas. The studies show that the nomadic residence time in the forests is changed from short spring residential time in to all seasons. These changes in the nomadic life style lead to the decreasing of the resources of the Khersan valley despite the increasing of the population in this valley.

Since there were no cities located in the reservoir of the Khersan-3 dam, the following items show the cultural, social and economic investigation on the villages which were located at the reservoir.

#### **3-4-2 Description of the villages in Khersan-3 dam reservoir**

According to the resettlement report, a total number of 24 villages are located in the reservoir of this dam, of which 15 villages belong to the "Kohgiluyeh and Boyer-Ahmad" province and Dena county and nine villages are in the "Chaharmahal and Bakhtiari" province

and the Lordegan county. Moreover, three villages called Darb Kalat Mahmoodi, Baraeshgeft, and Narmeh were located outside the defined boarder of the dam reservoir but considered as dam affected villages. These three villages experienced to massive destruction like, the destruction of the bridges, lose part of their access routes, and the disconnection of the rural routes and connections because of the construction of the dam reservoir. It should be noted that the construction of an alternative bridge in Dena county and the alternative roads of the three above-mentioned villages were fully considered into the implementation plan. Table 9, shows different types of land use within the dam reservoir area. Based on the data from the Table a massive parts of the reservoir area was belong to the natural resources lands (1072 hectares). Moreover, from the total reservoir land (700 hectares) belongs to “Chaharmahal and Bakhtiari” province 16% was related to the agricultural land while in Kohgiluyeh and Boyer-Ahmad province 44 % of the total reservoir land was agricultural lands. Thus, the agricultural activities in Kohgiluyeh and Boyer-Ahmad’s reservoir land was much more than the Chaharmahal and Bakhtiari (Statistical Center of Iran, n.d.).

Table 10, shows the national divisions of the villages located in the reservoir which sorted by province, county, district, rural district, and village in order to get a better overview of the location of these villages (Statistical Center of Iran, n.d.).

Table 11, shows the national divisions of the three villages (Baraeshgeft, Kalat Mahmoodi, and Narmeh)which were not in the dam reservoir but parts/entire of their communication routes were damaged because of the construction of the Khersan-3 dam (Statistical Center of Iran, n.d.).

**Table 9-** Different types of land use in Khersan-3 dam reservoir and powerhouse (numbers are in hectare)

<b>Description</b>	<b>Chaharmahal and Bakhtiari</b>	<b>Kohgiluyeh and Boyer- Ahmad</b>	<b>Total from Reservoir</b>
--------------------	--------------------------------------	--	---------------------------------

<b>Total Reservoir Area</b>	<b>700</b>	<b>1700</b>	<b>2400</b>
River and Riverside	60	300	360
Agricultural	117	753	870
Residential	19	79	98
Natural Resources	504	568	1072

**Table 10-** The national divisions of the villages which are located in the reservoir and powerhouse of Khersan-3 Dam.

Province	County	District	Rural District	Village													
				Maze-Gaz	Bozhgan	Kahle-Hamam	Munj	Deh-Paen	Dashchoz	Kalegah	Sansour	Sarel-dingo	Lahsavah	Golchereh	Benva	Dozdak-olya	Poshtchah
Kohgiluyeh and	Dena	Pataveh	Sadat														
Chaharmahal	Lordegan	Markazi	Sardasht														

**Table 11-** The national divisions of the villages that have been damaged in terms of the communication routes by construction of the Khersan-3 dam.

Province	County	District	Rural District	Village
<b>Kohgiluyeh and Boyer- Ahmad</b>	Dena	Pataveh	Sadat	Baraeshgeft
	Dena	Pataveh	Sadat	Kalat Mahmoodi
<b>Chaharmahal and Bakhtiari</b>	Lordegan	Ferald	Poshtkoh	Narmeh

The villages located in the reservoir of the Khersan-3 dam have a tribal structure. They are belong to two tribes named Bakhtiari and Boyer-Ahmadi. Nine of villages have Seloung and Chaharloung of Bakhtiyari traditions and from Khaledi's family. Furthermore, Fifteen villages belong to the Boyer-Ahmadi tribes and from Sadat's family and have Boye-ahmadi



tradition. The language of both the tribe are Lori with a Persian dialects and some of them understand Turkish as well. The religion of both tribes is Islam with Shia branch.

In the recent years, residents of the villages located in the reservoir of the dam do not have a real nomadic life, but they use high alpine pasture that have more fodder and cool weather during summer time for their Yaylak period. Moreover they come back to their villages during winter time and use their houses for their Kishlak period. Villagers belong to the Bakhtiyari tribes use Rig and Shoroom mountains as their Yaylak place. These two mountains located on the both side of the beginning of the reservoir. However, villagers belong to Boyer-ahmad tribes use Shabliz mountains located on the left-end side of the reservoir for their Yaylak period (From interview).

### 3-4-3 Demographic investigation of the villages located in Khersan-3 dam reservoir

According to the latest population and housing census in 2011, the total population of the villages located in the dam reservoir area was 4722 inhabitants, with 1008 households. From this population, 2078 people belong to the Bakhtiyari tribes and Khaledi family and 2644 people belong to Boyer-Ahmadi tribes and Sadat Mahmoudi family.

Table 12, illustrates the population of the villages located in the reservoir or effected by the reservoir in Dena county which are belong to Sadat family (Statistical center of Iran, 1986, 1996, 2006, and 2011).

**Table 12-** Demographic data and the percentage of growth rate in the villages located at Khersan-3 dam and powerhouse related to the Dena county.

Province	Village name	Population census 1986	Population growth rate (percentage) 1986-1996	Population census 1996	Population growth rate (percentage) 1996-2006	Population census 2006		Population growth rate (percentage) 2006-2011	Population census 2011	
						Household	population		Household	population
Boyer-Ahmad and Kohgiluyeh and	Benva	36	0	36	-10	3	13	20.48	6	33
	Bizhgan	171	65.1	201	-5.6	21	103	-24.07	6	26
	Poshtchah	200	4.0	208	-5.7	23	94	16.76	45	204
	Dashtboz	458	6.0	488	-8.6	48	241	-7.18	39	166

	Dozdak	360	2.2	448	-1.1	80	399	0.74	101	414
	Dehpacen	144	2	176	3.0	33	181	-0.33	44	178
	Dorah	396	9.1	478	25.0	109	490	1.35	139	524
	Sartal-dingoo	155	35.0	161	-6.1	30	138	-3.92	29	113
	Sarsour	42	6.3	60	-8.0	11	55	-4.36	9	44
	Kalegah	75	5.1	87	4.0	20	90	1.51	23	97
	Gholchehreh	119	2	145	-3.2	21	115	6.42	32	157
	Lahsavareh	122	8.0	132	-2.3	19	95	4.43	25	118
	Munj	381	2.0	389	-2.1	64	343	-3.04	72	294
	Kahlehamam	45	5.0	73	-3.1	11	64	4.82	17	81
	Mazegaz	—	—	476		52	237	-3.83	43	195
	Total	2704	3.1	3082	-4.2	545	2658	0.11	630	2644

According to Table 12, many of the villages which were in the reservoir had negative growth rate. Moreover the maximum number of inhabitants were live in Dorah village (524 people) in addition, Benva and Bizhgan villages (33 and 26 people respectively) had the minimum number of inhabitant in the Dena county based on the latest census (Statistical center of Iran, 1986, 1996, 2006, and 2011).

Furthermore, the following Table (Table 13) shows the population of the villages located in the reservoir or effected by the reservoir in Lordegan county which are belong to the Khaledi family (Statistical center of Iran, 1986, 1996, 2006, and 2011).

**Table 13-** Demographic data and the percentage of growth rate in the villages located at Khersan-3 dam and powerhouse related to the Lordegan county.

Province	Village name	Population census 1986	Population growth rate (percentage) 1986-1996	Population census 1996	Population growth rate (percentage) 1996-2006	Population census 2006		Population growth rate (percentage) 2006-2011	Population census 2011	
						Household	population		Household	population
Chaharmahal and Bakhtiari	Atashgah	233	4.2	296	6.2	66	382	6.24	104	517
	Jajoo	157	-4.1	137	-9	10	54	3.78	13	65
	Dehgah	118	-8.1	98	2.4	26	147	1.45	24	158
	Dorj	10	22	74	-1.5	8	43	-0.95	6	41
	Talaeih	515	4	766	1.1	147	858	5.72	195	1133
	Faj	285	-1.5	168	-4.10	10	56	0.35	11	57

	<b>Monom</b>	59	3.2	74	-7.5	6	41	-2.03	7	37
	<b>Gahkadeh</b>	21	-1	19	3.8	10	42	-3.04	12	36
	<b>Varkab</b>	17	-5.2	13	-6	2	7	37.15	6	34
	<b>Total</b>	1529	3.1	1742	1.0	309	1752	3.47	378	2078

According to the Table 13, Varkab village had the minimum households and inhabitant which were six and 34 respectively while Talaeih village had the maximum households and inhabitants which were 195 and 1133 respectively based on the latest census in 2011 in Lordegan county.

### **3-4-4 Investigation of the literacy status and housing status**

#### ***3-4-4-1 Literacy***

In November 2011, 59.3% of the total population of Khaledi family (tribes) located in Dena county were literate. 58% of the literate people were men and 42% were women.

At the same year the total literate people in Sadat family (tribes) located in Lordegan county were 1610 which was 65.7% of their total population. From 1610 literate people, 56.8% were men and 43.2 were women (Statistical center of Iran,2011)

Thus, more inhabitants of the Dena county were literate compare to the inhabitants of the Lordegan county.

