

Water Dilemma in Isfahan and International Tourists' effect on it



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Master's dissertation 15 credits

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Abstract

Tourism is one of the leading industries, in terms of international trading between countries. In addition to receipts received at destinations, international tourism has also generated US\$211 billion in exports through international passenger transport services. The study is conducted in Isfahan, a city in center of Iran. The city is unique in its cultural heritage and archeology. It is one of Iran's oldest cities at more than 1,500 years of age. An important cultural and commercial center, Isfahan is Iran's third largest metropolitan area. Isfahan experiences an arid climate, like the rest of the Iranian plateau with low rainfall. Isfahan has a high capacity to attract international tourists to provide a better understanding of Iran's history, culture, and natural environment to the world. Zayandeh Rud which means "life-giving River" is the largest Iranian plateau and the most important surface water in Isfahan. It starts from Zagros Mountains and ends in the Gavkhouni Swamp, a seasonal salt lake in the southeast of Isfahan. The catchment area has been affected by two drought periods within the last 15 years. Decreasing surface and groundwater availability has been accompanied by an increase in water withdrawal for irrigation, domestic uses, industry, and water transfers to neighboring provinces. This has led to severe ecological and social consequences. This study identifies the potentials of Isfahan in attracting international tourists and also evaluate the water crisis that the city faces. The research is based on qualitative method. The primary data is gathered through face to face and phone interviews and questionnaires. The results show some finding solutions to water crisis in Isfahan and some suggestions for improving tourism industry in the city.

Keywords: *Tourism Industry, International Tourists, Water Scarcity, Water Management, Climate Change*

Acknowledgments

I would like to express my sincere gratitude to my supervisor, Saeid Abbasian for his intelligent guidance and helpful and essential advices and comments throughout the time I have been working on my thesis. I would like also thank Christian Widholm for his valuable guidance on the literature review.

I would like also to thank the participants who contribute to the quality of this research. I would like also thank to my friend Paria for her encouragement and insights. Finally I would like to appreciate my loved ones. I would specially thanks my husband and my dear son for their support, love and bearing me during this whole while, my dear brother for his support and my mother and my father for their endless love and affection. Carrying on my study has never been possible without the help of one by one of them.

Abbreviations and Glossary

- WANA** An abbreviation for "West Asia and North Africa" region
- WDM** An abbreviation for "Water Demand Management"
- IWRM** An abbreviation for "Integrated Water Resources Management"
- Evapotranspiration** Refers to the process by which water is transferred from the land to the atmosphere by evaporation from the soil and other surfaces and by transpiration from plants.
- Evaporation** is a type of vaporization that occurs on the surface of a liquid as it changes into the gas phase.
- Precipitation** Refers to any or all of the forms of water particles, whether liquid or solid, that fall from the atmosphere (e.g. rain or snow).
- Drought** is a recurrent feature of climate that is characterized by temporary water shortages relative to normal supply, over an extended period of time – a season, a year, or several years.
- Water Scarcity** Refers to the relative shortage of water in a water supply system that may lead to restrictions on consumption.
- Desertification** means land degradation in arid, semi-arid and dry sub-humid areas resulting from various factors, including climatic variations and human activities.

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Chapter 1. Introduction

1.1 Background

In 1991, the United Nations World Tourism Organization declared that “Tourism includes the activities of persons travelling to and staying in places outside of their usual environment for not more than one consecutive year for leisure, business or other purposes”. At this stage, it is possible to distinguish between domestic and international tourism (Yuksel, 2004). Domestic tourism refers to travel that is exclusively undertaken within the national boundaries of the traveler’s home country. International tourism refers to travel outside the borders of one’s home country (Camilleri, 2018).

Tourism is one of the leading industries, in terms of international trading between countries. In addition to receipts received at destinations, international tourism has also generated US\$211 billion in exports through international passenger transport services that were rendered to non-residents in 2015, bringing the total value of tourism exports up to US\$1.5 trillion, or US\$4 billion a day, on average (Camilleri, 2018). International tourism currently represents 7% of the world’s exports in goods and services, up from 6% in 2014, as tourism has grown faster than other world trade, over the past four years (UNWTO, 2017). More than half of the world's population lives in cities or in similar areas within an urban environment (McClain J. , 2015). The importance of these urban spaces cannot be considered enough; these cities are where most people choose to live in, and as such, is the lifeblood of most countries in the world. A study by the UN predict the growth of the world's urban population at 61% by 2030 (or 5 billion more persons living in cities in the next fifteen years). Interest in urban tourism is expected to increase in the coming years, which would make it an important incentives in building economies and accelerating urban development.

As cities grow and adapt to changing socioeconomic perspectives, more and more people are demanding new tourism experiences and products. Globalization also plays an important role in this phenomenon; people want things that are familiar to them, wherever they are in the world. Whether it is in Japan or England, they want the same kind of hotel rooms, and the same type of connections only in new environment. This high demand can lead cities to invest more in infrastructure, education, conservation, and promotion, which in turn, will result in more profits for the entire communities. It's a win-win situation for all. Tourism brings more than just financial benefits to the cities it blesses. It revitalizes and invigorates communities. It connects people; from strangers to friends to family. It is a platform for learning. Tourism is a vehicle for adventure. It teaches people how to live with diversity, how to connect with people whose culture is vastly different from your own. Tourism is more than just an economic driver; it is a lifestyle one that can provide intrinsic benefits for all that is involved (McClain J. , 2015).

1.2 Isfahan city and its international tourism

Understanding the potential and abilities of each geographic region in all economic, human and natural areas will help researchers and planners to identify and introduce them in order to develop in the region, taking into account current situations and local strengths. Iranian people call Isfahan as a half of the world. The city is unique in its cultural heritage and archeology. It is one of Iran's oldest cities at more than 1,500 years of age. An important cultural and commercial center, Isfahan is Iran's third largest metropolitan area. Whether you're in town for tourism or business, many places are worth a visit. Isfahan's valuable historical collections include the oldest and most valuable monuments which are architecturally unique (Moosavi Nor & Rahmat Shah, 2012). Isfahan experiences an arid climate, like the rest of the Iranian plateau with low rainfall. In winters the temperature is between -2°C and 8°C in January. Snow falls at least once in winter but in contrast, summers can get hot with highs topping 36°C in July but with pleasant nights just above 21°C . The best time to visit Isfahan is during spring and fall, although the temperatures are comfortable year-round and it never gets too humid. Isfahan has a high capacity to attract international tourists to provide a better understanding of Iran's history, culture, and natural environment to the world (Moosavi Nor & Rahmat Shah, 2012). Each year it accommodates a significant number of Iranian and foreign tourists. Isfahan is the third largest city in Iran and one of the largest cities in the world. Isfahan is an important city because it is at the intersection of two main routes north-south and east-west that passes through Iran. Isfahan flourished from 1050 to 1722, especially in the 16th and 17th centuries in the Safavid dynasty, when it became the capital of Iran for the second time in its history. Even today, the city keeps more of its past glory.



Figure 1-1 Map of Iran and the location of Isfahan Province in the center of Iran *Source:* <http://www.discoverpersian.com/isfahan/>

1.2.1 Isfahan City Attractions

Isfahan is famous for Perso-Islamic architecture, large boulevards, bridges, palaces, tile mosques and minarets. Isfahan also has many historic buildings, monuments, paintings and artifacts. Isfahan has a great potential for attracting foreign tourist and every year thousands of foreign tourist visit the city.

Isfahan Attractions	Number	Era	Century
Historic Square	1	Safavid Dynasty	16
Historic Bazaars	4	Safavid Dynasty	16,17
Historic Bridges	5	Safavid & Seljuq Dynasty	12,16,17
Historic Caravanserais	1	Safavid Dynasty	17
Historic Churches	4	Safavid Dynasty	17
Historic Palaces	3	Safavid Dynasty	16,17
Fire Temples	1	Sasanian Empire	Unknown
Historic Baths	4	Safavid Dynasty	16,17,18
Historic Libraries	1	Achaemenid Empire	6 or 5 B.C
Historic Houses	8	Qajar, Safavid, Afsharid and Zandieh Dynasty	18,19
Mausoleums	6	Abbasid Caliphate, Seljuq, Safavid, Timurid, Ilkhanate, Muzaffarids	9,12,14,15,17
Historic Mosques	16	Safavid, Qajar, Samanid, Buyid and Seljuq dynasty	9,11, 17,19,20
Historic Minarets	6	Buyid Dynasty, Seljuq Dynasty, Muzaffarids, Ilkhanate	11,12,14
Historic Museums	4	Safavid & Timurid Dynasty	15,16 or 17
Historic Schools	5	Qajar, Safavid & Ilkhanid Dynasty	14,17,18,19

Table 1-1 Isfahan Historical Attractions

1.3 Problem Statement

The growing population and increasing agricultural and industrial water use are in contrast to decreasing water availability which is also linked to climate change. Zayandeh Rud which means “life-giving River” is the largest river of the Iranian plateau and the most important surface water

in the center of Iran (Mohajeri, et al., 2016) in semiarid to arid environment. It starts from Zagros Mountains and ends in the Gavkhouni Swamp, a seasonal salt lake in the southeast of Isfahan (Mohajeri, et al., 2016). The catchment area stretches across two provinces, covering a total area of 26,000 km² (Mohajeri, et al., 2016). Along its 405 km route, the Zayandeh Rud passes through extremely different climatic and natural conditions ranging from humid over semi-arid to arid environment at the estuary, the salt lake Gavkhuni (Mohajeri, et al., 2016). This river provides the main source of water for one of the most important agricultural areas in Iran (Isfahan) for the growing industry sector and about 4.5 million citizens (Mohajeri, et al., 2016). It's not a seasonal river and it used to have significant flow all year long. Water from the Zayandeh Rud River helped the growth of the population and the economy, helped established Isfahan as an influential center, and gave a green landscape to Isfahan, a city in the middle of a desert.

The Zayandeh Rud catchment is affected by two periods of drought over the past 15 years, and due to increased gap between water capacity and water demand, groundwater resources have been overused. This greatly reduction of the level of groundwater, leads to a wide variation of groundwater flow conditions and even a dry river bed in the main parts of the river. No water flows for a long time in dried up Zayandeh-Rud River. What remains is a desert of gravel and burst red soil. It runs like a scar through the city. For the purpose of covering the increasing water demand, three tunnels were built in 1954 and later in 1985, through which water is being rerouted from the neighboring province toward the Zayandeh Rud dam. But neither fully control of the Zayandeh Rud dam outflow, nor the additional water transfer from neighboring provinces are capable to solve the water shortage in Isfahan completely (Madani & Mariño, 2009; Gohari et al., 2013). The dry bed of Zayandeh Rud means about 2 million people-40 percent of the population- in the Zayandeh Rud basin who depend on agriculture have lost their income. This leads to immigration to Isfahan city for finding and changing their jobs which consequently leads to rapid population growth in Isfahan city. The river's choking has a great impact on Isfahan city which is built around the Zayandeh Rud. While recently agriculture has been suffering from serious supply problems, the number of industrial businesses, including the water demand for industry, has steadily increased. In addition there are over 30 large individual industrial units like Mobarakeh Steel Co. which share approximately 75 % of the total industrial water consumption in the catchment area (Mohajeri, et al., 2016).

Si-o-se bridge which is built in 1602, or Khaju Bridge, which is one of Isfahan's age-old landmarks which were built over the Zayandeh Rud River. With the drying of river, these and other historic bridges in Isfahan are facing serious challenges and standing as symbols of what is missing. Many geologists and national heritage experts believe that the foundations, construction materials, and Si-o-se pol piles have been endangered by the long dryness of the river and lack of humidity. The water flowing highlights the magnificence of these structures.” (Persia Digest, 2019).

An environmentalist in Isfahan believes: “Not paying attention to the water crisis in Isfahan can lead to social unrests and break up of infrastructures.” For example, the opponents of transferring

water from Isfahan to Yazd cut off the pipes in this project for the 24th time. Although Isfahan has great potential for receiving international tourists, the water crises leads to many problems and water and energy organization has faced lots of problem due to providing citizens' drinking water during five recent years (2013- 2018) especially last summer (2018). After 30% reduction of Isfahan's water distribution network, first water rationing took place in 2013 in Isfahan.

Intermittent and irregular water and electricity cutting off began mid July 2018 and the power distribution company in Isfahan has also announced the blackouts. Water and electricity were rationed in Isfahan city in last summer (2018) and in every part of the city, two hours of electricity were cut off daily. Residents of the apartments have also water problem during the non-electric hours, as most of these apartments have tankers to pump water to higher floors. In apartments several people had been stuck in buildings' elevators because of power outages and endured many stresses until the arrival of the firefighters. Even in the streets, by stopping traffic lights, there was a lot of traffic jams on streets (there was a lot of chaos in the car traffic). In hot summer days in Isfahan, people should use a water cooler, which, of course cannot compensate for the heat of the summer noon. Unfortunately, the power outages were carried out precisely at the peak hours of the heat and caused people'. According to IMNA's reporter, Isfahan mayor in a radio program on 4th of May 2019 advised citizens on optimal use of water: "this year, as in the past year, we have to manage water consumption, it is true that water in Zayandeh Rud River is current (due to recent rainfalls on March and April 2019) and we hope it will continue. But it should be noted that water scarcity has not yet been compensated and the infrastructure required for water supply is not completed, so in any case, we should consider optimal water consumption. Recent heavy rains in Isfahan has re-hydrated the soil but the Zayandeh Rud dam has not been filled yet. It has brought good news for residents as helped Isfahan to emerge from the hard drought conditions that was expected to face with in summer; however, water reservoirs are still alarmingly in low level and drinking water in short supply. Therefore, there is still cause for concern."

1.4 Research questions

In this research the author's aim is to address the following questions:

- 1- What are the reasons of water crisis in Isfahan?
- 2- What are the solutions of the Isfahan water crisis?
- 3- Does the arrival of international tourists to Isfahan intensify the existing water crisis?
- 4- Can Isfahan accommodate international tourists with current water shortage situation?

1.5 Research objectives

- 1- Evaluating the water crisis in Isfahan
- 2-Identifying the potentials of Isfahan in attracting international tourists

- 3- Investigating if the city of Isfahan can be accepted the international tourists considering the existing water crisis or not.
- 4- If the international tourists' arrival will add a problem to the existing problem of water shortage in Isfahan or not.
- 5- Suggesting some finding solutions to water crisis in Isfahan

1.6 Research limitations:

- 1- There's not a comprehensive research about the water crisis and international tourists in Isfahan so great effort was made to data collection considering the shortage of time.
- 2- Most of the data was primary data which needed extensive field work and it needs interview with stakeholders including officials' involved (Cultural heritage, Handicrafts and Tourism Organization of Isfahan Province, Water and Wastewater organization of Isfahan Province, Isfahan Agricultural Organization and Hotels)
- 3-None of the stakeholders cooperated well and they refused to interview without a formal letter from the author's university.
- 4- There was limited documented data about Isfahan water crisis and international tourism.
- 5- It seems all of the stakeholders had more information to share but they didn't put at my disposal easily.
- 6- Almost all of the data was in Persian and great effort was made to translating the big amount of data.
- 7- There was no easy access to the authorities in Isfahan.
- 8- There was no data bank related to the thesis subject.

1.7 Research Outline

This research consists of six chapters. The introduction part presents the general background of the study, Isfahan the area of the study and its attractions, problem statement and research objectives and research questions. The research method part represent description of approach, methods, validity and reliability of the study. The third chapter presents the literature review of water scarcity in area of the study and water scarcity globally and offered solutions. In four and five chapter the empirical findings are compared and discussed in relation to the previous studies in order to answer the research questions. The study ends with a conclusion.

Chapter 2. Research Method

This chapter will present detailed information about the present research. There are a series of steps to create a thesis. These steps are: Research Purpose, Research Approach, Data Collection and Data Analysis.

2.1 Research Purpose

There are many ways to carry out research. However, there are certain procedures that all researchers follow. According to Saunders, Lewis and Thornhill (2012, p.170), the nature of the research project will also be either Exploratory, Descriptive, Explanatory or a combination of these.

2.1.1 Exploratory research

An exploratory study is a valuable tool for finding out what's going on; seeking new insights; asking questions and evaluating phenomena in a new light (Robson, 2002, p. 59). This is especially useful if you want to clarify your understanding of a problem, for example, if you are not sure of the exact nature of the problem (Saunders, Lewis and Thornhill, 2006, p.133). Hence, this kind of research is designed to allow the researcher to "look around" with respect to some phenomena, with the aim of creating suggested ideas. When the research goal is understanding a phenomenon or gaining a new insight into it in order to formulate a more precise problem or to develop a hypothesis, exploratory studies are useful. This method is sometimes known as a theory-based approach to qualitative or interpretive research, and is an attempt to discover the theory from the data itself, rather than from an inclined hypothesis.

2.1.2 Descriptive research

The purpose of the descriptive research is "to display the exact characteristics of individuals, events or circumstances" (Robson, 2002, p.59). This may be an extension of, or a forerunner to, a piece of exploratory research or a piece of explanatory research. The author needs to have a clear picture of the phenomenon he/she wants to collect the data before gathering data. (Saunders et al. 2006, p.134). Descriptive research describe the characteristics of the population or phenomenon studied. The objective of this kind of research is to provide a description of various phenomenon connected to individuals, situations, or events that occur. The descriptive research may also be used when developing empirical generalizations. When such generalizations begins to emerge, they are worth explaining, which leads to theory development.

2.1.3 Explanatory research

Studies that create causal relationships between variables may be called explanatory studies. In order to find cause/effect relationships between given variables, besides having to come up with

well-defined research problem, hypotheses need to be stated. The emphasis here is to study a situation or a problem in order to explain the relationship between variables (Saunders et al. 2006, p.134). This kind of research is very complicated and the researcher can never be completely sure that there is no other factor for causal relationship, especially when treated with the attitudes and motives of individuals. According to Miles and Huberman (1994) explanation means “making complicated things understandable by showing how their component parts fit together according to some rules, that is, theory.”

Based on the definition, this research is a mix of both descriptive and explanatory research. It is a descriptive research because it wants to describe the water crisis problem in Isfahan city and also wants to look for the reasons which caused water dilemma in Isfahan city. It also wants to analyze how the stake holders want to manage this problem and how they want to make balance between this problem and receiving international tourists. This research is also an explanatory research because its goal is explaining and more understanding of water dilemma problem in Isfahan city which people cope with. It also wants to acquire new insights into it in order to find out how the stakeholders want to manage this problem with regard to increasing number of tourists to the city.

2.2 Research Approach

Research approach is a plan and procedure that consists of the steps of broad assumptions to detailed method of data collection, analysis and interpretation. It is therefore, based on the nature of the research problem being addressed. The author is expected to show that he/she carried out his/her work with due care and that had good reasons for doing what he/she did. First, deductive versus inductive research approaches will be discussed and then qualitative versus quantitative researches will be stated.

2.2.1 Deductive versus inductive Research

A deductive approach is to "create a hypothesis (or hypothesis) based on existing theory and then design a research strategy to test the hypothesis (Wilson, 2010, p. 7). The deductive approach can be explained by hypotheses that can be extracted from theoretical propositions. The inductive approach also known in inductive reasoning, begins with observations, and theories are suggested at the end of the research process as a result of observations (Goddard & Melville, 2004, p.65). Inductive research involves searching for patterns from observations and developing explanations - theories - for these patterns through a set of hypotheses (Bernard, 2011, p.7).

According to the above definition, this research is not a deductive research because there isn't any predetermined theory or a conceptual framework. This research is an inductive research because there is no theory at the beginning of the research and after collecting data, the theory is build.

