

Utilitarian Bioclimatic Architecture in Bosnia and Herzegovina

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Abstract— In a broader sense, 'utilitarian architecture' follows the well-known paradigm of Modern architecture - 'form follows function' from the beginning of the 20th century. The paradigm suggests that the form of a building or object should be based mainly on its function and purpose, not just on its aesthetics. The term 'utilitarian architecture' in this paper refers to traditional production facilities that use water current energy in their functioning. In doing so, the natural flow of water (river or stream) is used, which is made particularly efficient by more or less additional arrangement.

Keywords— Utilitarian bioclimatic architecture, Bosnia and Herzegovina.

I. INTRODUCTION

Architecture is a discipline that a priori implies a 'purposeful structure' which is the framework of life. Unlike other arts (painting, sculpture, music, literature, for example) where the 'artistic dimension' is their essence, architecture is a physical structure conceived and materialized in an empirical way to remain stable in its natural and social environment. It is always understood that architecture has its 'artistic component', which, like its functionality, is part of its essence [1]. The title of this paper (Utilitarian bioclimatic architecture in Bosnia and Herzegovina) refers to those examples of architecture where their essence is their functionality. In the way in which this architecture is organized, we discover the 'beauty of architecture', which derives from its obvious functionality and the way in which the current of water, that is, its kinetic energy, is used to satisfy people's needs.

II. TRADITIONAL FORGES (MAJDANI) IN OCEVLJE NEAR VARES

Majdani (blacksmith workshops) are one of the examples of business in Bosnia and Herzegovina¹ that has existed in its authenticity for more than five hundred years²; it is a specific way of producing a wide range of wrought iron products using resources from the immediate environment (geographical coordinates: 44°10'07.39"N, 18°27'58.62"E, altitude: about 805 m), (Figures 1,2,3). Iron production has been a strategic issue since the beginning of human civilizations³, both for the

¹ Apart from Ocevlje (which will be discussed here), such workshops are also established in Vares Majdan, Kresevo and Vijaka; this business was exclusively practiced by catholics (descendants of the Saxons).

² As far as the author knows, a similar example can only be found in Germany, on the Schwarzwald mountain. Maidans in Bosnia and Herzegovina were established by the Saxons in the 15th century.

³ The whole, long period of human history (around the 8th century BC) is called the Iron Age, precisely because of the discovery of iron, iron products (for the needs of everyday life); thanks to the extraordinary quality of these

individual and for all levels of the social communities to which he belonged.

The exploitation of iron ore, as well as its processing, has always been strictly supervised and controlled by the very top of a social community (emperor, king ... president of the state and its military top).



Figure 1. Traditional blacksmith workshops (Majdani) in Ocevlje near Vares. The location

Source (left): https://upload.wikimedia.org/wikipedia/commons/8/88/Bosnia_and_Herzegovina_in_Europe.svg, Accessed 12.30.2022.
 Source (right): Google Earth, Accessed 12.30.2022.

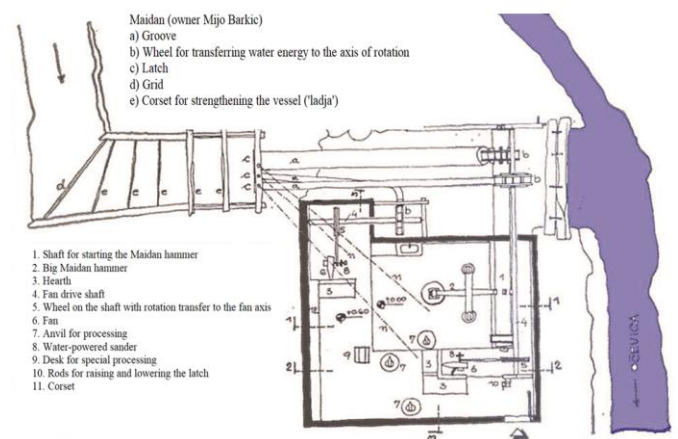


Figure 2. Majdan (owner Mijo Barkic). Plan
 Source: Author (Drawings, 1988)

The establishment of such workshops always implied the existence of certain preconditions:

1. Proximity to the exploitation of iron ore and its processing to the form of pig iron,
2. Existence of generous watercourses,
3. Existence of quality (mainly beech) forest,

products, the possibilities offered by iron as a material, this metal has always been associated with 'power', 'conquest', 'empires'...