#### ***3-4-4-2 Housing***

Most of the rural residential units in the villages were old and made by natural components such as stone, mud, , cement, brick, gypsum, and lime and they usually were approximately between 100 to 300 square meters. However, the newer residential units were made by more updated technology and industrial materials (stone, cement, iron and steel doors). The architecture of the newer buildings was more compatible with the principles of the new architecture and design, but such new design residential units were not dominant in this area (From interview).

### **3-4-5 Facilities and amenities of the villages located in Khersan-3 dam reservoir**

Most of the villages located in the Khersan-3 dam reservoir were not even equipped with the minimum facilities in terms of social and welfare services up to 20 years ago. However, the primary schools were the only social services in some villages (such as the Atashgah, Dashteboz, Deh-paeen, Talaeih, Lah-savare, and Munj). Nevertheless, in spite of some improvements by the time, the welfare situation and the facilities of the villages in the region were differ from the desired situation before the resettlement processes as well. The new life style of tribes (nomads) in the area to not move long distance for their Yaylak and Kishlak period made it necessarily to equipped nomadic villages with more social and welfare facilities. In this regards, all villages located in reservoir had rural electricity, water pipes, and primary schools prior to the resettlement process. However, just a small number of them (such as Dozdak, Talaeih, Atashgah, and Dashteboz) had middle schools but none of the villages had high schools prior to the resettlement. In addition, out of 24 villages located in the dam reservoir, only four of them had health centers (Dorah, Dashteboz, Talaeih, and Atashgah villages) which provided very initial health services to villagers in the region. From these four health centers, only two of them had nurses and two of them had only paramedics. In addition to what mentioned above, a few number of villages had not any social and welfare facilities or even proper communicational roads and paths to access them (Monom, , Varkab, and Dorj). These villages had lowest population among the villages located in the reservoir and based on the 2011 census the population of these villages were less than seven households and most of their inhabitants moved to the bigger villages like Talaeih, and Atashgah. Tables 14 to 19 , show the detailed facilities and amenities that the villages locate in the Khersan-3 dam reservoir had, prior to the resettlement process and construction of the dam (Aban Pazhoh, 2005).

**Table 14-** Facilities and amenities of the villages located in Khersan-3 Dam reservoir- Kohgiluyeh and Boyer- Ahmad province.

Village Name	Population in 2011	Type of Roads	Nature status	Public transportation	Village Council	Police Station	Water pipeline	Electricity
Mazegaz	195	Dirt Road	Mountainous-Forest	-	+	-	+	+
Dehpaen	178	Dirt Road	Mountainous-Forest	-	+	-	+	+
Munj	294	Dirt Road	Mountainous-Forest	-	+	-	+	+
Dorah	524	Asphalt Road	Mountainous-Plain	-	+	-	+	+
Sarsour	44	Asphalt Road	Mountainous-Forest	-	-	-	+	+
Kalegah	97	Asphalt Road	Mountainous-Forest	-	+	-	+	+
Sartal	113	Asphalt Road	Mountainous-Plain	-	+	-	+	+
Dozdak	414	Asphalt Road	Plain	-	+	-	+	+
Gholchehreh	157	Asphalt Road	Mountainous-Plain	-	+	-	+	+
Kahlehamam	204	Asphalt Road	Mountainous-Forest	-	-	-	+	+
Poshtchah	81	Asphalt Road	Mountainous-Plain	-	+	-	+	+
Lahsavareh	118	Asphalt Road	Mountainous-Forest	-	+	-	+	+
Bizhgan	26	Asphalt Road	Mountainous-Forest	-	+	-	+	+
Benva	33	Dirt Road	Mountainous-Plain	-	-	-	+	+
Dashteboz	166	Dirt Road	Mountainous	-	+	-	+	+
<b>Total</b>				<b>0</b>	<b>12</b>	<b>0</b>	<b>15</b>	<b>15</b>

**Table 15-** Facilities and amenities of the villages located in Khersan-3 Dam reservoir-Kohgiluyeh and Boyer- Ahmad province.

Village Name	Health Clinic	Pharmacy	Health Center	General Practitioner	Dentist	Paramedics and midwife	Veterinary Physician
Mazegaz	–	–	–	–	–	–	–
Dehpaeen	–	–	–	–	–	–	–
Munj	–	–	–	–	–	–	–
Dorah	–	–	+	–	–	–	–
Sarsour	–	–	–	–	–	–	–
Kalegah	–	–	–	–	–	–	–
Sartal	–	–	–	–	–	–	–
Dozdak	–	–	–	–	–	–	–
Gholchehreh	–	–	–	–	–	–	–
Kahlehamam	–	–	–	–	–	–	–
Poshtchah	–	–	–	–	–	–	–
Lahsavareh	–	–	–	–	–	–	–
Bizhgan	–	–	–	–	–	–	–
Benva	–	–	–	–	–	–	–
Dashteboz	–	–	+	–	–	+	–
<b>Total</b>	<b>0</b>	<b>0</b>	<b>2</b>	<b>0</b>	<b>0</b>	<b>1</b>	<b>0</b>

**Table 16-** Facilities and amenities of the villages located in Khersan-3 Dam reservoir-Kohgiluyeh and Boyer- Ahmad province.

Village Name	Mail Box	Post Office	Phone Line	Mosque	Primary school	Middle School	High school
Mazegaz	–	–	–	–	+	–	–
Dehpaeen	–	–	+	+	+	–	–
Munj	–	–	+	+	+	–	–

Dorah	+	+	+	+	+	-	-
Sarsour	-	-	+	-	-	-	-
Kalegah	-	-	+	+	+	-	-
Sartal	-	-	+	+	+	-	-
Dozdak	+	+	+	+	+	+	-
Gholchehreh	-	-	+	+	+	-	-
Kahlehamam	-	-	+	-	+	-	-
Poshtchah	-	-	+	+	+	-	-
Lahsavareh	-	-	+	+	+	-	-
Bizhgan	-	-	+	+	+	-	-
Benva	-	-	-	-	-	-	-
Dashteboz	+	+	+	+	+	+	-
Total	3	3	13	11	13	2	0

**Table 17-** Facilities and amenities of the villages located in Khersan-3 Dam reservoir- Chaharmahal and Bakhtiari province.

Village Name	Population in 2011	Type of Roads	Nature status	Public transportation	Village Council	Police Station	Water pipeline	Electricity
Talacih	1133	Dirt Road	Mountainous	-	+	-	+	+
Atashgah	517	Dirt Road	Mountainous	-	+	-	+	+
Monom	37	Dirt Road	Mountainous-Forest	-	-	-	+	-
Varkab	34	Dirt Road	Mountainous-Forest	-	-	-	-	-
Dorj	41	Dirt Road	Mountainous	-	-	-	-	-
Dehgah	158	Dirt Road	Mountainous	-	+	-	-	-
Faj	57	Dirt Road	Mountainous-Forest	-	+	-	+	-

Gahkadeh	73	Dirt Road	Mountainous	—	-	—	—	—
<b>Total</b>				<b>0</b>	<b>4</b>	<b>0</b>	<b>4</b>	<b>2</b>

**Table 18-** Facilities and amenities of the villages located in Khersan-3 Dam reservoir- Chaharmahal and Bakhtiari province.

Village Name	Health Clinic	Pharmacy	Health Center	General Practitioner	Dentist	Paramedics and midwife	Veterinary Physician
Talaeih	—	—	+	—	—	+	—
Atashgah	—	—	+	—	—	+	—
Monom	—	—	—	—	—	—	—
Varkab	—	—	—	—	—	—	—
Dorj	—	—	—	—	—	—	—
Dehgah	—	—	—	—	—	—	—
Faj	—	—	—	—	—	—	—
Gahkadeh	—	—	—	—	—	—	—
<b>Total</b>	<b>0</b>	<b>0</b>	<b>2</b>	<b>0</b>	<b>0</b>	<b>2</b>	<b>0</b>

**Table 19-** Facilities and amenities of the villages located in Khersan-3 Dam reservoir- Chaharmahal and Bakhtiari province.

Village Name	Mail Box	Post Office	Phone Line	Mosque	Primary school	Middle School	High school
Talaeih	—	—	+	+	+	+	—
Atashgah	—	—	+	+	+	+	—
Monom	—	—	—	—	—	—	—
Varkab	—	—	—	—	—	—	—
Dorj	—	—	—	—	—	—	—
Dehgah	—	—	+	—	+	—	—
Faj	—	—	—	—	—	—	—



Gahkadeh	—	—	—	—	+	—	—
Total	0	0	3	2	4	2	0

### 3-4-6 Communication and road path

Due to the mountainousness and the lack of the proper roads in the dam reservoir's area, access to all villages, especially in "Chahar Mahal and Bakhtiari" province was a great difficulty prior to the construction of the Khersan-3 dam. To reach the dam site, the Lordegan-Sardasht- Atashgah road was used . This road had was a very low quality mixture of pavement and dirt road and some part of it was impassible (Figure 2). In this area the only way to access to villages located in the right side of the Khersan river was a very unsafe and small suspension bridge that was made by old lumber. Thus the only way to access to Jajo, Faj, Dorg, Varkab, and Monom villages which were located in the right side of the river was this bridge. The unsafe bridge pass had led to the fall of a number of villagers into the river. Moreover, access to Atashgah village from the Talaeih bridge (Figure 1) were possible through the four km unpaved and narrow road.

