Indigenous knowledge a solution against drought in cities of Iran (the case study: Qazvin city)

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Iran has been located in hot and dry region and water scarcity is always a permanent problem in this country. In recent years by global warming of the earth the water resources of Iran have been decreases so much and there will be a serious crisis in Iran. In past years Iranian harvested water from underground water by a more sustainable technique which called "Qanat". This technique was more sustainable than deep wells in harvesting water to irrigate cities and farms. The morphology of cities obeyed from the track of water of Qanat as well.

Harvesting and supplement of water in historical cities in Iran (hot and dry regions of Iran) was according an indigenous knowledge which was so innovative and intelligently.

Iranian harvested and used water in the most effective and efficient ways which can have some good lessons for recent generation which uses water in an uneconomical and illogical way.

This paper will review the indigenous knowledge in harvesting and supplement water in historical cities of Iran to learn some sustainable solutions to challenge with the drought which is the result of global warming of the earth.

The case study of this paper is Qazvin city. This city has been located in semi hot and dry region in Iran which was irrigated by several Qanats and a traditional supplement of water in city which determined the morphology of the city.

Key words: global warming, traditional urban planning, Qanat, indigenous knowledge

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Introduction

Water is a scarce element in most parts of Iran and there are few rivers and lakes in Iran specially in central parts of Iran.

Iran has been covered with vast desserts and Iranian earned water by an intelligent technique which called "Qanat".

This system is the most prevalent system to earn water for settlement and agriculture. Iran has been survived by "Qanat" or "Kariz". Actually we can notice a "Karizian civilization" in Iran which is an ancient civilization in a hot and dry region. Cities and villages was formed according the recourses of water and path of Qanat. In the other word cities were formed based on the path of Qanat and water was an important factor in morphology of cities.

The location of many buildings of the cities especially hydraulic structures was determined according the path of Qanat.

Old Iranian has a rich knowledge in harvesting water and supplement of water in cities. By this indigenous knowledge water was earned and supply in a most efficient way which water was consumed in the optimum way. This paper is about indigenous knowledge in harvesting and supplying water which enabled Iranian to maintain and spread their cities for a long time.

Methodology

Methodology of research is descriptive – analysis and by an exploring and surveying method study the role of water in the morphology of the historic city of Naragh. In the other word traditional harvesting of water (Qanats and wells) and traditional water supplement have a very important effect in morphology of city which in this paper was described.

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1- Qanat and its elements:

This system contains a horizontal corridor to transfer water to a settlement or farms. Other elements of Qanat are a mother well and some shafts which enable pitmen to construct and maintain the Qanat.

Water appears in mouth of Qanat on the ground then transfers to everywhere which need water such as houses, hydraulic structures and farms.

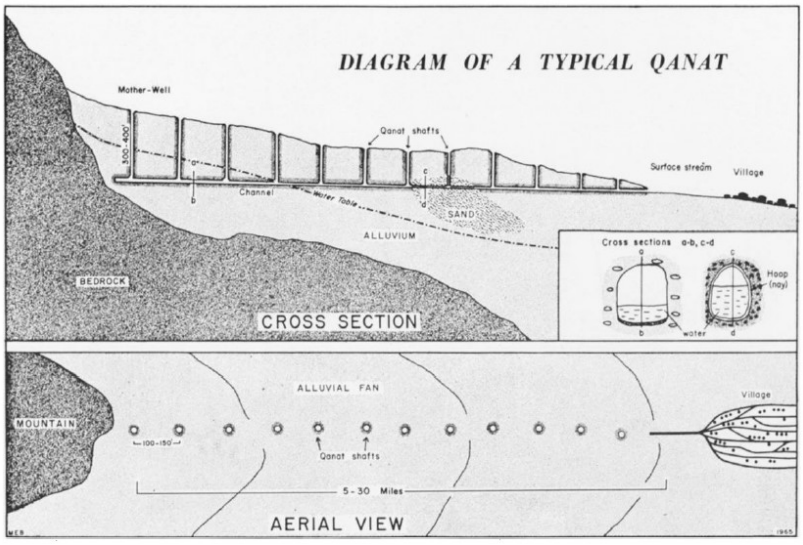

Fig 1- The section and plan of Qanat (source : English)

2- Hydraulic structures:

The most relevant historical hydraulic structures in Iran were Payab, traditional bath, water reservoirs, ice houses, water mills. The location of these structures were obeyed from the path of water which mostly was from the water of Qanats. Sometimes cities obtain their water from rivers or streams. However, these hydraulic structures were feed by water and were located next to the path of water. The water sometimes followed underground. Some houses of cities have this score which water passed through their courtyards. Usually these kind of houses were more expensive and belonged to elite and rich citizens.

