“The Iranian Underground Water Supplies from Perspective of Log Book Writers in Safavid Age”

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INTRODUCTION

Springs are some of the primary water supplies on the ground, which have been used as the simplest tools for exploitation from underground waters. During the periods of drought in some parts of Iranian plain where there is no access to spring, some other techniques may be employed of which one can refer to invention of aqueduct and well. Aqueducts are excavated as some canals in the horizontal gradient on piedmonts and long with wells they have many uses including irrigation of farming lands, fresh water supply, cultivation of deserts, and working of watermills etc. From the log time, water in these resources has been directed by Iranians to houses and especially the gardens in order to create a viable place for living at the heart of dead deserts.

These vital arteries have been developed later particularly at Safavid age in order to create a suitable environment for life, living, and amusement. For a long time, European travelers looked at Iran as an old and ancient land and suitable for their trip and wrote Iranian events and accidents, especially during Safavid dynasty that was the peak point in establishment of Iran’s relations with other countries. Among the subjects related to Iran and Iranians, water supplies have been one of paramount and most vital issues, which have drawn attention of tourists during Safavid age and they have allocated the major part of their log books to this subject.

2- Attitudes of historians, writers, and explorers before Safavid dynasty:

In all ancient and Islamic periods of Iran, water has been assumed as a precious and significant element before Iranians and its importance and methods of its uses, construction of canals, preparation of potable water, excavation of aqueducts and culverts have caused many historians and authors to write valuable subjects in this regard.

One of the historians from ancient era under title of “Polybius”, who was typically a Greek narrated about some aqueducts in Medes land during the battle among Arthaxerex III (Parthian king) and Antiochus (Seleucid...
king) in 209 BC: “There is no water on the ground in this area of this country; although, there are many underground ducts each of them includes a lot of watercourses wells” [21].

Abu Ali Ibn Rasteh, Arab historian who had travelled to Iran in early Islamic period (290 Hegira/ 903AD) explains about Isfahan water supplies which were derived from Zayandeh-Rood (river) that its water penetrated into ground strata and also about the watercourses, which have been certainly aqueducts [20].

“Gardizi”, a historian, wrote about the importance of water and irrigation in (224 Hegira/ 859AD): An earth quack took place in Khorasan and many houses were destroyed. The inhabitants of Neishaboor city referred to Abdullah Taher (Caliph) to address affairs concerning to culvert but if there was no related subject in jurist books and Holy Prophet (PBUH) tradition so Abdullah invited all jurists from Khorasan in order to write a book about aqueducts and they called this book “Qena (Art of excavation of aqueducts)” and all instructions about aqueducts are based on this book [4].

Abureyhan Biruni, as one of the famous Iranian authors, in book of “Asar Al- Baghiye” writes about fresh water springs that: The water is erupted in this springs and climbed up to the top because the reservoir of water is placed higher than the springs otherwise water never goes up unless its supply is located higher than it [1].

Moqadasi, a historian in tenth century (AD) describes Kerman and Shiraz very well and says: There are a lot of gardens in Kerman that are irrigated by water from aqueducts and drinking water is extracted from the well and Shiraz is an ancient and wide and cultivated city with excellent gardens and water- abundant spring courses [2].

Regarding water extraction in Kerman, Ibn Fqih Hamedani tells: One of Iranian kings invited a group of philosophers and ordered to settle them in Kerman. Kerman was a land in which the well had no water up to 50m depth underground. The scholars drew the plan to extract water in order to bring water onto the ground and then they plants trees so that all lands were covered with trees in Kerman and as a result Kerman included a lot of trees, watercourses, and springs. Also, people trained that plan from them [4].

In 740 Hegira (1339AD), Handullah Mustofi recalls about culverts in cities of Tabriz, Gonabad, and Ghayen: Tabriz city includes a lot of gardens and water of Mehran-Rood (river) originates from Sahand Mount and nine hundred and a few culverts which the wealthy people have constructed are consumed for those gardens. Water is supplied from culvert in Gonabad city and this culvert is 24’000m long and its well is approximately 700m deep and it provides water for some other places and in this region water is supplied by culvert and most of these culverts are deep and their course moves from south to north direction. Ghayen is a big city with firm fortress and several water culverts are placed inside this town (ibid: 54). Similarly, in book of Nachat Al- Qulub, he describes high land of Hamedan that was irrigated by 1600 mountainous springs originated from Alvand Mount. The water from these springs has irrigated gardens and outskirt of Hamedan City and it has provided the excellent crops and fruits for that area [8].

Naser Khosrau Ghabadiani writes about aqueduct in Neishaboor city: In Neishaboor that is located 210km distant from Sarakhs; there is a large plain which is irrigated by Sangoor River. Aqueducts feed the city and all of them are underground. It is narrated that in order to complain about people in Neishaboor city, an Arab man has said: How beautiful city Neishaboor was if these aqueducts were on the ground and inhabitants of this city lived underground! [20].

As a world explorer in Teimurid Dynasty, Marco Polo entered Iran in 1300 AD and in his log book, during his trip to Kerman city and to Kubanan area, he introduces there as a wild and poor region and says: “Three days after leaving Kerman and moving this path we entered a desert in which there was no river, brook, and water. We reached to a fresh water brook in fourth day, which flowed underground and there were some cavities within some of its parts from which water flow could be seen.”[22].

3- Attitude of world tourists in Safavid era:
3-1- Log book of Adam Olearius [3]:

Olearius was the secretary of Holstein (Gottorp) in Germany and he came to court of Shah Suleiman Safavid King along with a delegation from Holstein in order to expand political and commercial relations and during his residing in Iran, he has expressed exactly and exhaustively what he had seen in Iran and after returning to Germany, he has written his log book and published it in 1654 [3].

