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Old Crafts Forever on Examples from Bosnia and Herzegovina

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Abstract
The first examples of using water and wind energy are related to grinding grains into flour. Mills were the first 'industrial' objects in which some form of energy (most often the power of the water flow) was used as the driving force in the technological process. Bosnia and Herzegovina abounds with examples of folk architecture that is organized on the principles of bioclimatic architecture: individual residential buildings (rural and urban), residential complexes (Velagicevina on Buna river, Begovina near Stolac, Ilidza settlement, Gornji Seher in Banjaluka...), utilitarian architecture (mills, woolen cloth presses - stupa, fruit drying, corn and wheat warehouses) ... Majadani in the Ocevlje village near Vares are examples of bioclimatic utilitarian architecture in Bosnia and Herzegovina. By the way of using water power, architectural and technological organization of space, design and parts of details, they are a brilliant way of expressing national genius and a way of beautiful and purposeful human creations.

Keywords: Old Crafts, Water, Mill, Majdans, Sustainable Living

1. Introduction

The first mills had horizontal bladed wheels, an arrangement that later became known as the 'Nordic wheel', as many were found in Scandinavia [1]. The paddle wheel was attached to a vertical shaft which was attached to the center of the upper millstone called the 'runner stone'. The rotation generated by the water jet directed at the wheel with a vertical axis was transmitted directly to the 'stone runner', generating its rotation on the lower, fixed, stone of similar size and shape. This simple arrangement did not require gears, but had the disadvantage that the speed of rotation of the stone depended on the volume and flow of water available and was therefore only suitable for use in mountainous regions with fast streams. This dependence on the volume and rate of water flow also meant that the speed of rotation of the stone was highly variable and that the optimum grinding speed could not always be maintained. The earliest evidence of a water-powered wheel appears in the technical treatises 'Pneumatica' and 'Parasceuastica' by the Greek engineer Philo of Byzantium (c. 280 – 220 BC) [2]. The British historian of technology Michael Jonathan Taunton Lewis (born 1938) has shown that those parts of Philo of Byzantium's mechanical treatise describing water wheels, which were previously thought to be later Arabic interpolations, actually come from a Greek original of the 3rd century BC [3]. Lewis dates the invention of the horizontal wheel mill to the Greek colony of Byzantium in the first half of the 3rd century BC, and that of the vertical wheel mill to Ptolemy's Alexandria around 240 BC [4].

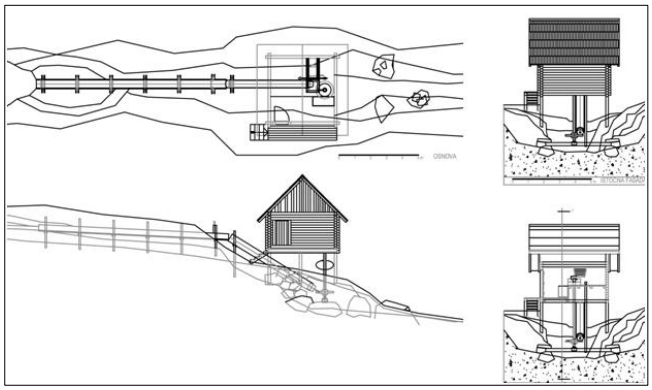
The Greek geographer Strabo reports in his 'Geography' that a water-powered grain mill existed near the palace of King Mithradates VI. Eupator in Cabira, in Asia Minor, before 71 BC [5]. The Roman writer, architect and military engineer Marcus Vitruvius Pollio (ca. 80 – 70 - ca. 15 BC) gave the first technical description of a watermill, dated 40-10 BC, where the device is equipped with a wheel and the power is transmitted through gears [6]. The 2nd century multiple mill complex at Barbegal in southern France has been described as "the greatest known concentration of mechanical power in the ancient world" [7]. It contained 16 water wheels that powered an equal number of flour mills. The capacity of the mills was estimated at 4.5 tons of flour per day, which is enough to supply enough bread for the 12500 inhabitants who occupied the town of Arelate at that time [8].

Mills (watermills)

Watermills are one of the most fascinating examples of bioclimatic architecture in Bosnia and Herzegovina [9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19] (Figures 1-12). Such a powerful attribute added to an extremely simple construction seemed appropriate for several reasons:

1. The watermill 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 mill had a power that was not equaled 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.