In addition, access to a large part of the reservoir was through a road forked from the Lordegan-Yasuj road which was a paved road and interconnected the villages of the right side of the dam reservoir with the villages of the left side including Benva, Bizhgan, Lahsavareh, Kalegah, Kahle-Hamam, Poshtchah, Golchehreh , Dozdak, Sartal, and Sarsour. Then by a metal- concrete bridge connected to the Dorah village and from Dorah village connected to the Kalat Mahmoodi, and Baraeshgeft villages. The Dehpaeen village connected to Dashteboz, and Mazegaz villages by a bridge which was suitable for cars to pass through it as well.

It should be noted that the access roads to Baraeshgeft, Kalat Mahmoodi, and Narmeh villages (which are out of the dam reservoir) will also go under water after the operation of

the dam. Thus construction of the alternative access roads and bridges in Dena and Lordegan counties were one of the agenda of the Khersan-3 dam construction project (From interview).



Figure 1- Talaeih metal bridge which was located on the upstream of dam site.



**Figure 2-** Inappropriate quality of the road in 4.80 Km after the Sardasht police station to the dam site.

### **3-4-7 Occupational status of the inhabitant of the Khersan-3 dam reservoir**

Animal husbandry and agriculture are the most common economic activity in the reservoir's area. Based on the data from ministry of Labor and Social Affairs (2004), the main occupation of about 84% of households in the reservoir area were animal husbandry and agriculture. Official and government jobs, salesmanship, seasonal workers in cities, and taxi driving were the other types of occupations in the area. Table 20, shows distribution of households by their occupation's type. Moreover, Table 21 demonstrate the inhabitant's occupation status in each of the villages located in the reservoir of the Khersan-3 dam. Based on the data from this Table, the unemployment rate was high in almost all of the villages and the women employment rate were significantly low in the villages located at the reservoir before constructing the dam.

**Table 20-** Distribution of households by occupation.

Type of Occupation	Distribution (percentage)
Agriculture and Animal Husbandry	84.2
Governmental Occupations	5.0
Manual Labor	4.6
Taxi Driving	4.2
Other Occupations	1.9
Total	100

**Table 21-** Occupation status of the villagers lived in the reservoir of the Khersan-3 dam.

Village Name	Percentage of people with occupation (people from 10 years old and more)		
	Men & Women	Men	Women
<b>Benva</b>	35.7	66	0
<b>Bizhgan</b>	30.4	60	7.7
<b>Poshtchah</b>	34.8	56.3	10.7
<b>Dashteboz</b>	42.3	67.1	16.9
<b>Dozdak</b>	34.6	65	6.1
<b>Dehpaeen</b>	52.2	83.7	22.7
<b>Dorah</b>	44.4	76.1	14.2
<b>Sartal-dingoo</b>	28.2	55.8	43.8
<b>Sarsour</b>	30.5	78.5	0
<b>Kalegah</b>	36.2	75	4.5
<b>Golchehreh</b>	30.8	60.8	0
<b>Lahsavareh</b>	33.6	64	3.9
<b>Munj</b>	38.9	69.5	11.6
<b>Kahlehamam</b>	41.3	52.6	29.7
<b>Atashgah</b>	35.8	74	1.4
<b>Jajoo</b>	39.2	86.9	0

<b>Dehgah</b>	36.1	73	1.7
<b>Dorj</b>	48.2	93.3	0
<b>Talaeih</b>	31.4	64.8	1.2
<b>Mazegaz</b>	28.1	45	10
<b>Faj</b>	45	85.7	0
<b>Monom</b>	50	93.7	0
<b>Gahkadeh</b>	34.6	65.3	3.8
<b>Varkab</b>	38	61.5	0

### ***3-4-7-1 Agriculture***

Based on the agricultural report prepared by Aban-Pazhoh company (this company did the environmental assessment for the Khersan-3 dam project) in 2006, irrigation farming lands were mostly located on Khersan river terraces and in the areas where river could be diverted and transferred to the farms (the end of the reservoir area) or in the river springs and alluvial valleys. The irrigation farming lands were not concentrated in one location and based on the availability of the water and soil resources, they were scattered around the reservoir area prior to the dam construction.

Dry farming lands were located in the areas where high quality of soil was available however because they were located in high elevated land there were no access to the water resources. These type of lands in this area were usually parts of the forest lands which gradually lose their forest trees.

There was not a wide diversity of production from agriculture sector in the Khersan-3 reservoir area. The productions of irrigation farming were rice and clover, the productions of dry land farming were wheat, barley, and legums, and the orchards' productions are mostly walnut and grape trees. Figure 3 was taken prior to the Khersan-3 dam construction and shows the rice cultivation in irrigation farming land.



**Figure 3-** Rice cultivation on Khersan river terraces.

### ***3-4-7-2 Animal husbandry***

Based on report prepared by Aban Pazhoh company in 2006, the number of livestock in the villages affected by the construction of Khersan-3 dam was estimated at about 15074 sheep and goat and approximately 1099 cattle and calves.

Livestock pastures in the dam reservoir area included rangelands around the area, and mountains and their foothills. Some villagers were use handmade fodder for their livestock. On the other hand, cattle herding was mostly relied on handmade fodder and manual feed. Tribes in the area had to move animals from one region to another in order to graze them. These livestock were in the Yaylak places from the middle of May to the middle of October and in Kishlak places for the rest of the year. However, the Yaylak-Kishlak movement trend were decrease in the recent years and nomads are more eager to stay in one place for the whole year and having industrial animal husbandry. Figure 4, shows the some livestock and pastures around the villages located in the reservoir area which was taken prior to the dam construction.



**Figure 4-** Pastures and livestock in the reservoir of the Khersan-3 dam.

### ***3-4-7-3 Fishery***

Khersan River and its sub-branches have some types of native fishes that were hunted by fishing nets and hooks, and most of the time with unconventional and illegal methods. The hunted fishes were often used locally thus, the accurate fish hunting rate through the Khersan river prior to the Khersan-3 dam construction is not available (Aban Pazhoh, 2006).

### ***3-4-7-4 Beekeeping***

Beekeeping was another type of economic activity within the dam's reservoir area. In the villages located in the reservoir, there were 701 old and new beehives, with annual honey production of 5809 kg per year. The amount of honey production per hive is depending on harvesting method and the rainfall condition per year. In Table 22, the number of hives and amount of their production in the villages located in Khersan-3 dam reservoir area are presented and Figure 5, shows a sample of beekeeping in this area (Aban Pazhoh, 2006).

**Table 22-** Beekeeping status in the villages of Khaladi and Sadat tribes.

Tribe Name	New Hive			Old Hive		
	Number of Hives	Honey Production (Kg)	Average Performance per hive(Kg)	Number of Hives	Honey Production (Kg)	Average Performance per hive(Kg)
<b>Khaledi</b>	64	532	8.31	7	35	5.00
<b>Sadat</b>	614	5163	8.41	16	79	4.94
<b>Total</b>	678	5695	8.40	23	114	4.96



**Figure 5-**Beekeeping in Khersan-3 dam reservoir area.

### ***3-4-7-5 Handicraft***

Another occupation of the inhabitant of the villages located in Khersan-3 dam reservoir area was handicrafts production. The diversity of handicrafts in these areas was very limited, and households mainly produced their own needs or very limited number of handicraft to sale in nearby cities and villages, and there were not any definite market in this regard. Handicrafts



made by villagers live in the reservoir areas are : carpet weaving, gabbeh weaving, embroidery, sewing, and beadwork.

Generally, villages belong to Lordegan county which are related to Bakhtiari tribes have less diversity in handicrafts comparing to the villages related to Boyer-Ahmad tribes. Bakhtiari tribes have no carpet weaving and gabbeh weaving. (From interview)

All different types of handicrafts in this area such as sewing and embroidery works are inspired by the surrounding nature's cheerful colors.

### ***3-4-7-6 Other economic resources/occupations***

The newer types of occupation of the inhabitant of the Khersan-3 dam reservoir were more created through the new social and economic communications and were less dependent on the natural resources of the region. For example: working at grocery shops or other types of shops, work as a labor in the construction projects (for example: Lordegan-Yasuj road), and work as a tour guide at tourist attraction places in the region (for example: Atashgah waterfall). However as mentioned earlier in Table 20, the percentages of these kinds of occupations were not significant in the occupational pattern of the inhabitants of this region. Nevertheless, despite the natural capabilities of this region, it is possible to grow the occupational market.

In addition, due to the difficult living conditions in the villages of this region, the production and sale of smuggling coal has also become widespread in this areas. According to local authorities, about 1000 hectares of the forests in “Chaharmahal and Bakhtiari” and “Kohgiluyeh and Boyer- Ahmad” provinces are affected by these illegal activities.(From interview).

## **3-5 Resettlement and compensation issues**

### **3-5-1 Introduction**

As mentioned earlier, within the defined borders of the Khersan-3 dam, powerhouse and reservoir by “Iran Geographic Organization”, 24 villages were located in the reservoir of this dam. According to the latest population and housing census in 2011, the total population of the

villages located in the reservoir area was 4722 people with 1008 households. From the total population, 2078 (44%) of them belong to Bakhtiari tribes (Khaledi family), and 2644 (56 %) belong to Boyer-Ahmad tribes (Sadat Mahmoodi family) (Statistical Center of Iran, 2011).