2.2.2 Qualitative versus Quantitative Research

Quantitative and qualitative paradigms are two research approaches that look at the world through different lenses. Quantitative and qualitative terms in business and management research are widely used to differentiate data collection methods and data analysis procedures (Saunders et al., 2006, p. 145). Both methods have some advantages and disadvantages and neither one of them can be held better than the other one. Both qualitative and quantitative methods may be appropriately applied to any research paradigm (Saunders et al., 2006, p. 100).

2.2.2.1 Quantitative Research: Benefits and Drawbacks

In the natural sciences and social sciences, quantitative research carries out systematic empirical research of visible phenomena through statistical, mathematical or computational methods (Given, 2008, p. 37). Bryman (2012, p. 35) defines quantitative research as "the research strategy that emphasizes measurement in the collection and analysis of data. The goal of quantitative research is the development and use of mathematical models, theories and hypotheses related to the phenomenon. Quantitative data is any data in a numerical form such as statistics, percentages, and so on (Given, 2008, p. 210). Pros and cons of quantitative research are as follows:

In addition to providing researchers with a fast and efficient way to study large sample sizes, quantitative research yields objective results. Because the data is straightforward, the results can be easily compared with other data. Another advantage of quantitative data is that it uses statistical collection methods. This allows researchers to understand and interpret large amounts of inherent characteristics in the data. In addition to sampling, analysis of data takes less time using statistical software such as SPSS (Connolly, 2007, p.68). Data collected by researchers through quantitative research can be considered for future use by creating campaigns and programs targeted to the studied group. Quantitative research results can be disseminated anonymously, which makes participants more involved in the study and makes it easier to evaluate critical issues. The quantitative findings may be generalized to a whole population or a sub-population because it includes the larger sample that has been randomly selected (Carr, 1994).

Although quantitative research gives individuals a fast and easy way to sample a large group, it also has some drawbacks. The research paradigm of positivism leaves out the common sense of social phenomena. Also, it cannot ascertain the deep meanings and explanations (Rahman, 2016). Another limitation of quantitative research is that the positivism cannot account for how the social reality is shaped and maintained, or how people interpret their actions and others. A more weakness of quantitative research method is that it tends to take a snapshot of a phenomenon: It measures variables at a specific moment in time, and ignores whether the photograph happened to catch one looking one's best or looking unusually disarranged (Schofield, 2007, pp.181-203). Lastly, the quantitative research paradigm overlooks the respondents' experiences and perspectives in highly controlled settings because there is no direct relationship between

researchers and participants in the data collection process. As a result, the method of obtaining data becomes objective (Rahman, 2016).

2.2.2.2 Qualitative Research: Benefits and Drawbacks

According to Heigham and Croker (2009, p.3), we are already familiar with many of the qualitative activities, and we actually do them ourselves every day. The two main skills of qualitative researchers are observing and interviewing. A wide range of research approaches has been developed within qualitative research, including narrative inquiry, case study, ethnography, action research, phenomenology, and grounded theory. These approaches use a wide range of data collection methods, such as observations, interviews, open-ended questionnaires, verbal reports, newspapers, and discourse analysis. Qualitative researchers provide a lot of detail than quantitative researchers when reporting their research. There are some advantages of using qualitative research approaches and methods. Firstly, the qualitative research methodology provides a thick (detailed) description of the participants' feelings, opinions and experiences; and interpret the meanings of their actions (Rahman, 2016). Secondly, some argue that the approach of qualitative research (interpretivism) comprehensively understands human experience in particular settings (Rahman, 2016).

Thirdly, qualitative research approach is considered as an ideological research, study of individual cases or accidents (Klein & Myers, 1999); and it has the ability to understand different people's sounds, meanings and events (Rahman, 2016). Fourthly, qualitative research encourages researchers to discover the participants' inner experience and to figure out how the meanings are shaped through and in culture. A qualitative approach can help us understand the markers' working assumption of what should be evaluated, and the meaning of a score or degree (Rahman, 2016). Fifthly, qualitative research methods such as participant-observation, unstructured interviews, direct observations, and descriptive records are most commonly used to collect data (Cohen, Manion, & Morrison, 2011, p.270). During data collection, researchers communicate directly with the participants, as happens when data is collected through interviews. As a result, collecting data is subjective and accurate (Rahman, 2016). Finally, the design of qualitative research (interactive approach) has a flexible structure, since design can be further developed and rebuilt to a greater extent. Therefore, a comprehensive and appropriate analysis of a topic can be generated using qualitative research methods, and therefore participants have the freedom to determine what is compatible with them (Rahman, 2016).

Beyond the benefits explained above, some limitations are obvious. First, Rahman (2016) cited by Silverman (2010) that qualitative research approaches sometimes go away from text sensitivities and focus more on meanings and experiences. Second, policymakers may have little credit to the results of a qualitative approach (Rahman, 2016). In addition, purely qualitative research may ignore the social and cultural structures of the studied variables (Richards & Richards, 1994, p. 445-462). Third, in terms of the research method, smaller size increases the generalizability issue

for the entire population of research (Harry & Lipsky, 2014, pp. 445-460 & Thompson, 2011, pp. 77-82). Then data interpretation and analysis may be more complicated (Richards & Richards, 1994, pp. 445-462). Finally, analysis of cases takes a considerable amount of time, and results can be generalized in only a very limited way to the larger population. However, despite these shortcomings, qualitative research plays a prominent role in language testing research (Rahman, 2016).

2.2.3 The Chosen Method For this thesis

This research is a qualitative research because it isn't a systematic investigation of observable phenomena via statistical or mathematical techniques but it tries to give more valuable and deeper understanding about the phenomenon (water crisis problem and making balance between this problem and increasing number of tourists to Isfahan city). It's a social qualitative research because it focuses on the making balance between the problem of water crisis and increasing number of tourists to Isfahan city that it is neither a problem which can be quantified nor patterned. It doesn't attempt to investigate the answers to the questions starting with how many or how much but it attempts to answer the question of "why the water crises happened in Isfahan and how the stakeholders want to manage this problem and how they want to make balance between the water problem and increasing number of tourists to Isfahan city". The objective is not to develop and employ a mathematical model, theory and hypothesis pertaining to making balance between water crises and increasing number of tourists to Isfahan city. There isn't a theory at first and the theory is driven after analyzing the data. The data isn't in numerical form such as statistics or percentages. It's non-numerical data. It doesn't emphasize on measurement in the collection and analysis of data and it doesn't deal with a large sample size of population. The data won't be analyzed with the help of statistics applications.

2.3 Qualitative data collection methods

As Heigham & Croker (2009, pp.17-18) implied, in most qualitative studies, researchers use different research methods to collect data, in order to obtain as many views as possible on the phenomenon being researched. Six data collection methods are often used in qualitative research in applied linguistics: Observation, Interviews, Open-response items on questionnaires, Verbal reports, Diaries and Discourse analysis. These data collection activities are typically carried out in close proximity to a local environment for a sustained period of time. Qualitative data are not so much about behavior as they are about actions which carry with them goals and meanings and lead to consequences. Qualitative data focus on naturally occurring, ordinary events in natural settings, so that we have a strong category about what "real life" is.

Data for this research is collected through phone and face to face interviews and open-response items on questionnaire and also four-choice questionnaire for primary data. The questionnaires have printed and distributed by hands among the respondents and they are collected immediately.

The interviews are conducted in a conversational manner and all of them are recorded. The respondents may provide information, ideas and their own insights about phenomenon. In doing this research structured questionnaires for local, international tourists, hotels and related stakeholders in Isfahan city are used and structured interviews questions are made. Secondary data gathered by another researches and which could be applied for this specific phenomenon as well.

2.4 Sampling

Qualitative researchers usually work with a small samples of people who are in their field and study in-depth. Qualitative samples are targeted instead of random. Samples in qualitative researches are usually not fully indicated but when an investigative work begins, they can be evolved (Miles, Huberman & Saldana, 2014, p.46). A wide range of sampling strategies are available to qualitative researchers within a complex case or across all cases. They can be selected before the time or can evolve during early data collection. It is impossible to prescribe the best sampling strategies for any kind of study, because there are unique conditions in each of the projects (specific research questions, sites, special cases, etc.). But you should be able to justify your readers why you selected certain types of samples from others (Miles et al. 2014, p.47). Qualitative research sampling tends to be more strategic and purposeful, because qualitative researchers focus on unique fields.

Samples for this research are not big samples but they are purposeful and targeted small sample size. The samples are local people, International tourists, six hotels in Isfahan city, related water-tourism stakeholders and authorities in Isfahan (Cultural Heritage, Handicrafts and Tourism Organization of Isfahan Province, Water and Wastewater Organization of Isfahan Province, Agriculture Organization, Governorship of Isfahan, Mobarakeh Steel Company) and two professors in Iran and Norway who are expert on tourism, water management and environmental issues. There was a phone interview between the author and professor Nasser Karami in Norway and the phone interview was recorded and translated to English. There was a face to face interview between the author and the professor in Art university of Isfahan and the interview was also recorded and translated to English. 37 local people were elected in different parts of the city randomly. The stakeholders were water- tourism officials in government organizations in the city. The interviews' questions were different and purposeful. The interviews were recorded by the author and translated to English. 35 International tourists were randomly selected in Naghsh-e-Jahan square in three different days and they were given four-choice English questionnaires. Two 5-star hotels, one 4-star hotel, a 1-star hotel, a 2-star hotel and a traditional hotel were selected among the hotels in Isfahan city and they were given also four-choice questionnaire by the author.

2.5 Qualitative Data analysis:

According to Miles et al. (2014, pp.31-33) qualitative analysis are as three current streams of activity flow: (1) data condensation, (2) data display, and (3) conclusion drawing/verification.

Data condensation refers to the process of selection, concentration, simplification, abstraction, and/or conversion of data that appear in the full body of written notes, interview transcripts, documents, audio or video recording, print/digital artifacts and other empirical materials. The second main flow of analysis activity is data display. In general, a display is an organized, compressed assembly of information that allows results drawing and action. Good displays are a major way to strong qualitative analysis. The third and last stream of analysis activity is conclusion drawing and verification. From the beginning of data collection, the qualitative analyst interprets what things mean by referring to patterns, explanations, causal flows, and propositions. The competent researcher holds these results lightly, maintaining openness and skepticism, but the conclusions still exist, ambiguous at first, then increasingly explicit and grounded. Final results may not appear until data collection is over. Results are also verified as the researcher proceeds.

The analysis of qualitative data can be divided into five categories: Content analysis, Narrative analysis, Discourse analysis, Framework analysis and Grounded theory (Saunders et. al. 2006, p.5).

Content analysis is an approach to analyzing documents and texts that seeks to quantify content in terms of preset categories and in a systematic and repeatable manner (Bryman, 2012, p. 290). One of the key advantages of using content analysis to analyze social phenomena is its non-invasive nature, in contrast to simulation of social experiences or collection of survey responses. The exercises and philosophies of content analysis vary between academic disciplines. All of these include systematic reading or observation of texts or artifacts which are assigned labels (sometimes called codes) to indicate the presence of interesting, meaningful pieces of content (Hodder, 1994, p. 155). By systematically labeling the contents of a set of texts, researchers can analyze quantitative patterns using statistical methods, or use qualitative methods to analyze meanings of content within texts. There is strong correlation between qualitative content analysis and thematic analysis (Vaismoradi, Turunen, & Bondas, 2013).

The data in this research is analyzed through content analysis which is analysis of notes, interviews, audio recordings, and text documents.

2.6 Reliability and Validity

Reliability means that data collection methods or analysis procedures will provided consistent findings. Robson (2002) believes that there may be four threats to reliability. First of all is subject or participant error. If you are studying the amount of enthusiasm employees have for their work

and their employer, you may find that a questionnaire completed at different times of the week may produce different results. You should choose a more 'neutral' time. Similarly, there may be subject or participant bias. Third, there may be an observer error. Finally, there may have been observer bias (Saunders et al. 2006, p. 177). Validity or credibility is an important key to effective research. If a piece of research is invalid then it is worthless. Therefore, validity is a requirement for both quantitative and qualitative research. In qualitative data validity might be addressed through the honesty, depth, richness and scope of the data obtained, the participants approached, the degree of triangulation and the lack of interest or objectivity of the researcher. In qualitative data, the respondents' subjectivity, opinions, attitudes, and perspectives contribute to a degree of bias (Cohen, Manion & Morrison, 2000, p. 105).

Validity for this research is addressed through the honesty, depth, richness, and scope of data obtained and the lack of people's interest in answering the questionnaires. As with validity, perfect reliability is difficult to achieve in qualitative tourism related researches because they are based on people's experiments, behavior and attitudes. This work is also deal with the international tourists and water dilemma in Isfahan city which is a social and political issue and is also deal with the main stakeholders in Isfahan city so maybe they don't give enough and perfect information and statistics. There may be participant's bias. Another problem with reliability for interviews could be that the respondents may answers the questions differently because of the interviewer effect. One respondent may feel comfortable with the interviewer or the interviewer may have a different style of asking questions which can have effect on respondents' answers. Reliability on this work is also depends on the author's interpretation of the results. On the other hand the authenticity of work can be checked because all the interviews are recorded and the answers are stated exactly as the respondents have said. Another weakness of this work may have been the instrument for data collecting (the open-end questionnaire) and open-end interview. The benefit of the chosen methods on one hand is acquiring deep and detailed information but on the other hand coding the answers is very difficult.

2.7 Ethical issues

As Veal (2006, pp.70-71) explains ethical behavior in research, as in any other field of human activity, is important. Certain ethical considerations, deal with issues such as plagiarism and honesty in reporting of results, occur in all research, but additional issues occur when research involves human subjects, in the biological and social sciences. The principles of research ethics are global – they respected things like honesty and respect for the rights of individuals. Professional groups, such as market researchers, have created the explicit ethics that members are forced to adhere to. Most universities have codes of ethics that is being implemented by ethics committees. Research ethics codes have intrinsic value in protecting the rights of humans and animals that may engage in research, but they also serve a professional and organizational performance. Researchers may be judged and can lose professional indemnity if they are not seen to have adhered to the appropriate code of ethics principals. A related consideration is the question of public relations

and the position of organizations responsible for the research within the community. Some practices may be ethical, but still illegal, so the value of the data collected using such practices should be weighed against the bad intention which may be generated. Ethical issues arise in designing and conducting of research and reporting of results. Regarding the design and conduct of research, many ethical rules are associated with laboratory practices, but this is a discussion of ethical issues. As far as reporting the results is concerned, the same ethics applies irrespective of the methods involved. General principles commonly used in research ethics codes are:

- a. that no harm should befall the research subjects;
- b. that people should participate freely; and
- c. that people should participate on the basis of informed consent

The ethical issues for this research may have been the anonymity of the respondents and authorities who worked in water-tourism related organizations. Another ethical issues is freely participation of local people and stakeholders in the research and also participation of people on the basis of informed consent.

Chapter 3. Literature Review

Literature review has an essential function when conducting a research. Valuable information about tourist destinations in Middle East, European countries, Iran and Isfahan has been gathered by different researchers through articles. Relevant extracts have been taken from those and used by the author in order to strengthen, validate and confirm the data collected within the study. There are several ways to examine literature in terms of methodology and what is essential to is find the type suiting the phenomenon and the research question. The author has selected the context review as the main type of literature review, with the help of which she intend to carry out the study. The author classified the articles to different categories. It is a common type, which appears in the beginning of a study and introduce it within a broader range of framework.

3.1 Studies on tourism destinations with water crisis and their finding solutions

WANA Countries

Water Security was a central theme of WANA Forum 2010, where regional experts warned that the 21st century wars will be fought over water. About 90% of the WANA (West Asia & North Africa) region is considered as arid or semi-arid which receive less than 200mm of rainfall per year. The WANA region except Turkey has minimal rainfall and limited aquifers. It is one of the driest parts of the Earth. It is mostly known for its abundance of oil rather than for its shortage of water. It is the driest region in the world with renewable water resources less than the critical level of 1000 m³ per person per year, as defined by the WHO (El Kharraz, El-Sadek, Ghaffour, & Mino, 2012).

It is estimated that at least 19 WANA countries will be in the grip of severe water poverty by 2025. Climate change will only exacerbate regional problems that have already been stressed by lack of water, food and political and social unrest. An depth assessment of the region showed that across the Arc of Crisis, from Somalia, Sudan and Egypt in Africa to Yemen, Iraq, Pakistan, and Afghanistan in West Asia water scarcity in the region has already lead to drought and famine, loss of livelihood, the spread of water-borne diseases, forced migrations and open conflict. 13 Arab countries are in the category of countries with water shortages or water scarcity.

With high demand from agriculture, a growing populations and virtually no remained untapped water sources, the need to develop water-management strategies in the region is crucial. Irrigated areas use rivers and groundwater resources, which are becoming depleted from over-use. The imbalance in the population-water resources equation strains society and has an negative impact on domestic hygiene, public health, and household water costs, and could create political problems as serious as bringing down governments. On the social side, water shortage adversely impacts job opportunities, farm incomes, credibility and reliability of agricultural exports, and the ability of the vulnerable to supply the cost of domestic water. Economically, the adverse impact is displayed

in the loss of production of goods, especially agricultural goods, the loss of working hours due to the hardships society faces as a result of water scarcity.

If nothing changes, most of the WANA countries, which accounts for a major population of the world's dry area, in less than a generation will encounter serious problems in managing inland. According to El Kharraz et al., 2012, for millennia, societies in the WANA region made innovations to improve water management and deliver water reliability and in modern times, the region is in the vanguard of some of the most advanced water management techniques.

These techniques include constructing dams under conditions of high seismic risk (Iran), desalinating brackish and salt water (Saudi Arabia and other Gulf countries), managing complex irrigation and drainage networks (Egypt), successfully privatizing urban water utilities (Morocco), managing efficient public sector water utilities (Tunisia), encouraging farmers to install water-saving irrigation technologies (Tunisia and Jordan), and using flash food (spate) flows to irrigate crops (Yemen) (El Kharraz et al., 2012).

Beyond the improvements to resource management, there is significant progress in water demand management such as using various tools at their disposal (technical, legislative and legal, institutional, economic, planning and concerted action, training and awareness-raising), establishment of water accounts as a strategic tool for inter-use reallocation (on national level or on basin level), cost-effectiveness analysis and economic analysis of the various water uses (El Kharraz et al., 2012).

Some other different political instrument to promote WDM in the agriculture sector in WANA countries are agricultural subsidies, especially for equipment in modern irrigation systems, Agro-environmental aid, the conditions for agricultural aid, and changes in tariffs for agricultural water. The authors also have some useful suggestions concerning social, economic and technical aspects of WDM. Different case studies in WANA region are also analyzed. The paper also shows that the large amount of water used for irrigated agriculture that leads to abstracting large amount of non-renewable fossil groundwater. Arab countries should focus on reductions of demands from the agricultural sector as well as creating additional water resources to reduce groundwater abstractions (El Kharraz et al., 2012).

The WANA area has become a global leader in sea and water desalination which is a non-conventional water resources in this region. In 2000, more than 70 percent of domestic water requirements in Gulf Cooperation countries Council relied on desalination. Other countries such as Algeria have recently adopted a huge desalination program to overcome the water deficit. Almost all countries in the WANA region are or will be dependent on the desalination of sea water for a significant part of their needs for fresh water. Due to the lack of natural fresh water and the cost of desalination, waste water processing for reuse is or could be another source of water for the nations of the region (El Kharraz et al., 2012).

Water supply management, water use efficiency and demand-oriented water management must be balanced within a sustainable development perspective, the economic, social, environmental impacts of the issues and also the impacts of the climate change need to be better assessed, applied and targeted research and replicating successful experiences across the region are essential for sustainable development and understanding the impacts of climate change on droughts, Governance should be improved to ensure full participation of all stakeholders, decentralized service provision and use of IWRM, generation and transparent exchange of information and data in scarcity conditions (El Kharraz et al., 2012).

