

Potential within hydraulic heritage for facing water-related disasters



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By analysing a successful example in Iran, this research introduces hydraulic heritage as a potential for learning in order to face water-related disasters. The type of the research is descriptive-analytical which has a qualitative approach. Using available information and factors like images, surveys, books etc., categorizes this paper in field research.

These days with the massive changes in climates, the number of environmental problems are rapidly increasing [1] [2]. Looking at statistics, it is claimed that water-related issues account for a large part of the natural disasters in different parts of the world [3]. Flood, as the most common water-related disaster have been severely damaging and threatening most of the cities. Several reports of the flood damages on the one hand, and a growing number of these catastrophic events on another, have turned it into one of the serious hazards that threatens

people's lives and properties in the 21st century. Added to flood, other types of water-related disasters such as rising sea levels, heavy storms, tsunamis, etc. ring numerous bells that serious actions should be taken into account. Recently an extended number of researches have studied water-related problems especially in urban sites, and have considered this issue as one of the most dangerous events that can happen globally to a large number of waterfront cities like Wrocław [4] and Krakow [5] in Poland, Dezful and Ahvaz in Iran [6]

Exploring examples of historic hydraulic structures such as watermills, bridges, dams, aqueducts, could lead to a result that these types of heritage has shown a great deal of sustainability in facing water-related issues. This study proposes hydraulic heritage as a potential learning resource for facing water-related disasters. Considered that the lessons learnt from the past, could practically account for future sustainable developments [7]. The case study for this research is a group of watermills located in south west of Iran, Dezful. These structures occasionally encounter water-related issues, and in response, have demonstrated a great deal of sustainability over centuries.

Methodology/ Scope of Research

The type of this research is descriptive-analytical which is concerned with fact-finders. The approach chosen for this research is Qualitative since it does not have numerical data. This is categorized in field research type which includes information based on case study and life history. the case study is analysed by using the factors and information already available like images, surveys and books to make an analytical evaluation. This research was conducted in the field of architecture and heritage studies on historic hydraulic structures, which has been examined from architectural aspects. the outcomes of this study are useful for future efforts in the field of sustainable development.

Case study

There are many different type of historic hydraulic structures in Iran. And most of the examples are found in south west of Iran, Khuzestan. Cities like Shushtar and Dezful are known globally for their extended hydrau-