Regarding the method of exploitation of water for farming lands in Iran, he explains: “Iranians are well familiar with method of extraction of water from the mountain. They collect the mountainous spring water into a duct with maximum two forarmns (unit of length in Germany about 60-80cm) and flow it into piedmont and thereby they irrigate farms and gardens. Whereas there is a shortage of raining in Iran thus the lands are irrigated in such a way that they have prepared some farming plots with area of forty to sixty square meters along with each other and they have created a small water block between each of these framing plots so that after opening the brook water, these plots are irrigated subsequently.” (ibid: 250) According to attitude of Olearius, Ardebil city is one of the most beautiful cities in Iran. This city includes the greatest mosque, which is situated on the top of a hill approximately at the middle of city and with high and lofty minarets. He says that most of people are going and coming in this mosque and there is an aqueduct on its opposite side, which has been excavated by
the order of Sara Khajeh. The water of this aqueduct has originated from one mile distance at southwestern side of the city and water has been guided from here through underground watercourses into the city. The people, who went to the mosque for prayer, already wash their own with water from this aqueduct (ibid; 122-123).

Following to his trip, he went to Qazvin city and described aqueducts and iceboxes of this town: “Qazvin lacks any spring and water should be brought to this city by aqueduct from Alvand Mount and guided toward water storages and they can exploit it under necessary conditions. Qazvin includes a lot of underground iceboxes in which ice can be stored in them during summer. When the hot weather pressured on us, we went to these glaciers and made us cool” (ibid: 154).

Olearius adjusts the water supplies in Kashan city to remarks from one of the other explorers and says: “I confirm the authenticity of remarks of Cart Wright, a British man, who wrote that people of Kashan lack fresh water springs and they had to extract deep wells to achieve water while this activity might be rarely done during period of our residence there and some amount of water had been directed to the city through underground water courses (the author meant aqueducts) (ibid: 167).

Zayandeh- Rood (river) was one of the attractions of Isfahan city based of viewpoint of Olearius who assumed beauty of the city was owed to it and it is located at southwestern side of this city and some brooks are branched from this river, which flow into some water raining reservoirs called pool and pond; although, there is water well in yard of houses. It may be noted that Sanson, a Christian missioner, who resided in king Abbas’ court for a while, has described Zayandehi-Rood River like Olearius, and he illustrates: “Zayandeh-Rood River bed is very large and a pile of stone and rock that is brought from its resource mount may cause change in river bed. In winter season, Zayandeh- Rood River is greatly beautiful but whereas it is the only supply that provides water for Isfahan plain the people separate several brooks from this watercourse and those ducts are divided into small rivulets for irrigation of lands” [9].

According to opinion of Olearius, the technique of preparation of ice in Isfahan and the facilities for its storage is very marvelous. Based on his remarks, Isfahani people have iceboxes underground that they use them in summer. He says the icy condition and snowfall is rare during winter and degree of coldness is so lower that it may create ice with diameter of a finger but about noon this ice is melt again nevertheless they could prepare ice with a half of a forearm unit (30-40cm) in this way: They cover a gradient land plot with pavement in a cold place toward north and during icy weather during the night, they flow water on this pavement and thereby an ice layer with about 30-40cm diameter forms during an icy night. The next day, they cover the place before sunlight warmth penetrates into this area and they continue this activity the next night. When the diameter of given ice layer became too thick they crush it and use it during summer (ibid: 246).

3-2- Log book of Jean Batist Tavernier (1605-1689):

Tavernier is one of the great French explorers, who came in Safavid court more than nine times and his trip took place during the monarchy periods of Shah Safi, King Abbas II, and king Suleiman. In his log book, Tavernier has explored deeply all the subject of that era, beliefs and customs of Iranian people, wars and disputes, crafts and professions etc [5].

Concerning problems of water in Iran, he says: The subject of water is crucially important in Iran; the underground canals and brooks are still used and Azerbaijan may cry in sorrow of its lost springs. There are few rivers in Iran but there are numerous culverts and the people flow the water by these culverts. Iran is a country that might not have any crop if the canals from these springs did not irrigate its lands [20].

He describes one of the rivers in Tabriz city that there is a sepulcher near its bank and Iranians supposed that it belongs to sister of Imam Reza (PBUH). The water of this river has originated from the northern mountains and it is poured into Uroomiyeh marsh and it is called Ajq Su or Ajy Chay (i.e. Talkheh Rood River) and it includes the water with the worst quality and even there is no fish in this water. According to his remarks, a piedmont is seen outside this city that contains a lawn ranch and a few springs flow there and their water are expanded as they moves away from this region and they irrigate the surrounding lands (ibidem; 71&72).

In his log book, Tavernier has illustrated water as an element for washing and ablution and he writes in this sense that there is single hill at southwestern side of Shiraz where a plateau is seen around it and several springs have flown on its northern piedmont that make up a river. There is a temple on top of the hill with several embossed reliefs and worshipers of these idols first go into the river and then perform ablution for prayer (ibid: 663). Tavernier explains about dervish’s huts, which are located outside Shiraz city on the piedmont of a mount that is called “Pirhuno”. What it has adorned their hut, are beautiful trees, which have been planted there and also a big spring that irrigates surrounding gardens. There is a large aqueduct near the houses of dervishes that encouraged Imamgholi Khan to construct a garden on this place. For this reason, Imamgholi Khan created fences and walls around this land and planted trees and gathered many animals there for visiting people (ibid: 666). Based on Tavernier, there are many numerous watercourses (storage) in Lar city and some people comment in this regard that the more numbers of water courses exist, it is better. He says: When it rains, the people block the pores and cavities of these water courses in first day and do not allow water to enter them. After one day, when it rained and washed the pollutions on the ground then they direct water to watercourses.
The process of division of water is very systematic and routine in Lar as well. They never open more than three watercourses at the same time and at the time when the gate of watercourse is opened the ruler or his trustee should be present there (ibid: 676). Based on Tavernier’s view, sea waters are very poor and hard in Persian Gulf and inhabitants in Persian Gulf acquire fresh water by a very odd method. Those ones, who want to extract fresh water, have employed some particular frogmen, who submerge into the middle part of sea and they fill some pitchers from the water out of the bottom of the sea and bring it up to the sea level and that water is fully fresh. He writes in other point that: At the banks of Oman Sea and Indian Ocean where no fresh water can be found, when sea water retreats on the ebb, the women took their pitchers and approach to the water and after digging the sands they bring the water within these sands by a small vessel and fill their pitchers and that water is very fresh [1].