Mallorca

The issues of water management presently being faced on the island of Mallorca are typical of many Mediterranean resorts that have experienced the mass tourism boom of the post-1945 period. Mediterranean climates, with seasonal warm temperatures and low rainfall, are popular as tourist destinations, but have a natural disposition for drought. Surface water storage is a problem on Mallorca due to the high permeability of the dominant limestone geology. Peak visitor volumes and demand for water supply are concentrated in the season of low rainfall and high evapo-transpiration (Kent, Newnham, & Essex, 2002).

Per capita, tourists demand more water than local residents. Efforts to revitalize the tourist infrastructure through increased landscaping and open spaces in resorts and the provision of golf courses, have increased the demand for water further. In order to meet these demands, over-extraction from aquifers has lowered the water table, causing saline intrusion and salt water contamination of the main sources on the coastal plain. Without effective water management, the issues of water scarcity and deteriorating quality represent constraints on the growth of the tourism industry on Mallorca (Kent et al., 2002).

A number of water management measures have already been introduced on the island to address the problems of water supply and quality, providing an indication of the urgency attached to the resolution of these issues for the economic, social and environmental sustainability of the island. The implementation of these measures has also, however, highlighted the economic, political, technical, social and environmental acceptability of potential solutions. Water import from the Spanish mainland was expensive and politically unacceptable in the source region. Desalination plants are also expensive and generate other environmental impacts from their high energy use which are at odds with principles of sustainable development.

The encouragement of sustainable measures, design and architecture in new or existing development is limited by the willingness of private individuals or businesses to adopt new and partially tested practices, especially given the additional barriers of affordability and availability of technical expertise. The introduction of an ‘eco-tax’, to generate revenue from tourists to spend on environmental conservation, revitalization and/or water supply improvement, was politically contentious, especially amongst local tourism businesses and the powerful tour operators. Their

lack of support for the tax, together with a stagnation in the number of visitors, was a key factor in the abolition of the tax.

In 1998, the regional government (the Govern Balear) produced the 'Proposal for a Hydrological Plan for the Balearic Islands. The three-volume report has set clear targets and strategies for water supply and management goals for the 21st Century based on 21 hydrological units within Mallorca. Of the 21 hydrological units, two are over-exploited in terms of groundwater abstraction and six are described as both over-exploited and suffering from saline intrusion (Kent et al., 2002).

The plan suggested several ways of making up the difference between supply and demand. The hydrological design emphasizes heavily on treatment, reuse and recycling of water, and this recycling water plays an important role in irrigation and watering of parks, landscaping and golf courses. Problems of saline intrusion of aquifers are acknowledged and various suggestions are made for artificial recharge of selected aquifers in all six of the salinized hydrological units (Kent et al., 2002).

The plan also emphasizes the importance of maintaining and training on rational use of water, education of residents and especially tourists in the accurate use of water and proposes a wider introduction of water measurement. The Plan does not, however, accurately project tourism growth, and hence demand for water, or address the potential implications of the 'greenhouse effect' on future climate change and water supply. The article concluded that in coastal areas, water planning should be aimed at maintaining long-term equilibrium between supply and demand so that the needs and aspirations of the economy and society are sustained without serious damage to the environment or to source of supply (Kent et al., 2002).

Gigante

Between 1986 and 2013, tourist arrivals and receipts to Central America grew at average annual rates of 9.3% and 14.2% respectively, exceeding the average global rates. Within Nicaragua, tourism arrivals have almost tripled in the last 15 years and contributed 5.0% of total GDP in 2015. This contribution is up from 4.0% in 2013 and is expected to grow 5.1% per annum from 2016 to 2026. A paper traced the global growth of tourism to the local context of Gigante, where all users are reliant on groundwater (LaVanchy, 2017).

Gigante is a small coastal community on the southwest coast of Nicaragua. A small portion of its inhabitants live along a short stretch of beach on the Pacific Ocean, while the remainder are distributed along two stretches of dirt roads connecting the coastal community to a larger municipal road. In the late 1980s, the land was confiscated by the Sandinista government and re-distributed. Since that time, the land around Gigante has been settled, sold, and bought in waves as various individuals, entrepreneurs, and developers have recognized the abundant natural beauty and wealth of the region (LaVanchy, 2017).

This commodification of land was stimulated in part by the interest of surfers from North America and Europe who discovered pristine surfing sites along the coastline. Over time, news spread about the opportunities for world-class surfing near Gigante and tourism arrivals and expenditures increased. With this growth came the development of a hostel, a few small hotels, and several restaurants. Additionally, interest in buying land and building vacation homes led to the establishment of several gated communities poised exquisitely along prime coastline (LaVanchy, 2017).

Despite the fact that the southwest coast consists of dry-tropical forest and receives only an average annual rainfall, tourism promotion for this region such as website images, magazines ads and billboards are overtly ‘green’ in its depiction and branding of pristine and portray the wet season version of the landscape. This projection then creates a fundamental lack of awareness of the hydrological challenges in this area. In turn, large amounts of water (up to 65% of total daily usage) are required by tourism developments to provide tropical and green landscaping for homes and public spaces during the dry season that meet the expectation of owners and visitors (LaVanchy, 2017).

The sharp rise of tourism and declining trend in precipitation in Gigante has led to unpredicted pressures on water resources. 42% wells were dry even after the start of the 2015 rainy season, with an additional 43% approaching critical levels. Most people in the region rely on groundwater to sustain their livelihood since perennial streams are few and in some locations, non-existent. Given this reliance on groundwater, geology and precipitation become important contributors in the provisioning of water resources for locals and tourism developers, and only those with money and power can overcome these naturally limiting factors (LaVanchy, 2017).

Water management around the world can be categorized by two end-member approaches—free market and government regulation and control. The latter approach is employed in Nicaragua through a robust and nuanced national water law (Law 620 of 2007) that established water as a public good and provided a framework for the state to ensure its role in social and environmental well-being and to protect against over-abstraction. but although Law No 620 has great potential to reach its stated goals, but as of yet has no practical success in resolving water conflicts due to the barriers of “transaction costs of inter-institutional coordination, information gathering, property rights protection and enforcement, and strategic costs” (LaVanchy, 2017).

However, some alleviation to the water crisis is found through management initiatives as the recent drought has caused some tourism developers to actively monitor water usage and take steps to protect water. To some extent, this has taken the form of small placards and signs in restaurants or hostels to remind tourists to save water. The largest protection has been achieved by installing water meters on individual houses in most of the gated communities around Gigante. This strategy has brought much needed realization to homeowners of the amount of water being used (often on landscaping), as well as incentivized the pinpointing and remediation of leaking pipes. Several of

the gated communities have implemented tiered tariffs, thereby economically discouraging heavier demands for water (LaVanchy, 2017).

To further reduce their water footprint, one gated community is actively replanting water intensive landscaping with plants that use less water, yet still provide color and variation to the seasonally brown hillsides. It is worth noting that tourism developers largely operate on their own, with little to no communication or sharing of best practices amongst each other. To facilitate a modicum of exchange, research results were shared with all tourism developers at various stages of the study. This dissemination led to or promoted most of the water management initiatives mentioned above (LaVanchy, 2017).

Other various management related schemes which have taken by other tourism destinations are helpful examples for the Nicaraguan government and tourism developers to follow such as Kent, Newnham, and Essex (2002) solution for the Balearic Islands whereby a government imposed ecotax would generate revenue to be used towards evaluating water supply, guiding water management based on supply, and educating both residents and tourists in careful water use. A similar tourism tax in Nicaragua could fund education and research on water in collaboration with tourism developers in high growth and under water-resourced areas like the southwest coast. In addition to funding research to establish safe yields for groundwater abstraction, the fund could provide sustainability education to tourism developers and foster equitable relationship between local communities and developers interested in corporate social responsibility (LaVanchy, 2017).

A tradable permit system for hotels in Barbados is proposed by Cashman and Moore (2012) based on assigned water rights. In such a scheme, an overall water budget is created to determine the amount of water sustainably available to all stakeholders. Allocations are then made to tourism developers in a prioritized fashion that reflects governmental economic development goals and established presence of developers. Therefore these 'water rights' set and cap total water usage by tourism developers and would encourage an increase in efficiency by developers wishing to expand their business. Further credits could be granted to tourism developments implementing water-saving technologies. Such an approach would enable both economic development vis-à-vis tourism and equitable consideration of the water needs for local populations (LaVanchy, 2017).

Morocco

Morocco is one of the top twenty destinations in the world and at the same time has become a role model for sustainable tourism in the Mediterranean (Tekken & Kropp, 2015). As well as at the global level, tourism is a fast-growing industry in Morocco (UNWTO, 2014). The tourism sector has continued to develop favorably, increasingly contributing to Moroccan GDP and employment (WTTC, 2014).

A research on water resources in Morocco shows that water resources are very limited and the total actual renewable water resources per capita and year are below the global average (Tekken

& Kropp, 2015). In north-eastern Morocco, water availability has already been at risk and led to water shortage in recent decade due to high agricultural demand. Existing water problems are caused by increasing water scarcity, distribution problems, water intense agriculture, and shifting seasonal climate patterns. Therefore, the establishment of an additional industrial water consumer such as tourism could foster a constant water shortage crisis unless countermeasures are taken (Tekken & Kropp, 2015).

Following an iterative research approach, and based on current scientific evidence and postulations in regional sectoral policy documents, the current state of intent and implementation of sustainable water management standards for the luxury tourism complex (including 5-star hotels, golf courses, pool areas, private villas, a marina, and beach promenades) in Saidia, north-eastern Morocco, is evaluated. Four main problem categories within the context of sustainable regional tourism development were identified: population growth and urbanization, over-abstraction of fresh- and groundwater, lack of adequate water management, and climate change (Tekken & Kropp, 2015).

There are some strategies for criteria that could support a sustainable form of tourism without compromising future water availability in the region, not only for tourism: 1-Technology evaluation for the implementation of technological innovations for water-saving, water production and water supply, for example by the use of the regional solar power potential 2- Consider a water tax for luxury tourism facilities 4- Hotels and other large water consumers are committing themselves to maintain high environmental standards and become certified 5- consider a marketing strategy to become a unique sustainability tourism destination 6- Instruments to make tourism companies' sustainability commitment measurable and transparent (e.g. ISO standards, sustainable tourism certificates) 7- Regular environmental audits 8-Regular public consultations/hearings to discuss adequacy of water standards 9- Initial survey of actual and future sectoral water needs 10-Monitoring system and active water management 11-Participative governance design 12-Regulations for public administration and private businesses and control mechanisms to ensure compliance (Tekken & Kropp, 2015).

Jordan

The major environmental challenge that Jordan faces today is lack of water. A critical review of the existing water resources situation in the country reveals that present water problems are attributed to the lack of precipitation, climatic change, rapid population growth along with the massive influx of refugees, Inadequate industrial and municipal wastewater treatment capacities and the high level of water consumption especially in agriculture (Hadadin, Qaqish, Akawwi, & Bdour, 2010). The water budget of Jordan is considered relatively low when, compared to the country's social, economic, and environmental needs. In each water strategy the following stakeholders: domestic, industrial, tourist, and agricultural sectors should be considered (Hadadin et al. 2010). Jordan's main water resources are aquifers and basins which are fed annually through rainfall but about 93.9% of the total amount of water is lost to evapotranspiration annually, which

leaves only a small amount of surface and groundwater to enter the water supply. Water in Jordan is primarily used for agriculture that accounts for 77.5% of total water consumption while the rest being for domestic and industrial use (Hadadin et al. 2010). There is also a yearly increase in demand for water in Jordan that is attributable to urbanization and industrial expansion, as well as to increased domestic consumption, mainly due to population growth. Implementation of suitable irrigation technologies such as sprinkler systems, drip irrigation, subsurface irrigation systems and plastic greenhouses improve water savings during hot seasons (Hadadin et al. 2010).

Sewage treatment for reuse in the agricultural sector is a viable option and already in use (and being further developed) in the Jordan. The cost to treat and deliver water for agricultural needs depends on the crop and quality required, and on the proximity of the farm to the city. Fortunately desalination has been proven and continues to be made more cost effective (Hadadin et al. 2010). The cost of producing seawater for drinking water has decreased from \$1.50 to probably \$0.63 per m³. Because Amman is above sea level and distant from the seacoast, the cost of desalination to its residents would have to include additional pumping and transport costs of approximately \$0.25 to \$0.35 per m³(Hadadin et al. 2010).

Another alternatives is transporting and processing seawater from the Mediterranean or Red sea. The Red–Dead sea mega project is currently under the environmental impact assessment phase. Another option is to import fresh water from Turkey to the area either by pipeline or by sea in ships or even in large plastic bags (Hadadin et al. 2010). Greywater can be reused to replace fresh water used in flush toilets, while the use of proper showerheads will reduce demand on fresh water. Moreover capturing and storing rainwater from roofs can reduce the demand for fresh water for other domestic purposes such as gardening purposes (Hadadin et al. 2010). Jordan's comprehensive program of educating the public on the water issue can provide support for fair conditions for the final status negotiations and also their help in maintaining the shared waters quality. The harvest of surface runoff for recharge of groundwater is an appropriate approach to address part of the water scarcity problem in Jordan and rehabilitating the ecosystems damaged by groundwater mining (Hadadin et al. 2010).

It is recommended to build micro-dams along the main waterways to store floodwater in winter, to use it again in the summer farming seasons, as complementary irrigation water, rather than the flowing aimlessly through abandoned, uncultivated areas. This method is considered efficient water harvesting of rainwater; this action will benefit the farmers, and increase the national food sufficiency (Hadadin et al. 2010). Wastewater desalination is suggested. Severe water shortages needed to impose a rationing program on the distribution of water to users. Private sector involvement in current water resources is one of the option to assist in developing Jordan's water infrastructure and hence reducing water losses (Hadadin et al. 2010).

Water and wastewater projects designs, water meters, domestic appliances, leak detection equipment, pipes, pumps and wastewater treatment plants need to be improved (Hadadin et al.

2010). Proper maintenance to water distribution network to reduce drinkable water losses through leakage is also suggested. Jordan must maximize the full potential of surface water and ground water based on economic feasibility, while taking into account the relevant social and environmental impacts. In addition, Jordan must make periodic assessments for its existing and future water resources (Hadadin et al. 2010).

Southern Europe

The current regional imbalance of water resources across the Europe continent makes water scarcity to be a major problem in many parts of Europe, particularly in zones with a semi-arid climate (South of Portugal, South East Spain and parts of the central area, South East Italy plus Sardinia and Sicily and South East Greece) (Estrela, Marcuello, & Iglesias, 1996). Water availability for human consumptive uses, and for other purposes has poor quality. Eutrophication of rivers and lakes, over-exploitation of and salt intrusion in aquifers and climatic change are the most important features of poor water quality in semi-arid areas.

The average annual precipitation in semi-arid areas is much lower than annual potential evapotranspiration. The values are generally very low and the dry season usually lasts for several months (Estrela et al., 1996). Aquifer recharge in semi-arid zones is also lower than in wet areas, not only because the precipitation is lower, but also because of uneven temporal distribution of rainfall (Estrela et al., 1996).

Demands are more than available resources and the agricultural sector consumes an extremely high percentage of water resources in these areas. Most crops require water for a limited number of months, but these do not coincide with the seasonal distribution of rainfall and runoff (Estrela et al., 1996).

The conjunctive use of surface water and groundwater is a main factor in order to meet demands in semi-arid zones. The use of technologies that improve efficiency (e.g. drip irrigation in agriculture) is an example of water conservation. Another possibility involves investigating new types of crops varieties with less water requirements that temporarily coincide with the wet season. These new crops should be consistent with the European Joint Agricultural Policy (Estrela et al., 1996). But sometimes neither saving measures nor proper management of water resources of the basins is sufficient. Water transfer from surplus basins to those with a deficit by means of works such as aqueducts is essential. These types of works include political, social, economic and environmental considerations that need to be included as resource planning elements to which governments have to resort occasionally. (Estrela et al., 1996).

In urban areas, the main problems are water supply, sewage treatment and flood prevention. Water supply can be guaranteed by storage in reservoirs, or pumping groundwater whenever possible. Wastewater should be treated before being returned to a river whose discharge is very low throughout the year or in the dry season. After treatment, it can be used to recharge aquifers, by percolation from shallow pools or injection wells, but it is not common in semi-arid areas. After

proper treatment, wastewater can also be used for irrigation purposes, a method which has been used recently in Greece.

Water resource problems related to climatic change, desertification, flooding, erosion and sediment transport, water contamination, over-exploitation of aquifers, etc., are expected to become more acute in the future, and this will make the sustainable development of water resources even more difficult so it's necessary for European countries to calculate the annual mean values of precipitation, potential evapotranspiration and runoff to produce comparable acceptable information. Understanding of various water resource problems in different countries and regions is also essential. Guidelines for environmental impacts analysis, management tools, etc. for potential use of surface water and underground water should be developed to improve water efficiency in semi-arid areas (Estrela et al., 1996).

Maps of drought risk, resilience and vulnerability of European countries should be prepared and drought affected areas should be identified. Knowledge of how the change of land use affects access to water resources in the EEA area should be improved, especially in semi-arid areas (Estrela et al., 1996). Nevertheless, the lack of reliable data will make that very difficult. Data on land use can be an important aid for water management. Water re-use should be done more in semi-arid areas. Some areas of Greece have used of such methods for agricultural purposes, but it has not yet been widely used throughout semi-arid regions. Studies on the use of water re-use methods will be useful (Estrela et al., 1996).

The ecological quality of rivers must be maintained by maintaining a minimum flow. In order to preserve the hydrological and ecological functions of their drainage networks, rivers should not dry-up or have their physical regimes significantly altered This question should be considered when planning and managing the water resources. Ecological discharges, which occur as a result of the aquifer discharges in a natural regime, can be artificially maintained by reservoir management. Therefore the determination and mapping of ecological flows is importance for semi-arid areas of EEA (Estrela et al., 1996).

Bali, Indonesia

In Bali, a small tropical island in Indonesia, despite the sufficient amount of water, the residents suffer from water shortage and Balinese suffer from the consequences of the unsustainable development. It is a touristic island with 3.6 million population and a warm and humid climate (Cole, 2014). Bali currently has nearly 200 star-rated hotels, with an average occupancy rates of 63%, and more than 1600 non-classified hotels and other forms of tourist accommodation and hosted more than 5 million tourists (Cole, 2014).

The Bali water crisis is due to a complex set of reasons and tourism has been just one of them, but tourism industry will have most seriously impacted by the pending crisis. The inter-related reasons include: inadequate regulation, social and cultural factors, deforestation, lack of awareness and

building so many tourism infrastructures (Cole, 2014). Groundwater resources have been polluted, and in the most popular resorts in Southern Bali the underground water is unsuitable for human consumption. Many of the hand-dug wells had dried, and the use of bore wells increased, for those who could afford them. For those people who could not afford a bore well, the only option was to buy refilled water bottles with very low quality. Lots of farmers sell their paddies to tourism developers. Loss of rice fields also means the loss of one of main tourist attractions in Bali and the loss of a sustainable local food source (Cole, 2014).

There are 11 different government departments responsible for clean water in Bali. Having many departments with different responsibilities and rules means that coordination across all departments is a challenge. Many of the departments blame others and they are not aware of the extent of the problem. Significant problems of Bali's water were “weak law enforcement”, “lack of control”, the “regulations do not work”, “weak supervision” or that the “laws are not implemented”. In addition, the rules for groundwater use were unclear (Cole, 2014). According to Cole (2014), because of the activities of the tourism industry the destination residents’ right to access to water for domestic use has been violated. These violations are having significant effects to other rights. For example, it has affected the right to health and life, as shown by the health statistics related to water-borne illness and deaths in Bali (Cole, 2014).