Source: Author (Drawings, 2002)

Fig 1: Watermill

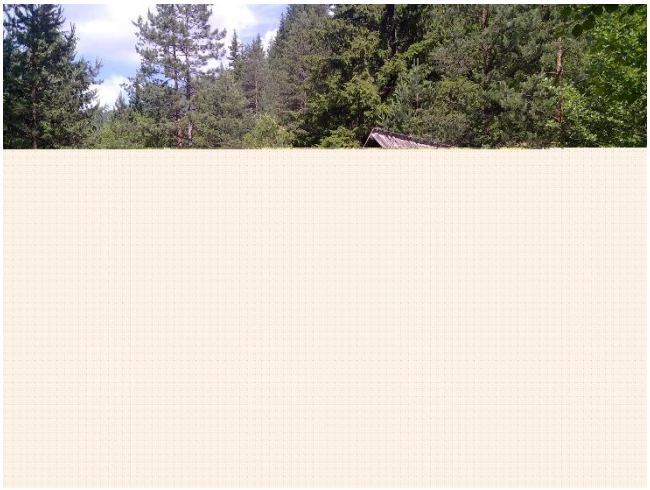
Source (left): Sakim Hodzic (2008)

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

Fig 2: Left: a stream in Zepa village where there used to be several mills (Geographic coordinates: 43°57′27.07″N, 10°07′15.10″E, Elevation 453 m). Right: mills on the Pliva river in Jajce (Geographic coordinates: 44°20′51.36″N, 17°13′38.67″E, Elevation 425 m)

Source (right): Author (2008 and June 3, 2012)

Fig 3: Left: watermills in the Umoljani village on the Bjelasnica plateau. Right: The source of the stream where eight watermills were built (Geographic coordinates: 43°39′37.01″N, 18°13′38.14″E, Elevation 1284 m)



Source: Author (June 11, 2011)

Fig 4: Watermill on the Vojnica river near Careva Cuprije on the Krivaja river (Geographic coordinates: 44°15′45.92″N, 18°24′37.86″E, Elevation 452 m)

Source: Author (2002)

Fig 5: War watermill of the Kljajic family on the Zunovski stream in the Krivaja river valley (1992-1995), (Geographic coordinates: 44°10′36.45″N, 18°32′54.71″E, Elevation 530 m)

Source: Author (April 23, 2011)

Fig 6: Watermill in the Cadovina village near Rogatica (Geographic coordinates: 43°45′43.75″N, 19°04′06.57″E, Elevation 661 m)

Source: Author (June 16, 2013.)

Fig 7: Watermill in the Dimitrije-Mita Reljic house complex in Martin Brod (Geographic coordinates: 44°29′14.02″N, 16°08′39.26″E, Elevation 356 m)

Source: Author (July 20, 2011)

Fig 8: Watermill 'Muric' in Mala Kladusa (Geographic coordinates: 45°07′33.34″N, 15°51′57.35″E, Elevation 162 m)

One of the more successful examples of people's sustainable life is the construction and operation of a well-organized watermill for grinding grain on the Godusa river (Geographic coordinates: 43°56′27.00″N, 18°10′13.76″E, Elevation 486 m), which is part of a wider estate households - growing cereals [9,142,14,18] ().