3-3.- Log book of Pietro Della Valle (1586-1652):

Pietro Della Valle was one of the Italian gentlemen, who decided to travel to the east in 1614 and he added the nickname of “Il Pellegrino” (literally pilgrim) to the end of his name. On January 4th 1617, he travelled toward Iran and entered in King Abbas. His log book is one of the most interesting log books in which he has embedded all the observed scenes with unique accuracy and care [7].

In his visit from Ardebil city, Della Valle observed many brooks, which have been branched from the flowing river out of the surrounding mountains and saw the amply abundance of water in this city that he reminded of Venice city. He explains about the kinds of fish in these brooks and he said these fish also existed in Egypt but peoples in both countries had been deprived from eating them. He did not refer to reason of this deprival for eating these fish but his reason might be the same as what Figueroa had mentioned since Iranians assumed eating of these fish as religiously inhibited. The Ardebil brooks are much more abundant with water according to Della Valle opinion but they will be filled with amply water in winter and for this reason several bridges have been built over them [7]. Similarly, regarding fresh water in Tehran, he implies: Tehran is a great city and larger than Qazvin. The city is fully covered with great gardens. This city is located on the road to Firoozkooh city and its streets are irrigated with several water ditches, which are extraordinarily numerous and these wide and narrow and short and long brooks are employed for irrigation of the gardens (ibid: 229).

In his log book, Della Valle has referred to water supplies in Iran less than any other subject and according to author’s idea, the intention of Della Valle for traveling to Iran has affected on this issue. The political issues and problems concerning to Christians and Muslims were some of the most major reason for traveling of Della Valle to Iran and this has caused him to pay less attention to other issues and cases in Iran. But, Iranian gardens, especially gardens in Isfahan and Behshahr, he has mentioned several interesting issues, which will be discussed in the given chapter.

3-4.- Log book of Jean Chardin (1643-1713):

One of the French great figures and gentlemen is Jean Chardin, who came in Iran six times during Safavid dynasty and he acquired a great position before King Abbas the Great and his was nicknamed as the Merchant “Tajerbashi” there. His log book is one of the most detailed and comprehensive log books, which have illustrated Iran conditions and situations well [12].

Chardin did not suppose any people more skilful than Iranian in recognizing underground waters and in operation of water extraction from depths of earth. He has divided Iranian underground water supplies into four classes. Two first types include springs and rivers, which flow on the grounds and two later groups are wells and aqueducts. According to him, the process of extraction of aqueducts and utilization from their water is in this way that initially a well is excavated on the piedmont and then after achieving water, they guide this water to the lands by drilling several wells and connecting them together through underground courses [10].

In his log book, Chardin also refers to bull power in extraction of water from wells and says: Iranians bring up well water by force of ox and bull and they make some bucket of leather. The ox brings up the water filled bucket with a firm rope that is twisted around a wheel and pours it into a pond that located completely near the well and then this water is led from the pond toward farming lands (ibid: 861). According to Chardin viewpoint, the technique of irrigation by water from spring and rivers is very interesting and he says the irrigation is done by these two supplies based on weekly or monthly need in such a way that they put some copper vessels among of which there is a small hole at their bottom on the canal that leads water to farming land. The water enters from this hole into this vessel gradually and it is filled at certain time and then submerges into water. The person, who is in charge of dividing water portion, exits vessel out of water and makes it empty and again puts it on the water to repeat this operation and it lasts two or three hours in average in order to fill the empty vessel with water and submerges and thereby the period that requires for farming irrigation is measured (ibid: 862). In his log book, Chardin explains about method of production of Ice that: Ice is sold in the areas outside the city and outdoor regions and it is produced in this way: A deep pit is drilled in a yard toward north and several square ponds with dimensions 16-20 thumbs (40-50cm) are provided like basin on its opposite side. Afterwards, these basins are filled with water to the top at the evenings and they are completely frozen at mornings and they
break this ice with gardening saw or rake and divide them into parts and store all these parts in the given pit. Then these square basins are filled with new water and they spray with water on ice parts in the given hole at the evening in order to stick better together. After 8 subsequent days of working, icy parts with 5-6 feet result and then at night they gather the local people and with crying and happiness while they have torches in their hands they go down into this pit and crush ice packs and the ice fridge is filled with ice during a week. After filling Ice fridge, they cover its surface level with a type of sea sedge (reed) that is called “Butomus Umbellatus” and extracted besides the waters [17].

3-5. Log book of Don Garcia Figueroa (1550-1624):

Don Garcia Figueroa was a gentleman from Ferpa dynasty, who was born in Zafra city from Badajoz province in Spain in 1570 and he was courtier of Phillip II, Spain King. He was dispatched as ambassador of Phillip III to court of King Abbas the Great in Iran at age 57 in 1614. His log book is one of the most reliable log books during Safavid dynasty [16].