From the villages located within the dam reservoir area nine villages belonging to the Bakhtiari tribes and Khaledi family. The Khaledi family follows the traditions of the tribe of the Seloung and the Chaharloung tribes. Moreover, from the villages located within the dam reservoir area, 15 villages belonging to Boyer-Ahmad tribes and Sadat family.

According to what mentioned above, in the proposed resettlement options ,the tribal structure of the villages located in the Khersan-3 dam reservoir was considered. Thus, the proposed places for Khalidi and Sadat families were separated from each other and within the same clan.

Resettlement solutions for damaged villages located in the dam reservoir area were designed in the following ways. However, it is clear that reaching to the desired result requires the cooperation of all the relevant organizations, NGOs, and to be affected inhabitants. It is necessary to mention that according to the interview with the Khersan-3 dam project manager, the following works were have done in the very beginning of the initiation of the Khersan-3 dam's project plan regarding to the resettlement issues:

- Carried out correspondence with all relevant organizations.
- Hold various meetings with the presence of governors from different provinces which will effected by the Khersan-3 dam project
- Conducted surveys to find out the region inhabitant's opinion on resettlement issues.
- Hold various meeting with the effected village representative.

### **3-5-2 Different types of resettlement investigated for the effected inhabitants**

#### **I. Optional resettlement**

In this method, effected inhabitant had their own responsibilities to choose their new occupations and new place to live. Moreover, the “ Iran Water and Power Resource

Development Company” (IWPCO) was responsible to do the accurate calculation of the damages to each households and pay the compensation to the head of the family or to the village council as a representative of the head of each family.

In this resettlement method, the effected villagers have not any legal rights on their lands after having completely disposed of and transfer their lands to IWPCO company. Moreover ,they have to choose their desired new place to live, occupation, and business. On the other hand, the project authorities have the right to use villagers’ lands based on the requirements and objectives of the project.

This method was not recommended because most of the villagers were not accept it and they believe that they may face to major problems in future in terms of occupations and settlement issues. In addition, the optional resettlement method is not cost effective for the project as well based on the IWPCO’s report.

## **II. Resettlement in predetermined locations**

In this type of resettlement the proposing and selecting the proper alternative lands for residential and agricultural purposes is doing by the project authorities. The alternative lands are selected with regards to the social and cultural structure of the villages that will effected by the Khersan-3 dam’s construction. Moreover, project authorities do the land selection in coordination with other officials and authorities at the province and national levels related to the project including: county governorates, municipalities , Forest, Rang and Watershed Management organization, Iran’s department of environment, Iran’s ministry of energy, and Iran’s ministry of road and transportation.

In this method the new locations of residential lands, agriculture lands, and infrastructure lands in the areas were planned and designed by the relevant authorities and with the agreement of the villages representatives. Afterwards, the project authorities initiated to provide and build necessary residential buildings(towns) as well as other welfare, health, and

school buildings based on the designated plan which was approved by all the relevant authorities such as provincial authorities. Moreover, new infrastructures including roads, water, electricity, telecommunications, gas pipeline, sanitation, and police station, were also provided in the new towns.

In order to provide new job opportunities for the villagers, it was suggested that villagers can invest in the dam-related projects with the help of cooperative formation. Obviously, the activities of such dam-related projects will continue until the end of the useful life of the dam. Villagers, by investing in these projects can reach to the financial independency and by living in predetermined locations, they can choose their occupations in accordance with the dam-project plan. Moreover, according to the studies carried out by the University of Tehran's Entrepreneurship faculty which is summarized in Table 23, it should be noted that by using the facilities made by Khersan-3 Dam reservoir, it is possible to create at least 2500 direct and 2500 indirect job opportunities in the construction phase of the Khersan-3 dam and powerhouse. Moreover, in the operation phase of the dam 1500 direct and 1500 indirect job opportunities will be remaining permanently. These massive number of the new job opportunities will cause a great positive changes for the local inhabitant in term of their occupational status.

Resettlement in predetermined location method had been identified as a suitable method by the project authorities. However, achieving this method was only possible when the villagers and relevant official authorities were agreed on. In this regards, lots of meetings were held by the project authorities in order to explain the benefits and disadvantages of this method to the villagers and local authorities at different levels and prior to designing the dam project plan (From interview), (IWPCO, 2006)

**Table 23-**The employment rate of Khersan-3 dam and powerhouse

Subject	Direct Employment	Indirect Employment
Construction period	2500	2500
Dam and powerhouse operation	200	100
Fishery	600	600
Tourist Center	50	50
Horticulture	300	400
Total temporary employment creation during construction	2500	2500
Total permanent employment creation during operation	1150	1150

### **3-5-3 Works have been done on resettlement issues and suggestions**

The following information provided from my interview with the Khersan-3 dam resettlement's specialist in IWPCO company.

#### ***3-5-3-1 Resettlement issues and suggestion for Khaledi tribes (family)***

- 1- Based on the result of various meetings with the official authorities of the region, accommodating villagers belong to Lordegan county and Khaledi family in Sardasht region was proposed. Inhabitant of Sardasht region are also from Khaledi family (tribes) thus they have almost the same culture and life style as the villagers from khaledi family who lived in the dam reservoir.
- 2- During a joint meeting, the resettlement issues of the inhabitant of the Talaeih, Atashagh, Monom, Varkab, Dorah, Dehgah, Jajoo, Faj, and Gahkadeh in the Sardasht district were discussed. The results of this meeting confirmed by the villages' representatives. Moreover, the required land for resettlement process was determined.

This land was mostly belong to the heads of the effected villages which made it easier to discuss about building a new town in it.

- 3- The existence of Sardasht- Lordean road near to the proposed alternative land (in Sardasht region) as well as existence of electricity, gas pipelines, telecommunication lines and the possibility to provide water supply through the nearby rivers, made the proposed land suitable and easy for building a new town in it to resettle the effected villagers.
- 4- In terms of new job opportunities for about 378 households that should be resettled in the Sardasht region, the following situations are possible with regards to the pervious occupational status of these villagers as well as the job potential that will be created through the construction of the dam:
  - Employment in teams required for the operation of the Khersan-3 dam, such as security, gardening, service occupations, driving, cooking, etc. at least for 70 people.
  - Considering the necessity of the conservation of the Atashgah waterfall as a natural resources (Atashgah water fall located upstream of the dam reservoir) and the commitment of the IWPCO company to provide a pavement road access to the waterfall, as well as the possibility of installing part of the dam workshops' equipping facilities as the camping location for the future waterfall's tourists and the possibility of construction a quay for transferring the tourists to the waterfall by boat, it is possible to create at least 20 direct jobs and the same number of indirect jobs. These job opportunities could be related to the tourist camp of the waterfall and the waterfall's associated facilities.
  - By installing local pumping stations (about 50 meters pumping), with an annual volume of about half a million cubic meters of water (the volume of the Khersan river is about 3000 million cubic meters of water per year), it is possible to do orchard farming through water pumping for about 50 hectares of dry lands of the Talaeih village (these

dry lands are located above the dam's operation level). These lands have the capacity to provide about 100 direct jobs and the same number of indirect jobs.

- Fish breeding can be another potential occupational development activity in Khersan-3 dam. Each hectare of fish farming which is consist of about 10 baskets, can produces at least 10 direct jobs and even more than 10 indirect jobs. Previous experiences in the area shows that it is possible to harvest 100 to 130 tons of fish per hectare annually. Accordingly, the providing only 20 hectares of fish breeding in cages could create more than 200 direct jobs and the same amount of indirect jobs.
- Considering the situation in Sardasht and the accumulation of villagers in one place and improving their amenities, it is expected that the occupations such as the production of various types of handicrafts as well as beekeeping in the region have an increasing rate by the time.
- Since many of the villagers' rangelands are located above the reservoir of the Khersan-3 dam. Animal husbandry can continue with the pervious situation. However, with the creation of other new reliable occupation, it is expected that the animal husbandry will have a decreasing trend and consequently the livestock pressure on the forests of the region dropped notably.

#### ***3-5-3-2 Resettlement issues and suggestion for Sadat tribes (family)***

- 1- On a meeting which was held in April 2014, Margown city's municipality governments proposed Bonestan and Shabliz villages surrounding areas as a resettlement place for the Sadat tribes and families. This proposed has accepted and welcomed by the representative of the villages that Sadat tribes live in at the same year. The villages' representatives agreement letters are also available (in Persian language).
- 2- In addition to the Shabiliz village, with the coordination with Kohgiluyeh and Boyer-Ahmad provinc's governor and Dena county's municipality representative, the

following areas were determined as the resettlement places for the Sadat tribes who were effected by dam construction:

- Resettlement of villagers in the predetermined areas of the upstream of the of the Bonestan and Bizhgan villages.
  - The area around of Rudashti village on the border of the Yasuj communication road (near to Shabliz village).
- 3- Based on the result of the meetings and studies done about the resettlement places of the Sadat tribes , it was recommended that the inhabitants of the Dashteboz, Munj, Dozdak, Mazegaz, Golchehreh, Poshtchah, and Benva villages will be located in Shabliz area. Moreover, inhabitants of the Bizhgan, Kahlehamam, and Lahsavareh villages will be located at the upstream of Bonestan village. The most important reasons for submitting the proposed resettlement places are as follow:
- Many of the above-mentioned inhabitants owned lands in the Shabiliz area from many years ago. Thus, according to the approval of the representative of the villages mentioned above, the villagers agreed to relocate to Shabdiz area if they received the necessary permits and promised infrastructure.( agreement letters are also available in Persian language).
  - In the recent years, due to the oldness and poor quality of the rural buildings and infrastructure of the villages like Bizhgan, a significant number of residential buildings in these villages had been moved to the upstream of the Bizhgan village. This relocation was done in cooperation with the Iran’s ministry of housing and urban development. In fact, because of this relocations, these villages have located outside the reservoir of Khersan-3 dam and near to the Bonestan village prior to the resettlement. With continuing these relocations and expanding the relocation area toward Bonestan village,



it is easier to resettle the mentioned villages in the minimum distance from their current residential palaces.