The tourists and residents also both have duties and they must take responsibility for their own actions. It's also important to inform tourists about Bali's water problem. Clearly, more sensitization of both locals and tourists can be a useful step forward. It is particularly important for the tourists to regard the tourism–water connection as according to Cole (2014), “the determinants for hotels to implement water saving initiatives are demand-based: . . . to improve hotel image, improve service quality and increase customer loyalty” (Cole, 2014). The power of tourists to choose a hotel which does not abuse the rights of local community against water can be enhanced by sustainability reporting that includes human rights-related practices (Cole, 2014).

There were competing demands for Bali’s fresh water supply, not only between tourists and residents but also between tourism and agriculture. To fulfil the competitive rights, tourism must be developed within the limits of the ecosystem. Water management should be recognized as a shared risk and a shared opportunity. At the hotels or destination level, providing sufficient and safe water supply is essential for the tourism industry. In order for tourism to be fair and sustainable, the local residents must not miss out on water because of tourists. Tourism, with significant potential impact on politics and the environment, could be a powerful lobby in developing country destinations. Taking a rights-based approach, the tourism industry can bridge the governance gap created by rapid globalization, while enhancing its own reputation and preventing litigation (Cole, 2014).

3.2 Water crisis in Iran and Isfahan

Iran is the second largest country in the Middle East (after Saudi Arabia) and 18th largest country in the world located in West Asia, bordering the Caspian Sea in the north, and the Persian Gulf and Sea of Oman in the south (Madani, 2014). With an estimated population of over 77 million, Iran is the second most populated country in the Middle East (after Egypt) and the 17th most populated country in the world (Madani, 2014). Iran has a great climatic variety of climates mainly affected by the subtropical high-pressure belt. Most of the country receives less than 100 mm rainfall per year. The highest amount of rainfall is when that is not needed by the agriculture sector (Madani, 2014). The considerable spatial and temporal variability of rainfall in Iran has been the main motivation to construct numerous dams and large reservoirs to regulate water flows. Most (65 %) of the country is considered to be arid, 20 % is semi-arid, and the rest has a humid or semi-humid climate. The rapid socioeconomic development has created a serious water crisis for Iran (Madani, 2014).

In the west of the country, Lake Urmia, the largest lake in the Middle East and one of the largest hypersaline lakes in the world, has shrunk because of repeated droughts and interference with the use, diversion and storage of water. In the east, Lake Hamun is disappearing as a result of the everlasting transboundary conflict with Afghanistan and water mismanagement in the Iranian portion of the watershed. Water scarcity and frequent dust storms have forced some of the small villages in the area to migrate. In the center, Zayandeh Rud River dries seasonally and imposes great pressure on agriculture, industry and urban population (Madani, 2014). There is almost no hope of retrieving the Gavhhouni wetland and its valuable ecosystem at the end of the river (Madani, 2014).

There are other lakes and wetlands in Iran that are drying and are losing their health because of the anthropogenic effects of short-sighted development projects and the low value of ecosystem service benefits (Madani, 2014). Iran ranks third in the world in terms of the number of dams under construction. As one of the main products of the Iranians hydraulic mission, dams are built one after another to store water in reservoirs to support agricultural activities, increasing electricity generation and providing urban water supplies. However, the results of this remarkable record are tragic for a country that has been able to maintain development under serious international sanctions (Madani, 2014).

The Iranian water disaster is not limited to surface waters. Iran is one of the world's top groundwater miners. The Iranians have already used most of their groundwater reserves. The government has limited control over abstraction of groundwater. Energy and water are highly subsidized and provide no motivation for farmers to increase the efficiency of water use (Madani, 2014). Due to high standards of water treatment and quality, the quality of Iran's domestic water supply is generally good and significantly better than the other countries in the region but concerns about the quality of tap water in urban areas are increasing due to extensive agricultural activities

near urban areas as well as lack of proper sewage collection and treatment system, which allows for gradual discharge of domestic wastewater into groundwater (Madani, 2014).

With old water distribution networks, water losses in major cities can exceed 30 % while interest is still in seeking new supply sources rather than retrofitting the old systems to minimize network losses. Water shortage and increased demand have created new problems for water security and increased tension over transboundary water systems at regional and international levels. Internationally disputes continue over sharing surface water. Examples are the conflict with Afghanistan over the Hirmand River in the east and over the ownership of the Caspian Sea and Internally, disputes continue between provinces over transboundary water systems such as Urmia, Karkheh, Ghezel-Ozan and Zayandeh-Rud (Madani & Mariño, 2009).

The Zayandeh-Rud river basin, in central Iran is the highest-volume river with a semi-arid climate and is one of the strategic and important river basins of Iran with large agricultural, industrial and domestic water uses. Zayandeh Rud is one of the most important heritage of Isfahan. Zayandeh Rud is a river which divide Isfahan into two parts and makes civilization in this city. It has an important role in balancing weather conditions, beautifying, attracting tourists, providing drinkable water, supporting agriculture and industry (Koushafar, Amini, & Azadipour, 2007). It is an example of a complicated watershed system where the lack of complete knowledge about all the interacting subsystems has led to failure of the policy makers in addressing the water shortage in the basin (Madani & Mariño, 2009). It starts from Zagros Mountains in the southwest of the country and ends in the Gav-Khuni Swamp, a natural salt pan in the center of Iran (Madani & Mariño, 2009).



Figure 3-1: Map of Zayandeh Rud River and Gavkhuni Swamp

Source: (WaterWired, 2015)

The population compression index in the Zayandeh Rud basin is more than twice as it is in the rest of the country. Agriculture is the largest consumer of water in the basin despite the increasing demands from other users. Like the other parts of Iran, the precipitation is off-season and does not coincide with the cultivation season in this basin and is not effective. Due to the low rainfall in the central and eastern parts of the basin, Zayandeh Rud provides irrigation for more than 260,000 ha crops. It also provides water for more than 3 million in the Zayandeh Rud basin and 1.5 million people in cities outside the river basin (Madani & Mariño, 2009).

The arrival of various industrial and agricultural pollutants, too much water demand, making tall buildings, industrial and urban development, lack of information and attention to the benefits and role of the river, especially in local planning (Koushifar et al, 2007), High agricultural use of water and population growth and industry, trans basin diversions to Yazd and Kashan (Murray-Rust, Salemi & Droogers, 2002) ,along with droughts in the Zayandeh River basin, has led to the management of water resources a critical issue in the region (Madani & Mariño, 2009). To date, the basin's growing demand has been met by transfer of water within the basin, and by extraction of groundwater resources (Madani & Mariño, 2009). For more than 50 years there has been a gradual increase in water resources in the basin and the basin remains under stress (Murray-Rust, et al., 2002). Nevertheless, water scarcity has occurred rapidly after each new water source has been tapped. As soon as more water supply is made available, water demand increases and it is fully allocated. From 1998-2001 water supplies more or less disappeared. Irrigation was restricted in the summer of 2000 and no surface water was delivered in 2001. All surface water was reserved for urban and domestic use, and any irrigation relied on extraction of groundwater from 1999 onwards (Murray-Rust et al. 2002). Zayandeh Rud River also does not provide enough water for the Gavkhuni swamp, which is a world class natural wetland so it is threatened with environmental degradation (Madani & Mariño, 2009).

3.3 Tourism and Water

Tourism is dependent on both fresh water resources and an important factor in the use of fresh water. When taking part in recreational activities such as ski or golf tourism (snowmaking and irrigation), when using spas, wellness areas or pools, when washing or using the toilet, tourists need and consume water (Gössling, et al., 2012). Fresh water is also needed to maintain the gardens and landscaping of hotels and attractions, and is embodied in tourism infrastructure development, food and fuel production (Gössling, et al., 2012).

The FAO (Food and Agriculture Organization of the United Nations) distinguishes agricultural, domestic and industrial fresh water consumption (Gössling, et al., 2012). On global average, approximately 70 % of water consumption is for agriculture, 20 per cent for industrial and 10 per cent for domestic purposes, including households, municipalities, commercial establishments and public services (Gössling, et al., 2012). There are significant differences in these shares within countries and on an average per capita basis but on a global average, domestic water consumption

is 160 L per capita per day. International tourism generally accounts for less than 1 % of national water consumption. Some tourism destination are exception such as Barbados, Cyprus and Malta (Gössling, et al., 2012). The ration of water consumption ratio in the tourism sector is typically below 5 per cent of domestic water consumption, but can be as high as 40 %. According to Gössling et al. (2012) from 54 world's most important tourism countries, the tourism sector accounts for more than 10 per cent of domestic water consumption in 19 of them. This finding shows that national-level discussions of water security should not neglect tourism as a sector. By 2020, tourism's share of water use is likely to increase with increasing numbers of tourists, higher hotel standards and increased water-intensity of tourism activities. The World Tourism Organization (2003) forecasts over 1.56 billion international arrivals by the year 2020 and the tourism destinations which developed new tourism courses are expected to face water shortage in the decades ahead such as China or Middle East and Eastern Europe (Gössling, et al., 2012).

Even if water consumption in the tourism sector is typically less than 1 % of national water consumption, the situation may vary across the regional level, especially where water may be scarce and the number of tourists are significant. In the future, tourism will face significant greater problems in many regions due to amount of water available and quality due to increased water consumption and climate change (Gössling, et al., 2012). It has been suggested that an international tourist consumes 222 L per day but Gössling et al. (2012) suggests this estimate should be considered conservative.

In one study of hotels in a tropical environment, most of the water in hotels was used for continuous irrigation of gardens (50 per cent, or a weighted average of 465 L per tourist per day), a result of the insufficient storage capacity of the soils, high evaporation, and plant species not adapted to arid conditions. Conversely, in guesthouses, the second dominant accommodation category, irrigation accounts for only 15 per cent of the total water consumption (37 L per tourist per day) and in general high class hotels use more water than hotels with lower class (Gössling, et al., 2012).

For agriculture section, there is no specific regional or national water use statistics for tourism. There is direct water use (accommodation and activities) and indirect water use (fossil fuel use for transports, food, and infrastructure) in tourism sector. The estimated total water consumption for a tourists is 2000-7500 L per day. In general water consumption in tourism can be considerable and shows that water management in tourism should go beyond direct water consumption (Gössling, et al., 2012).

3.4 Tourism Potential of Isfahan

Tourism is an important part of economic development. This industry is the largest and most popular service sector in the world that ignoring or less attention to its achievements is inexcusable. It creates a series of cultural, economic, social and environmental effects and changes in tourism destinations. Significantly, this industry should be seriously targeted to achieve short-term and

long-term economic benefits. Local communities and geographical areas are the central core of tourism destinations and a successful and healthy program is a good benchmark for measuring the success of tourism industry (Moosavi Nor & Rahmat Shah, 2012). Isfahan's unique geographical and historical abilities have made this region as one of the most attractive tourism destinations domestic and foreign tourists. It is very important for many tourists' attractions and its position on the national and international levels (Moosavi Nor & Rahmat Shah, 2012).

Isfahan, located in the center of Iran, has been shining on the darkness of human civilization for centuries, with its artistic and cultural wealth, and the brilliance of its minarets and tiles has caused admiration and wonder of the world (Moosavi Nor & Rahmat Shah, 2012).

Historically, Isfahan is the place where art, technology, and spirituality were created in. Natural attractions such as the deserts, the Zayandeh Rud River, Sofeh Mountain along with cultural and historical attractions, including mosques, minarets, churches, historical bridges, dovecotes, squares, fire temple, large bazaar, historical schools, traditional architecture, unique crafts, good networks of roads, highways, railroad and airport attract thousands of domestic and foreign tourists to the area every year (Moosavi Nor & Rahmat Shah, 2012).

Zayandeh Rud River is one of the largest rivers in Iran that flows from west to east and is the main reason for the greenery and fertility of this region. After a 360-kilometer journey through the mountains, valleys, plains, Gardens, forests and agricultural land, Zayandeh Rud reaches its tomb in the Gavkhouni Swamp and is the only river that does not end the sea. Sides of the river are very beautiful and 28 ancient bridges have been constructed on the river which annually attracts lots of tourists to the city. Gavkhouni Swamp is the catchment of Zayandeh Rud River and a protected treasure of natural and cultural landscapes of the past which is also interesting for ecotourists (Moosavi Nor & Rahmat Shah, 2012).

The swamp area has lots of attractions such as unique plant species, salt marshes, animal species, glider flight, camel riding, motorcycling, and wilderness hiking which are interesting for both ecotourism enthusiasts and tourists. Existence of several specialized and super specialized health care centers and medical and laboratory equipment have increased health tourism in Isfahan (Moosavi Nor & Rahmat Shah, 2012).

Many cultural venues such as theatres, cinemas, libraries and museums, playgrounds, swimming pools as well as green spaces and parks in the city of Isfahan, also offer a leisure program for tourists (Schramm & Davoudi, 2014). Both mountains and desert areas can be visited in a relatively small area so a number of different types of tourism and recreational activities such as hiking, sailing, fishing, skiing, golf, swimming, biking, camping and picnicking by the water are possible due to this diversity (Schramm & Davoudi, 2014).

Due to the favorable natural conditions, in the geographical center of Iran, the ability to communicate with other parts of the country and cultural and civilizational demonstrations, Isfahan has long been a good place to attract tourists (Moosavi Nor & Rahmat Shah, 2012).

Some tourism companies in Isfahan such as Saman Gasht Naghsh-e-Jahan and the Arabian Horse Tourism company (Schramm & Davoudi, 2014) and Prestige-tour organize incoming tours to attract foreign tourists to Isfahan, especially tours from Isfahan's twin cities in various Arab countries. 20% of foreign tourists visiting Iran come to the city of Isfahan, totaling more than 50,000 people per year. 10% of domestic tourists visit the city of Isfahan, totaling is about 210,000 people annually (Schramm & Davoudi, 2014).

The costs that tourists pay includes the cost of food, recreation, accommodation, local transportation, sightseeing, tours, the Internet, telephone and souvenirs. These costs are such as exports of goods and services to the country of tourists, which can be calculated as invisible exports and increased national revenues. The total income of Isfahan Tourism in one year is 61040000 \$. (Moosavi Nor & Rahmat Shah, 2012).

The number of foreign tourists in the province and the city of Isfahan increased from 2002 to 2006, fell between 2006 and 2008, increased between 2008 and 2010, and has fallen again since 2010. The low water levels of the Zayandeh Rud River with an almost dry river bed may be one reason for this, but international political conflicts may also play a role (Schramm & Davoudi, 2014).

As mentioned above, Isfahan has great potential to attract international tourists to the city. Those in charge, especially officials at Water Authority and Tourist Board, know that sustainable tourism development is closely related to how the Zayandeh Rud River water will be used in the future (Schramm & Davoudi, 2014). Therefore, due to the problem of water scarcity and excessive utilization of the Zayandeh Rud River water resources, the question should be raised, do international tourists' arrivals to the city exacerbate water problems? And also, given that the river bed of Zayandeh Rud dried up and attractiveness of the bridges has diminished, can the city still attract foreign tourists?

3.5 Water management in Isfahan

Depending on future developments, different trends in water demand and its effects on water management are conceivable. Demand for water in the tourism sector is not identified as an independent entity in the sector module, but is defined as part of the sector module 'urban water management'. System dynamics modeling and simulation is specifically designed for modeling and analyzing of large-scale socio-economic systems and has been used in many environmental and water resource studies, including water resource planning and management and environmental sustainability (Madani & Mariño, 2009). System dynamics provides a unique framework for integrating the disparate important physical and social systems for water resource management.

The main goal of a system dynamics study is to understand how and why the dynamics of concern are generated and to search for managerial policies that can improve the situation (Madani & Mariño, 2009). Every decision is made in a feedback loop which is a closed loop of causes and effects. There are basically two different types of dynamic feedback archetypes: (1) reinforcing (positive) loop and (2) balancing (negative) loop. Reinforcing loops are the engines of growth and cause the system to gain momentum in time, either growing or declining (Madani & Mariño, 2009). Balancing feedbacks, which work whenever there is a goal-oriented behavior, drive the system to transform toward an external goal. If the system goes out its way by some change, the negative feedback tries to balance the system by neutralizing the effects of that move (Madani & Mariño, 2009). Madani & Mariño (2009), based on system dynamic principals, developed a causal loop diagram (CLD) for Zayandeh Rud watershed problem. They consider hydrological, environmental, economical, political and social drivers of the problem and their interactions. Two subsystems are identifies for the Zayandeh Rud water resource management system and for each subsystem a CLD is developed. The combination of two CLDs is the CLD for the whole problem (Madani & Mariño, 2009).

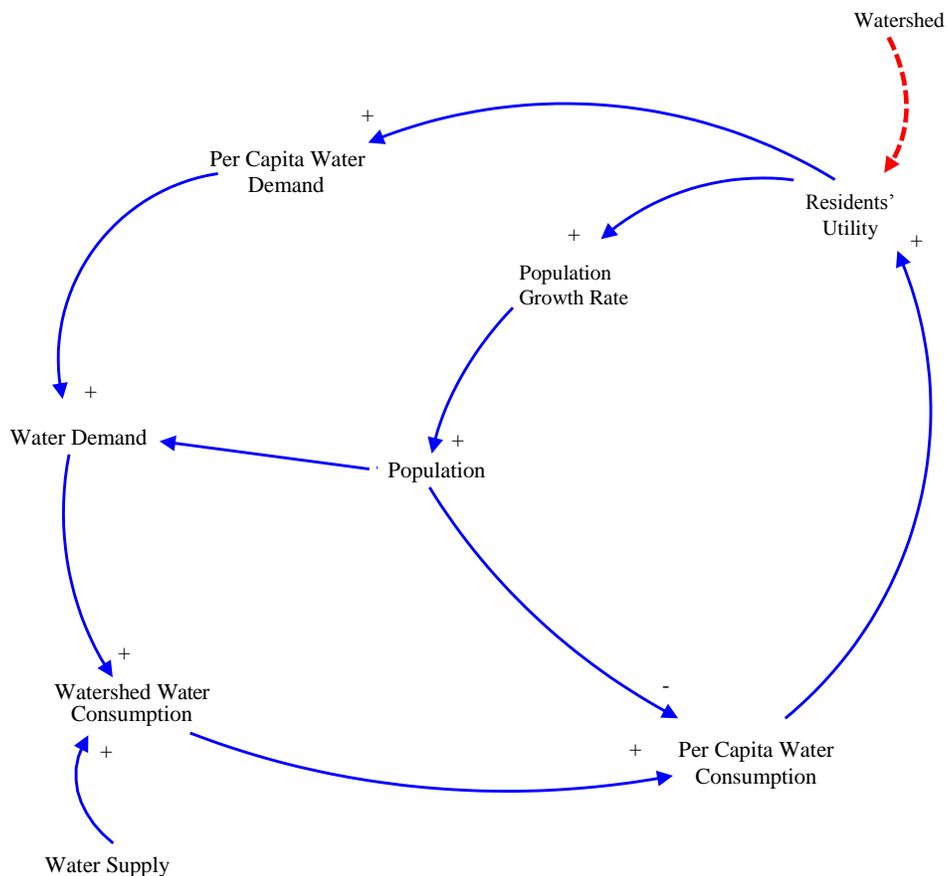


Figure 3-2: CLD for the Zayandeh-Rud river basin problem

Source: Madani & Mariño 2009 p. 2173

The CLD for the Zayandeh-Rud river basin problem is a combination of hydrological and socio-political and economic subsystems' CLDs. Water supply, water demand and watershed water consumption are the elements of the boundary layer of each subsystem and connect subsystems to create the overall CLD (Madani & Mariño, 2009). The polarity of the link (+/-) indicates the direction of change induced by a cause. A positive sign indicates a change in the same direction (increase/decrease induces increase/decrease) while a negative sign indicates a change in the reverse direction (increase/decrease induces decrease/increase) and residents' utility refers to the full satisfaction of the watershed's residents from the available services in the water basin (Madani & Mariño, 2009).