2-1 Payab:

To reach the underground path of Qanat people construct a building which is called Payab contains some steps, which lead to underground water and there was a room which water pass through it and there was a hole on the roof to let the sunshine come in. There were public and private Payab both. The number of steps which lead to water depended on the depth of underground water of Qanat.

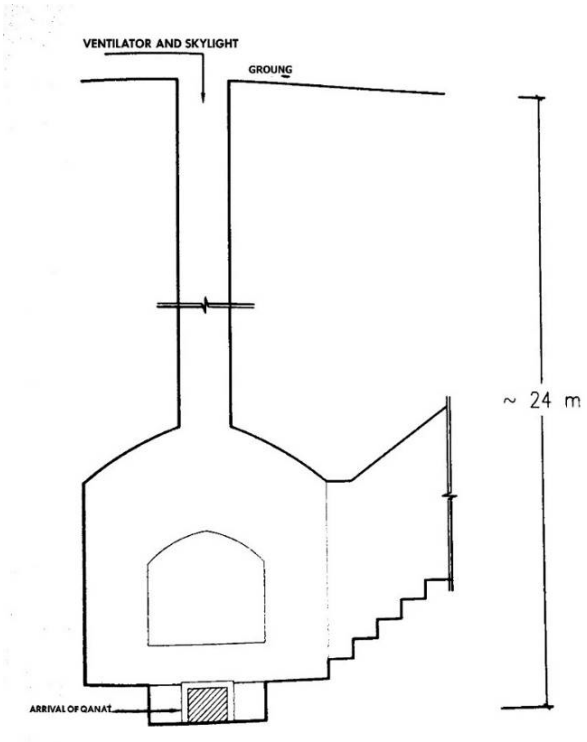

Fig 2. Section of a Payab (source:semsar Yazdy)

2-2 Water reservoir (Ab Anbar):

Water should be reserved in large structures which was called water reservoir (Ab Anbar).

The elements of this building consisted as large tank which was constructed inside the ground and a large doom covered this tank and the air of this building was ventilated by some wind tower (badger).

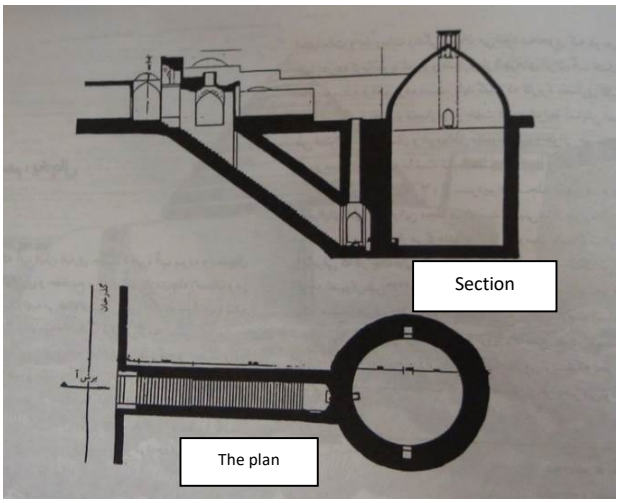

Figure3: section of a water reservoir in Kashan city (source: Ghobadian)

2-3 traditional bath:

Traditional bath is another building type in hydraulic structures. In Islam there is an important emphasis on washing and cleaning. According to Islam roles people should clean and wash themselves so in cities there were several bath to serve citizens. As usual the bath was fed by water of Qanats and traditional bathes had a plan but in this paper there isn't enough space to describe them.