- The availability of Yasuj- Lordean road near to the recommended settlement in the upstream of the of Bonestan and Bizhgan villages, and the available access road to Shabliz area, as well as the existence of electricity, telecommunication lines and the possibility to provide water supply through the nearby rivers, made the proposed land suitable and easy for building a new town in it to resettle the effected villagers.
- 4- In terms of providing new job opportunities for about 630 households that should be resettled in the above-mentioned region, the following situations are possible with regards to the previous occupational status of these villagers as well as the job potentials that will be created through the construction of the dam:
- By installing local pumping stations (about 50 meters pumping), with an annual volume of less than two million cubic meters of water (the volume of the Khersan river is about 3000 million cubic meters per year), it is possible to do orchard farming through water pumping for about 150 hectares of dry lands of the Lahsavareh, Kahlehamam, and Benva villages (these dry lands are located above the dam's operation level). These lands have the capacity to provide about 200 direct and the same number of indirect agricultural job opportunities.
  - As mentioned earlier, fish breeding in cages can be a potential occupational development activity in Khersan-3 dam. Thus, the development of only 40 hectares of fish breeding's cages (the area's potential) could create more than 400 direct and the same number of indirect job opportunities.
  - Considering the resettlement of the above-mentioned villagers in one region and improving their facilities and amenities, it is expected that occupation such as the

production of various types of handicrafts as well as beekeeping in the region increased significantly.

- Since many of the villagers' rangelands are located above the reservoir of the Khersan-3 dam. Animal husbandry can continue with the previous situation. However, with the creation of new reliable job opportunities by the dam construction, it is expected that the animal husbandry will have a decreasing trend in the area and consequently the livestock pressure on the forests of the region dropped notably (the same situation as Khaledi tribes).

## **4 Discussion**

### **Social impacts of Khersan-3 dam construction**

In this chapter social and cultural consequences of the construction of the Khersan-3 dam will be discussed with the aim of assessing positive and negative impacts of construction of this dam. In order to have a better evaluation of the impacts, each of the impacts of the construction of Khersan-3 dam will be discussed in three parts: First, investigation of the impact during the construction phase. Second, investigation of the predicted impact in the operation phase. Third, investigation on the impact's prospect without dam construction.

#### **4-1 Demographic and immigration effects**

##### ***Construction phase***

According to the data summarized in Table 23, over 2500 job opportunities were created during the construction phase started from 2007. Additionally, construction of the dam has resulted in training local professional specialists by exposing local workers and scholars to training courses. This has led to creating secure jobs in the area which in combination with housing in suitable settlements can lead to increase of the prosperity in the region, population growth and preventing the migration of villagers to the cities. In my opinion, population growth and immigration prevention are positive impacts of constructing of the dam the in construction phase.

##### ***Operation phase***

Similar to construction phase, due to the potential of creating more than 1,500 direct and the same amount of indirect job opportunities in different fields (according to the data available at the University of Tehran's Entrepreneurship Faculty and Table 24), it is expected to see the increase of welfare services and prosperity in the region and consequently population growth and preventing migrants from villages of this region to cities in the operation phase. Thus,

population growth and prevention of immigration will be the definite, and positive consequences of the operation phase of the dam.

### ***Prospect without dam construction***

Between 1976 and 2005, the total population of the villages located in the reservoir area of the Khersan-3 Dam had increased. Reversed trend was observed between 2005-2011 in the Benva, Sarsour, Monom, Faj, Jajoo, Munj, Dorj, Varkab, Bizhgan and Dashtebaz villages with the population of these villages decreased according to Iranian Statistics Center (data summarized in Tables 12 and Table 13).

Moreover, over the past four decades, population growth rate in the reservoir area had significant fluctuations. In particular, between 1976 to 1986 the growth rate was 5.8% which dropped dramatically to 1% percent between 1986-1991. Between 1976 and 1986 inhabitant villages outside dam area migrated to the villages located in the dam reservoir area. This also contributes to having positive growth rates during these years. Change in life style also contributes to population growth. Positive growth rate between 1976 to 1986 coincide with settlement of nomadic tribes in this area for the whole year (or having shorter Yeylak time). Thus changing the nomadic tribes life style is the main reason for having positive growth rate between 1976 to 1981. Please note that all aforementioned migrations were inter-regional.

After 1986, inter-regional migration declined due to unemployment and lack of appropriate facilities. In particular, a portion of population gradually migrated out of the region seeking secure jobs and sustainable life. This migration continued until 2007 when Kheran 3 dam construction project started. Immigrants selected nearby cities such as Isfahan, Shahr-e kord, and Lordegan as their destination. Unfortunately, immigrants were usually involved in false jobs like simple labor, peddling, and other unprofessional service activities (according the interview with one of the village's representative).

Overall, if Khersan-3 dam has not been constructed, urbanization would have continued in this area which is expected to have definite and negative permanent impacts on population growth and migration rate.

#### **4-2 Infrastructure and communications effects**

##### ***Construction phase***

After finalizing the dam location, the implementation and construction of the dam began at the dam site. Therefore, the Khersan river fellow and access roads' directions were changed temporarily to facilitate access during the construction period. The construction site of the dam and the dam reservoir area is planned to cover 24 km<sup>2</sup>. As mentioned in Result chapters, 24 villages located in the construction site and the dam reservoir area with 9 villages belonging to "Chahar Mahal and Bakhtiari" province (Khaledi tribes) and 15 villages belonging to "Kohgiluyeh and Boyer- Ahmad" province (Sadat tribes). Fortunately, the Yeylak-Keshlak relocation routes of the nomads (who used to live in the dam reservoir) were not located in construction area. As such their relocation routes has not been damaged during the construction period. Moreover, according to the latest census of the Iranian Statistics Center, villages in the reservoir area usually had low population. The largest village had 195 households (Talaeh village) whereas the smallest villages had 6 households each (Varkab and Benva village). Please refer to Tables 12 and 13 for additional details.

Due to the mountainous nature of the dam reservoir area, access to all reservoir's sections is difficult. Sardasht- Lordegan route was used to access to the dam site which is a very low quality paved road up to the dam site continuing to Talaeh and Atashgah villages after dam site as an unpaved road. In addition to Lordegan- Sardasht road, a forked road from Lordegan- Yasuj route was also used to access some other parts of the dam site. This road is continues further to Kalat Mahmoodi village which is located in the left margin of the reservoir. In addition to these

roads, two metal bridges in Dozdak and Munj villages connects the two sides of the river to each other.

Moreover, as mentioned in the Result chapter, only a handful of accommodations had new designs, technologies, and industrial standards (where stone, cement, iron and steel doors were used during the construction) and the majority of village houses were old and made by natural components and materials.

Furthermore, all villages located in the reservoir area had electricity, and water supplies. In most of these villages primary schools were the only welfare services with only a few number of villages having middle schools (Talaeih, Atashgah, Dozdak, and Dashteboz). Four health centers (located in Dorah, Dashteboz, Talaeih, and Atashgah villages) were accessible to residents of the dam's reservoir areas. Moreover, Monom, Dorj, Dehgah, Faj, and Jaju villages (very small villages) had no welfare services and social facilities other than electricity and drinking water supplies.

During dam construction phase, villages located in the reservoir were gradually evacuated and completely destroyed before the dam impoundment. New towns were built for the resettlement of the effected villagers. These new towns have a set of necessary facilities such as primary, middle school, high school, and health centers. One new town was built for Khaledi tribes in Sardasht village's area and another new town were built for Sadat tribes in Bonestan and Shabliz village's nearby locations. Therefore, residents begun to benefit from additional infrastructures as a result of resettlement in new towns which can be considered as an indirect consequence of dam construction. Additionally, communication routes were required to have a gold standard to facilitate transfer of construction material through which the entire population nearby the dam benefited from. As such, having well-maintained communication roads can be considered as one of the short-term positive effects of dam construction.

Thus, inhabitants of the villages located in the dam reservoirs get lots of benefits in terms of infrastructure and communication facilities in the construction phase of the Khersan-3 dam.

### ***Operation phase***

Infrastructural and communicational impacts during operation phase are expected to be similar to that of construction phase. During operation phase, residents not only benefit from having a new resettlement towns and availability of more secured job opportunities, but also benefit from tourism attraction associated with recreational activities upstream of the dam. Positive infrastructural and communicational impact is more evident especially considering infrastructural deficiency prior to dam construction. Thus, operation of the dam is not expected to damage major infrastructures and a few of the infrastructures which might be damaged by the dam construction (settlements) is planned to be rebuilt or already rebuilt. Therefore, it can be conclude that the dam operation is not expected to have any long lasting negative effect on the region's infrastructures and communication roads. On the other hand, the inhabitant can benefit from the new infrastructure and communication roads in the operation phase.

### ***Prospect without dam construction***

According to what was described before regarding the infrastructures and communication roads, there were not any proper facilities before the dam construction in this area. Likewise in the future without constructing of the Khersan-3 dam there will not build any new facilities in this regards as well since there is not any specific national plan to improve the infrastructures and communication roads in this region (according to the interview with the Lordegan's municipality authority).