Figueroa travelled to Iran through water voyage and via Persian Gulf and he firstly entered Hormuz Isle. He illustrates his observations about wells and watercourses in this isle as follows: There is a round and high hill in Hormuz isle behind of which there are some of ruined towers where the kings had used those turrets. There are several brooks throughout this isle, which their water is contaminated with salt and it has no drinkable water except a few more or less salty runoff water wells. But if it necessitates, the water of some springs can be drinkable, which emerge upon sea ebb. There is a plain among city and mountains, including some watercourses, which filled and locked with rain water. The rain water that stay and is settled in this watercourses is a unique and much better than well waters; although, it is not equal to the water that is brought from Qeshm isle or land in terms of drinking quality (ibid; 48-49). According to Figueroa’s remarks, the techniques of water extraction and irrigation are similar in Iran and Oman. Before his trip to Iran, he had travelled to other littoral states in the Persian Gulf including Oman and expresses his observations as follows: What it caused our surprise in Muscat city, were the efforts of farmers, who told the soil is very shallow here and by excavation up to two or three feet they may encounter the rock. They irrigate garden ground by a well and whereas this water was very fresh and healthy therefore it was not consumed only for irrigation of orchard but it was used for drinking as well (ibid; 31). In other point, he mentioned a place called “Turobnak” locating on Hormuz isle in and this place is situated at southwestern side of this isle and since it had been as pavilion for the former kings in Hormuz isle and many types of trees have still stayed in this garden including palms. The reason for nominating this area is the existing two big wells, which are called Turobnak wells under title of this region. Based on Figueroa’s opinion, water of Turobnak wells is better and less briny than other wells. He says there is watercourse in the pavilion that is filled with waters from wells or Small River that flows from the adjacent mount. The water of this river is less polluted with salt compared to other rivers, which irrigate the eastern and northeastern side of Isle (ibid; 50 & 51). The special water taps for people in Hormuz city are very interesting and marvelous based on Figueroa’s opinion: In Hormuz Isle, the people store water in small and big bushels and tar-coated wooden boxes, which are called Estakhr (pool) and their capacity is about 2000 water taps (ibid; 419). After leaving Hormuz isle, Figueroa travels to Lar city and explains about salty water in Lar springs and claims that he lost enjoying water with leaving Hormuz Strait as well. He explains about a caravanserai in this city and its watercourse and method of water extraction by Arab from the well that: I saw one of the newest and beautiful watercourses near Kaji caravanserai that included some cool and fresh water and no water could be more fresh and colder than it. Since some sludge may be settled at the bottom of these watercourses when water is extracted under these conditions thus Arabs have invented a technique and they selected a part of round and polished leather with about two feet diameter and provided some holes around it. A rope is passed through these holes and they fasten some yarns within the interval among two holes on this rope and thereby while watercourse may not include even more than a foot of water they could extract transparent and clean water without smirching water with sludge (ibid; 71 & 72). Tang Dalan caravanserai is one of the large caravanserais in Lar city and it includes two watercourses and it water is provided by means of handmade duct that enters caravanserai and Figueroa introduces its water as one of the Iranian waters with best quality. According to Figueroa’s remarks, after rushing into the valley, the water of this mountain enters in an underground passage and then it is poured into a desert with more than eight kilometers width after departure and it is divided into several canals and irrigates some land plots (ibid: 80). Lar city includes a relatively large canal that wealthy people and rulers of this city and even ordinary people have typically entered water from this canal into their houses and consumed it to irrigate their gardens. Based on Figueroa’s declarations, people enter this water into their homes in order to accumulate it into pools and creation of water fountains for their landscape that made up the major part of their entertainment. He declares that well-to-do have exclusive watercourses and some pious and virtuous people in their will recommended construction of several watercourses as charity from their endowments, which are small or big ones proportional to holiness and wealth of the testator (ibid; 90).

Figueroa describes another watercourse that is like a cross and water flows together from its vertical and horizontal bars. Without considering the predicted space for its chamber, each of bars in watercourse included
center and place of intersection with 50feet length and 15 or 16feet width and 3 cubits (135cm) depth and its water was very transparent and cool (ibid: 99). The beauties of landscapes and ranches which are located on Lar-to-Shiraz road and paddy, barley, and cotton fields as well as fascinating palm gardens have not been hidden from sharp and shrewd eyes of Figueroa. According to his remarks, the large aqueducts from which several canals are branched and irrigate this plain that have doubled the productivity and greenery of this location. He says that water of these canals not only irrigates paddy fields and palm gardens but they rotates several mills in their course as well (ibid: 104). In his visit from Shiraz town, Figueroa called it as tame land or smooth city. From his view, although Shiraz has been situated between mountains and river and Fasa Bridge and like Lar State it is arid and dry, it includes many water courses (i.e. the same as aqueduct, according to author’s view), which have fresh water. He says: On of Assyrian kings, called Jamshid, has created beautiful springs by cleaving and cutting great mounts among the city and thereby he irrigated throughout Shiraz. Likewise, he praises marvelous efforts made by Jamshid and says: The large aqueducts, which originated from Chehel Manar Mount along with other brooks, enter Shiraz in which very transparent water flows there. There is a very old mosque along the path of this brook and Shirazi people respect this area because it includes the tomb of one of the religious great figures. There is brook that flows in canal of the deep aqueduct under the yard of the mosque and it creates a square pools that filled with transparent water at its frontage and includes big and small fish (ibid: 143&144).