4. The existence of good communications with the main communications network in the country [2,3,4,5,6,7,8,9,10,11,12].

Vares and its surroundings are known as a mining town; moreover, it was created and developed on the basis of the exploitation of iron ore and its processing into pig iron. Ocevlje is a place located between two municipal centers, Vares and Olovo. According to tradition, iron ore was once exploited in Ocevlje itself and processed into pig iron there (in the existence known as the blast furnace) [10].



Figure 3. Majdan Mijo Barkic, today

Source: Lejla Hadrovic (May 2007)

III. MILLS AND STUPAS IN STOLAC

Stupas are devices for rolling (stepping) woolen products (rugs, blankets, himbuljes, gunjes, raincoats, for example). These products are common equipment in the everyday life of the rural population. Stupas are commercial buildings and almost always follow mills (Figure 4). We are talking about a small group of buildings, two or three at most, where necessarily one building is a stupa shop. Stupas are made of 4 types of wood: acacia, oak, spruce and mulberry. They were located in an open space, but more often in buildings, which were also called stupas. Stupar buildings are built with limestone and mortar, without any decorations as objects of a purely utilitarian nature. They were covered with stone slabs or tiles. There were stupas on the ground floor of those buildings, and a shop with a wing for drying cloth on the first floor. Shops usually had two rooms each, a chimney and a room for customers.

Stupas and mills in Stolac were first mentioned by Evlija Celebia in 1664 in his travelogue. He says that there are 10 water-powered mills in Dol on Bregava [11].

The driving energy of the column is running water, where a part of the water is separated from the river flow by special backwaters. In order to achieve the fall, dams were built. Rukavac was built with various building materials such as stone, mortar, lime and clay. The partitioned part ('bent') had several openings ('badza'). The water flowed down the chute (wooden trough) to the car. Through the circuit, the power of the water powered all the devices for stepping. The wheel is mounted on the spindle. The spindle rests on a wooden log to which water flows through a groove. Wooden oak crosses are built into the spindle for lifting carts and sledgehammers. Tapestries are placed on water circles. Three spoons (shovels) are embedded on the tapestry, so there are twelve of them in total. The cloth is placed in a trough made of oak wood, which is hit alternately by one mallet after another. The mallets weigh around 90 kg each and have three prongs in the ridge. On the upper part of the stupa there are tops carrying mallets. They are made of birch wood to have a nicer and more tonal sound.

The facilities of the water mill and the stupa were in active use until the end of the Second World War. After that, they are gradually abandoned. The main reason for this is the change in the way the economy functions and the gradual demise of small business facilities [12,13,14,15]. Accelerated industrialization, electrification, lack of maintenance, but also deliberate demolition, as well as war destruction in the period from 1992-1995, led to the fact that today very few are in use.



Figure 4. Mills and stupas on Bregava in Stolac

Source: <https://www.klix.ba/lifestyle/putovanja/mlinice-na-bregavinajljepsi-spoj-prirode-i-kulturno-historijskihobogatstava/170722020>.

Accessed: January 21, 2023.

IV. WATERMILLS

Vodenice are one of the most fascinating examples of bioclimatic architecture in Bosnia and Herzegovina [13,14,15] (Figures 5-14). Such a powerful attribute added to an extremely simple construction seemed appropriate for several reasons:

1. The water mill is a small building, at first glance simple, without architectural attributes; however, its purpose (grinding grain into flour) makes it almost sacred. Here man comes to the basis for his bread, the symbol of existence.
2. The conversion of grain into flour is done by the source of existence, water.
3. The way in which the power of water is transformed, from an uncontrolled flow in open nature to the highly regulated and purposeful movements of tools made by human hands, is as simple as it is sophisticated.

We include the mill in the architecture because of its mental strength, because of the enormous symbolism that accompanies man in his daily life.

In the conditions of great dependence of man on nature, the water mill had a power that was not matched by any real estate owned by man.