Therefore, if the Khersan-3 dam has not been constructed, there will be no/a few new communication roads and infrastructures added to the area at least in near future. Thus, it can be conclude that the situation of infrastructure and communications remains unchanged without the dam construction.

### **4-3 Employment and income level effects**

#### ***Construction phase***

The inhabitant of the villages located in the dam site and reservoir areas were mostly involved in agricultural activities prior to the dam construction (Table 20). They had lost their lands due to the dam construction and face to noticeable changes in term of their occupations and consequently noticeable changes in their incomes. Considering the fact that most of the villagers in this area owned their agricultural lands, with the disappearance of their lands by the dam construction, they would move to bigger villages and cities like Lordegan, Yasuj, and Sardasht and would mostly involve to false jobs, if there were not any proper plan for resettle them. From this point of view, the construction of the dam and its impoundment have negative effect on the employment status and as a result on income level of the effected villagers in the absence of a proper resettlement management in the long-term.

On the other hand, it should be noted that in the construction phase of the Khersan-3 dam and powerhouse about 2500 direct and the same amount of indirect job opportunities are created and most of these job opportunities are occupied by indigenous people (Table 23). Moreover, the engagement of the non-indigenous specialists personnel in the region can help to train indigenous people and the region's specialized expertise will increase by the time.

All in all, it seems that the number of the jobs which are disappeared by construction of the Khersan-3 dam are less than the number of occupations which are created by the dam construction. Moreover, the income level of the inhabitants are increase by their involvement in the dam related occupations. Therefore, the construction phase of the dam have a positive effect with a permanent impact on increasing the number of job opportunities, indigenous income, and the number of specialized people if all the inhabitant can involve in the dam related jobs. However, some inhabitants (most of the elders)which cannot involve to the dam created



job opportunities due to their ages, disabilities, or any other reasons become jobless and loss their income sources.

### ***Operation Phase***

According to the studies carried out by the University of Tehran's Entrepreneurship Faculty (Table 24), at least 1500 direct job opportunities and 1500 indirect job opportunities can be made by operating Khersan-3 dam and powerhouse project.

As mentioned in detail in result chapter, the proposed jobs for effected villagers located in “Chahar Mahal and Bakhtiari” and “Kohgiluyeh and Boyer- Ahmad” provinces can be summarized as follows:

- 1- There will be an essential need to create job opportunities for about 378 households from Khaledi tribes that are resettled in near Sardasht region, the following situations are possible with regard to the current conditions of these villagers and the potential of job opportunities that are created through the dam project (according to the interview with the Khersan-3 dam's specialist at IWPCO):
  - Employment a teams of people required for the operation of the Khersan-3 dam, at least for 70 people.
  - The possibility of creation at least 20 direct and the same amount of indirect job opportunities for operating the camp of the Atashgah waterfall and its associated facilities.
  - Creation of 100 direct and 100 indirect job opportunities through dry land farming by the help of water pumping stations.
  - Creation of 200 direct and 200 indirect job opportunities through fish breeding in cages.
  - Creation of a number of job opportunities in handicraft and beekeeping fields.

2- There will be also an essential need to create job opportunities for about 630 households from Sadat tribes that are resettled in near Shabliz region, the following situations are possible with regard to the current conditions of these villagers and the potential of job opportunities that are created through the dam project:

- Creation of 400 direct and 400 indirect job opportunities through fish breeding in cages.
- Creation of 200 direct and 200 indirect job opportunities through dry land farming by the help of water pumping stations.
- Creation of a number of job opportunities in handicraft and beekeeping fields (Shabliz village region is very suitable for beekeeping activities).

All in all, according to what mentioned above, the operation phase of Khersan-3 dam and powerhouse will have a positive and permanent impacts regarding the increase of employment rate and the income level of the inhabitants of the region and even the surrounding areas. However, the problem of the minority of the inhabitants (for example: elders, disable people) who cannot involve in the dam related jobs will be remaining.

#### ***Prospect without dam construction***

The pervious situation in the region showed the high number of unemployment rate specially in the rural areas (Table 21) and lack of the industrial activities (Table 8) in the region which result in insufficient incomes of the inhabitants prior to the Khersan-3 dam construction. Therefore, if the Khersan-3 dam has not been constructed, there will be result in eliminating of more than 1150 permanent job opportunities and eliminating lots of tourism industries in the region which could be created by the dam construction. Additionally, the lack of generating of over 1.1 megawatt hour of hydroelectric energy per year will have negative impact at the national level.

#### **4-4 Effect on animal husbandry**

##### ***Construction phase***

The Khersan-3 dam construction works such as earth excavation were lead to destroying of some of the pasture lands and made some disruption to the animal husbandry activities in the reservoir area. It should be noted that animal husbandry was one of the most common economic activities in the region prior to the dam construction which was done with traditional and non-industrial methods (Table 20). The main popular livestock in the region was goat, which due to the mountainous nature of the area was the most proper kind of livestock for the inhabitants. As previously mentioned, animal husbandry was one of the main cause of damage to the forests of the region and even to the Dena protected area. In the construction phase of the dam and the resettlement process, the pressure of traditional animal husbandry activities on the forests of the region is decreasing. On the other hand, the employment of the local inhabitant to construction activities of dam resulted in the changing their employment type from animal husbandry to the dam related industrial activities. Beside these impacts, by creating the dam related jobs the traditional animal husbandry will be decrease dramatically.

Therefore, the construction phase of the Khersan-3 dam has positive impacts in terms of decreasing the livestock pressure to the forest of the region by changing the employment status of lots of the villagers from animal husbandry in to the dam related industrial activities. However, it has permanent negative effect on animal husbandry activities with decreasing the number of local inhabitants who involved in.

##### ***Operation phase***

The negative impact of the reduction of traditional animal husbandry activities will be continued in the operation phase due to the availability of the permanent dam related industrial jobs. However, based on a plan proposed by Iran Animal Husbandry Union, there is a possibility to replace the traditional animal husbandry to the industrial animal husbandry with

giving all the facilities to the villagers who are interested. Within this plan, the animal husbandry activities will not be reduced anymore and additionally the forest area of this region will not be destroyed by traditional animal husbandry. Thus, considering the implementation of Iran Animal Husbandry Union's plan, the animal husbandry industry will be improving in the operation phase of the dam. However, the traditional methods of animal husbandry will be missed permanently by the time.

#### ***Prospect without dam construction***

Obviously with the absence of Khersan-3 dam, the dam relate job opportunities will not be created and traditional animal husbandry will be continued by the villager which result in the damage to the forest and pasture lands of the region. Moreover, due to the scattering of the villages in the region and consequently the reluctance of the private and public sectors to invest in these areas, there is no possibility of converting of the traditional animal husbandry to the industrial ones in the future (by Iran Animal Husbandry Union's plan).

#### **4-5 Effect on quality of life and literacy**

##### ***Construction phase***

The arrival of non-indigenous employees to the dam construction project is one of the factors that will increase the demand for commodities in the region. This increase in demand, due to constraints exist in this region will lead to an increase in the prices of such goods. On the other hand, displacement of villagers and their resettlement processes will mainly increase the cost of living in the new area due to the more appropriate infrastructure. The increase of the living cost will be imposed on the people who have resettled. Nevertheless, it should be noted that the operation of Khersan-3 dam and powerhouse will provide at least 2,500 direct and indirect job opportunities with a proper income to the indigenous people . Additionally, the arrival of the non-indigenous specialist employees to the region will provide training for indigenous people and increase the expertise of the local people noticeably. Thus, the

construction of the dam will have a negative (increasing) effect on the living costs in short-term. However, with increasing job opportunities with the proper income and increasing the level of specialization of the indigenous people, the construction of the dam will have a positive effect with and permanent impact on the quality of life of the indigenous people in the long-term.

On the other hand, the minority of the dam effected inhabitant who cannot involve in the dam related jobs or continuing their pervious jobs will experiencing inflation without increasing of their incomes. Therefore, the dam construction have negative impact on the quality of life of these type of inhabitants both in short and long-terms.

Moreover, it is not expected to see any changes in the literacy rate during the construction phase of the dam since the schools and educational facilities are under the construction.

### ***Operation phase***

The same as the construction phase of the dam, the quality of life expected to increase during the operation phase due to the increase of the permanent dam related job opportunities with the proper income and increasing the level of specialization of the indigenous people who involved in these types of job. In addition, the minority of the dam effected inhabitant who cannot involve in the dam related jobs or continuing their pervious jobs will effected negatively in terms of the quality of their life.

Furthermore, with the resettlement of villagers in new towns and the provision of necessary infrastructure, including primary, middle, and high schools, the level of literacy rate is expected to improve significantly in the short time during the operation phase.

### ***Prospect without dam construction***

If the Khersan-3 dam has not been constructed, the direct and indirect job opportunities resulting from the dam construction project will not be created and the quality of life of villagers

will be reduced due to the loss of natural resources because of the massive and improper use in the near future. Moreover, the literacy rate expected to have no change at least in near future.

#### **4-6 Effect on culture and traditions**

One of the main factors caused the change in the indigenous people's culture and traditions is the presence of non-indigenous employees for several years in the region for the dam construction project. The non-indigenous employees can cause a long-lasting impact on the region's culture and traditions by bringing different patterns of behavior and culture, sometimes initiate disagreements between them and the indigenous people.

These impacts can be eliminated when the project is finished and the non-indigenous employee's leave the area or can be permanently exist based on their strength.