After leaving Shiraz toward Isfahan, Figueroa observes very eye-catching landscapes and beautiful rivers and springs and from his viewpoint this path may create hilarity for wayfarers and passengers in this course. Figueroa says: There is a river around this area that Quinte Curce (Roman historian) and Strabon (Greek historian) introduced it as Aras River and it is currently called Band-E-Amir today. According to Figueroa’s remarks, the width of this river is very similar to Xenil River in Spain. He says, people purpose paradoxical claims about this issue and some of them say this river passes through the Isfahan- Kerman road and some other tell that this river passes through the Karamani plain among Kerman and Pasargad that links to Persian Gulf near the Hormuz Isle. Anyway, what is it important for Figueroa, is irrigation of the adjacent lands and plains to this area by water from this river and because of fresh water of this river the farming crops and abundant citrus from this area can be compared with citrus in Valencia, Spain (ibid; 169-170). There are some villages called Ujan and Asepas, which are situated after Marvdash city and Figueroa has resided in both locations for some period of time and they include beautiful rivers and springs, which their water are consumed by caravanserais and water mills from these two counties, but according to Figueroa, drinking water of Asepas River may very hazardous. He argues that although this water seems to be transparent and good, the type of land strata out of which water flows, is inappropriate and risky, especially due to its adjacency to the sludgy river that creates bad odor in weather of all surrounding areas (ibid; 193, 196). When had resided in Ghomsheh city in a caravanserai titled Hies-de-Gas near to Isfahan, he saw some water ducts, which separated from the average rivers and brooks and they were crossed with valley from different points and created productivity for the surrounding regions. In some other points, he explains about aqueducts and pits, which their waters were provided from farther areas so these regions might not be irrigated without aid of these aqueducts (ibid; 199 & 374). Figueroa says: having leathery case for storage of potable water is necessarily a requisite in areas with shortage of water like Lar, Shiraz, and Isfahan. Following to his remarks, he referred to this point that Iranians and Arabs habitually fasten a belt to their saddle horn of horse or mule for trip all seasons of the year and hang some leathery cases full of water to this belt under the trunk of the given animal. The water inside these cases remains cool and cold due to continuous movement of animal. This form of water transport is so routine and old especially among Iranians that Strabon has also narrated it in this way (ibid: 375). After arrival at Isfahan, Figueroa observes a river (i.e. Zayandeh Rood) that separated two immigrant-dwelling townships of Jolfa and Tabriz and there is a very beautiful road with 1500feet length and 100feet width at shoulder of this region. According to his remarks, a ditch or water duct with twelve feet width and 6feet depth divides the road into two parts and some of very beautiful gardens are located at both sides of road with pine trees which lead to a pretty bridge. This bridge is one of the best Iranian architectural works and buildings constructed by Allahverdikhan, who built it at his own incurrance. He says bed of Zayandeh-Rood River is shallow but it is very wide and it can be guessed that volume of its water is the same as Xenil River in Spain (ibid: 221). After departure from Isfahan and moving toward Kashan and Qazvin, Figueroa is led to a garden that belonged to one of Safavid Princes and it was called Emamzadeh Garden. He assumes that drinkable water in this region and surrounding Kashan is only extracted from well and he introduces its water as good and sound. More than introducing and review of watercourses, ice boxes, aqueducts, and methods of ice preparation and their storage and types in various tropical cities in his log book, Figueroa has paid more attention to landscapes and ranches and techniques of irrigation of under-cultivation and farming lands and wherever he has observed productive plains and fruit gardens and treed roads in his traveling path, he has described them along with flowing and current brooks and rivulets.
3-6- Log book of Gemelli Careri (1651-1725):

Gemelli Careri was an Italian tourist, who came in Iran during monarchy of King Suleiman from Safavid Dynasty in 1664 and then participated in ceremonies of coronation of King Sultan Hossein. According to his remarks, one of his great wishes was traveling to Iran and he has forgotten all pains and difficulties of traveling after he succeeded to take this trip. The main title of his log book is “Voyage round the world” which the chapter of trip to Iran from this book has been translated [12].

Tabriz was the first Iranian city that Careri entered in. At the beginning of this arrival at this city, he explains firstly about Mehran-Rood River and introduces it as Shin Chay (the other name of Mehran Rood) that is passed through the middle of Tabriz. He says: This River has amply and transparent water and sometimes its water is flooded and influences the down part of the city by its waves. Rather than the presence of Shin Chay River, Careri assumes that beauty of Tabriz city is owed to transparent springs which flow at the margins of this city and some of them also provide the drinking water for the houses. But he says that people of Tabriz have to go down some steps lower to use this water from these springs [18]. One of the beautiful monuments, which have drawn attention by Careri, is a watercourse that was located along with a covered market and this market has been built by Mirza Sadegh khan as deputy of Azerbaijan ruler. According to his remarks, this watercourse includes a brick dome and a pool is linked to it from outside. In winter the people crush the ice in this pool and pour it in store and keep them for summer (ibid; 33). Following to his trip, Careri goes to Mianeh as one of the other cities in Azerbaijan and introduces it as a very verdant plateau with very beautiful mountains and bridges. According to his observations, a river flows in this city over which Si-Cheshmeh (thirty springs) Bridge has been built and only six springs of them had remained at the time when he has visited there. Careri says: There is a mount called Kaplanto (Ghaffankhooh) in that area with a very long piedmont and it is led gradually to Qezel Ozan River and Si-Cheshmeh Bridge has been built on this river. After passing through Gilan State, which its water was consumed through numerous canals for farming, this river is poured into Caspian Sea (ibid; 44). Careri explicitly claims that Iranian could not live in villages where there is no flowing water therefore he supposes the greenery and verdancy of Persian villages are owed to current flowing waters. He expresses about the watercourses which are located in path of his trip that some of them have been embedded at the heart of plains and some others are constructed along with caravanserais and or inside them while water is a bounty for passengers that it quenches them. One of the hydraulic buildings, which have been extremely noticed by Careri, is a great dam that was located at six miles distant from Giaivarabad (Ghayoorabad) caravanserai at Kashan. He declares this dam has been constructed by King Abbas II in order to provide urban water when springs of Kashan are dried. This dam approximately has 100feet length, 30feet width, and 50feet height. Rain water is accumulated behind this dam and its water is provided by seven springs at its downstream and it is used to the needed extent (ibid: 59). After entering Isfahan, Careri visits from its beautiful gardens and description of them will be purposed in chapters of gardens in details, but he simply illustrates Isfahan city as follows: Isfahan was not only a county when Persian kings set Qazvin and Soltaniyeh as capital but after conquest of Lar and Hormuz, King Abbas selected Isfahan as capital due to its appropriate geographical situation and highly contributed for cultivation and development of this city and abundance of water and building several canals in Zayandeh-Rood River. Similarly, he says about landscapes of Cheharbagh Street: A very beautiful market is located in the path of Jolfa and Cheharbagh Street is situated after it. A big edifice has been constructed at the end of this street that it includes balconies from outside, which have been prolonged inside king’s court. A water ditch has been built from engraved stone at the middle of this street and its water is provided from an aqueduct and this aqueduct fills four other pools along with this street and some motley fish are swimming there (ibid: 62&67).

