



Symbols of Water Supply Technology in The Central Plateau of Iran

Hamideh Beigi^{1*}, Maedeh Beigi²

¹Assistant Professor, Faculty of Literature and Human Science, University of Guilan, Iran.

²M.S Student in Watershed Management, Faculty of Natural Resources, Islamic Azad University, Meybod Branch, Iran.

ABSTRACT

Technology is techniques and the use of tools, machines, materials and processes resolving difficulties of humans. In a land like Iran's central plateau, of which a big part is covered by low water areas, the water supply has long been one of the main concerns of the inhabitants of the area. Careful study of the existing library documents show that access to water and transferring it to the adjacent land and the plains surrounding water source has been difficult so that the Iranian people, especially those from the central plateau of Iran with sufficient knowledge of the water cycle in the nature and the surface water issues, have created installations so that their precious works are evident in the study area.

Keywords: Cistern, Watermill, Bukan, Shoal, Qanat, Ice cavern.

Corresponding author: Hamideh Beigi

INTRODUCTION

WATER as the most important element of life has a key role in the development of human civilizations and establishment of the cities in the world (Hassan, A.F; 2011). especially in Iran. Social life and the survival and prosperity of the towns and villages have been dependent on the presence of water more than anything else. The special status of water resources and uneven distribution of rainfall, successive droughts and lack of conforming to the principles of conservation and protection of water resources preoccupied human creative mind throughout the history to explore different ways of searching for new and innovative solutions to address the problem and think of efficient use of techniques to exploit the available water and promote further training in this field.

In a land like Iran's central plateau, of which a big part is covered by areas with water scarcity, water supply has long been one of the main concerns of the inhabitants of the area. Access to water and transferring it to adjacent lands and plains around the water source has been difficult. Since one could engage in production of farming and gardening products by organizing irrigation and developing irrigation systems, generally ancient civilization centers in Iran have been on the sides of rivers or streams separated from them or in the vicinity of springs and Qanat.(Papoli Yazdi, M. and Labaf Khaniki, M;2000).

Traditionally, irrigation development in Iran gradually provided some family groups with power to create the first local authorities as local governments and consequently big governments such as Medes and then Achaemenids and etc were born in Iran by the connections of the families, who were responsible for managing the water supply(Montakab, 2013).

From the past centuries, the social system of Iran was formulated, developed and implemented based on the religious teachings and orders and rules of customary; As in the ancient Persian cults such as the Zoroastrian religion, water supply and cultivation of dry land through running waters and groundwater was important and desirable as well as growing plants and planting trees and reclaiming land is also recommended.

In the religious teachings of Iranian people before Islam as in the religious book of Vandidad, it says that "Ahura Mazda hails in answer to the question of the Prophet Zoroaster to one who sows more wheat and plants more trees and irrigates dry land and dries and cultivates wetlands"(Reza, A, Kuros, Gh., Imam Shushtary, M., Entezami, A; 1971). And water has been among the four elements, and Zoroastrians believe it was considered the most sacred element following the fire(Bagheri, P;2000).

Water has high spiritual concepts and values in Islamic teachings and culture, above which is the divine power and knowledge that is introduced as the source and essence of life(Aminzadeh, B;2003). Thus, the role of water in the genesis of creation has been discussed in many verses of the Qur'an and Islamic tradition. The word "water" has been used frequently in Quran and has been studied in many different ways: "And we made everything living thing of water".

Iranians have sufficient knowledge of the water hydrology cycle in nature and the problems of surface water in the past and also paid great attention to the practical aspects(Beaumont, P., AB;1982) . To exploit water of rivers and running water, they have created installations of which valuable remains are observed in different provinces of Iran, including the Central Iranian Plateau area. Hydraulic structures of predecessors indicate their deliberation and skills in water engineering knowledge(Javaheri, P., Javaheri, M;2006) . This paper discusses constructs that are symbols of technology and creativity of the residents of the central plateau of Iran to extract water from the available sources.