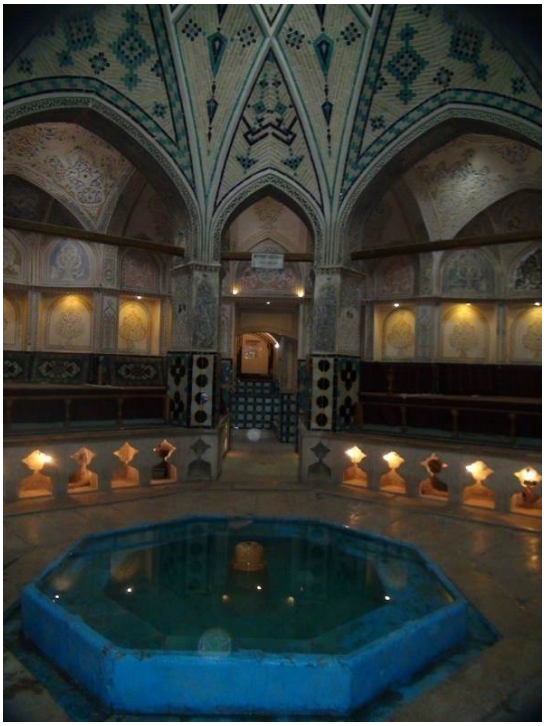

Fig 4. Amir Mhammad Bath in Kashan (source : author)

2-4 Ice houses:

Iran has hot and long summer. There is an intelligent system to produce ice for hot days. In ice houses there are two main elements: a tall wall and a storage. In winter water froze in shallow pools which was in shadow of a tall and long wall.

People cut the ice and stored it in a huge structure which was erected inside the ground and was covered by a large doom. In summer people brought out the ice and consumed it.

Fig 5: Ice house Kerman city (source: author)

2-5 water mill:

In past time most of water mills worked by hydraulic power. As there are few rivers in Iran people use the hydraulic power of water of Qanat. So there were several water mills in the path of water of Qanat and the wheel of water mill moved by the power of water and produced the flour of people.

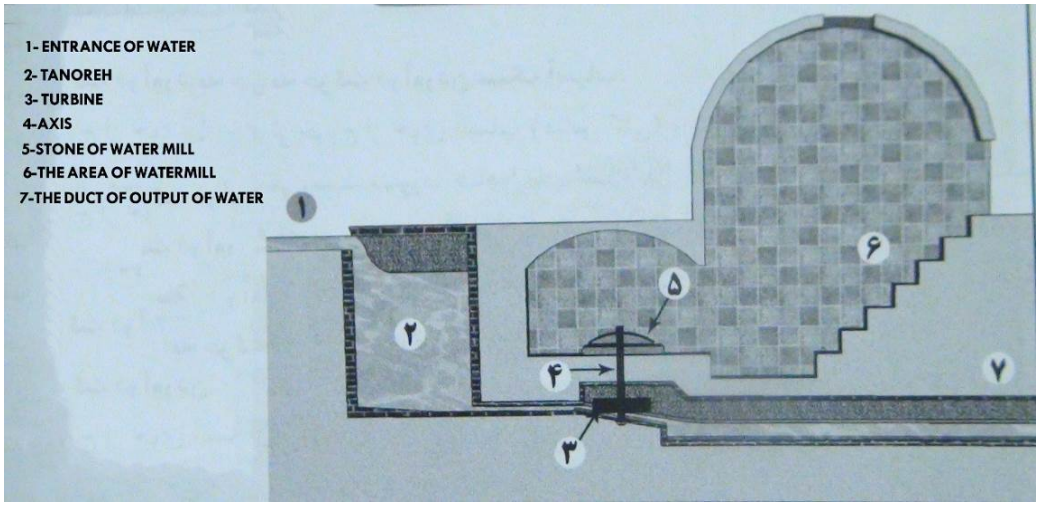

Figure 6: section of a watermill in rout of Qanat (source:Semsar Yazdy)

3- The location of hydraulic structure in cities:

As it was mentioned before, the location of hydraulic structure was determined by the path of water in cities either followed on the ground or underground.

However, usually first of all water mills were located on the path of the water and then water passed through some public and private Payabs, traditional bathes, ice houses and water reservoirs. Mosques usually reached to water by Payab to achieve a ritual of praying (vozu). Of course water was used in a hierarchy in hydraulic structures and finally was lead to farms and gardens.

In two below maps the path of two Qanats of Qazvin city in Iran and its hyrulic structures have deen shown.