In many places in Bosnia and Herzegovina, in suitable places, on streams and rivers, series of watermills were installed. Those were perhaps the most beautiful pictures that people could see.

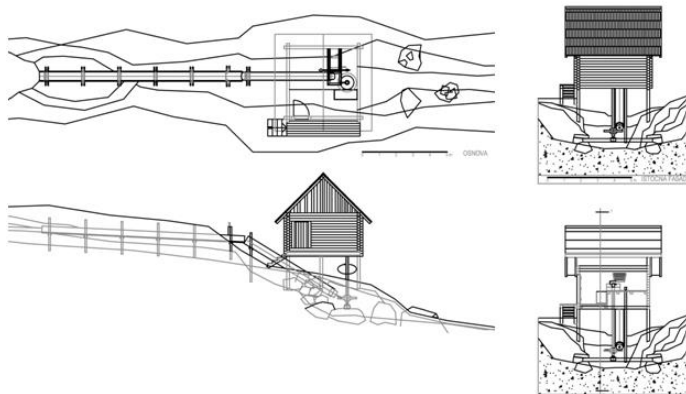


Figure 5. Watermill

Source: Author (Drawings, 2002)



Figure 6. Stream in Zepa where there used to be several mills (left).

Watermills on the Pliva river in Jajce (right)

Source (left): Sakim Hodzic (2008)

Source (right): Author (August 12, 2011)



Figure 7. Waterworks in the village of Umoljani on the Bjelasnica plateau (left). The source of the stream on which eight mills were built (right)
Source (right): Author (2008 and June 3, 2012)



Figure 8. Watermill on the Vojnica river (near Careva Cuprija on the Krivajca river)

Source: Author (June 11, 2011)



Figure 9. War watermill of the Kljajic family on Zunovski potok (1992-1995)
Source: Author (2002)



Figure 10. Watermill in the Cadovina village near Rogatica

Source: Author (April 23, 2011)



Figure 11. Dimitrije-Mito Reljic's watermill in the house complex in Martin Brod near Kulen Vakuf

Source: Author (June 16, 2013.)

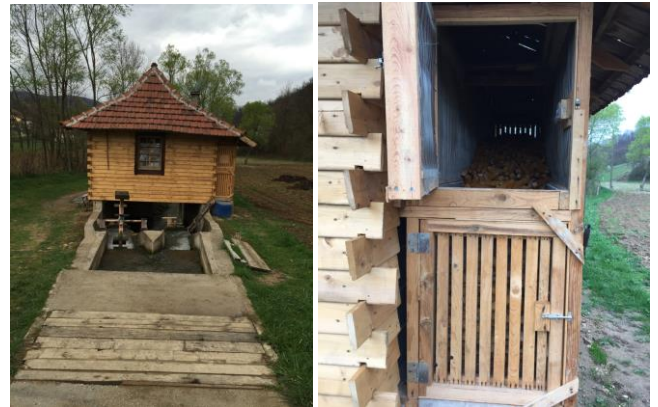


Figure 12. Watermill 'Muric' in Mala Kladusa

Source: Author (July 20, 2011)



One of the more successful examples of the sustainable life of the people in the Godusa settlement near Visoko is the construction and operation of a well-organized watermill for grinding grain on the Godusica river, which is part of a wider household property - grain cultivation (Figure 13).



Figure 13. Watermill on the Godusica river in the Godusa settlement near Visoko (owner Sead Rizvo)

Source: Author (April 8, 2017)





Figure 14. Watermills on the Listica river near Siroki Brijeg
Source: Author (June 22, 2013)

V. BUČNICE

'Noisemakers' ('Bucnice') are custom-made devices that use the powerful energy of water jets and water turbulence in a basket in which rough textiles (blankets, blankets, shirts, and various clothes) are washed. The baskets with the equipment to be washed are 'flow-through', so that the equipment is always washed with clean water. Beautiful examples of bellows can still be found today on the Bregava river in Stolac and on the branches of the Una River in Martin Brod near Kulen Vakuf (Figures 15, 16).