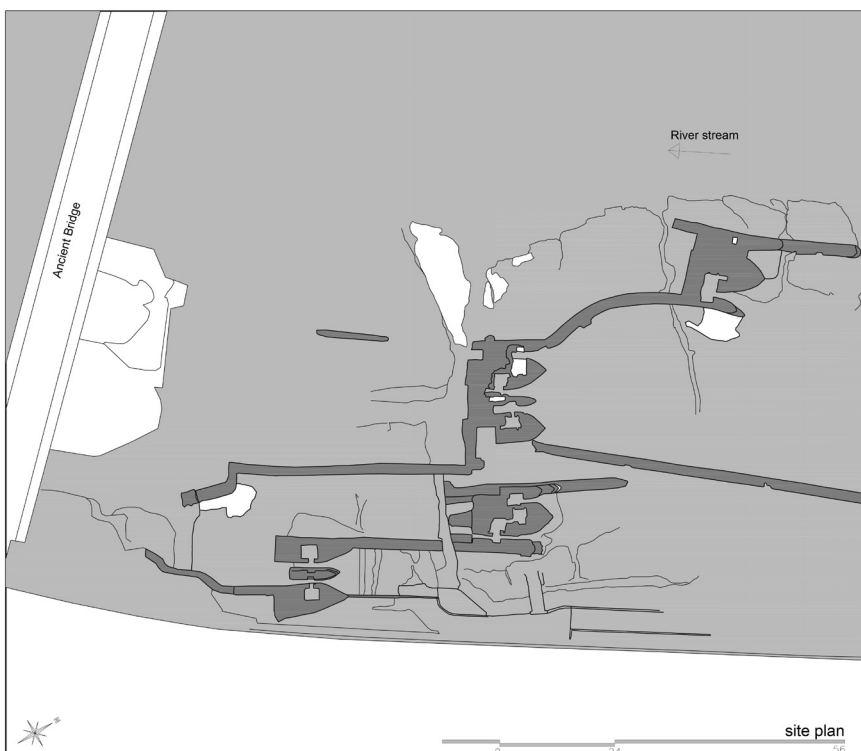


Fig. 1. Drawing of the watermills close ancient bridge of Dezful; source: authors



Fig. 2. Watermills of Dezful during the flood – 2016; source: Ramin Karamzadeh

lic heritage and brilliant water management systems.

watermills of Dezful are a series of hydraulic structures that date back to more than 1500 years ago. These structures are spread along the Dez river in the vicinity of the old town of Dezful. According to a recent census by authors the number of watermills were around 45 to 50 in the mid-20th century. All of these structures are built on the conglomerate beds in the river and all of them

are classified as slope mills [8]. The method of operation for slope watermills are similar to typical mills of Europe which is based on three water wheels. the basic building materials for this structure includes well-baked bricks, river stones and an ancient mortar called "Sarooj". The watermills of Dezful were operational for the locals until the industrial movements in 20th century [9] which resulted in their abandonment and deterioration. The case study for the research is focused on

a group of structures close to the ancient bridge of Dezful. This group is a chain of structures which contains nine watermills.

During the comprehensive studies conducted on the hydraulic structures of Khuzestan [8], the historical watermills of Dezful were thoroughly studied and analysed. According to the mentioned studies the structures were not damaged during the long-term floods. Considering the constant volume of flood in Dez River [6], it seems that the structures were intelligently constructed to withstand water-related issues. For instance, In April of 2016 a massive flood happened in Dezful, Iran (fig. 2.). During the time of flood, the historic watermills of Dezful were completely submerged by water for more than two weeks. What is more, the flood had a great pace and it was forcing the structures, which were standing against it. After two weeks, when the flooding time was over and the river turned back to its normal size, the structures were seen with almost no sign of damage (fig. 3.).

Considering that these structures are hundreds of years old and the river has frequent floods, it is surely obvious that we can take these types of heritage as a learning resource to face floods.

Discussion

Although there have been several efforts for exploring the idea of sustainable development [10], it seems that there is still a massive



Fig. 3. Watermills of Dezful after the flood – 2016; source: Ramin Karamzadeh



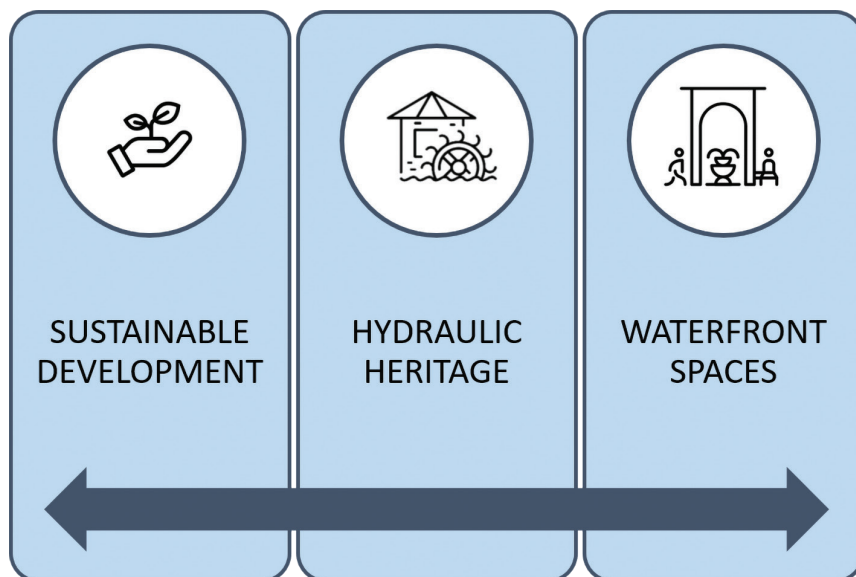


Fig. 4. Potential use of hydraulic heritage for sustainable re-development of waterfront spaces; source: authors