MATERIALS AND METHOD

The central plateau of Iran

1) The study area of Iran's central plateau is located between the latitude of 32 degrees 48 minutes and 36 degrees 48 minutes North and the longitude of 49 degrees 55 degrees and 40 minutes East. It is covered by Qazvin plain to the North West, and Damghan to North East, the South West is limited to Kashan Sialk and South East is covered by Kavir plain. This area is located adjacent to the tropic and northern temperate zone. The short distance from the Tropic of Cancer led to pass the desert strip of the northern hemisphere through the area and dominate certain natural conditions. Figure 1, shows the location of the study area.



Figure 1. Map of study area in central plateau of Iran

Symbol

Symbol is among the most important concepts in communication sociology. Symbol is a sign that there is neither objective similarity nor proximity relationship between its form and concept, but there is a contractual relationship rather than innate or spontaneous (Mohsenian Rad, M;2002). Humans are dependent on both biological resources and social facilities for the creation and application of symbols. The application of symbols by human is not merely the result of biological evolution, but also includes social development. Human by using interaction is able to expand the use of symbols and keeps them at a place called society and transmits them to future generations. Symbols development has led to the organization and ultimately the complexity of social life.

Technology

The technology is techniques and the use of tools, machines, materials and processes resolving difficulties of human. The Larousse dictionary (Larousse, P;2008), knows technology the study of tools, methods and techniques expected and used in different fields of industry. Technology is a human activity and, therefore, is more ancient than knowledge and engineering. The term implies the set of "knowledge" available to create the requirements and artifacts of any kind, for dealing with manual practices and skills (with the exception of religious, magic, military, or cooking activities) and for the extraction or collection of a variety of materials (except for the material used for feed or religious or magical activities) (Gould, V and Koum, J;2005). Technology is the factor converting natural resources,

capital and human resources to goods and services of which elements or pillars include hardware, man-ware or specialist human resources (Fathian, M. Mahdavi Nour, H;2007).

Symbols of Water Supply Technology

Symbols of technology that are provided in social land of the country's central plateau of Iran, with thought and policy of the human communities of the territory and through technology and canvas materials, are as follows:

Qanat

Qanat is a canal dug in the ground through which water can flow. Qanat is a deep canal to connect a series of wells originating from "mother well" to direct water to the surface and manage water for agriculture and other applications. This canal may take up to thousands of meters to reach the surface (Ajam, M;2004). With the increasing population and the progress of civilization in ancient Persia, Iranians made a new initiative called Qanat thousand years ago, not to stay only in narrow and limited areas in valleys and on the sides of streams and springs, farm hoping for random rain, and have difficult life and limited agriculture and farming drawing water from wells by the force of their arms or by using brute force. But the use of the invention that is unique in its kind in the world, significant amount of groundwater can be collected and brought to the surface that like a spring, the water runs throughout the year without any assistance be executed from within the earth's surface. Figure 2, shows these structures.

Qanat consists of an open mouth and a sloping underground longitudinal canal and several vertical wells that finally connect the underground canal to the ground, the wells, also called bars at the time of drilling, operate the ventilation of the underground canal, in addition to the application for transferring the excavated material to the ground, and are considered as pathway for dredging and repairing the canal and observing within the canal. The water exit of qanat is also called Mazhar (Mohammedian Kookheradi, M;2003).

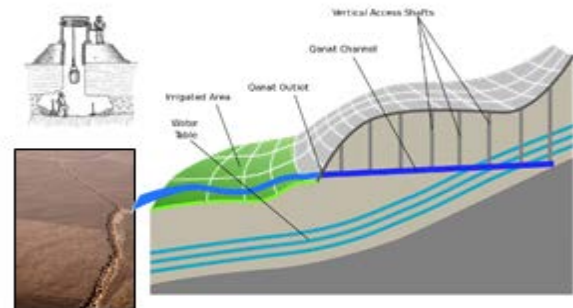


Figure2. Hydraulic system of Qanat

Bukan

Bukan is the architecture of vertically platens. The structure is a room-like shield in the depth of the ground that long ago was the living place of Moghanians of Yazd that contributed in the construction of a qanat in the middle of the desert, since the length of some qanats exceeded tens of kilometers in Yazd, before the generalization of wheeled and motorized vehicles daily commute in the desert in hot and cold weather was impossible. So Moghanian were forced to abandon their homes

for a while for their jobs and provide temporary housing in the desert wilderness around Yazd in the construction place of qanat. Other applications of Bukans that have been observed in areas such as the Shahr-Babak of Kerman, was for maintenance of animal or storage of fodder and an underground room like Bukan is usually mounted on the side of Bukan called "man of the house", which is used by the shepherd as the shield (Safi Nejad, J. and Sabzian, M;1988). Figure 3, shows structure of Bukan.