4- The presence of water in Iranian garden- building art:

The garden-building art is one of the ancient Iranian arts, which possesses especial value and according to attitude of oriental people, it is an allegory for Eden Paradise and fascinating place for human’s attachment to earthen nature. Arboriculture (garden decoration) is deemed as a marvelous phenomenon in terms of symphony and harmony in Islamic architecture and it has been embedded in a uniform and systematic texture and cross point of passages, which include life and verdancy within their own range [13].

In Persian poetry and literature, some concepts like garden and flower, Paradise and Garden of Paradise (Rozeh-E-Rezvan), High Eden, Eram Garden, life water, and hundreds of other allegories have identical and mixed synonymy with the nicknamed paradise and garden of nature and as the Eternal Shiraz Poet expresses:

Oh Hafez, High Eden is my inherited domicile:
In this ruined abode then I never reside (ibid: 199):

So with their nature and predominance of freshening elements, garden may convert the hot and cumbersome condition of environment into a haven and safe shelter for human and display the distinct manifestation of life of earth and plants and physical and spiritual life for its creator. With its symbolic concepts of elements and form and certain geometry, garden is a memory and image and sign of spiritual life for human.
This life and thinking about life is not possible except with water [2]. According to Greek historians, several gardens have encompassed the Persians’ houses, which were called Pardis and this subject has been mentioned in Dekhkhoda Dictionary. We can also see this term in Avesta that is composed of two parts: one concept is “surrounding” that means accumulation and building walls and also the latter meaning refers to horticulture and arboriculture around the building [11]. It has been narrated about pre-Islamic gardens that Cyrus the Great was the first person, who emphasized on planting trees trough ordered rows and plots. The image of trees on steps of Jamshid’s Throne and signs of irrigation in some points of this object might refer to importance of garden from Persians’ point of view (ibid:131). Water plays the paramount role in formation of Persian garden as well as trees and plants after water where the stream of their presence stems from the water as well. Water forms character of surrounding environment in garden. Gravity of earth may be symbolized in expression of brooks and water fountains and water current guides human in garden space [14].

In Persian gardens, water is not only presented for irrigation and fascinating eyes but with its motion and rotation has also referred to freshening of environment rather than display unity and unification of life (Aminzadeh; 2004:155). It has been tried in Persian gardens that not only water is not wastefully consumed, but also it may be utilized in various forms. To do so, Iranian artist embeds water in ditch, water flues, water spouts, fountains, and pools in order to increase humidity of atmosphere rather than creating a gentle sound [6]. Waterwheels, waterspouts, aqueducts, culverts, water ditches, brooks, and watercourses and water distributors were used to provide water; for example, Dolatabad garden in Yazd was irrigated by an aqueduct with 60km length and it has detailed endowment title (ibid; 116). Water in gardens and especially in garden pools has been noticed and praised by Iranians due to its opaqueness and reflection. Water sound has been always pleasant and favorable for Iranians. Construction of garden in gradient lands has caused creation of water ditches from which water was poured down with a lot of noise and somewhere in which there was some difference among ground level with this water they decorated the gradient part with stepwise design and paved its floor with stone in order to seem water gentle current more noisy after hitting to stones. Water fountains were constructed in pools or garden pond and the water were provided by a lead pipe for them and they could create mixed designs with opening and closing of valve in any pipe [24]. Contrary to European gardens, fountain is shorter in Persian gardens and it has never decorative characteristic so it only recalls nature motion, beating, and order.

This beating is associated with rhythm of universe and cosmological system. Iranians were especially skillful in construction and using short fountains to create music. These water melodies, which are Persian specific music, may show how we can be in ecstasy and glee [23]. Water ditches or brooks are one of the aesthetic elements in gardens, which they create beautiful cascade by waterfall. But since Iran is a semi-arid region and the volume of water in gardens is a function of this process thus to solve this problem, water flows on the gradient level and on the ramp and some chips are created in the stone that is known as “partridge flange”. The water with very small volume may seem voluminous by flowing on these levels and this valuable art has been employed in many Persian gardens including Ghadamgah Garden in Neishaboor and Dolatabad Garden in Yazd [11].

4-4- The attitude of tourists in Safavid era about Persian gardens:

“Adam Olearius” says about Persian gardens: Decoration that has been utilized by Iranians in their gardens includes some pools which they have created margins around them and they have built regular water ditches for them and water flows from this pond to the other pools. Generally, one pond is placed higher than other pond and leads their water to or, respectively. Similarly, he says in other point that: The outside Isfahan city at southern side and not far from the bridge, Cheharbagh garden is located and it is nominated by this title (Cheharbagh literally four gardens) because it is divided into four identical gardens by a cross-like river. The perimeter of this garden is one quarter mile and the garden has been built as square. Around and at the middle of this garden, water is directed by underground watercourse from Zayandeh-Rood River to here and it is passed through several brooks and is erupted from many ponds. The water from these ponds is poured into a large pool at the bottom among of them some fountains jump the water to about 7.2m height (ibid: 245).

Pietro Della Valle introduces the entrance of Persian gardens as very regular ports with special order against each other. According to his remarks, a small but beautiful building has been constructed above the entrance of gardens, which one could enter in them rather than strolling and entertainment. Della Valle says, “There are long and regular queues of thicketed trees inside the gardens and outside them in the street, which their harmony is unique. A great brooks flow on stony bed and the pond irrigates the gardens and water is erupted in most of these pools and in some others the water falls as small cascade.” [7].