#### **4-7 Effect on the tourist attraction points and natural scenery of the area**

##### ***Construction phase***

Considering that the construction of the dam will be carried out in a relatively limited area, the negative impact of these activities on the tourist attraction site of this area will be temporary and with a small-size. At the same time, it should be noted that the improvement of the access road condition from Lordegan to the dam site will, in practice, improve access to the Atashgah waterfall (is one of the tourist attraction points of the region) during the construction phase.

##### ***Operation phase***

In the dam reservoir's surrounding areas, the existence of valleys, wetlands, waterfalls, river springs, and natural forests provide a good potential for tourism and amusing sports that remains unknown at the national level. The most famous attraction points in this area are Atashgah waterfall, Munj river, and Darehgajereh waterfall and river. Fortunately, none of these attraction points located in the reservoir area of the Khersan-3 dam. With the dam reservoir impoundment which turning the dam reservoir to the beautiful lake, the natural

scenery of the area will change and this area can be an attractive place for the provincial and national tourists. In addition, due to the small width and long length of the lake, this lake will be a suitable place for a different of water sports.

Therefore, changing the natural scenery of the area which will caused by the construction of the dam's lake is considered as a definite positive effect both in the short-term and long-term (until the end of the life of the dam).

### ***Prospect without dam construction***

The tourist attraction points in the dam surrounding areas are not have a proper status in the recent years. There are not any proper tourist facilities and amenities such as the car parking and public toilets in the tourist attraction points located in the Khersan-3 dam catchment areas. For example visit the Atashgah waterfall means getting to this place only with the help of private cars and bringing all the necessary facilities for a few hours stay in the area to go mountain climbing and enjoy the natural scenery (based on my own observations and interviews with two local tourists). In this regard, if the Khersan-3 dam has not been constructed, there will be no significant improvement in the tourism industries of the region.

### **4-8 Effect on the religious and ancient monuments**

#### ***Construction phase***

At the end of the construction phase of the Kheran-3 dam and by the impoundment of the reservoir, the cemeteries belonging to the villages which are located at reservoir area will be devastated. In accordance with the plans, these cemeteries were moved to a new place in coordination with the competent authorities and in accordance with the existing religious laws and regulations.

In addition, there were two Imamzadeh's holy shrines located in the dam reservoir prior to the dam construction. According to the plans made by the IWPCO company, it was agreed that

these two Imamzadeh will be relocated to the side of the new constructed Sadat tribes' town. These relocation was done in accordance with the existing religious laws and regulations. Thus, it can be concluded that the construction phase of the Khersan-3 dam has a high negative impact on religious monuments of the region since the villagers of these areas are very religious unless the relocation of these places was done properly.

On the other hand, studies on the existence or absence of historical and ancient monuments had been carried out through the Iran Cultural Heritage, Handcraft and Tourism Organization (ICHTO) in the entire dam catchment areas, and due to absence of such monuments, the permission of the dam construction in this regards had been issued.

#### ***Operation phase***

In the operation phase of the dam, the same status as the construction phase will be expected. Thus the operation phase itself will not have any additional effect regards to religious and ancient monuments.

#### ***Prospect without dam construction***

If the Khersan-3 dam has not been constructed, there will be no negative effects on religious monuments and cemeteries located in the reservoir.

### **4-9 Effect on the industrial development**

#### ***Construction phase***

The presence of numerous and large contractors for construction of Khersan-3 dam and powerhouse and additionally more than a twelve thousand billion Iranian Rials of investment (based on the interview with Iranian Ministry of Energy's authorities) over the ten years of the project's construction period will surely promote the expansion of industrial activities and other development activities in the region. Therefore, the effect of the dam construction on industrial activities and other development activities of the region is a positive, and permanent effect which has started from the beginning of the dam construction and will be continued in the



future.(based on the experiences got from the construction of other large dams in Iran like Karoone-3 and Karoon-4, which lead to the industrial development of the Dehdez, Eizeh and Lordegan cities previously).

### ***Operation phase***

In the operational period, the generation of hydroelectric power by the dam will certainly have a positive effect on increase of industrial activities in the region. In addition, based on the available data by the University of Tehran's Entrepreneurship Faculty (Table 23), Khersan-3 dam and powerhouse construction create the potential of 1500 direct and 1500 indirect job opportunities for the region. Therefore, the impact of the dam construction project on industrial activities and development is positive in the operation phase as well.

### ***Prospect without dam construction***

There were no large-scale industrial activities/ investment in the Khersan-3 dam and powerhouse project's area prior to the dam construction. The only active industries were a few small- scale mines of gravel and fine sand which were not noticeable (Table 8).

If the Khersan-3 dam has not been constructed, there will be not any significant improvement in regards to industrial investment in the region. Moreover, the region will face to the lack of electricity production.

## 5 Conclusion

More than half of the world's major rivers had experience dam constructions with some 57,000 large dams by 2015. Large dam constructions are significantly contribute to the human development. The benefits drives from the multifunctional dam constructions are considerable including producing clean hydropower energy, storing water, and controlling floods, and providing recreational facilities. While many people get benefit from the services that large dams provide, the large dams construction and operation phase resulted to many significant, negative social and cultural impacts. Large dams constructions resulted in to the displacement of 40 to 80 million people around the world. These displacement have lots of negative social impact on the effected people. Thus, more investigations on the social impacts of the large dam constructions seems crucial.

Iran which was a pioneer nation in the Middle East in terms of sustainable water resource management for thousand years is facing lots of modern water related issues in the recent decades such as drying lakes and rivers. In order to combat the water crisis and reach to the desired development in this regards, Iran have built lots of large dams on the rivers during the past decades. However, the outcomes of this huge dam constructions for Iran are heartbreaking. The tragic out comes of construction of dams in Iran includes, significant damages to the ecosystem, degradation of the quality of water, losing the historic sites by reservoir's impoundment, changes in the land use types, and increased downstream side development under the shadow of increased water availability. Lots of researches and studies have done regarding the technical and environmental aspects of the large dams' construction in Iran however, barely any within social consequences on the effected inhabitants have been carried out so far. In order to fill this gap, the Khersan-3 dam located on Khersan river was selected as the case study of this thesis for further social investigations regarding the consequences of large dam constructions. The upstream side of the dam was selected for this investigation as the

majority of the displaced and effected inhabitants were from the 24 villages which were located in the reservoir area of the Khersan-3 dam. Below, I will give a brief overview of the main evaluated social impacts of the construction on the Khersan-3 dam.

- The Khersan-3 dam construction have positive impacts on population growth and preventing the migration of villagers to the cities since its construction provide more job opportunities and better living facilities to the region.
- The dam construction has also positive impacts on improving the region's infrastructures and communication systems since lots of new/more updated welfare serviced, accommodations, and roads are added to the region during the construction time and according to the dam project's plan.
- The construction of the dam has also positive impacts on the employment status and the income level of those inhabitants who are involved in the dam related jobs. However, the negative impacts expected for the minority of the inhabitants who are not involve in the dam related jobs or continuing their pervious jobs since the living cost in the region is increasing by the dam construction.
- The construction of the Khersan-3 dam has negative impacts on traditional animal husbandry activities in the region by decreasing the number of inhabitants who involved due to providing a large number of industrial dam related jobs and providing the opportunity for industrial animal husbandry in the region.
- The construction of the dam has definite positive impact on the literacy rate of the inhabitants by providing more primary, middle and high schools for the students in the region.
- The construction of the dam has a definite negative impacts on the culture and traditions of the inhabitants, due to the presence of non-indigenous employees for several years in

the region for the dam construction project. These impacts can be temporary or permanent.

- The dam construction has short-term negative impact on the tourist attraction points and natural scenery of the region due to the construction phase of the project but it has positive and long-term impacts in this regards after the dam impoundment and by creating more facilities to the other attraction points of the region (like roads) according to the project plane.
- The construction of Khersan-3 dam has positive impacts on the industrial development of the region due to the presence of lots of well-known contractors and huge amount of governmental investments in the region during the construction phase.

Generally, as mentioned above there are lots of positive and negative social impacts associated with the construction of the Khersan-3 dam on the upstream inhabitants. Most of the negative impacts can be predicted based on the information gathering for the project plan and experiences from other national dams in order to minimizing the negative social and cultural impacts of these kinds of projects. Unfortunately, the decision makers in Iran focus on reactive management with the aim to cure the existing symptoms(while the roots of the problems are getting deeper over time), rather than proactive management to avoid social negative impact of the large dam constructions. In my point of view, if the Iranian dam decision-makers wants to reach to sustainable development in in water resource management, they need to change symptom management method with proper problem prevention method. This action would not happen if there will be not a clear understanding about the problem causes as well as problem production mechanisms prior to the initiation of these kind of projects.