Cistern

Cistern, basement, pool, source, and some kind of indoor and sealed water tank often built below the surface of the ground to store drinking water for a period of scarcity or stability in the summer, in towns, villages, castles, along caravan routes and in the mountains. These water tanks are called "cisterns" in most parts of Iran, and in some places, such as Birjand are called "stock", "pool", "pond", and in other Iranian cities have names like Morghey Morghak (in Saveh), and Hud (probably another form of pool in Khur and Biyabanak) (Farokhyar, H;2007).

Cistern construction has a very long history in Iran and the oldest extant works of cisterns almost coincide with the emergence of the first civilizations in Iran, and there are still cisterns of the 6th and 7th century AD left. In the Islamic era, cistern like other urban structures was constructed in centers, such as bazaar centers and community centers as well as in road caravanserais.

Cistern architecture in different parts is influenced by local architecture. For example, architecture of Qazvin cistern has been built with rectangular tanks and lofty domes. Cisterns with staircase tanks have been built in Khorasan and in Semnan and Garmsar they have been designed and built with a circular tank that are mostly simple and are far from tiling (Kheirkhah Arani, R;2006). The Central Plateau of Iran is the position of the largest number of cisterns in Iran So that Qazvin called "the land of cisterns" and the most ancient cisterns can be found in the cities of Kashan and Semnan. Figure 4, shows these kinds.

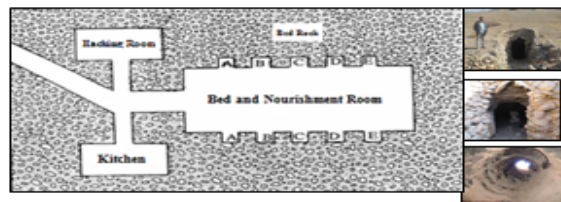


Figure3. Bukan Structure

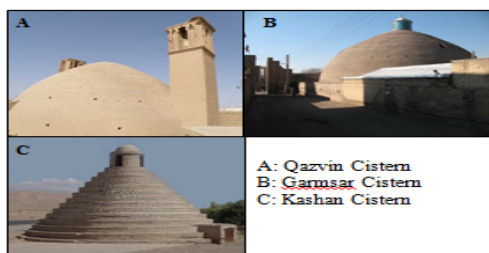


Figure4. Various kind of architecture in Central Plateau of Iran cistern

Shoal

Shoal is a structure for easy access to the underground water canal and is a furnace tilted from the surface and opened to the canal and is connected to the furnace through some steps, in Ardestan, some have several shoals along their underground canals of which a number are familial and some are for public use. Drinking water supply, renewing ablution, washing clothes, and provide soothing and comfort are some uses of shoals. Shoal environment has an almost constant temperature of about 28 and 29 degrees during all seasons of the year, due to its underground structure and proximity to qanat water.

In places where the qanat depth prevents the water to rise to the surface, it is necessary to build shoals. Shoal architecture is not complex in terms of their function to access qanat water. The main area of shoal has a room with plan built in square and octagonal shapes. There is a pool on the floor, the circular or polygonal pool has holes that bring into the qanat water from one side and remove it from the other side, and the pool is usually deeper than the floor, in the vertical body of the shoal types of platforms are embedded for sitting. In shoals of houses, there are shelves to place food or other objects. A chain was hanged from the ceiling above the pool and a basket was connected to it and substances such as meat were kept (Zarabi, A;1999).

Water mill

Water mill consists of two large circular stone, wheel or wooden blades, well (stokehole) and wooden rod. This type of mill is an underground structure located at a depth of several meters. Qanat or well water is running on top of the mill. Water is poured from the canal in the ground surface into the cement well (stokehole) a few meters (6-8 feet) above the mill level. As the stokehole is almost filled with water, water is poured onto the blades of the wooden wheel with pressure from a hole at the bottom of the stokehole, and the wheel begins to spin by the water force, as the result of the wheel spinning, the upper stone of the mill begins to move and the wheat is poured by the movement of the wooden rod connected to the upper stone through the hole next to the rod into the hole embedded in the middle of the upper stone. The movement of the upper stone and immobility of the lower stone cause the wheat to become flour. This type of flour has higher quality than those produced from flour mills today (Parsaei, Sh., Goudarznia, A;2008).