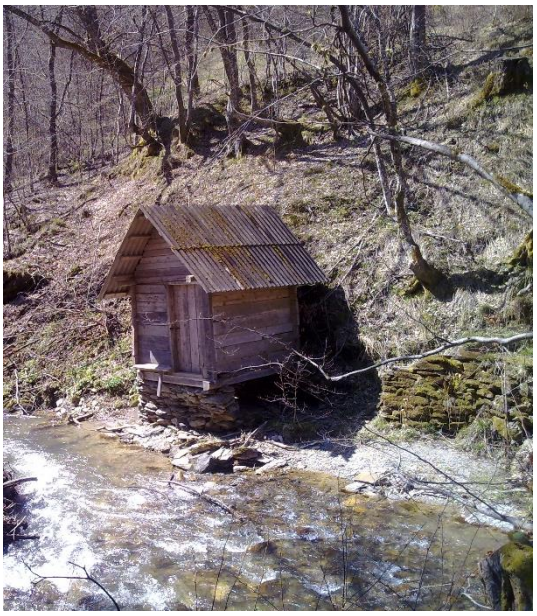

VODENICA
KOD VUKA

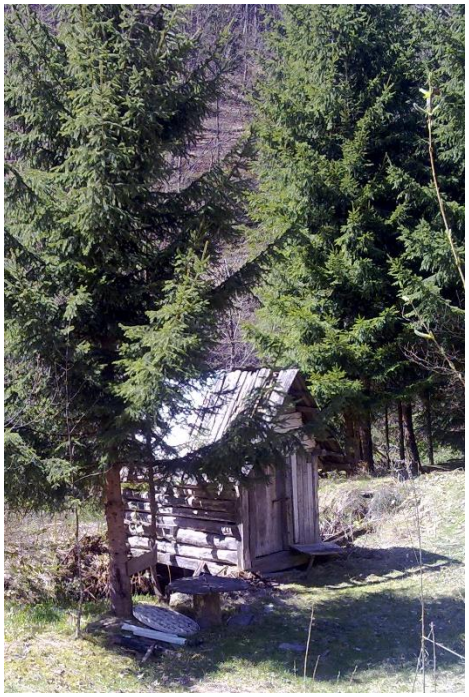
Source: Author (April 8, 2017)

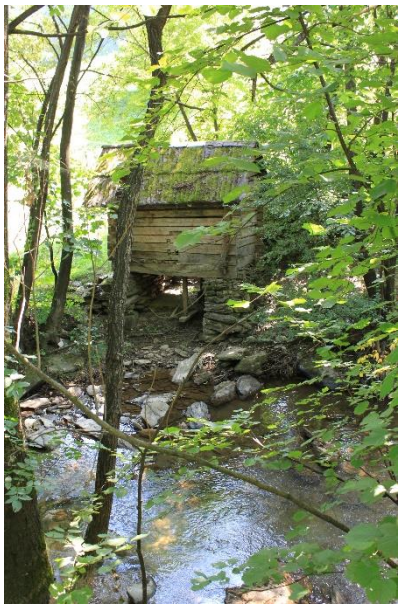
Fig 9: Watermill on the Godusica river in the Godusa settlement near Visoko (owner Sead Rizvo)

Source: Author's Photo archive

Fig 10: Watermill in Hadre village, Bosnia and Herzegovina (Geographic coordinates: 44°10′44.52″N, 18°32′36.52″E, Elevation 525 m)







Source: Author (April 17, 2011)

Fig 11: Watermills on the Kozica river near Fojnica (Geographic coordinates: 44°00′54.02″N, 17°53′01.94″E, Elevation 710 m; 44°01′36.32″N, 17°54′42.23″E, Elevation 541 m)

Source: Author (July 2012)

Fig 12: Watermill in Niksar, Türkiye (Geographic coordinates: 40°39′29.34″N, 37°11′42.21″E, Elevation 1244 m)

In conditions where there were no water flows, the driving energy for mills for grinding grain was the wind (especially famous windmills in the Netherlands), the power of animals and people (Figure 13).

Source: Professor Ejub Dzaferovic (April 22, 2008)

Fig 13: The author next to the traditional mill (National Museum Riyadh). (Geographic coordinates: 24°38′50.81″N, 46°42′38.76″E, Elevation 587 m)

Majdans – blacksmiths workshops

Majdans (blacksmith workshops) are one of the examples of business in Bosnia and Herzegovina that has existed in its authenticity for more than five hundred years; it is a specific way of producing a wide range of wrought iron products using resources from the immediate environment (Geographic coordinates: 44°10′00.48″N, 18°28′20.28″E, Elevation 789 m), (Figures 14,15,16). Iron production has been a strategic issue since the beginning of human civilizations, both for the individual and for all levels of the social communities to which he belonged. 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 products, the possibilities offered by iron as a material, this metal has always been associated with 'power', 'conquest', 'empires'...