If only the two reinforcing loops of Figure 3-2 are considered, without interference of the balancing loop, residents' utility, population, per capita water demand, watershed's water demand, water consumption and per capita water consumption grow or decline one after another as a result of rise or fall in the value of any of them. For instance, if the residents' utility rises all other variables increase continuously. The feedback relationship enhances the residents' utility which in turn continuously increases the value of all CLD variables except the water supply and economic development rate. If this behavior continues, the overall system will be unsustainable. However, the balanced loop interferes and changes the situation. An increase in population induces a decrease in per capita water consumption, which reduces residents' utility.

It is observed that, based on the CLD, residents' utility is not only a function of per capita water consumption. The economic development rate of the region has a positive correlation with residents' utility. This parameter changes the natural behavior of the system and neutralizes the negative impact of the per capita water consumption variable. In other words, the effect of the balancing loop will disappear somewhat. The economic development of the region which is followed by good job opportunities and good standards of living increases the utility of the residents. This motivates more people with good economic conditions to immigrate to the water basin and neglect the availability of water (Madani & Mariño, 2009).

According to Madani & Mariño (2009), continuing the management of the Zayandeh-Rud watershed in the same manner (business-as-usual) can have dramatic impacts on the watershed. The system is greatly sensitive to population and water demand. If these two factors are controlled, system performance greatly improves, groundwater mining stops, and the Gav-Khuni Swamp becomes revived again. Unfortunately, Iranian water planners have focused more on providing more water to the residents and they don't pay enough attention to environmental issues. Population and development projections are usually done by non-water agencies. Such agencies, usually, do not consider water availability as a constraint to population growth, and neglect the dynamic interrelations of various variables (Madani & Mariño, 2009). The solution for current problems in Zayandeh Rud is not only to transfer more water to the basin and increase the surface water withdrawal capacity. Water transfer may result in resident's false perception of water availability. To have sustainable water resources, attention must be paid to all aspects of the system

(resident's utility, population, per capita water demand, watershed's water demand, water consumption and per capita water consumption) , not only the efforts to provide residents with water and neglect of other troubled drivers (Madani & Mariño, 2009). Four province governments are responsible for deciding over Zayandeh Rud River. So, the coordination and collaboration between institutions within the catchment area, i.e. between sectors at the same level, are of particular importance for the integration of different interests regarding the water resources (Mohajeri, et al., 2016). Coordination between institutions at different levels, for example between national and regional levels, is important. Ideally, command-and-control approaches should incorporate participatory, bottom-up decision-making and management approaches. Addressing these coordination problems requires a re-creation of governance structures and institutions, as has been described for many other countries (Mohajeri, et al., 2016).

Some other solutions may be: the use of new environmental technologies in industrial units and factories should be paid more attention. High water requirement plant should be replaced with those which need less water in green spaces. Governmental control should increase. Environmental NGOs (non- governmental organizations) representatives should be invited to take part in Zayandeh-Rud meetings (Koushafar, Amini, & Azadipour, 2007), drilling of the wells should be checked, water resources should be controlled.

3.6 Tourism-water stakeholders in Isfahan

According to Cole (2014), stakeholder analysis is an essential step prior to the identification of rights holders and duty bearers. Figure 3-3 shows the water-tourism stakeholders in Isfahan. It identifies the linkages of relevant stakeholders in Isfahan. As mentioned above Isfahan has lots of tourism attractions which direct or indirect consume water. Among the attractions in Isfahan some of them use great amount of water such as Isfahan Aquarium or Flower Garden. Isfahan Aquarium is located in Nazhvan Forest Park. The Complex is constructed on a land covering 4000 square meters and it is seven meters below the surface of the ground (Isfahan Aquarium, n.d.). It's a unique experience from the depths of the ocean, consist of thirteen wall-mounted aquarium lengths of 5 to 10 meters, an aquarium tunnel with a length of 35 meters and a capacity of 1.5 million liters of water, three large aquarium cylinders with a capacity of 2500 liters, coffee shops, gift store and a big parking lot (Isfahan Aquarium, n.d.). The Flower garden of Isfahan is one of the great green space projects in Iran that was completed in Isfahan in 1990s. This garden serves many purposes. It's a recreational, cultural, educational and research center.

Among different sectors in Isfahan, Agriculture is the largest and most water consumer. More than 80% of water wasted due to lack of advanced irrigation technologies in this sector. Nowadays, agriculture in Isfahan province is facing a serious challenge due to limited water resources. Industrial section is another water consumer in Isfahan. Isfahan is an Industrial city with ten thousand small industries inside the city, seventy industrial Settlements, eight private industrial Settlements and eight industrial ones under construction and in general nine thousand seventy-six

factories operate in the industrial sector (IMNA, 2019). In the industrial section, Mobarakeh Steel Company and Isfahan Steel Company are the largest water consumer in Isfahan (Khabar Online, 2014).

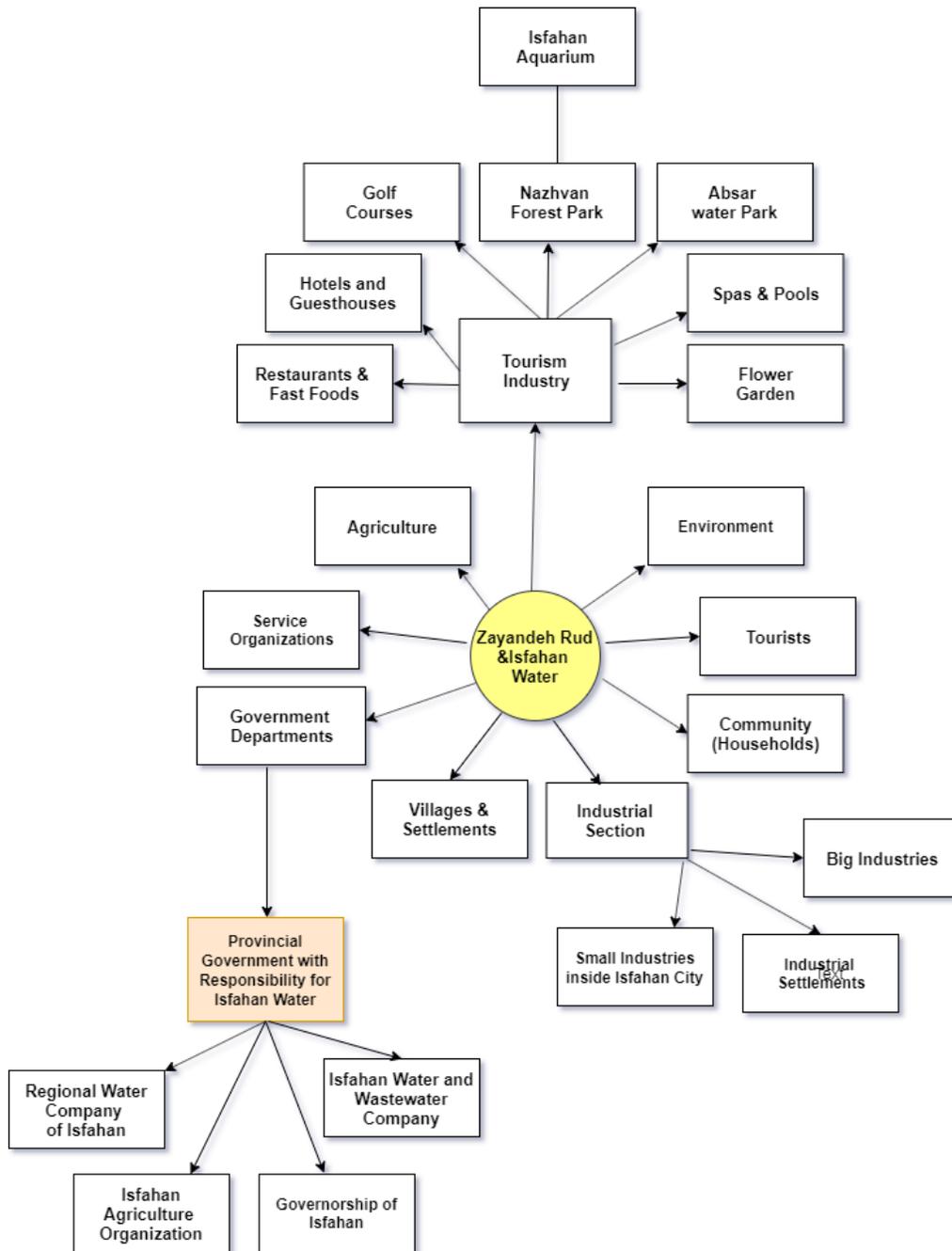


Figure 3-3: Isfahan’s water-tourism Stakeholders map (inspired by Cole, 2014)

3.7 Summary

After analyzing the literature review, it can be concluded that there is no single solution for fixing the water shortage in Isfahan. Combination of approaches and several areas of action need to be considered to address weaknesses in the current water resource management system. As results of the different water resource plans showed, supplying more water is not the only solution for water shortage in Isfahan. It can be a solution even if water demand, population growth and water withdrawal is controlled. Water supply planning shouldn't be based on development and population projections and projections should consider the relationship of development and population growth rates with other factors such as water availability. Integrated planning and consideration of different socio-political and economic elements of the system and their interactions are essential to sustainable management of water resource.

Chapter 4. Empirical Results

This chapter represent the empirical findings. It analyzes demographic information of the samples and their answers to questionnaires and also analysis of interviews with different water-tourism stakeholders/authorities involved in water dilemma in Isfahan. The thesis samples consists of 37 of the local residents and 40 international tourists and Four Hotels in Isfahan City. Interviews have done with two University Professors in Norway and Isfahan, and also with some officials in water-tourism stakeholders in Isfahan.

4.1 Analysis of Local Questionnaires

4.1.1 Demographics

The demographic questions reveals information on gender distribution, the age group they belong to and the educational level of the interviewees.

4.1.2 Gender distribution

The total number of local residents answered to the questionnaire were 37. Out of thirty seven participants, eighteen people were Males and nineteen people were Females (See table 4-1).

Number of Local Participants	N	%
Male	18	49
Female	19	51
Total	37	100

Table 4-1 Male and Female Participation

4.1.3 Age distribution of the interviewees

Out of thirty seven of the participants, sixteen people belong to age group of thirty five to forty four. This was the largest group (43.24 % out of the total number of the participants), the second largest group was in the age range of twenty five to thirty four (32.43 %) (See table 4-2).

Age of interviewees	N	%	Female	Male
18-24	2	5.41	1	1
25-34	12	32.43	6	5
35-44	16	43.24	9	7
45-54	5	13.51	4	1

55+	2	5.41	1	1
Total	37	100	21	15

Table 4-2 Frequency distribution of the age in reference to the gender at the time of conducting the survey

4.1.4 Level of education distribution of the local participants

Six levels of education were identified in the survey: less than high school, high school diploma, university student, associate degree, bachelor degree and graduate degree (master degree and PhD). The largest group consists of sixteen participants (47.06%) with a bachelor degree. Three person who didn't answer the "educational level" question were not included in the final count for this question (See table 4-3)

Level of Education		Percentage by educational level	Male	Female
	N		N	N
Less than High School	2	5.88	1	1
High School Diploma	4	11.76	2	2
University Student	2	5.88	2	0
Associate Degree	2	5.88	1	1
Bachelor Degree	16	47.06	8	8
Graduate	8	23.53	3	5
Total	34	100	17	17

Table 4-3 Frequency distribution- education levels / gender

The local questionnaire consisted of twenty four questions. Eleven questions were related to water shortage and water problems in Isfahan city and thirteen questions were related to international tourists in the city.

4.1.5 Analysis of Citizens' Responses to Water Problem questions in Isfahan

The purpose of this section was to explore the views of citizens on Isfahan water scarcity, their knowledge of Isfahan water pollution, the effects and symptoms of water scarcity in Isfahan, their recommendations and solutions to the government on Isfahan water scarcity and its related challenges and the most important causes of water scarcity in Isfahan from the people's point of view.

About 95% of citizens agreed that Isfahan has water shortage problem and more than seventy percent of people believe that Isfahan water is contaminated due to high chlorine in the water, unpleasant odor, use of unauthorized and unhygienic water for drinking water supply, and due to

industrial and agricultural pollutants in upstream of the river. About 27 percent believe that Isfahan water has good quality.

About ninety-five percent of people knew that installing water-saving optimization equipment would reduce the amount of wasted water and would agree to install these kind of equipment at their home but they didn't know how much this equipment would reduce water consumption.

The Most Important Causes of Water Shortages in Isfahan from Citizens' Point of View

According to citizens, 'the most important causes of water shortages in Isfahan' are as follows: 1-Zayandeh Rud water transfer to neighboring provinces 2-Rural and southern provinces migration to Isfahan city 3-Population growth 4-Lack of comprehensive management 5-Climate change 6-Large industries in Isfahan province 7-Digging of deep and unauthorized wells 8-Lack of proper watershed management 9-Wrong policies in water management 10-Existence of two big water-intensive steel companies in upstream of the river 11-Poor and wrong consumption patterns in the water supply 12-Agricultural and industrial sectors 13-Lack of standardized valves in the home 14-Planting of water-intensive crops in agriculture sector 15-Lack of rainfall due to nuclear sector in Isfahan province 16-Excessive water consumption by citizens 17-Lack of sufficient knowledge to manage water resources in the province 18-Outdated water distribution networks 19-Water leakage in the distribution network and in homes 20-Expensive water consumption optimization equipment in agriculture and water supply sectors.

Citizens' Solutions for Water Management in Agriculture sector

1- Replacing modern irrigation methods with traditional rainfed agriculture 2-Providing agricultural loans to farmers to provide optimum water use equipment 3- Empowering farmers and creating enough income to make farmers less dependent on farming 4- Stopping the planting of water intensive crops 5-Shift to less water intensive crops 6-Reforming Planting methods 7-Applying the experiences of successful countries in this field 8-Educating and informing farmers, 9- Greenhouse planting 10- Planting crops compatible with the region's climate.

Citizens' Suggestions for Water Management in Households Sector

1-Changing users' behavior 2-Awareness raising among households to use water-efficient strategies and equipment 3-Not using of drinking water for washing cars, yards, paved and path areas 4- Encourage conscious consumption and awards to low usage households 5-Penalize high usage households 6-Repair distribution networks 7-Remove drinking water from other sectors 8-Educate children on national media on how to properly consume water 9-Sale of water optimization equipment to households in installments 10- Raising water prices

Citizens' Suggestions for Water Management in Industrial Sector

1- Wastewater recovery and reuse 2-Use of modern technology 3- Replace outdated equipment in the companies with energy-efficient alternatives 4- Using air- cooled equipment instead of water-cooled equipment for cooling purposes 5- Removing high quality water from cleaning processes

6- Not using drinking water for non- essential activities such as landscaping in this sector 7- Using drought- resistant plant species in factories' landscape 8- installing water efficient sink faucets in companies

Citizens' Suggestions for Water Management in Environment Sector and Underground Water

The citizens' believed that Isfahan Municipality always water parks and green areas in the heat of the day. They suggested the best time to water is in the evening. They also believed that the watering systems in Isfahan is disaster and municipalities should choose another watering system for watering. Another suggestion was training gardening staff to reduce water use where possible. Other suggestions were: Using grey water for watering in the gardens and green areas, Using drought tolerant plants instead of grass in green areas, Not using groundwater and preventing the digging of deep wells, Guiding surface water and seasonal floods to groundwater aquifers, prevent excessive construction and eliminate vegetation, The use of experienced experts, Dredging the river

Citizens' Solutions for Isfahan's water problem and its related Challenges

Watershed Management and using appropriate Consumption Patterns, Optimal Consumption Training in all Sectors (Home, Agriculture, Industrial, Governmental Institutions), Further Monitoring of Available Water Resources, Providing Accurate Statistics of Renewable and Non-Renewable Water Resources, Greater monitoring of Municipalities to green spaces in the parks and streets and Prevent water wastage in these areas, Use of proper methods for irrigation of green spaces in the city, Not transfer water of Isfahan to surrounding provinces and cities, Use of solar panels, Use of qualified managers, Using water resources management experiences of countries facing water shortages , Using appropriate methods for collecting rainwater and snow, Surface Water Guidance, Using Sustainable Drainage Systems and Fertilize the clouds

4.1.6 Analysis of Citizens' Answers to Questions related to International Tourist Sector in Isfahan City

The purpose of this part of the questionnaire was to understand citizens' views about the arrival of international tourists to their city in conditions of water scarcity. Do they think the influx of tourists into the city of Isfahan worsens the situation? Isfahan still able to accommodate international tourists with current water scarcity conditions? And can Isfahan authorities strike a balance between water shortages and the influx of foreign tourists into the city?

After surveying this part of the questionnaire, it was found that more than 90 percent of the citizens consider Isfahan one of the most popular tourist destinations among international tourists and more than 90% believe that Isfahan city can still welcome foreign tourists. In their view, the situation of Isfahan's water deficit do not get worse with the arrival of tourists to their city and even believe that the arrival of international tourists to their city would be beneficial and contribute to the city's

economic growth. Citizens believe that international tourists had better consumption patterns than Iranians, and even if the city of Isfahan does not face water shortages, international tourists are saving on water consumption better than citizens themselves.

4.2 Analysis of International Tourists' Questionnaire

The purpose of this section was to explore the views of International tourists about Isfahan City as a tourist destination, their views on quality of Isfahan tourism facilities and tourism services, and their knowledge about Isfahan water Problem. 35 international tourists in Isfahan City surveyed with different nationalities. They were from European countries (France, Germany, Spain, Finland) India and China. Some of them were in Isfahan for reasons other than sightseeing.

The questionnaire had two parts. One parts were related to Isfahan water problem and one part were related to Isfahan tourism facilities and services. The questionnaires were distributed by hand among tourists in three different days in Naghsh-e-Jahan Square and were collected immediately.

4.2.1 Answers of International Tourists to Isfahan Water problem questions

The first question in this part explored how many males and female heard of Isfahan Water Problem. Ten tourists (25%) were aware of Isfahan's water problem and had obtained this information prior to their trip to Isfahan. Thirty tourists (75%) were unaware of Isfahan's water problem and they seemed to be very surprised to learn that Isfahan had water shortage, especially when the questionnaires were completing, the Zayandeh Rud River was flowing due to recent rainfalls in spring. More than 80% tourists didn't know that Isfahan's citizens are suffering from water shortage. Less than 20% (12.5%) answered "Yes" to the question "Have you noticed your accommodation making attempts to encourage you to save water?" and 85% of tourists responded "Yes" to "Do you think the accommodation should make attempts to encourage you to save water?". Nearly 90 % said they would make efforts to conserve water and that they wanted more information to help them do so. 65% reported that their towels were changed every day and 90% responded "Yes" to "if I knew Isfahan has water problem so that towels are only washed if I needed them to be." This indicates that lack of knowledge is an important reason for tourists not saving water at this tourist destination. More than 90 % chose "Strongly Agree" to "If a hotel took responsible actions to help the local community's water supply, I would be more likely to choose it". This suggest hotels in Isfahan don't acknowledge the fact that for some tourists, there may be increasing awareness of environmental and social considerations, and some tourists may reward companies that can show they are environmentally and socially concerns (WTO, 1999).