Ice cavern

The structure of old Ice cavern is the strangest architectural elements. There are mysteries in the presence of Ice cavern and their products that brought cool fresh water into the house in the middle of the hot summers that tells the story of humble miracle of adobe and power of a sage architect who put a brick on brick loving to serve. Throughout the territory of Iran, especially in hot and dry areas of Central Plateau of Iran with onerous summers, ice has always been considered essential to people that was used to preserve foods in addition to cool the water.

The Ice caverns mainly consisted of three parts: long shading wall, ice tank and ice production ponds.

The shading wall was long and high, which is sometimes up to 10 meters in height. Throughout the day, the wall protected the frozen waters of the pond from sunshine. Sometimes in order to further stabilize the shading wall, big back walls were constructed in the southern part of the wall. Shading walls were thick at the bottom and the diameter was decreased gradually to the upper parts. The ice production ponds were

rectangular basins drilled parallel to the shading wall and in the northern part of it and their length was slightly less than the length of the wall and their depth was 30 to 50 cm and sometimes more. The ice pond is where the ice is prepared in the cold winter nights. The ice pond is usually found behind the shading wall and in southern part of it and in some cases enters the northern part by one or more entries. Ice storage is also deep and large pits dug in the middle of the ice pond. The ice tanks are of two types:

- A. Dome tanks in the form of Baroque conical cover.
- B. Tunnel-shaped tanks in the form of long rectangular atrium.

The pits are circular in domed Ice caverns with a radius of about 4 meters, and sometimes more. The wall of the pits is made of stone or brick or thatch and the back is covered with insulation materials such as coal dust or other material. Small stairs built in the wall can be used to reach the bottom of the pit. A well is also drilled out of the Ice cavern so that water from melting ice will lead to the well through narrow canals embedded in the floor of the ice pits (Alizad Gohari, N., Latifi, M.;2006). Figure 5, shows the kinds of shading walls and situation of domes and Ice dams

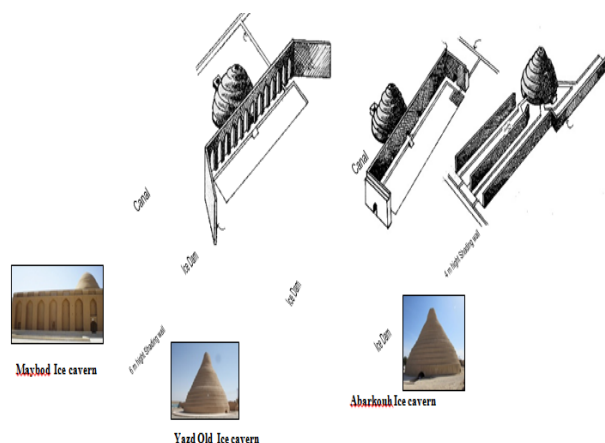


Figure5. The kinds of shading walls and situation of domes and Ice dams

RESULTS AND DISCUSSION

Water harvesting is a complicated and regulated technology of which different methods show the hydrological creativity and knowledge of peoples of the region. Today, the concept of indigenous technology is more important because of the energy crisis and the abnormal environmental conditions, so that patterns and symbols of indigenous technology and renewable energies should be utilized to achieve growing communication between nature and industry. In Iran, especially in the Central Plateau of Iran, with the unique range of indigenous technologies and industrial heritage has taken place, but it has not been properly introduced. In addition to protecting the material and spiritual values of the heritage of Iranian civilization, the indigenous technologies of water supply and transferring this knowledge to the next generations could lead to sustainable development of water resources even in the part of the country with the lowest water. This will be accomplished only by revolution, overall review and culture of

public opinion toward traditional hydraulic structures and collaboration with universities and scientific centers, offices and concerned agencies responsible for water supply of the country.

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