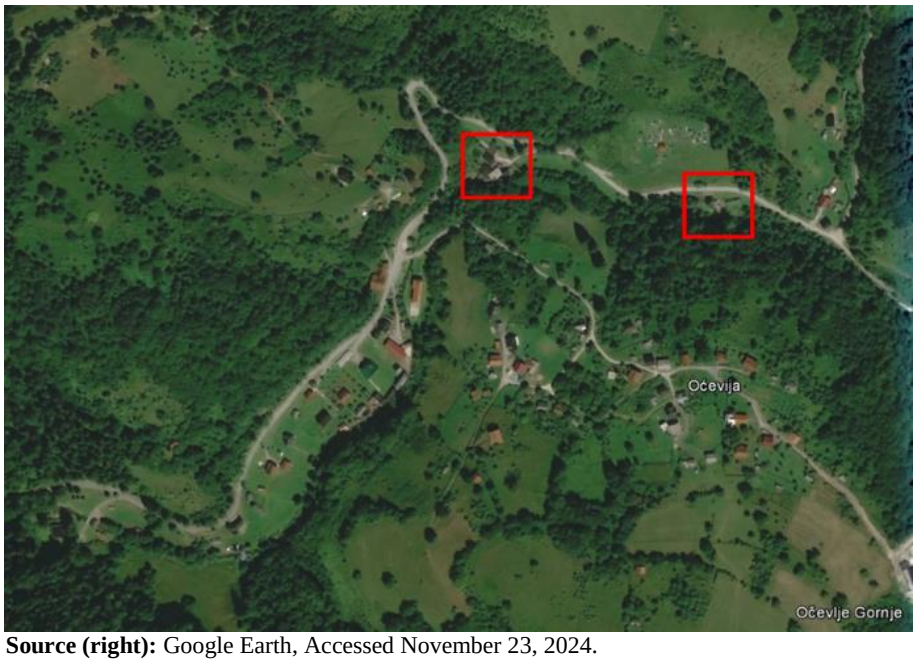
The exploitation of iron ore, as well as its processing, has always been strictly supervised and controlled by the very top of a social community (emperor, king, president of the state and its military top).

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,
4. Existence of good communications with the network of main communications in the country.

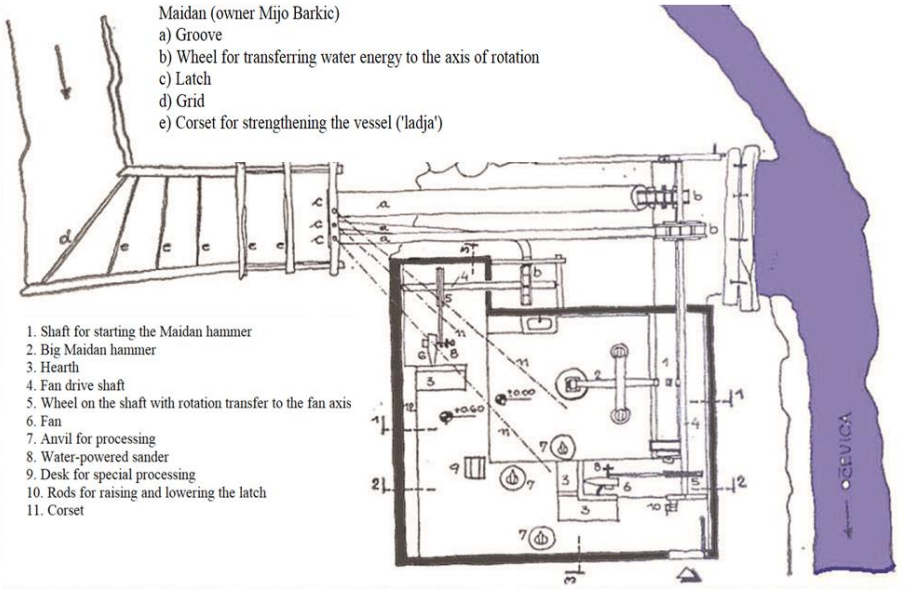
Vareš and its surroundings are known as a mining town; moreover, it was created and developed on the basis of the exploitation of iron ore and its processing into pig iron. Ocevlje is a place located between two municipal centers, Vares and Olovo. According to tradition, iron ore was once exploited in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

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 November 23, 2024.