## 6 References

- Aban Pazhoh Consulting Company. (2005). *Khersan-3 dam resettlement plan* (Archived/In Persian).
- Aban Pazhoh Consulting Company. (2006). *Khersan-3 dam Environmental assessment* (Archived/In Persian).
- Abarghouei, H. B., Zarch, M. A. A., Dastorani, M. T., Kousari, M. R., & Zarch, M. S. (2011). The survey of climatic drought trend in Iran. *Stochastic Environmental Research and Risk Assessment*, 25(6), 851.
- Abbaspour, M., & Sabetraftar, A. (2005). Review of cycles and indices of drought and their effect on water resources, ecological, biological, agricultural, social and economical issues in Iran. *International journal of environmental studies*, 62(6), 709-724.
- Ahmadi, H., Samani, A. N., & Malekian, A. (2010). The qanat: a living history in Iran. In *Water and sustainability in arid regions*. Springer Netherlands.
- Bates, B. (2009). *Climate Change and Water: IPCC technical paper VI*. World Health Organization.
- Behmanesh, I., Madani, K., Geiger, C. D., & Bahrini, A. (2013, October). Stability analysis of the proposed Caspian Sea governance methods. In *Systems, Man, and Cybernetics (SMC), 2013 IEEE International Conference on* (pp. 1777-1782). IEEE.
- Berg, B. L. & Lune, H. (2012). *Qualitative Research Methods for the Social Sciences*: Pearson.
- Bryman, A. (2015). *Social research methods*. Oxford university press.
- Bryman, A. (2012). *Social research methods*. 4th ed. ed. Oxford: Oxford University Press.
- Cernea, M. M. (1998). Impoverishment or social justice? A model for planning resettlement. *Oxford, New Delhi*.
- Fathian, F., Morid, S., & Kahya, E. (2015). Identification of trends in hydrological and climatic variables in Urmia Lake basin, Iran. *Theoretical and Applied Climatology*, 119(3-4), 443-464.
- Foltz, R. C. (2002). Iran's water crisis: cultural, political, and ethical dimensions. *Journal of agricultural and environmental ethics*, 15(4), 357-380.
- Garcia, M. (2011). Micro-methods in evaluating governance interventions.
- Hussein, A. (2015). The use of triangulation in social sciences research: Can qualitative and quantitative methods be combined?. *Journal of Comparative Social Work*, 4(1).

Intergovernmental Panel On Climate Change. (2014). Climate Change 2014 Synthesis Report Summary for Policy Makers. Retrieved from [https://www.ipcc.ch/pdf/assessment-report/ar5/syr/AR5\\_SYR\\_FINAL\\_SPM.pdf](https://www.ipcc.ch/pdf/assessment-report/ar5/syr/AR5_SYR_FINAL_SPM.pdf)

International River (2016). Human impacts of dams. Retrieved from <https://www.internationalrivers.org/human-impacts-of-dams>

International River (2017). Problem with big dams. Retrieved from <https://www.internationalrivers.org/problems-with-big-dams>

International Commission on Large Dams. (2017). Retrieved from [http://www.icolc-cigb.net/article/GB/world\\_register/general\\_synthesis/number-of-dams-by-country-members](http://www.icolc-cigb.net/article/GB/world_register/general_synthesis/number-of-dams-by-country-members)

Iran Meteorological Organization.(2016). Annual Report (In Persian). Retrieved from <http://www.irimo.ir/far/>

Iran Water and Power resource Development company.(2017). Report (In Persian), Retrieved from <http://www.iwpc.ir/>

Iran Water and Power Resource Development Co.(n.d.). Retrieved from:  
<http://www.iwpc.ir/> (In Persian)

Iran Water and Power Resource Development Co. (2006). Khersan-3 Dam Resettlement Report. (Archived/In Persian).

Iran's Ministry of Energy. (2014). Annual Report (In Persian). Retrieved from [http://www.moe.gov.ir/Rules\\_and\\_Regulations\\_Issue/%d8%aa%d8%ad%d9%82%d9%8a%d9%82%d8%a7%d8%aa%d9%8a](http://www.moe.gov.ir/Rules_and_Regulations_Issue/%d8%aa%d8%ad%d9%82%d9%8a%d9%82%d8%a7%d8%aa%d9%8a)

Iran's Ministry of Agriculture. (2012). Agricultural Planning, Economic and Rural Development Research Institutes' Report (In Persian). Retrieved from <http://www.agri-peri.ir/Home/ShowPage.aspx?Object=Publishing&CategoryID=699990dd-5f57-42ba-adb7-2a2580d05213&LayoutID=a538060b-3b96-48ee-b228-8129a8a8c214&ID=c63a058c-cb64-4d83-b0f7-490768708310>

Iran's Department of Environment. (2012). Climate Change office. Report (In Persian). Retrieved from <https://www.doe.ir/Portal/home/?177787/%D8%B5%D9%81%D8%AD%D9%87-%DA%AF%D8%B2%D8%A7%D8%B1%D8%B4%D8%A7%D8%AA>

Iran's Department of Environment. (2012). *Iran's Second National Communication to the UNFCCC*. Report. Retrieved from:  
<http://unfccc.int/resource/docs/natc/iranc2.pdf>

Iranian Farmer's Union. (2013). *Livestock Status in Khesar-3 dam Catchment*. Retrieved from:  
<http://www.damdaraniran.com/>

- Joozi, S. A., & Seyfousadat, S. H. (2013). *Environmental risk assessment of Gotvand dam in the operational phase* (In Persian)
- Lerer, L. B., & Scudder, T. (1999). Health impacts of large dams. *Environmental Impact Assessment Review*, 19(2), 113-123.
- Madani, K., & Hipel, K. W. (2011). Non-cooperative stability definitions for strategic analysis of generic water resources conflicts. *Water resources management*, 25(8), 1949-1977.
- Madani, K., & Mariño, M. A. (2009). System dynamics analysis for managing Iran's Zayandeh-Rud river basin. *Water resources management*, 23(11), 2163-2187.
- Madani, K. (2014). Water management in Iran: what is causing the looming crisis?. *Journal of environmental studies and sciences*, 4(4), 315-328.
- Madani, K., & Zarezadeh, M. (2014, October). The significance of game structure evolution for deriving game-theoretic policy insights. In *Systems, Man and Cybernetics (SMC), 2014 IEEE International Conference on* (pp. 2715-2720). IEEE.
- Madani, K., & Dinar, A. (2013). Exogenous regulatory institutions for sustainable common pool resource management: application to groundwater. *Water Resources and Economics*, 2, 57-76.
- Manouchehri, G. R., & Mahmoodian, S. A. (2002). Environmental impacts of dams constructed in Iran. *International Journal of Water Resources Development*, 18(1), 179-182.
- Mansournejad, M., Kalantari, B., Mahdavi, M., & Adeli, M. (2015). The Investigation of Negative Effects of Salt Dome on the Quality of Water in Gotvand Olya Dam and the Use of Cut-off Wall as Treatment. *American Journal of Civil Engineering*, 3(2-2), 53-56.
- Matthews, G. V. T. (1993). *The Ramsar Convention on Wetlands: its history and development*. Gland: Ramsar convention bureau.
- Ministry of Agriculture Jihad. (n.d.). *Land Status in Khersan-3 Dam Catchment* (Archived/In Persian)
- Ministry of Road and Urban Development. (n.d.). *Urban planning and Transport System*. (Archived/In Persian).
- Ministry of Industry, Mines, and Trade. (n.d.). *Industrial Investigations in Chaharmahal and Bakhtiari and Kohgiluyeh and Boyer-Ahmad Provinces*. (Archived/In Persian).
- Ministry of Labor and Social Affairs. (2004). *Occupation Status in Khesar-3 dam Catchment* (Archived/In Persian).

Raziei, T., Arasteh, P. D., & Saghafian, B. (2005, May). Annual rainfall trend in arid and semi-arid regions of Iran. In *ICID 21st European regional conference* (pp. 15-19).

Richter, B. D., Postel, S., Revenga, C., Scudder, T., Lehner, B., Churchill, A., & Chow, M. (2010). Lost in development's shadow: the downstream human consequences of dams. *Water Alternatives*, 3(2), 14.

Statistical Center of Iran. (2011). *Population and Housing Census* (Archived/In Persian)

Statistical Center of Iran. (2011). *Education and Research Census* (Archived/In Persian)

Tajziehchi, S., Monavari, S. M., Karbassi, A. R., Shariat, S. M., & Khorasani, N. (2013). Quantification of Social Impacts of Large Hydropower Dams-a case study of Alborz Dam in Mazandaran Province, Northern Iran. *International Journal of Environmental Research*, 7(2), 377-382.

Statistical Center of Iran. (n.d.) *Admonistrative Division of Iran* (In Persian). Retrieved from: <https://www.amar.org.ir/%D8%A7%D8%B1%D8%AA%D8%A8%D8%A7%D8%B7-%D8%A8%D8%A7-%D9%85%D8%A7/%D8%AA%D9%82%D8%B3%DB%8C%D9%85%D8%A7%D8%AA-%DA%A9%D8%B4%D9%88%D8%B1%DB%8C>

Vörösmarty, C. J., Green, P., Salisbury, J., & Lammers, R. B. (2000). Global water resources: vulnerability from climate change and population growth. *science*, 289(5477), 284-288.

World Commission of Dam (2000). *Dams and Development*. Retrieved from [https://www.internationalrivers.org/sites/default/files/attached-files/world\\_commission\\_on\\_dams\\_final\\_report.pdf](https://www.internationalrivers.org/sites/default/files/attached-files/world_commission_on_dams_final_report.pdf)

Yasuj Health and Medical Education Office.(n.d.). *Waterborne diseases Kohgiluyeh and Boyer-Ahmad Province* (Archived/In Persian).

Zarezadeh, M., Madani, K., & Morid, S. (2013). Resolving conflicts over trans-boundary rivers using bankruptcy methods. *Hydrology & Earth System Sciences Discussions*, 10(11).





**Norges miljø- og biovitenskapelige universitet**  
Noregs miljø- og biovitenskapelige universitet  
Norwegian University of Life Sciences

Postboks 5003  
NO-1432 Ås  
Norway