demand for practical solutions especially in field of water-related architectural and urban activities. These days, we are witnessing that recent activities by humans have caused severe damages to the balance between man and nature, while in the past times this used to be an intimate relationship, built on the huge respect for the nature and adaptation of humans to their living landscapes.

As noted in the case study, it can be demonstrated that hydraulic heritage structures were developed to act resilient against water-related disasters. By identifying and exploring these structures, we will learn on practical sustainable methods of development including building materials, smart locating, other architectural and structural aspects and, moreover, maintenance and management. The gathered information may become a potential source of useful knowledge how to preserve and use already existing structures and how to design new ones to benefit from more sustainable developments in the future.

Conclusion

Located and functioned by water (hydraulic energy), historic hydraulic structures are found in several parts of the world. Different types of these structures have served humans with numerous benefits. Considering the centuries of their durability and struggling with natural disasters like flood and storms, it seems that they could be recognized as successful practices in terms of sustainability.

By studying the cases in Dezful, it can be concisely concluded that hydraulic heritage objects are successful examples for building a valuable learning resource to act sustainable against water related disasters. Arguably, more precise conclusions need more samples and more extensive studies. In this case, a strong potential can be recognized in

the relationship between "sustainable development", "hydraulic heritage" and "waterfront spaces" which could bring about a great deal of benefits in facing water-related disasters.

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PRAWIDŁOWY SPOSÓB CYTOWANIA

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Abstract: These days, with the massive changes in climates, the quantity of ecological issues are on a rapid increase. It is asserted that water-related issues represent an enormous piece of the catastrophic events in various regions of the planet. Finding sustainable solutions for future architectural and urban developments in waterfront spaces is currently an essential need and a productive research area. Studying and exploring different examples of hydraulic heritage, could depict that these types of heritage has shown a great deal of sustainability in facing water-related disasters. By analysing a successful example in Iran, this research introduces hydraulic heritage as a potential for learning in order to face water-related disasters. The type of the research is descriptive-analytical which has a qualitative approach. Using available information and factors like images, surveys, books etc., categorizes this paper in field research.

Keywords: sustainability, hydraulic heritage, water-related disasters

Streszczenie: POTENCJAŁ HISTORYCZNYCH BUDOWLI HYDROTECHNICZNYCH W OBLICZU KATASTROF ZWIĄZANYCH Z WODĄ. Współcześnie, przy gwałtownych zmianach klimatycznych, liczba problemów środowiskowych powiększa się coraz szybciej. Można stwierdzić, że znaczna część katastrofalnych wydarzeń w różnych regionach planety jest związana z wodą. Dlatego znalezienie zrównoważonych rozwiązań dla przyszłych projektów architektoniczno-urbanistycznych w przestrzeniach nadbrzeżnych jest obecnie nie tylko podstawową potrzebą, ale także ważnym obszarem badań. Dzięki analizie wybranych obiektów dziedzictwa hydrotechnicznego możliwe jest wskazanie, że wykazują one dużą trwałość w obliczu katastrof związanych z wodą. Studium przypadku w Iranie pozwala stwierdzić, iż badania nad dziedzictwem hydrotechnicznym mogą być źródłem wskazówek, jak współcześnie przeciwdziałać katastrofom związanym z wodą. Artykuł jest wynikiem opisowo-analitycznych badań jakościowych, wykorzystujących dostępne publikacje oraz dane, a także badań terenowych.

Słowa kluczowe: zrównoważony rozwój, dziedzictwo hydrauliczne, katastrofy związane z wodą