Fig 14: Traditional blacksmith workshops (Majdans) in Ocevlje village near Vares. The location



Source: Author (Drawings, 1988)

Fig 15: Majdan (owner Mijo Barkic). Plan

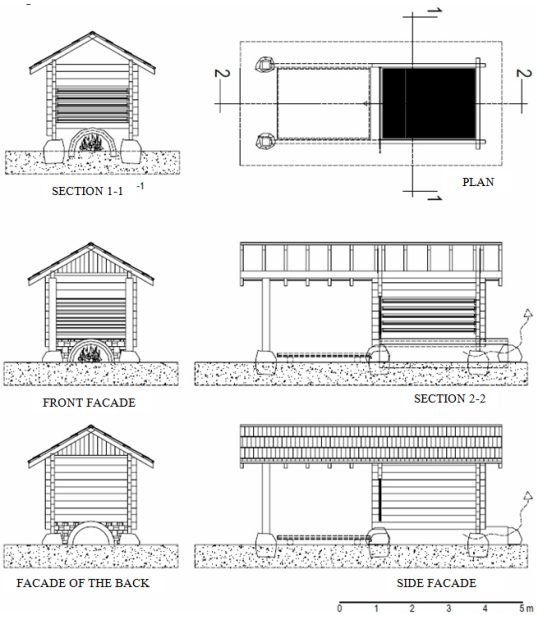
Source: Author (May 2007)

Fig 16: Majdan Mijo Barkic, today (Geographic coordinates: 44°10′00.48″N, 18°28′20.28″E, Elevation 789 m)

Kazandziluk Street in Bascarsija, Sarajevo's oriental quarter, is one of Sarajevo's oldest and most famous streets, which was once part of a much wider Kazandzija bazaar, to which the neighboring streets Luledzina and Oprkanj also belonged. The Kazan Bazaar in Sarajevo was built during the first half of the 16th century (after 1528) on the land of a rich craftsman - sagrdžija (tanner) Sagrakci Hadzi Mahmud, who is remembered for having built the mosque on Ulomljenica. Kazandžiluk got its name from the master coppersmiths, who at first made cauldrons (cauldrons) for the army, and later also other dishes and objects made of copper for everyday use (pots, kettles, dzeves, demirlijes, tables...) [20]. In the 'golden age' of the Ottoman Sarajevo, coppersmiths made about a hundred different items. Today, the assortment of Sarajevo's kazandzi has been greatly reduced, but Kazandžiluk still attracts a lot of attention with its irresistible charm, especially tourists, who throng this street at almost any time of the year (Figure 17).

Source: https://visitbih.ba/jedna-od-najstarijih-sarajevskih-ulica-kazandziluk-tradicija-duza-od-500-godina/, Accessed: November 23, 2024.

Fig 17: Kazandziluk Street in Sarajevo



Source: Author (Drawings, 2011)

Fig 18: Fruit dryer (Hosafhana)

Fruit dryer (Hosafhana)

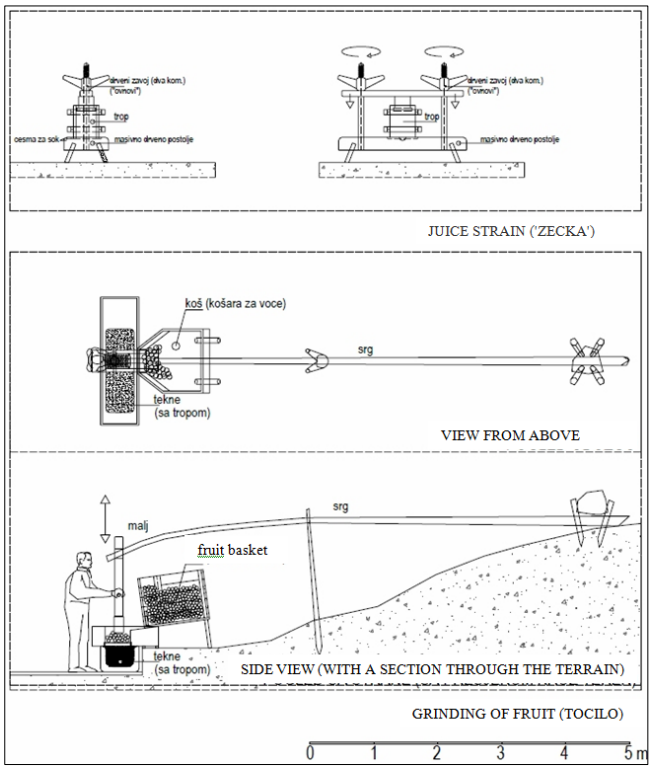
Fruit dryer ('hosafhana') was one of the most important structures of a household. It was located in the very orchard, near a small water flow, which, on one hand, rationalized the effort of bringing the fruit for drying, and on the other hand, this water was very useful in case fire broke out (Figure 18, 19).