4.2.2 International Tourists' opinions about Isfahan, Tourism Facilities and Services

Nearly 90% agreed that Isfahan is a beautiful, amazing and stunning destination in Iran. They were satisfied with variety of historical places in the city and they believe that Naghshe- Jahan- Square is the most beautiful sites they ever seen. According to the results of the polls, the most important points of Isfahan tourism are beauty and historical, souvenir supply, security and tranquility in the city, presence of guiding forces at the city, tourist and historical sites and cleanliness of Isfahan. 81% of travelers stated that their main motivation for traveling to Isfahan was recreation, 11% business and conferences, 3% medical and 5% pass-through. Almost 80% were satisfied with Isfahan Tourist Information percent and they believed they gave accurate and prompt information. They believed that you can find everything you need in Isfahan Tourist Information, including any type of information for visiting Isfahan, maps, your plan to visit, accommodation, day tours, best restaurants &, etc. The disadvantages of Isfahan tourism have been expressed by tourists, urban traffic, high prices of some hotels and some restaurants, inadequate rates for some taxis, lack of recreational facilities such as bars or discos and lack of attention to the preservation of monuments. 90% of tourists were satisfied with the beautification of the city and 80% with urban cleanliness and public services. Overall, Sixty percent of tourists said the Isfahan tourism status is very good and twenty four percent said it's good.

4.3 Analysis of Isfahan Hotels Questionnaires

The Hospitality industry is one of the private sector where water plays a determining part in everyday operations and potential growth. The scope of Isfahan's cultural and historical attractions is not reflected in the city's accommodation market. The city is significantly under supplied with 75 hotels offering 2684 rooms, of which only 2 five star hotels and 4 four star hotels and 28 guesthouses offering 472 rooms. A unique aspect of Isfahan hotel market is the accommodation of traditional hotels and houses that focus on providing traditional Persian hospitality in uniquely styled rooms and facilities. These traditional hotels generally offer a very limited number of rooms (5 to 25) because they are conversions of former palaces and large family homes. (See Table 4-4)

The aim of this section is to find out whether hotels are using water optimization tools, whether hotel staffs are trained in optimal water use or whether these hotels are adapting themselves to Isfahan water problem. Six hotels are selected among 75 hotels in Isfahan. Two 5-star hotels, one 4-star hotel, a 1-star hotel, a 2-star hotel and a traditional hotel.

Hotels Classification	Region	Number of Hotels
Five Star	City of Isfahan	2
Four Star	City of Isfahan	4
3 Star	City of Isfahan	16
2 Star	City of Isfahan	14
1 Star	City of Isfahan	26
Traditional	City of Isfahan	13
Guesthouses	City of Isfahan	28

Table 4-4 Hotels inside the Isfahan City

Source: Isfahan Cultural Heritage, Tourism and Handicrafts Organization
<http://isfahancht.ir/TourismFa.aspx?p=222>

Two 5- star hotels are Abbasi Hotel offering 225 rooms and Kosar Hotel near Zayandeh Rud River with breathtaking view of Siose Bridge offering 223 rooms. The most important and most beautiful hotel in Isfahan City is Abbasi hotel (formerly known as the Shah Abbas Hotel). It is a hotel drenched in an ancient past. It was built at the time of king Sultan Husayn of Safavid about 400 years ago. All of the rooms are well equipped and are constructed based on international hotel standards.

The Kowsar Hotel offers a high standard of quality apparent in the entire hotel furnished with all amenities. It is one of the best hotels in the country, the only one with ISO 22000 certification and one of the few in the whole Iran to be a "green" hotel saving the environment. Neither of these five-star hotels was willing to respond to the Isfahan hotel sector questionnaire and did not cooperate. But as both of these hotels are important hotels in Isfahan, it seems they are equipped with optimized water consumption systems.

Another important 4-star hotel is Aseman Hotel and it's known for being the tallest building in the historical city of Isfahan. It's located alongside the Zayandeh Rud River offering 93 rooms. After answering the questionnaire, it was found that the hotel is equipped with water consumption optimization facilities, new technologies have been used for bathrooms equipment. The hotel staffs have been trained to optimize their water usage and the hotel has upgraded all facilities. Laundry is always monitored. But there is no use of artificial grass and drought tolerant plants in the hotel's green area.

Three other hotels in the city were also examined, a one-star hotel, a two-star hotel and a traditional hotel. All of them confirmed the hotels are equipped with water consumption optimization facilities, new technologies have been used for bathrooms equipment. The hotel staffs have been trained to optimize their water usage and the hotels have upgraded all facilities. They always check the hotel's water meters to find out the leakage places and they have always repaired places where water leaks. Not all of these hotels use drought-tolerant plants for their green areas.

4.4 Analysis of Interviews

This part represent the empirical findings from the interviews conducted by the author. Five interviews were conducted with government organizations: Isfahan Cultural Heritage, Tourism and Handicrafts Organization, Isfahan Water and Wastewater Organization, Isfahan Province Agricultural Organization, Mobarakeh Steel Company, Governorship of Isfahan and two interviews were conducted with two university Professors, Dr. Nasser Karami in Norway and one of the tourism professors in Isfahan. All Isfahan authorities demanded that their names not to be mentioned in the thesis.

4.4.1 Interview with One of the Tourism Expert in Isfahan Cultural Heritage, Tourism and Handicrafts Organization

According to this official who works in tourism part of Isfahan Cultural Heritage, Tourism and Handicrafts Organization, Iran is ranked 97th out of 141 tourist countries in the world in terms of tourist attraction, despite numerous historical, natural, cultural and religious attractions and ranked fifth out of top ten destinations in the Middle East after Turkey, Saudi Arabia, United Arab Emirates and Egypt in terms of international tourist arrivals in 2017. In 2017, there were 57.7 million international tourist arrivals to the Middle East but Iran's share has been 4.9 million. Turkey's share (the first tourist destination in the Middle East) has been 37.6 million International Tourists Arrivals in 2017. This huge difference with a neighboring country that may not have been as old as Iran's history and lacks many of Iran's natural attractions indicates the inefficiency of Iran's tourism programs. If we want to increase the share of tourism in the Iranian economy, we need to pay attention to completing the infrastructure required for tourism in Iran and to increase investment in this sector by the private sector. Isfahan Province has attracted the attention of international and domestic tourists with more than 22000 monuments, of which 1,850 monuments have been nationally registered and seven have been registered worldwide. There are more than 600 historic houses in Isfahan province, more than half of them in Isfahan city. Of the 602 handicrafts identified in the world, 299 belong to Iran, of which 196 belong to the historic province of Isfahan. Isfahan province accounts for 60 percent of the country's handicraft production. Isfahan Province has 132 hotels, of which 75 belong to Isfahan City.

In his view, although Isfahan has the capacity to accommodate domestic and international tourists, there are many shortcomings in the tourism sector of the province. The tourist infrastructure of this city is not suitable for tourists as expected and in order to meet the standards of this industry, appropriate cultural, residential and security infrastructures must be created in Isfahan. In his point of view, Isfahan accommodation shortages, traffic congestion, rising prices for tourist in peak seasons, lack of traffic police co-operation on tourist car traffic, poor training of industry-related people, poor tourist safety, bureaucratic problems, lack of tourism calendar, weaknesses of infrastructure and problems such as insecure and inadequate roads, inadequate development of rail

transport network and hotel shortages, Lack of training to provide services to tourists, Destruction of tourism attractions and unwillingness of private sector investors to develop tourism infrastructure and lack of ability to accurately measure needs and deficiencies of this sector can be cited as tourism shortages in Isfahan. According to this official, Fereydoun Alahyari, the head of the Cultural Heritage, Tourism and Handicrafts Organization, has announced the number of foreign tourists arriving in the province of Isfahan has reached more than 450,000.

He pointed to the increasing USA political pressure on Iran over the past year, saying that these pressures have caused some European tourists to worry about traveling to Iran. He noted that issuing electronic visas for foreign tourists is one of those strategies that the Cultural Heritage, Tourism and Handicrafts Organization, in cooperation with Ministry of Foreign Affairs, has adopted to address the concerns of foreign tourists, especially Europeans and Americans. Most International tourists who choose their destination in Isfahan are cultural tourists and most of them are European and American, he said. Most international tourists are from France, Germany, Spain, northern Europe, China and Muslim countries, according to this expert. In fact, Europeans have been ranked first. He added: "Following the USA sanctions, European tourists travel to Isfahan has been reduced and we are looking to open new markets in Asian countries to the tourism industry." "In spite of all the difficulties, we have to continue to make progress in this area because tourism has a huge impact on the economy, employment and the transfer of culture to other nations," he added.

He pointed that malicious propaganda against Iran, ignoring the tourism industry, imposing sanctions and not prioritizing the development of hardware and software capabilities of the industry in recent years are among the factors that caused Iran to fall behind in this regard. He added that tourism is now a top priority for officials and that revenue generation and infrastructure development are also at stake. According to this official, decentralization and balanced development in tourism is essential in such a way that the Isfahan metropolis is not the only destination for tourists and other cities benefit travelers. He said foreign tourists visiting Iran's attractions on Nowruz holidays (Iranian New Year) were up 31 percent this year, according to statistics. The Cultural Heritage, Tourism and Handicrafts Organization is trying to provide conditions for planning and executing related plans so that future tourist arrivals in Isfahan are not concentrated and all cities of the province can host travelers and thus promote balanced tourism development in the province. He added: Experience gained in recent years shows that the concentration of tourists in Isfahan's metropolis makes it difficult to service at specific times, such as Nowruz, although other areas of the province have many capabilities and this capacity has been used less.

Isfahan is a good destination for tourists because of its ethnic and climatic diversity, but some parts of the province need to be upgraded in terms of infrastructure, especially hotels and residences, he said. According to the announced statistics, 2 million 871 thousand 921 tourists stayed in the province during this New Year, 50 percent of this statistic is related to the Isfahan metropolitan

area. This tourism expert in this regard believes that the volume of tourists visiting Isfahan province is such that in some seasons, in important destinations such as Isfahan and Kashan (another big city in Isfahan Province), demand exceeds supply and overflows and puts additional pressure on infrastructure. According to him, the unbalanced distribution of demand in the tourism sector will result in marginalization of other tourism capacities and advantages of Isfahan, especially in ecotourism sector.

He added: "Since tourists first encounter tourist guides, the activity of tourist guides must be specialized." He added: "Solving the problems of the tourism industry is not only the responsibility of governments and officials. To achieve this, we need the involvement of the private sector and the efforts of organizations to attract investors."

In response to the question 'whether the dryness of the Zayandeh Rud River and the lack of water in Isfahan have reduced the tourists or not?' Said: "As I said, most tourists who come to Isfahan want to visit Isfahan's cultural and historical monuments. Among these attractions, Naghshan Jahan Square and the Chehelsotoun Museum of Isfahan, which are both national and world records, are the most popular destination for domestic and International tourists. Malicious propaganda against Iran and USA sanctions malicious propaganda against Iran have caused some European tourists to worry about traveling to Iran. The drying up of the river, though it has lessened the attractiveness of the bridges, has not had much of an effect on the decline of international tourists."

In response to the question of 'which seasons most international tourists come to Isfahan and whether Isfahan is experiencing water shortage during these seasons?', he answered: Foreign tourists travel to the city in the spring and early fall at the beginning of the Christian New Year, and Isfahan does not face water shortages at this time.

4.4.2 Interview with a person in charge in Isfahan Province Governorate

According to this person who is an official in formality section, the problem of Isfahan's water shortage is not just a matter of climate change and rainfalls, because people in Isfahan have been facing periodic droughts for years. The problems, before returning to climate change, are due to the lack of a system of thought and planning, the absence of a well-developed structure in planning and managing water resources and not seeing the role of people in this structure. What both the country and Isfahan are suffering from today.

Asked 'why the water of Zayandeh Rud Basin is divided between other provinces', he answered: "Traditionally, Iran has been divided into six major catchments, each of which has been divided into sub-basins. Zayandeh Rud catchment or Gavkhuni catchment is one of these basins. The basin covers three provinces: Chaharmahal & Bakhtiari, Isfahan and Yazd. The basin was managed as regional water. About four billion cubic meters of water flows from Isfahan to other provinces. Water flows from Isfahan to other regions such as Khuzestan, Yazd, and Markazi, from

Kohkiluyeh to Chahar Mahal, and from Lorestan province to several other provinces. The disintegration of the catchment will later cause many problems. The breakdown of regional water and its provincialization was, in my opinion, one of the mistakes made in the Seventh Assembly. Now the four provinces, their fates are clearly linked in the water crisis: Isfahan, Chaharmahal & Bakhtiari, Yazd and Khuzestan. These provinces must be seen together. We cannot provide more water for one province and forget about another. Transferring water to new areas, such as low-water areas of the Isfahan province or moving to other provinces, is reasonable for drinking water and or the environment. Yazd, Kerman and other provinces cannot be deprived of the minimum freshwater for environmental and ecosystem sustainability. But it is not logical water- intensive industries like steel company to be created in Yazd, Kerman, and the arid regions of Iran , causing the Zayandeh Rud River to be dried and then, at high costs, water to be transferred to 400 to 500 kilometers, while Isfahan don't have water. The main issue is the lack of a system of thought and planning.”

In response to the question, ‘is it possible to reduce the production of Mobarakeh Steel Company in order to keep more water for the environment and agriculture?’ He said: "There is a prioritization and direction by the Ministry of Energy for the water organizations of the country to comply with, namely that drinking water first, industry second, agriculture third. According to this directive, water organizations cannot prioritize agriculture over industry. With this prioritization, if water remains, it is for agriculture, otherwise agriculture and the environment are useless. Meanwhile, the Gavkhuni swamp is dead. Basically, past and present policies need to be revised. Policies that set up Steel Companies in the upstream of the river and policies that placed water utilities in arid areas such as Isfahan and Yazd. The Isfahan Steel Company is mistakenly located upstream of the Zayandeh Rud River and among the lush fields. It consumes too much water, and it pollutes water, soil and air.”

In answer to the question ‘In an emergency, shouldn't priorities change?’ Said: “I think an industry like Isfahan Steel Company, which is not profitable and has a lot of debt and cannot pay pensions, should not be further developed and should try to renovate them in order to have less water consumption and less pollution. At present, not only Isfahan's steel industries are consuming a lot of water, but also in Yazd province, several large steel mills have built to supply their water with Zayandeh Rud. In the past, water affairs, especially distribution, was managed and supervised by local people, but now these systems are centrally entrusted to the government and the government decides under pressure. Therefore, the role of the government in exercising its sovereignty needs to be taken more seriously, and in my opinion, the water of the country and decision-making about it, must become national- regional again, of course, considering expert opinions and stakeholders’ participation. In the meantime, the expansion of activities and population should be commensurate with the amount of freshwater resources.”

He presented a report on the amount of rainfall and added: “Isfahan city had 145.5 mm of rainfall till now (September 2019), this number last year was 72 mm and the average in the long run is 119

mm. But according to Isfahan Meteorological Organization statistics, unfortunately in November and after that we will not have a good situation of precipitation in the whole province. According to the Meteorological Organization, estimates of precipitation are average and normal throughout the country, but unfortunately in Zagros, especially in Chaharmahal & Bakhtiari and Kohrang, the rate of rainfall is red and below normal, so the foresight is felt in this regard. We have no problem in Water Supply Sector but drops of water should be used safely and usefully in Isfahan Province. There is no other way than optimal water management in Isfahan province, and this must be taken seriously in addition to the need to conserve water resources.”

He said about the development of tourism industry in Isfahan city under the current conditions of water shortage: “According to experts, the tourism industry, as one of the world's highest-paid industries due to its significant financial turnover, has attracted the attention of many macro and micro investors, especially in the last decade. Isfahan, according to experts, has potential in this sector. Isfahan province has 107 cities and 1,934 villages, with more than 22,000 monuments. 1,850 of which are nationally registered, and four of them, Naqsh-e Jahan Square, Chehelsotoun Palace, Fin Kashan Garden and Jame Mosque, has reached a worldwide record and has always been the focus of domestic and international tourists. The diverse and unique range of villages with ethnic, cultural, climatic and religious diversity has created a wide horizon in the ecotourism sector of this province. He said: "Without a doubt, by supporting the tourism industry while creating jobs in Isfahan and especially in the villages, there will be a lot of revenue for Isfahan province. The Cultural Heritage Organization and tourism activists should further assist in this regard."

4.4.3 Interview with a person in charge in Isfahan Agriculture Organization

According to this person who works in Management and Resources Development Section, the most important problem which Isfahan's agricultural sector is facing now is the old methods of irrigation and not using new methods of farming which causes wasting a great deal of groundwater resources and this is the biggest challenge agricultural sector is facing. As he claims series of facilities are planned for farmers to provide new irrigation equipment but these practices are not effective in all areas of the province, or some farmers receive the facilities but use incorrect practices like using sprinkler irrigation system which in very hot rural areas all the water used in this way will be evaporated and not only does not help water deficit but also escalate it too. Also drip irrigation system which is currently being used in some areas has made some problems. In fact, the new irrigation systems that are currently in use do not match the regional and native characteristics of that city. Another problem is that not all farmers can use these facilities, and about 60% of Isfahan farmers still use old irrigation systems. The Ministry of Agriculture has recently adopted a strategy for using greenhouse systems because the old irrigation systems has caused many problems in all cities of the country even in the northern provinces of the country and also in Isfahan.

In response to ‘what extent has the industrial sector of Isfahan been affected the issue of water deficit?’ Said: "Isfahan's industrialization and poor consumption patterns in this part have affected the climate. Rainfall is reduced in downstream areas of the river, and caused a decline in agricultural production. Unrefined recycling is being used in some areas for irrigating crops such as wheat and barley. "

In response to ‘what impact does water deficit have on the tourism industry in the province?’ said: Dividing Zayandeh Rud's water between Yazd and Chaharmahal Bakhtiari provinces caused river drying and this drying has created a bleak landscape for the city's historic bridges that has reduced the number of tourists in Isfahan. But totally drying up of Zayandeh Rud has had little impact on the decline of international tourists. Meanwhile this year which the amount of rainfall was high and Zayandeh Rud had become full, there were more tourists in the city.

According to him the most important causes of the water deficit problem in Isfahan are: 1- weakness in managing the water resources; whether in distribution, division or in consumption, 2- low price of water 3- high water use in agriculture 4- Implementation of wrong macro policies in the field of water resources distribution which is due to poor management of water resources. In fact, in Isfahan water has been politicized and it is distributed according to the politics.

He believes in our country there is no proper consumption pattern and no suitable cultivation pattern for the agricultural sector. Consumption pattern in the drinking sector has to be cultured and the needed training for correcting consumption patterns must be given to people and also needed facilities must be provided for people to procure water-reducing equipment. In agricultural sector, water-intensive crops should be replaced with strategic crops and other crops should be imported from other countries. In the water sector, participation of private sector is also low and it should be encouraged to invest more. Technical knowledge of water is not enough in our country and also in the city of Isfahan. The research achievements of the water sector do not meet the needs of this sector, there is no necessary coordination between the water departments. There is insufficient knowledge for water recycling in Isfahan province. All of these issues should be considered a priority for the province. We also have to import large quantities of virtual water, for example buy hay, from other countries.

In response to ‘What issues do you think the province's water research sector is facing?’ answered: Lack of credits and technical knowledge. Currently the research department is working on the deep water. His evaluation of the performance of organizations involved in water is as follow:

Sections	Performance
Conservation	Average
Allocation	Good
Monitoring	Good
Watershed management	Good

Balancing	Good
Exploitation	Poor

His most important solutions for each of the following sections are as follow:

Agriculture: Planting pattern modification - irrigation systems change – greenhouse planting - stop planting high water consuming products like watermelon.

Industry: using modern facilities to keep the equipment cool - producing in proportion to the amount of water

Environment: Not interfering with the natural flow of water

Groundwater: Protecting and trying to restore the groundwater with watershed management which currently nothing is being done in this regard and there is currently no hope for restoring groundwater resources.

Wastewater: Invest in this sector for purification and reuse - raising knowledge in this area.

In response to ‘Do you think the presence of tourists escalate the issue of Isfahan water deficit? And is it possible to accommodate foreign tourists with the current conditions?’ said: "The presence of tourists has little effect on the water deficit in Isfahan, and Isfahan can still accommodate international tourists. Before the recent rains, Isfahan was facing drought and even the green spaces were irrigated by tankers, in some areas the green spaces were not irrigated and it resulted in drying of grass in those areas. In most of the urban areas of the province, there was water shortage but this year we have had no problems with recent rainfall."