Figure 15. 'Washing machine regulator' in the Dimitrije-Mito Reljic house complex of in Martin Brod

Source: Author (June 16, 2013)

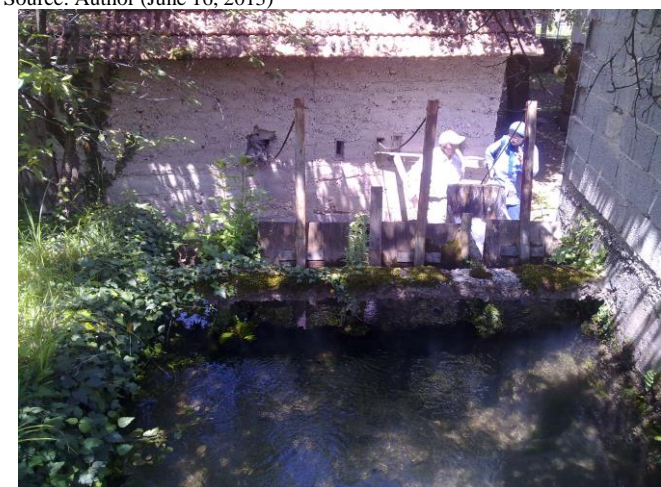


Figure 16. Dimitrije-Mito Rakic's 'bucnica' in Martin Brod

Source: Author (June 16, 2013)

VI. WATER CISTERNS (CATRNJE)

A cistern is a more or less complex utilitarian construction (system) for collecting spring water or rainwater in a suitable storage. There are several different types of cisterns that have been named depending on the context (natural and social environment) where they are built ^[16] (Figures 17-21). The more modern version of the cistern is arranged in such a way that the rainwater from the roof of the house is channeled into the pool, the walls of which are made of reinforced concrete. This cistern usually has a cover on its top, and a water outlet is mounted in its bottom through which the water is drained towards the house (kitchen, sanitary blocks).



Figure 17. Location of the water cistern in the fortress in Doboj. (Geographic coordinates: N: 44°44'16.06", E: 18°05'16.20", altitude: 169 m)
Source: Google Earth: Accessed: June 22, 2023.



Figure 18. Water cistern (catrnja) in Doboj fortress

Source: Author (July 29, 2011)



Figure 19. Water cistern (catrnja) in the Vranduk Old Town on the Bosna river (Geographic coordinates: N: 44°17'29.45", E: 17°54'14.45", altitude: 314 m)

Source: Google Earth: Accessed: June 22, 2023.



Figure 20. Water cistern (catrnja) with a stone trough (cattle trough) in the Narati village in Fatnicki polje

Source: Author (June 15, 2013)

One of the largest water cistern (caternja) in Bosnia and Herzegovina is the large 'state catrnja' built in the Osanici village near Stolac (1934). Although the building was built 89 years ago, it is still in a perfectly good structural, physical and functional condition. The surface from which the water (rainwater) collects is in the form of a trapezoid (sides 22 and 15 m, height 23 m) whose bottom is concreted. The water is collected in a concrete cistern, and from here it is caught with a container (with a chain over the pulley) and poured into the troughs placed on the side for the cattle, that is, it is poured into containers and taken home.

In case of excess water in the cistern, it flows through precisely arranged openings into stone channels outside the building and freely spills into the open space (Figure 21).



Figure 21. Large water cistern ('state catrnja') in the Osanici village near Stolac (built in 1934)

Source: Author (June 15, 2013)

VII. CONCLUSION

Architecture is a discipline that a priori implies a 'purposeful structure' which is the framework of life. Unlike other arts (painting, sculpture, music, literature, for example) where the 'artistic dimension' is their essence, architecture is a physical structure conceived and materialized in an empirical way to remain stable in its natural and social environment. It is always understood that architecture has its 'artistic component', which, like its functionality, is part of its essence [1]. The title of this paper (Utilitarian bioclimatic architecture in Bosnia and Herzegovina) refers to those examples of architecture where their essence is their functionality. In the way in which this architecture is organized, we discover the 'beauty of architecture', which derives from its obvious functionality and the way in which the current of water, that is, its kinetic energy, is used to satisfy people's needs.

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