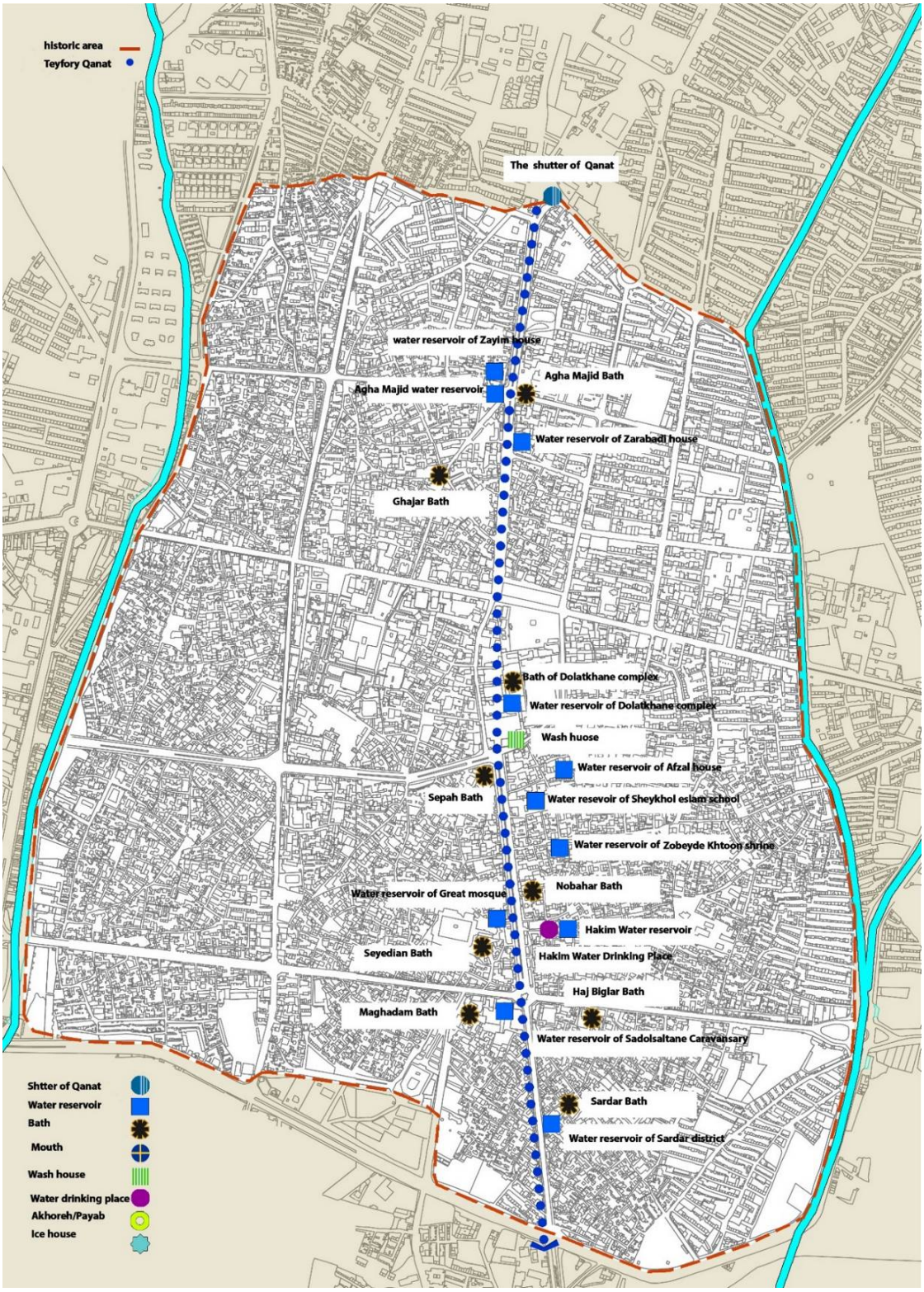

Figure 7. The rout of Teyfory Qanat in historic area of Qazvin and location of hydraulic structures on it (source : authors)