Hosafhana consisted of a basic closed corpus, built of wooden joists, where the interior had light platforms (similar to drawers) for fruit. Access to each platform had been closed with a sliding cover. The entire basic corpus had to be perfectly closed. Inside the space, there was a furnace, which on its front part had an opening for fire, while on the back there was another opening for smoke and ash. The furnace was built of ceramic (adobe) with clay as a bond, along the semi-circle body made of wicker. (This pletar would be burned in the very first fire, thus leaving a smooth inside surface of the furnace. Later on, instead of pletar sheet metal was used). On the front side of the main corpus there was an eave, which was a constituent part of the hosafhana's roof, and which was supported by two wooden pillars. Fruits, besides having been used as dried, were also consumed fresh by the second Hadrovic generation (apples and pears), and were also specially preserved for a longer period of time: different winter dishes (tursija), fruit jellies (plum 'bestilj' and apple and pear jams).

Source: Author (April 17, 2011)

Fig 19: Fruit dryers (hosafhane) in the Kozica river valley near Fojnica (Geographic coordinates: 44°00′53.24″N, 17°53′15.94″E, Elevation 721 m),

Preparing marmalade ('pekmez') was not an easy process, and was very complicated and expensive (Figure 20). It consisted of several stages: obtaining fruit juice (by squeezing fruits, and 'filtering' the juice in a specialized machine), distillation of the juice until it turns into marmalade, putting the marmalade into wooden or ceramic jars, and storing it in warehouses (special rooms that had to be dry and with little of light, relatively low and steady temperature).



Source: Author (Drawings, 2007)

Fig 20: Large mortar and pestle for fruits (first phase of fruit processing in order to get fruit concentrate – marmalade/'pekmez'), Bosnia an Herzegovina

The weaving of a wide variety of useful items made of wool (clothing, rugs, bags, sacks, equipment for domestic animals...) was represented all over the world (Figures 21, 22).

Source: Author (lična fotoarhiva, 2007)

Fig 21: Traditional weaving in the Hadre village in Bosnia and Herzegovina (Geographic coordinates: 44°10′28.30″N, 18°32′22.38″E, Elevation 580 m)

Source: Professor Ejub Dzaferovic (April 22, 2008)

Fig 22: Author next to Traditional weaving of wool (National Museum Riyadh), (Geographic coordinates: 24°38′50.81″N, 46°42′38.76″E, Elevation 587 m)

China hosted the Great World Exhibition „Shanghai World Expo China 2010“, which was held on April 30 - October 31, 2010. The main theme of the exhibition was „Better City, Better Life“. One of the more famous pavilions was the national pavilion of Spain designed by Miralles Tagliabue – EMBT Architects. The pavilion is an expression of the climate of Spain and how it is experienced through architecture. The design of the pavilion revives an aspect of the art of wickerwork, which expresses respect for tradition, and attempts to reinvent wickerwork as a new construction technique. The Spanish Pavilion in Shanghai explores the myriad possibilities offered by wicker weaving techniques. Wicker is, moreover, a material that adds an ecological and sustainable factor to every part of the building. The technique of making baskets, the process of hand-weaving plant fibers, is a global tradition shared by all cultures throughout history. Despite variations specific to geographic regions and plant species, nearly identical techniques are used in both East and West. In this way, the choice of materials for the pavilion