According to Della Valle viewpoint, Hezar Jarib Garden (literally thousand acres garden) in Isfahan is one of the most beautiful Persian gardens and he assumes its terminology in presence of quartet gardens in this place. Della Valle states: The level of gardens is higher than others and there is nothing except for trees with thick branches and leafs and any certain area includes certain trees; for example, one square meter was specified for fig trees and the other one square meter for peach trees and so forth (ibid: 34).
One of Kashan gardens, titled as Tajabad, has been described in log book of Della Valle as follows: In Tajabad Garden that is one of the king’s gardens, there are many fruit trees but what it causes its development and I have later observed in all king’s houses as well, was the landscape of a straight paved street that is continued from the great building to the end of garden wall and it is enclosed from both sides with cypress trees. A brook flows at the middle of this street, which is poured into several ponds and since it is relatively steep, some fountains have been predicted for it out of which water may be erupted and the water falls from the edge of ponds with a pleasant sound (ibid: 108). From Della Valle viewpoint, Frahhabad garden in Sari was a hidden garden for king’s wives and it has been enclosed completely with thick walls. Its yard is filled with trees and with fragrant flowers and vegetables. The row of box trees and fountains, for which this art has been employed, may not be seen in gardens at eastern lands. The water flows only in several brooks, which all straight and uniform. A small octagonal and multi-storey building has been constructed at the midpoint of gardens where streets crossed each other. All these places are specified to women and no man, except the king, is entitled to enter here (ibid: 210-211).

Don Garcia Figueroa has not mentioned many issues about Persian gardens and their description and illustration in his log book and the subject which has been dealt with more than any other issue and it was interesting for Figueroa and he has purpose it was the landscapes and nature at outskirt of city and roads, which he has allocated the most part of his log book to them. In his observations, he has only referred to a great garden in Lar city that was located versus a mosque. According to him, this garden includes a lot of fine fruit trees with the best palms and a large and fully round pool and several doors of this garden totally open toward the pool. A wooden bridge is used to enter it and there is a safeguard in its both sides. In Figueroa’s opinion, date fruits of this garden are too big that they can be compared with the cultivated tomato in Spain, which are called Serre la da du mange (greenhouse big tomatoes) (Figueroa: 98). Gemelli Careri explains about Isfahan gardens: The Isfahan gardens are placed higher than Chehardah-Cheshmeh Bridge that is passed over Zayandeh-Rood River. A fine pavilion construction is seen against the river and beside Jolfa where its ceiling is supported by a beautiful twenty- column structure. The thicket trees have been planted subsequently in this garden and a water ditch with engraved stony bed and several fountains have been provided at this midpoint and a small house has been constructed there like the house of Khoshkhanene Garden (Careri: 117). Concerning to Saadatabad Garden, Careri mentions: Saadatabad Garden is not too big and it has been divided into four parts by two cross-like intersected streets and tall pine trees were planted in this garden and it was led toward the great hall at the general court. This garden is decorated with a beautiful pond around of which silver fences have been installed as support for people and its surroundings were covered by precious carpet (ibid: 120). Isfahan Hezar Jarib Garden, which has also been well described by Della Valle, had three mile length and one mile width according to Careri’s viewpoint and a water ditch is passed through the middle of this garden and its floor is paved with carved stone and a branch of water has been derived from this brook to all parts of this garden and several beautiful waterfalls and ponds were provided there in which the image of the surrounding pine trees is mirrored through them and they have created a lovely landscape there. A great building has been constructed for royal court (Harem) at the end of garden and there is a pool at front of this area and a small boat is seen on it. Many minor brooks have been created as well for irrigation of trees and spraying water on in the garden streets at both sides (ibid: 68). Careri has expressed his attitude about gardens in Shiraz as follows: It can be difficult to say about Shiraz gardens that the benefit of enjoying taste of fruits are greater than eye-catching landscape by watching the long treed streets. The cypress trees are raised to the sky and shadowed over the clay houses in Shiraz. The area of the city in which twenty thousand people live, seems like a circular forest. Delgosha garden was located at the bottom of the mount and the water that was extracted from the mount, flows through the middle of this garden. The people of Shiraz used this water for washing and bleaching the cloth. There is an edifice at the top of mount, that seems to be already a fortress and a deep well has been excavated at the center of this building (ibid: 179-180).

Tavernier states about Persian gardens: A water right should be given to every garden based on its size in Iran in order to be irrigated once a week and it great brooks should lead the water into the gardens. Hezar Jarib garden in Isfahan has been described by Tavernier as follows: Hezar Jarib garden is situated at the piedmont of a hill and it includes sixteen stories where every storey is six feet higher than the other floor. There are some narrow ponds in this garden in which water flows. What it is more visible in this garden, is a large pond that situated on fourth storey and diameter of its circle is approximately 12feet. This pond has octagonal shape and a few pipes have been installed around this pond with equal distance from each other from which water is erupted up to three feet height. A brook is passed over the width of garden at the last storey where the garden is ended and it is intersected with all streets, which are located along with the garden [5].

Engelbert Caempfer, a German explorer, who has resided in Safavid court for a while, has described Isfahan gardens very aesthetically. Khalvat, Golestan, Oach Martabeh, Hezar Jarib, and nightingale gardens, which are located in Isfahan and Caempfer has visited them, included detailed description so it is referred to each of them in the followings.
Caempfer states: Khalvat garden is connected to Chehel Sotoon (forty columns) and it comprises of two palaces, which are encompassed by the garden. In one of the palaces which are common with Chehel Sotoon, there is a four-sided marble pond at the middle of its hall where water falls from this area and flows into the garden. Like the first palace, the other palace includes a square pond with a fountain at its center where water exits from this area invisibly and is poured into small pools, especially southern pool. An octagonal fountain is placed at the midpoint of garden of which water is erupted and falls into a ditch. This ditch comes from those two palaces and it is continued along with trees row and at last it is hidden at the end of the garden (Caempfer; 1971:209). Regarding Golestan garden, he implies: This garden is called Golestan (place of flowers) because of a lot of the existing roses in this garden. Design of this garden is octagonal and a double – storey hexagonal palace is seen at the middle part of this garden. There are two ponds in basement of this palace out of which one of them is filled with the water that comes from the garden and in the second pond; water is erupted below the ceiling. There is another palace with square design as well in which the main decoration is an octagonal pond, which is flooded with transparent marble at midpoint and transparent water flows from fountains toward four walls in palace and then it is hidden again at the threshold and it becomes intact and clean like sunlight in the ditches outside the building i.e., at the front of palace (ibid: 210-211).