In response to ‘Do you think it is necessary to explain the situation of Isfahan water deficit to the tourists or not?’ said: "Tourists have a correct consumption pattern and do not need to be explained but well, it’s better to tell them about that."

To ‘Do you have any another suggestion for the problem of Isfahan water deficit?’ answered:

" There should be work on water resources recycling and water consumption culture in all areas, we must obtain technical knowledge in the field of water from foreign countries and as I said before we must promote greenhouse planting in the city."

4.4.4 Interview with a person in charge in Water and Wastewater Organization

According to this person who works in customer service department, climate change, management issues, reduced rainfall and population growth are some of the factors affecting the water conditions in Isfahan province. He pointed to the industrial status of Isfahan province in the country: 70% of iron and steel production, 26% of refinery products, 12% of cement and 9% of electricity is produced in Isfahan province. This shows that water consumption in different parts of Isfahan including industry sector is considerable. Water resources in Isfahan face significant constraints and demand has exceeded supply. He added: Precipitation is not in the right place at the right time, or it does not commensurate with the time of planting and this indicates the need for more storage. However, storage is possible not only through the construction of dams but also by methods such as watersheds, aquifers, wells and marshes and other methods. He added: "All

these methods are tools for water resources management and each one has to be selected according to the need of the place and none will be superior to the other."

He said: industry is required to use wastewater for its other uses, except for drinking and sanitation. He added: steel companies in Isfahan have made good progress in optimizing water use and saving water. Urban wastewater collection, treatment and use of standard wastewater in the industry should be accelerated. Since the industries cannot be eliminated, cutting the cord of the industry with fresh water and using the industry with effluent properly utilizing it should be on the agenda of the industries in Isfahan. The optimal water consumption policy in the province is set to reduce water consumption in the drinking sector over a three-year period by 20%, with all relevant solutions outlined. He added: One of the solutions to this debate is to use a home-based water reducer and if 200 households equipped to a water reducer, about one cubic meter of water will be reduced per second. In the agricultural sector, water consumption should also be reduced by 50%, which can be achieved by changing the crop pattern and increasing productivity. By controlling supply and demand, we can transform Zayandeh Rud River from a seasonal river to a permanent river.

Referring to the process of consumption and reduction of groundwater in the country, he said: The reduction and drying up of groundwater would be the so-called 'silent death' of cities, which should be stopped by planning and implementing deterrence plans because when in the region, the groundwater is consumed and finished, that area will no longer be a place to live. He added: Groundwater consumption from sources that increase or decrease with precipitation (dynamic reserves) is reasonable, but unfortunately over the past few years static reserves have been used and this has exacerbated the crisis situation. In this regard, the use of patrol teams in the province, the organization of drilling companies as well as the information and planning of optimal water consumption are important. He pointed to the permitted and unauthorized withdrawals of water and added: "In permissible extractions, the amount of extraction permitted is clear, but there are no systems to control these extractions." It is sometimes observed that two to three times the amount of permits, groundwater and surface water are extracted. So, all surface and underground resource users were required to use smart meters in order to prevent over-exploitation of permits. He added: "So far, many meters have been installed and projected in the province, and we will strive to reach ten thousand smart meters because of the importance of extraction control."

He added many unauthorized wells are now blocked in the riverbed because they illegally extracted river water and hampered river water planning. Water recycling under current conditions is the best solution for reinforcing groundwater aquifers. To this end, there must be public education and capacity building. He emphasized that the world's emphasis is on conserving sustainable water resources and doing so with supervision, adding: "According to experts, by connecting underground wells to an internet network and creating an online network to monitor them, the existing problems can be solved." He said: "If we can recycle water or transfer recycle water back to the aquifers, even the water quality in the aquifers would be even better."

He also said: "We are facing some complications in the Zayandeh Rud basin, one of which is the decline in Zayandeh Rud water volume." He pointed to the presence of good experts in Iran and said: "There is a need for good communication between Iranian experts and international experts to solve water problems."

Regarding the impact of water scarcity on tourist attraction in Isfahan, he added: it can be said that the impact of Zayandeh Rud on attraction of international tourists has been moderate because political factors are stronger in this regard. Isfahan's tourist attractions are not just limited to bridges and there are other worthwhile attractions in the city. More foreign tourists come here to see Isfahan's monuments. Regarding recent rainfall in the spring, said: "We did not experience water shortages this year due to recent rains in the summer, but no preparations were made for the coming years," he said. "With the recent rains, we have only been able to fully meet the needs of different parts of the province to water."

4.4.5 Interview with a person in charge in Mobarakeh Steel Company

In response to the question of 'how much water is used by Mobarakeh Steel Company', he said: "The share of Mobarakeh Steel's extraction from the Zayandehrud River is only 23 million cubic meters, about 1.5 percent of the river's water discharge. It is a misconception that industry has been the cause of the drying up of Zayandeh Rud River in Isfahan. Nationwide, 92 percent of water is consumed in agriculture, about 6 percent is used for drinkable water, and only 2 percent is consumed in the entire industry. This means that water consumption in the steel industry and in the steel companies is extremely low. In the Zayandeh Rud catchment, our total water uptake last year was 23 million cubic meters, meaning we consumed 1.5 percent of the total river volume."

To the question, 'why you do not experiment with other solutions to supply the water needed by the industry?' Said: "By the way, we have done that. Although there has been no attempt in Iran to supply the steel industry with the exception of the rivers, in Iran we made our first attempt. We contracted with Isfahan Water Company to build a sewage collection network in the neighboring cities and we provide part of our need from it. We estimate that this sewage can be used in the Mobarakeh Steel Company for about 30 years. We have the best system for recycling sewage. We have the best sewage recycling system in place, and we want to make our 1.5% smaller share of the wastewater harvest still smaller. What has happened in Zayandeh Rud has nothing to do with the share of the steel industry's water harvesting, and the water consumption in the steel industry, especially Mobarakeh Steel, is very low."

In answer to the question that 'if you consume only 1.5% why did Zayandeh Rud dry just after the Isfahan Mobarakeh Steel Dam?' said: "The government gives this share to Mobarakeh Steel because it has reduced water consumption. Along the river, there are other extractions. We are not aware of what the province's policy and water resources look like. Our share of Zayandeh Rud water and our extraction of it is clear. After that dam you say, water passes. That is, the government

must have sufficient water resources to reach the rest of the consumers and ultimately to the Gavkhuni Wetland.”

In response to the question that ‘you can't remove the same 1.5 percent you say and get that share from other sources’, said: “Suppose we do not extract water from this river. What problem will solve with removing this small share? This small share brings a great deal of value back to the country and Isfahan Province. It directly creates jobs for 20,000 people and indirectly creates jobs for 350,000 people.”

In answer to the question, ‘is it true that heavy water from steel mills dumped in non-standard ponds, is highly toxic and also leaks to underground aquifers?’ said: "when the water in the steel industry be recycled for several times becomes so heavy that is no longer water. There are ponds that have protected and insulated layers, and this water evaporates in the sunlight, leaving the black and heavy mud at the bottom. When you see our refineries, these mindsets disappear. We have unique refineries."

4.4.6 Interview with Dr. Nasser Karami

Dr. Nasser Karami is a Geographer, Climatologist, and one of the most prominent environmental researchers, writers and journalists in the field. He has 25 years of experience in teaching and research on sustainable development and climate change in Iran and Norway. His research interests are sustainable development in dry areas, climate change, the relationship of totalitarianism and environment, and sustainable tourism.

According to Dr. Karami, to understand the impact of Isfahan water deficit on Isfahan tourism three issues must be considered: 1) the impact of water deficit on Isfahan tourist attractions (it has to be checked how much the water deficit has decreased the number of tourists), 2) the impact of water deficit on infrastructure needs to be studied (its impact on transportation services, health services and security of the city) and 3- the rate of change in water consumption should also be considered. In Dr.Karami's view, it's needed to shift from more water-intensive to less water-intensive jobs, which is one of the ways to adapt to drought. Ecotourism is one of these less water-intensive jobs. For example, villagers can rent their houses in villages that have the potential to attract tourists and their houses become tourist accommodation. Thus, the people of the village can create a suitable job from tourism while their water consumption has declined compared to the time they were engaged in agriculture. Even in villages where there are no natural attractions, you can create human made attractions. In his opinion, the most important causes of Isfahan water deficit problem are: 1- climate change and 2- not considering the ecological capacity in the region development.

Dr. Karami stated the province should consider the following approaches to cope with water deficit as the priority: 1- accepting the climate change as the definitive destiny of the region, 2- Trying to set up a comprehensive plan to adapt it (for all sectors including agriculture, industry, dams and

so on). In reply to the question "what do you think the province's Research Department is facing regarding water deficit", he said the issue of climate change has not been taken seriously in the research part and there has not been domestic knowledge in the social and economic sector to adapt to climate change. He replied to the question "what he thought of the water terrorism in Isfahan" said it was an unscientific word, and it was in fact the unstable and indefinite development. He believed that each section involved in water sector in Isfahan province (Conservation, allocation, monitoring, watershed management, balancing and exploitation) performed badly and poorly.

In reply to "What new solutions do you propose to government and water authorities regarding the management and the challenges that arise?" answered: 1- To accept the new fate of Isfahan. 2- To accept that the current pattern of development in Isfahan has been a false one even under normal circumstances which now in current situation is devastating and will destroy Isfahan's future, 3- To create a new program to adapt to the new situation.

His most important solutions for each of the following sections are as follow:

Agriculture: Change the pattern and reduce the area under cultivation, stop planting products like rice, watermelon which need high amount of water.

Drinking: Transfer the water based industries to other areas.

Environment: Observance of water rights of habitats.

Groundwater: Eliminate unauthorized wells.

Wastewater: Create refining and recycling technology.

In reply to "Do you think the presence of foreign tourists has a negative impact on Isfahan water deficit problem? And whether Isfahan can still welcome and accommodate foreign tourists" said: "as I said before, tourism is not disturbing the water issue and it helps us adapt to the current state of water deficit and with the current situation Isfahan can also accommodate international tourists."

In reply to 'How do you think there can be a balanced optimum use of resources and a reasonable reception of foreign tourists?' said: Tourists use Isfahan drinking water and in my opinion Isfahan has no problem with drinking water. Isfahan has problem in agricultural water. The tourism industry's revenue is so high that other solutions such as transfer water or even mineral water can be used.

In conclusion, his suggestions for water deficit and water crisis management were: "We should consider ecotourism and rural tourism as an alternative for agriculture and motivate the tourists who visit Isfahan to visit rural areas as well. For Isfahan, this planning is not difficult at all. Tours can tailor the international tours in a way that tourists visit the countryside for at least one day and that would offset the shutdown of agricultural sector. This method should be considered as an important way for Isfahan city."

4.4.7 Interview with one of the tourism professors in Art university of Isfahan

Asked ‘whether Isfahan is an important tourist destination in Iran’, she said: “Isfahan is one of the provinces of the country in the field of tourism industry which plays a unique role in the tourism system of Iran and as an international destination, it is visited annually by thousands of domestic and international tourists.” About the development of tourism industry in Isfahan city, she said: “Isfahan Governments have made major mistakes over the past four decades; they could have pushed Isfahan towards the development of tourism in cultural and historical areas and transformed the city into a scientific hub and acceptance of medical tourism. But the province has been turned to producing Steel, iron, and water-intensive crops, and it was a major mistake that confronted Isfahan with a serious crisis. If Isfahan had provided one billion cubic meters of water to accommodate 10 million tourists a year, it could have become the richest city and province in Iran, but in the last 40 years they have not allowed to build even one hotel. The water crisis in Isfahan is a major strategic error that cannot be resolved even with water transfer schemes. Managers today can show their courage when they announce that we no longer need to Steel and agricultural development, and then move on to build the infrastructure needed to boost tourism.”

In response to the question ‘what are the challenges in Isfahan Province tourism development’, she said: “The seasonal demand for tourism on one hand and the unbalanced distribution of demand in the Isfahan area, on the other hand, has caused many resources and capabilities of Isfahan province not enter the activity cycles of this industry, not being fully exploited and as a result, many cities and districts of the province are deprived of the economic and social benefits of the industry. Achieving equilibrium supply and demand, seasonally appropriate distribution of activities, balanced and equitable distribution of tourism industry activities in Isfahan province, and realization of investment projects in this area due to the interdependence of governmental institutions and agencies in investing in these projects and lack of government support in this regard are the main concerns of the Isfahan province's tourism development institutions.”

According to her the most important challenges in the field of tourism in Isfahan province in the macro area are as follows:

- Lack of long-term planning and fact-based development strategy, reasoned and accurate statistics
- Inadequate coordination and communication between the private and public sectors and lack of support for the influential private sector in tourism
- Weakness in attracting domestic and international tourists
- Lack of essential training to provide services to tourists
- The low growth rate of hotel demand which reflects the difficult situation of investment in this area
- Lack of real statistics and information on tourism supply and demand
- Limitation of Statistical Information on Economic Impact Assessment
- Weakness of communication networks and infrastructure in the field of tourism

- Weaknesses and inefficiencies of tourism services and marketing management
- Destruction of tourism resources and attractions in the province due to improper use
- Lack of education and communication between guest and host communities and lack of local participation in this area

According to this expert the smaller challenges of Isfahan tourism include:

- Accommodation Sections: Lack of standard accommodation centers, limitation of the variety of accommodation facilities, limitation of standardization of accommodation system, proportional distribution of residences, etc.
- Attractions: Lack of comprehensive Resource and Attraction Management System, Weakness in Attraction Marketing System, Lack of Coherent Program for Identification and Protection of Attractions and Restrictions on Tourism Infrastructure, Failure to Introduce Attractions and Intangible Heritage of Isfahan Province, etc.
- Leisure: Including lack of exciting leisure facilities, poor quality of services to tourists, asymmetric distribution of recreational and tourism centers in the province, etc.
- Shopping: Constraints and Weaknesses in the Crafts Marketing System...
- Nutrition services: Lack of proper supervision of nutrition centers in the province, poor quality of nutrition services, lack of attention to the beverage business, lack of marketing in the food and beverage industry, etc.
- Relocation and Transportation: Asymmetric scarcity and distribution of road service complexes in the province, undesirable quality of inter-provincial transportation, low levels of road traffic security and reluctance of private sector investors to create road services, exhaustion and overuse of existing road, stagnation of International transportation activity in the province
- Events: Lack of Isfahan Province Tourism Events Calendar, Lack of Attractive Tourism Events Fit to Isfahan's Position in the Tourism Industry, Inappropriate Time Distribution of Tourism Events, and Lack of Events Fit to Different Audience Groups
- Travel Services: Including lack of attention and coordination between the various entities involved in providing services to travelers.

Asked ‘whether the dry bed of the Zayandeh Rud River has an effect on attracting international tourists’, she added: “Isfahan without Zayandeh Rud has no meaning in the tourism industry, and international tourists and domestic travelers want Isfahan with Zayandeh Rud and increase the volume of passengers at the time of the river flows confirms this. If Isfahan authorities have put tourism at the center of development, they must plan and take serious action to keep the river flowing.”

Chapter 5. Results

Four research questions have structured this research. These questions aimed to study the reasons of water crisis in Isfahan and find solutions of the Isfahan water crisis, to see if the arrival of international tourists to Isfahan intensify the existing water crisis and to see if Isfahan accommodate international tourists with current water shortage situation.

The Zayandeh Rud is the most important river in Isfahan Province. It has long been the source of water for irrigated agriculture as well as for the urban water supply for Isfahan city. But today it runs dry because of water extraction before reaching the city of Isfahan. In the early 2010s, the lower reaches of the river dried out completely after several years of seasonal dry-outs. While the drying of the lower part of the Zayandeh River has been attributed to drought, the main reasons are man-made. Poor planning and populist politics have led to years of mismanagement and overuse which has led to seasonal dry-outs and ultimately caused the river to dry out completely before reaching Isfahan. Most of the farmers who worked the fertile lands around Isfahan have had to find a new way to make a living since the river dried up. Most of them immigrated to Isfahan which consequently increased the population of Isfahan city. The water crises leads to many problems and water and wastewater organization has faced lots of problem due to providing citizens' drinking water during five recent years.

After analysis the secondary data and review of the literature, it can be concluded that the most important reasons for water crisis in Isfahan are: 1- Economic development which leads to Population growth and neglect the availability of water 2- Focusing more on providing more water to the residents and not pay enough attention to environmental issues 3- Conducting population and development projections by non-water agencies 4- Lack of coordination and collaboration between institutions which are responsible for deciding over Zayandeh Rud River 5- Large agricultural, industrial and domestic water use 6- Climate change and lack of rainfall 7- Lack of information and attention to the benefits and role of the river, especially in local planning 8- Trans basin diversions to Yazd and Kashan 9- Extraction, reduction and drying up of groundwater resources 10- Lack of a system of thought and planning and the absence of a well-developed structure in planning and managing water resources 11- Poor consumption patterns in all sectors (Agriculture, Industrial, Tourism facilities, households, and environment) 12- Weakness in managing the water resources; whether in distribution, division or in consumption 13- Low price of water 14- Implementation of wrong macro policies in the field of water resources distribution which is due to poor management of water resources 15- Low participation of private sector 16- Lack of technical knowledge in Isfahan province's water research sector 17- Poor performance of organizations involved in water (Conservation, Allocation, Monitoring, Watershed management, Balancing, Exploitation) 18- Permitted and unauthorized withdrawals of surface and groundwater 19- Not considering the ecological capacity in the region development

It seems that there is no one specific solution to the problem of water shortage in Isfahan. Isfahan water deficit problem is not solved by water transfer. Supplying more water can be a solution even if water demand, population growth and water withdrawal is controlled. Water supply planning shouldn't be based on development and population projections. Projections should consider the relationship of development and population growth rates with other factors such as water availability. To be successful, water planning must seek to maintain a long-term balance between supply and demand so that the needs and aspirations of the economy and society are met without serious damage to the environment or to sources of supply. Integrated planning and consideration of different socio-political and economic elements of the system and their interactions are essential to sustainable management of water resource. Solving this problem relates to coordination and collaboration between four government institutions, the use of new environmental technologies in industrial unites and factories, governmental control, the management system, thought and planning, as well as to the management structure and how stakeholders are involved.

Implementation of demand management strategies for sustainable water management in the region is essential. Environmental NGOs (non- governmental organizations) representatives should be invited to take part in Zayandeh-Rud meetings, drilling of the wells should be checked, water resources should be controlled. Industries such as Isfahan Steel Company shouldn't be further developed and should try to renovate them in order to have less water consumption and less pollution. The impacts of climate change on the future evolution and extent of water scarcity and droughts must be further assessed. Applied and targeted research and replication of successful experiences are essential for sustainable development and understanding the impacts of climate change on droughts. The quality of water services should be improved. A comprehensive program of educating the public in Isfahan on the water issue is also suggested.

Figure 5-1 shows water demand in Zayandeh Rud Basin. Agriculture is the largest and most important water consumer in Isfahan and more than 80% of water resources are wasted due to the lack of advanced irrigation technologies. Water management in the basin has no alternative other than limiting agricultural development, limiting the growth of water-intensive crops (e.g. rice, alfalfa and corn), expanding rainfed agriculture (to replace the lost irrigated lands), and selecting an appropriate crop portfolio with particular attention to water availability in the basin. In addition, there is a serious need to increase water use efficiency in irrigation and drainage networks to reduce water waste in the existing outdated irrigation systems (Gohari et al., 2014).