meant building a bridge between the two cultures of the Spanish visitors and the Chinese hosts. The semi-transparent quality of plant fiber textiles has been used to create courtyards that, like woven baskets, create a particular atmosphere of light similar to the veiled transparencies of some Spanish-Islamic architectural elements — only partially seen, seeing without seeing, and an ever-changing play of light and shadow. Bright exterior light is diffused as it enters the interior through overlapping wicker and steel space frames. The largest courtyard in the pavilion opens outwards to greet exhibition visitors and draw them inside. The plaza can be considered to the city what the yard is to the house, a space for breathing and a space for relaxation and enjoyment. The other courtyards hover in an ambiguous territory between interior and exterior, in which visitors to the pavilion are in constant passage between one large courtyard-basket-plaza and the next; between spaces that are both inside and outside at the same time. The pavilion thus avoids the model of a box that contains one space and expresses itself through a series of hybrid spaces that enable easy and fluid movement. The form of the building was manipulated using sophisticated computer-aided design software, and the surfaces were then cut into vertical and horizontal planes creating curves that define the axes of the tubular structure. With this process, the shape of the double curvature was formalized into a combination of two pipe families with simple curves, horizontal and vertical, which reduced the complexity of making elements in the workshop. Complex three-dimensional models were also used as a communication system between the architectural studio, engineers and manufacturers in the workshops. Unlike the advanced construction of the tubular metal structure, the woven panels that cover the facade are made using much simpler, even ancient, methods. The panels are made by local wicker artisans from the Shanghai region who work in small shops using woven wicker stretched over slightly warped rectangular tubular metal frames that give the panels their deformation. An expressiveness rarely found in contemporary buildings of the 21st century was achieved using simple methods that differ very little from age-old traditional techniques (Figure 23).

Source: https://archello.com/project/spanish-pavilion-for-expo-shanghai-2010, Accessed: November 21, 2024.

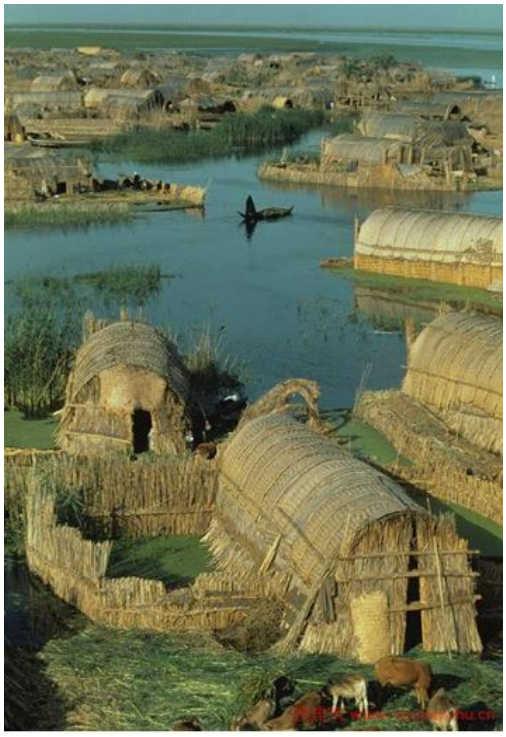
Fig 23: Spain Pavillion, Shanghai Expo 2010 (Geographic coordinates: 31°11′05.19″N, 121°28′56.84″E, Elevation 10 m)

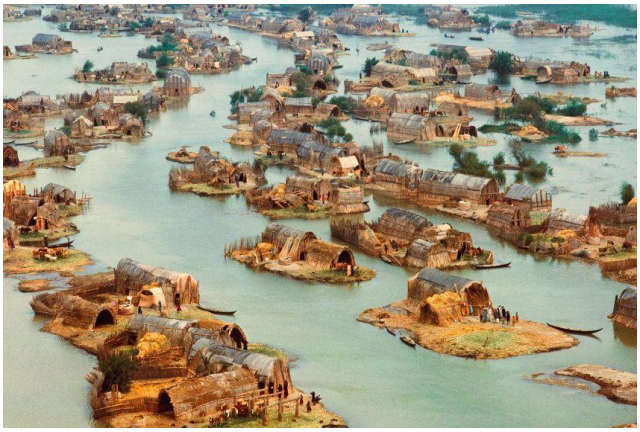
One of the oldest traditional Saudi crafts, Palm Weaving, the art of drying and weaving palm leaves, was introduced with a very practical purpose. Households would make floor containers for serving food, roofing material, floor mats and storage baskets. In southeastern Saudi Arabia is Al-Ahsu, a UNESCO creative city, and there is also AlUla, where there are palm weaving workshops at Madrasat Addeera. Local people welcome visitors to a project supported by Turquoise Mountain, a global program established by King Charles III to revive traditional crafts (Figure 24).