Oach Martabeh garden that means three- storey garden is located at eastern side of Golestan garden. Caempfer says that there are shallow water ditches at the midpoint of garden which their water are led to bath reservoir (storage) after flowing into all minor brooks. The building of Oach Martabeh is enclosed with a brook, which is widened at edges of palace and middle of directions and converted into a pond. A pump is seen at the opposite side of lawn that is limited to garden wall where water is extracted from a well by the aid of a horse that rotates around an axis and it is poured into a wooden tower at its adjacency and then from this point it flows by some pipes into ponds and fountain in royal court (Harem) and the adjacent buildings since this water that is extracted from the depth of land is more transparent than the water which flows in water ditches of city and for this reason it is only water which consumed as drinkable water (ibid: 212). In Caempfer’s opinion, Nightingale garden (Bagh-E-Bolbol) is the most beautiful garden throughout Iran and no garden may reach to this position. He states that the unique splendor and beauty of this garden has caused this garden is called Hasht Behesht (literally eight Paradises). This garden is situated at the middle of an open wide field that is flooded with squared stoned and a water ditch has been provided around it. There are several ways toward the palace from all direction at the margin of this garden where several pavements are decorated with beautiful fences around this area and pine trees have been planted at both sides of them. Eastern-western streets lead the water, which has been extracted from underground in Cheharbagh, to the garden. This water is used to fill the pool with eleven steps width and ducks and swans are floating over it. The permanent melody that is caused by falling water from the cross hole that has created from marble on place ceiling may sedate the visitor and s/he can avoid from his/her sleeping without difficulty during watching this splendid game of water (ibid: 23-214).

According to Caempfer’s remark, Hezar Jarib garden is the favorable garden for king of Iran and the king more tends to this garden than other gardens. And all surface of garden has been divided into some squares with these streets. Caempfer states that the garden floor is sandy and dry and it is cultivated and becomes green with three watercourses, which are branched from Zayandeh-Rood River. One of these springs is called “Chahsheh” and it is branched from Upper part of Zayandeh-Rood River. Two other brooks, titled “Bist-Va Panjeh” and “Abe- Nile”, flow toward Jolfa region. Chahsheh spring flows along with southern external great wall and from that point it flows into smaller brooks along with streets. These brooks irrigate throughout the garden and often they are converted into basins, which cause trees and orchards to grow remarkably. Caempfer says that one of the other advantages of Hezar Jarib garden is two wide octagonal pools, which have been constructed from the accurately polished stones and are located at the middle of garden. One could ride all over the area of this pool by a boat and enjoy the landscape of strong fountains at the midpoint and other small fountains at the edge of this pool (ibid: 215-216).

Conclusion:

The strength of Safavid governance and power bases and independent political structure at that period opened the door of connection between Europeans with Iran and accelerated growing relationship among Iran and Europe. The mutual and balanced relation with European nations has led to going and coming of European delegations as commercial political ambassadors to Iran. Traders and ambassadors and merchants, who constituted these boards, wrote about the existing issues in Iranian community of that time and inherited some sources in which paying attention to most vital element in human life namely water and ways of its extraction as well as methods of irrigation and water transfer were studied by the explorers. Recording some issues like way of extraction of potable water and method of storage and keeping of water whether in the fixed locations and or during trips and traveling, technique of guiding water to farming lands and gardens, way of excavation of aqueducts and culverts at piedments, methods of utilization from wells, technique of extraction of waters from depths of seas and description of leading water in garden building and the supportive and storage buildings for waters and ices are some of important mentioned issues in these log books and given that explorers during
Safavid dynasty have resided in Iranian royal court for a short period of time thus such an amount of subjects may indicate their accurate attention to issues and activities during that period. In general, the remarks and observations of tourists in Safavid era about Iranian water supplies can be divided into five classes:

1) Description of utilization from water supplies to irrigate farming lands, fields, and preparation of drinkable water;
2) Description of water supplies as valuable element by considering the cleaning feature for performance of prayer;
3) Description and explanation of waters as one of the fascinating attractions in the nature;
4) Narration of personal attitude about water supplies as one of the fundamental elements in art of garden-building with focus on its aesthetic value in construction of pools, fountains, and water ditches etc.
5) Description and illustration of buildings which are responsible for water storage and keeping ice for consuming it in certain seasons of a year.

Among other writers of log books, Olearius and Figueroa are unanimously agreed in description of rivers and springs in caravan roads and their numerous applications as well as illustration of cities with small and big watercourses and description of aqueducts and watercourse storages, which have been built for passengers’ exploitations near to caravanserais and they have considered these issues more than others. It has been also referred to subject of washing (ablution) by means aqueducts water that are versus mosques, the blessed tombs, and temples which are specified to other Iranian beliefs in log books from Tavernier, Olearius, and Figueroa as well. The techniques of ice production and description of iceboxes have been examined exclusively in Olearius and Chardin log books. In cities of Isfahan and Shiraz from which all explorers had visited the only element that has been often attractive and enjoyable for them was their gardens and Zayandeh-Rood River to which most of them have referred. Some of the purposed subjects in log books of European explorers include description the way of designing Persian gardens and placement of water in various symbols like water ditches for irrigation of trees, and ponds as a decoration and adoration element in garden and beautiful waterfalls in which the image of trees might create a fantastic landscape.

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