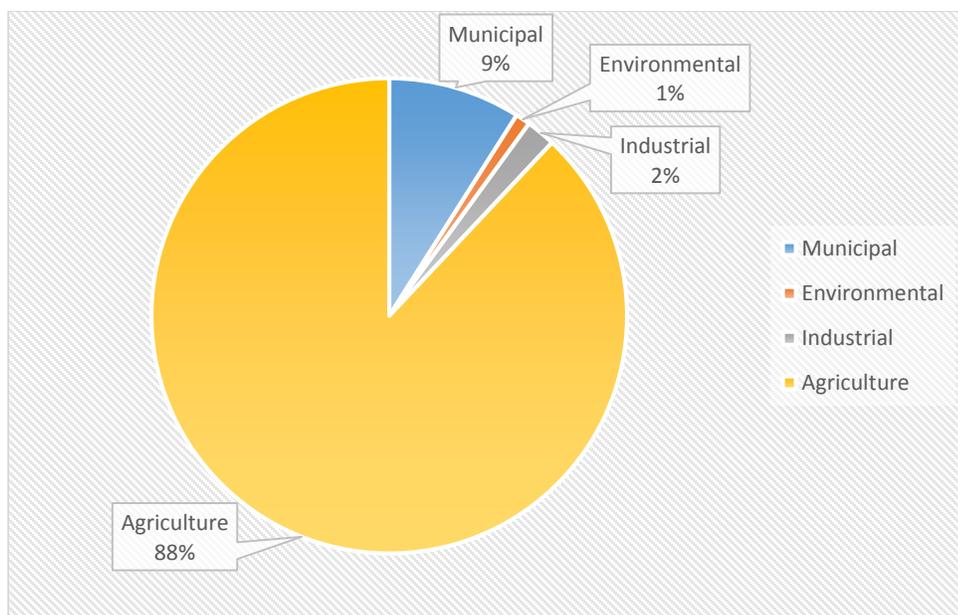


Figure 5-1 Water demand in Zayandeh Rud Basin (Surface water & Ground Water)

Source: Isfahan Water and Wastewater Organization

The most water-consuming activity is irrigation for agriculture, which accounts for 70 % of total water withdrawals and more than 90 % of water consumption. Agriculture is also the most important factor in the future growth of water consumption. Planning and implementing slow and socio-ecologically friendly reforms in the agricultural sector is essential, while at the same time focusing at the greatest benefit for water resources.

The challenges in Isfahan's agricultural sector:

- 1- Lack of a specific cultivation pattern in the province
- 2- Disagreement among policy makers to determine real water prices in agricultural sector
- 3- Excessive waste in agriculture
- 4- Lack of territorial integrity
- 5- Non-compliance of irrigation methods with conditions of soil and water and the actual needs of the plant in the climate
- 6- The private sector's reluctance to invest in this sector due to government price controls
- 7- Lack of knowledge of using scientific methods of farming and domination of traditional views among most farmers
- 8- Lack of proper coverage of irrigation and drainage networks for proper use of recirculating water flows and prevent leakage

The efficient ways of consuming agricultural water:

1- Correction of cultural infrastructure (aggregation of agricultural land in one area, Prohibition of drilling unauthorized wells for irrigation of lands and gardens, Modernizing land irrigation in accordance with the climate of the region, Collecting the water on the ground (rain, snow), Preventing cultivation of non-native plants in any area)

2- Correcting incorrect agricultural policies (such as drilling unauthorized wells, cheap sale of water and electricity, limited horizons of policymakers, threatening consumers' health by excessive use of pesticides, implementation of input-driven policies such as sale of water to prevent unemployment of workers which increases farmers' incentives to plant water-consuming crops and will cause the water deficit reach a deadlock in agricultural sector; so any input-driven policy will ultimately fail and it will add to the water crisis as the most important productive input.

3- Raising the level of agricultural knowledge (advice to farmers on how to improve their irrigation practices and to establish irrigated crops).

Good irrigation practices include not only questions about when and how much water is to be used, but also the application of appropriate irrigation and drainage methods, the establishment of cropping patterns, the management of poor quality water and soils.

The introduction of suitable irrigation methods is an important point that is directly related to the need for proper land development work (usually grading). There is great interest among many farmers in the potential of some of the recently developed methods: drip, mini-sprinklers, sprinklers, mechanized systems, etc. Technical advice on the suitability of these irrigation methods to a specific farm situation can be instrumental in saving labor and investment.

4- Using available up-to-date technology

Evidence from secondary and primary data reveal that Isfahan with a wide variety of tourist attractions has potential for attracting tourists to the city. It is like a global village that invites tourists. Isfahan has become a tourist destination due to its natural and climatic diversity, the scattering of monuments, and the wide variety of subcultures and authentic civilization. According to experts, in most cases this city has responded to tourists' needs and have made them needless for long trips to destinations outside the province. Isfahan is a genuine city in the heart of Iran whose charm attracts huge numbers of domestic and international tourists every year, especially in Nowruz Iranian New Year). A blend of intangible culture and heritage, and an outline of ancient rituals and noble flavors and souvenirs have made Isfahan a world-class museum and a charming city. Analysis of data also reveals that the international tourist arrivals doesn't intensify the existing water problem in Isfahan city and Isfahan can accommodate international tourists with current situation. Tourism is not disturbing the existing water issue and it helps us adapt to the current state of water deficit. In fact, another solution to the cultural, economic problems, especially the problem of water scarcity in Isfahan province, is the development of tourism industry. In order to realize tourism plans and promote tourism levels in Isfahan province, factors influencing the development of tourism industry such as economic, social, cultural and technological factors, geographical locations, markets, resources, competing factors and political,

legal and governmental factors, attractions and activities, facilities and Services, infrastructure and organizational elements (as internal factors affecting tourism destinations) should be examined. Each of the above factors has different micro factors for measurement and evaluation. Perhaps one of the most important priorities under consideration is the managerial and investment mechanisms for the construction of tourism infrastructure in the province and the creation of the necessary conditions for the entry of these funds into the tourism development field in the province. In addition to this priority approach, it is necessary to present a coherent and realistic plan of tourism industry in Isfahan province at three international, national and provincial levels. For providing this cohesive program, a very reasoned and realistic statistical database of internal and external factors affecting the tourism destination is required. The next step is to implement this plan by the institutions with the view that tourism will be a vital flow for future generations of Isfahan province.

In the meantime, there is a need for a fundamental solution to permanently Stream of Zayandeh Rud River. Zayandeh Rud is the beating heart of Isfahan and its absence is like cutting off one of the main vital veins of Isfahan tourism. Accordingly, the loss of the main attraction of Isfahan city can certainly have a negative impact on the tourist attraction and to reach the peak of the "tourism economy" which is nowadays one of the main foundations of the economy of all countries of the world.

Isfahan's historic archaeological register on the Zayandeh Rud route in UNESCO may be one of the solutions. The issue of the registration of the historic center of Isfahan on the Zayandeh Rud route in UNESCO has been mentioned before. What to do if done, in addition to Zayandeh Rud, four hundred buildings will be also registered in this World Organization. Such a proposal is immediately welcomed anywhere in the world, but after several years of this proposal, even the case has not been submitted to UNESCO for registration.

Due to the recent droughts, Rural Tourism Development, Ecotourism Development and Agritourism Development contributes greatly to the province's economy. Paying facilities to this sector can be expected to halt the migration from the village to the city. Decentralization and balanced development in tourism is essential in such a way that Isfahan metropolis should not be the only destination for tourists, and villages also contribute to the reception of passengers. Unbalanced distribution of demand in tourism will result in marginalization of other tourism opportunities and advantages of Isfahan tourism sector especially in ecotourism. Media tools, television programs, cultural and art events are ways to introduce lesser-known areas, villages and other cities in Isfahan Province to increase the number of tourists. For Isfahan province should not introduce a specific model of tourism, but should introduce a specific model and program for each region. Strengthening the province's tourism infrastructure requires special attention and basic measures and infrastructure work.

Agritourism is defined as any visit (recreationally or scientifically) the agricultural fields, gardens and animal husbandries that the visiting person will acquire knowledge from all stages of production to the processing of products or the visiting person actively participate in some parts of activity. It involves any agriculturally based operation such as buying products direct from a farm stand, picking fruit, feeding animals, or staying at a bed and breakfast (B&B) on a farm. Agritourism is one of the forgotten capacities of Isfahan tourism industry which requires identification, formulation of comprehensive plan and provision of infrastructure for this sector.

Spiritual and Religious Tourism capacities have not been considered in Isfahan too, despite its capabilities. Spiritual tourism is defined as an act of travelling domestically or overseas to visit spiritual places such as (1) mosques, churches, and temples and (2) natural environments such as forests, lake, spiritual gardens, wildlife parks for birds and animals, botanical gardens, caves, and rocks for spiritual reasons to fulfil the need for being grateful to almighty, forgiveness, and peace. Isfahan has a great potential for Spiritual tourism by having tombs and churches and mosques with magnificent architectures such as Isfahan Jome Mosque, but as it should, these capacities have not been exploited to promote tourism and diversify urban tourism. As mentioned before, Flower Garden in Isfahan is a botanical, recreational, cultural, educational and research garden includes 250 rock plant species, water fall, a pond with water plants, seasonal and permanent flowers and ornamental shrubs, a carpet like design made by different flowers, Rose garden, Greenhouse and Herb garden with species of herbs from different parts of Iran. Isfahan assets to develop the tourism industry are a lot but this capacity has been underused.

Some recommendations are also given for water management in household sector, industrial sector, tourism sector and environment sector.

Households Water Management

Humans use more than half of all accessible water runoff. Less than 10% of total water use is used for domestic use. Households are the smallest consumers of water, but have a large potential impact. Household water consumption is the largest growing segment (upwards of 80% over the next 25 years). Household water usage is a testing ground for developing the strategies and social behaviors necessary to reduce water consumption in agriculture and industry. Reduction of water usage can lower individual costs, lowers individual expenses for energy, lowers the demand for the renewable water supply systems and facilities as well as for costly water treatment facilities and can improve water availability for other uses. It's estimated that the growing number of citizens connected to the drinking water supply system will increase water demand by approximately 25 % to 450 million m³ in 2025 (Mohajeri, et al., 2016). Reducing the current level of water consumption and reducing of network leakages should be promoted in Isfahan. In the survey done by the author more than ninety percent of citizens did not know how much water use optimization equipment would reduce water consumption but would agree to install these kind of equipment at their home. About 30 percent of all household consumption is in the bathroom. Most of the drench shower heads are wide at Isfahan residents' home for aesthetic reasons. Reduction

of water consumption intensify without affecting on system performance is one of the way for reducing water usage. For this purpose, it is possible to take advantage of the water-saving shower heads or installing water flow limiters on the water inlet flow path at home. Water-saving shower heads can reduce water consumption during bathing by up to 70% without changing the pressure or velocity of the water outlet from the shower head (Isfahan Water and Wastewater Organization, 2019). In order to reduce water consumption, water use optimization equipment is being provided to applicants in Isfahan province and its cost will be deducted in the water bills in the long term. Consumption-reducing equipment can easily reduce up to 30% of household consumption and is recommended in light of drought conditions (Isfahan Water and Wastewater Organization, 2019). All the subscribers can register their application by visiting Isfahan Water and Wastewater Organization website and after necessary evaluation by the province's water personnel, necessary home appliances will be delivered and the subscriber can pay for it in cash and or pay in installments for up to twenty-four months in a water bill.

Kitchens use water for washing and preparing food, thawing food and cleaning dishes. Changing cooking methods, using efficient dishwashers and pre-rinse spray valves with smaller nozzles to achieve higher water fast, use of boiler less food steamers and efficient ice-makers, as well as flow control regulators in the sinks and basins can significantly reduce water usage while being highly economical (Smith, Hargroves, Desha, & Stasinopoulos, 2009). Buying newer energy and water efficient washing machines can consume up to 20% less water. They are more water and more energy efficient. Old dishwashers consume 60 liters of water per load. New dishwashers only use 10 to 20 liters and can be more efficient in terms of water saving compared to hand washing. Creating incentives in terms of economic tools and standards and restrictions can be very difficult when the results are not felt by the user. Behavior changes have the potential to halve household water consumption, however assuming rational actors, people will only change when it is to their benefit.

Other useful tips are: 1-Regular inspection of equipment or areas where leaks could occur, like pipe-work joints, connections and fittings 2- Check equipment in addition to pipes and hoses 3- Install monitoring or sub-meter systems that alert operators when excessive flows or reduced pressures breach normal ranges 4- Installing water efficient sink faucets and toilets

Water Management in the Industrial Sector:

Since industrial and manufacturing facilities are among the leading users of water in Isfahan, this sector is challenged to implement better water management practices that improve efficiency, reduce water waste, and lower their water footprint. This will not only positively impact the environment but also increase companies' bottom line. Significant improvements will be achieved with effective leak detection, repair of pipes, using more efficient technologies and equipment such as pipes, smart dosage systems, timers, higher efficiency cleaning system and water monitoring. Educate employees and raising awareness among workers in the industrial sector and Set up a Water Conservation Program increase water saving. Similar to Households water

management, changing behavioral patterns is beneficial. Industrial water efficiency can be encouraged by setting tariffs as a water conservation incentive. Industrial reuse and recycling also increases efficiency as it creates a new water source that does not need to be extracted or transported from elsewhere. This in turn reduces costs, energy consumption and pressures on freshwater resources. Mobarakeh Steel Company and Isfahan Steel Company don't need to use water with high quality for cooling purposes. These companies can use treated wastewater either directly or after simple treatment. Successful change of the industrial development in the region is essential: water intense industries like steel industry should turn away to industries that are not depend on water, like the IT sector. Eco-industry parks should be promoted instead of unsustainable industrial settlements.

Water-Saving Tips for Tourism Facilities

All tourist facilities can save significant amounts of water. For example, hotels can reduce indoor water consumption by 30 per cent by installing water-efficient equipment. Where irrigation is an important factor in water use, landscaping can significantly reduce the need for irrigation. For instance, Smith et al. (2009) suggest that reducing water use in landscaping can save 30-50 per cent of water. Measures include installing of water metres to monitor water use, selection of drought resistant plants and grasses, mulching of garden beds to reduce evaporation, installing drip irrigation systems with electronic controllers and humidity sensors, and using rain or grey water for irrigation. In pools, fountains, waterfalls or other features increasing evaporation should be avoided. Pool night covers also can reduce evaporation in hot climates and reduce water consumption. In tourism facilities and accommodation guest rooms, toilets, showerheads and faucet flow restrictors can be replaced with efficient ones. Given the proportion of water use related to toilet flushing, the use of dual flush, reduced flush and dry composting toilets can significantly reduce water usage. For example, the most efficient toilets can use 1 L for a "mini-flush", while in older models to 12 L. recycled water can also be used to flush toilets. Efficient and low flow showerheads can use less than 7 L per minute, compared to 13 L used by older ones. Faucet flow restrictors can reduce water usage by half to 2.5 L per minute.

Golf courses can participate in soil moisture measurements to control and optimize water use (Rodriguez Diaz, Knox, & Weatherhead, 2007), reduce irrigation in excess of what the turf needs; consider specific playing surface requirements (Balogh & Walker, 1992); reduce playing surfaces, i.e. return to smaller greens and more narrow fairways, accept fairways and greens that "pitch" less; change turf species to less water demanding or salt tolerant ones (Smith et al. 2009); use grey water or purified water for irrigation, and stop watering when and where it is not necessary (Hawtree, 1983).

Reuse of wastewater have been advocated as the best technological options for arid region destinations. Many tourism stakeholders are likely to perceive adaptation to climate change as being less costly, given that they only deal with direct operational costs (Gössling, et al., 2012).

Consequently, it is important for Isfahan tourism stakeholders to know that the overall costs of inaction are far greater than the costs of technical adaptation, as they may irreversibly affect important tourist assets and create unstable socio-economic situations.

Water Saving Tips for the environment

The core values of sustainable development are environmental protection and justice. The examples of bad environmental management are easy to find in Isfahan. Grassy lawns are not suitable for Isfahan climate. The Isfahan parks, with their bioregionally inappropriate English-style grass lawns, were the brainchild of certain city officials with connections to the landscaping business. In Isfahan, in summer months, city gardeners water grassy park lawns during the scorching mid-day heat, against the dried up river bed. Someone in Isfahan can even see a gardener using his watering hose as a spray to clear the lawn of fallen leaves, instead of using a rake. Hoses and faucets running full force into the ground, sometimes every hundred yards or so. When the wells dry up, the preferred solution is simply to dig a deeper well and get a larger pump. In the past, local politicians have thinned out the trees [which retain moisture and limit erosion] all along the bank of the Zayandeh Rud River, for the simple reason that they feared children would get lost in the woods (Foltz, 2002)

According to one environment expert in Isfahan, To save Isfahan from drought, green spaces should be expanded more. Unfortunately, instead of looking for a solution in the administrative system, we often wipe the face of the problem. When confronted with water shortage, we simply deprive the city of green space. While all beings on earth and humans need oxygen to survive, so we must look for a solution. Isfahan officials should move to planting plants that need less water and then limiting water use by using new irrigation technologies, the expert said. Isfahan is prone to the growth of "C4 Plants" due to the excessive heat. The importance of urban green space is no less important than agriculture. Certainly, urban green space should be taken into consideration after drinking water and before paying attention to agriculture, especially in the current situation.

Chapter 6. Conclusion

Solutions to overcome the water problems of Zayandeh Rud Basin are Integrated Water Resource Management, Extraction Control, Wastewater Treatment and increasing knowledge in this regard, Renovation of the Irrigation Network, Completion and Development of Irrigation Canals, Improvement of Irrigation Methods in accordance to regional and native characteristic of the area, Water Tariff Modification, Greenhouse Planting, Cultivation of drought resistant plants in all the sectors and Optimal consumption in all consumption sectors, including agriculture, drinking and industry, Technology evaluation for the implementation of technological innovations for water-saving, water production and water supply (for example by the use of the regional solar power potential), Regular environmental audits, Private sector involvement, Understanding of various water resource problems. In sum, Diversify the economy, Adapt to the new situation, Raise awareness and Empower the farmers are the most important strategies in Isfahan Province.

In order to adapt to inevitable changes in water availability, as well as to mitigate its own contribution to climate change and its pressure on limited water resources, tourism needs to engage in energy and water management, focusing on policy (e.g. compliance with national greenhouse gas reduction goals, building codes, measurement and charging of water consumption), management (for instance, including measures to reduce water consumption, treat sewage and reuse water), research and development (e.g. to implement renewable energy-driven desalination; understanding the religious, philosophical and ethical issues of wastewater recycling and reuse), as well as education and behavioral change to encourage tourists and staff to involve in water-saving measures. Most of the measures that can reduce water usage are economical and that investments to ensure sustainable water use will help to secure the future for tourism. Therefore, Investments in sustainable technologies and water conservation management are key strategies to be followed. However, strong policy environments are required to achieve this goal, including the widespread use of economic incentives and appropriate water pricing to encourage water conservation.

The scarcity of fresh water resources is one of the major problems in Isfahan province and it requires a long-term and thoughtful planning system appropriate to the conditions and capacities. Consideration of preparation (i.e. distribution of activities, resources and population) is also very important. The preparation should be commensurate with the capacities. Those who are currently in charge of affairs lack a well-developed and systematic way of responding to Isfahan's problems and do not use the opinions of experts. On the issue of water, the most important issue is population distribution. The population distribution of each area must be regulated by the need to conserve the aquifers and water resources. For example, there are now about 5 million people living in Isfahan province, with over three million people living in the Zayandeh Rud basin, central Isfahan, with a very high density. Policies should be such that the population of the region does not increase. However, the future of Isfahan is worrying. What we see now is an example of Isfahan's frightening future, if not thought of.

6.1 Further Research

There should be further research on the impact of water deficit on Isfahan tourist attractions (it has to be checked how much the water deficit has decreased the number of tourists), the impact of water deficit on infrastructure needs to be studied more (its impact on transportation services, health services and security of the city).

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