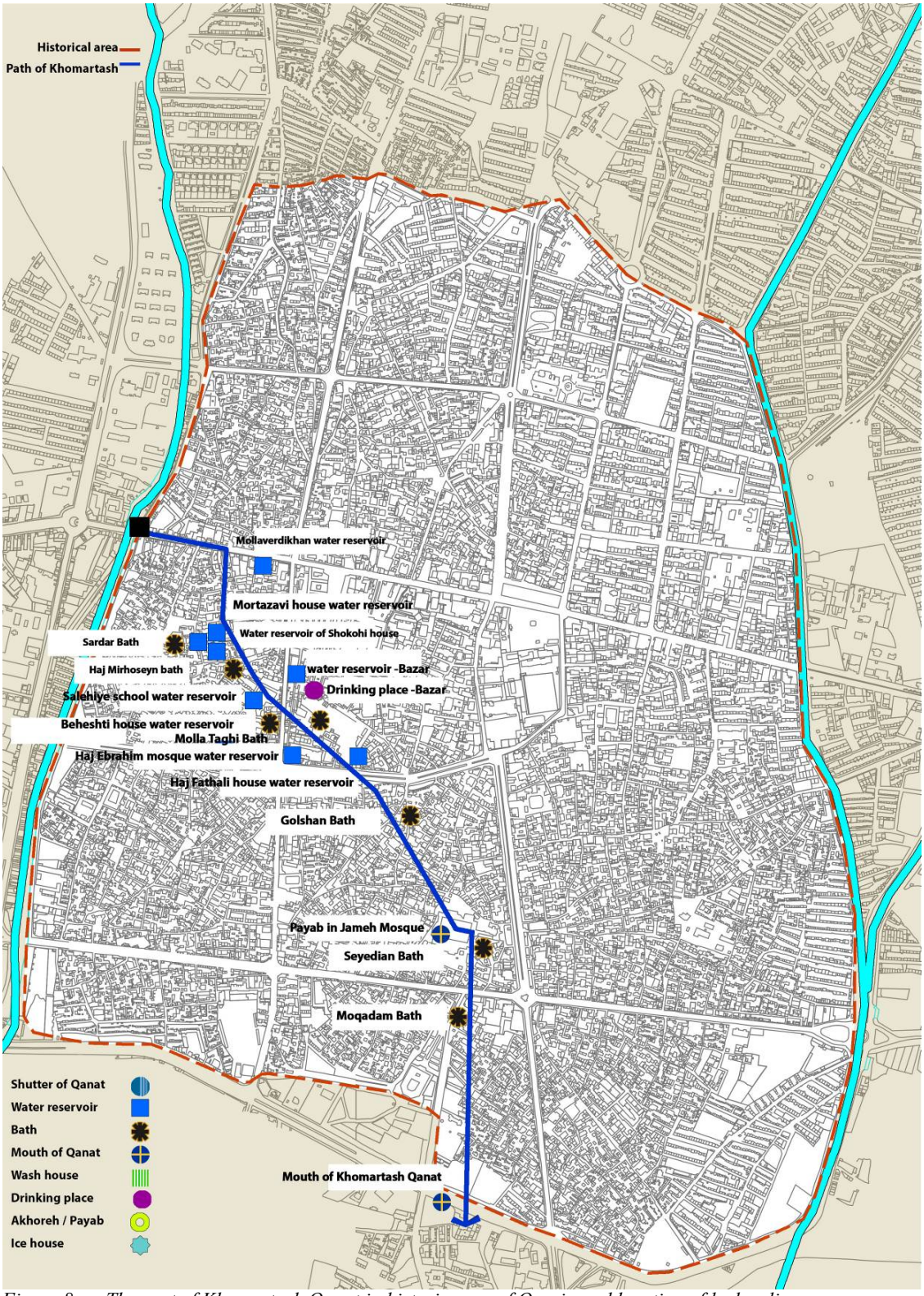

Figure 8 - The rout of Khomartash Qanat in historic area of Qazvin and location of hydraulic structures on it (source : authors)

4-Comparing Qanat with wells in harvesting underground water:

Water harvests mainly by two systems: Qanat or deep wells. In comparison harvesting water by Qanat is more sustainable than wells.

Qanat harvested water from alluvial fans and the amount of water directly depends on the water of alluvial fan.

But deep wells discharge the water of alluvial fans so fast so its water will finish and can't be back anymore.

5-Conclusion:

Water is the main factor to survive a settlement. Iran in spite of scarcity of water has an old civilization which was based on the water of Qanat. Qanat and hydraulic structures invented by a rich indigenous knowledge.

Reviewing this knowledge will be very useful and can lead us to more sustainable ways to achieve more efficiency in harvesting and consuming water.

In the other word we need the best solutions to achieve two major problems: the water scarcity and drought and referring to indigenous knowledge will be a good solution.

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