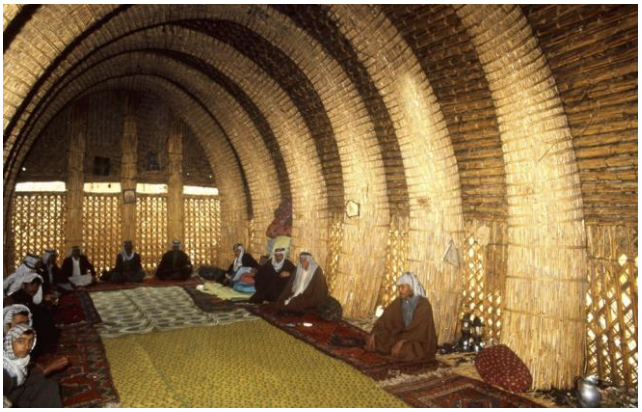
Source: https://www.shutterstock.com/search/handicrafts-saudi, Accessed: November 21, 2024.

Fig 24: Traditional craft of basket weaving in Saudi Arabia

Iraq's 'Garden of Paradise' is an area of unique marshland in southern Iraq, where a people known as the Ma'dan, or 'Marsh Arabs', lived in a 'Mesopotamian Venice', characterized by unique floating houses made entirely of reeds harvested from the open waters . These unique constructions, known as 'mudhif', were built without nails, wood or glass in less than three days. The islands on which the houses rest are made of compacted mud and reeds. It is a construction method that the inhabitants of the plains have used for thousands of years. It was considered a lost culture until a remarkable recovery began to take place in 2003 when local communities began breaking through Saddam Hussein's dikes after the US invasion of Iraq. In the same year, a four-year drought ended, and the wetlands have now been restored to cover more than 50% of their 1970s water levels. However, ecosystems can take much longer to rebuild than their destruction, and many of the Marsh Arabs have moved on, and those who return are greeted with no clean drinking water, poor sanitation, and no health or education facilities. Only miles away from war-torn cities, few are willing to risk their lives to save the swamp and its dwindling eco-friendly community, however, there is hope. Nature Iraq, founded by an Iraqi-American hydraulic engineer who gave up his life in California to help restore the country's lost Garden of Eden, is leading the effort with financial support from the United States, Canada, Japan and Italy. In one of their latest attempts to rebuild the Ma'dan community, the organization reconstructed a traditional mudhif, to show how alternative, low-cost and sustainable construction methods can work again (Figure 25).



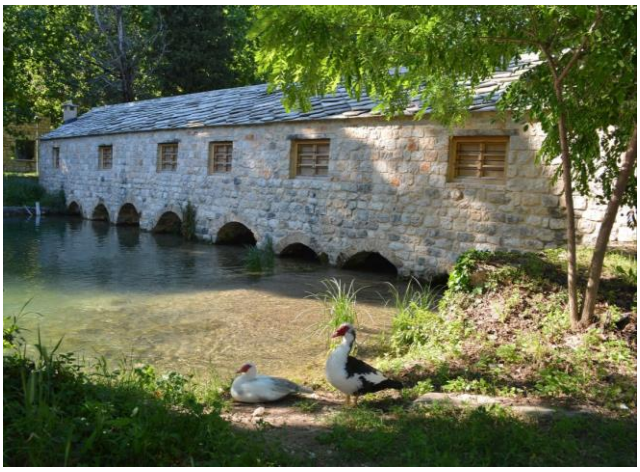




Source:
https://museumofpassion.wordpress.com/2024/04/24/venice-of-the-middle-east/, Accessed: November 21, 2024.

Fig 25: The Marshes near Nasiriya in Iraq (1974). (Geographic coordinates: 31°02′20.50″N, 47°01′22.75″E, Elevation 1 m)

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 26). We are talking about a small group of buildings, two or at most three, 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 Celebi in 1664 in his travelogue. He says that there are 10 mills powered by water in Dol on Bregava. 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 construction 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. 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.



Source: https://www.klix.ba/lifestyle/putovanja/mlinice-na-bregavinajljepsi-spoj-prirode-i-kulturno-historijskihbogatstava/170722020. Accessed: January 21, 2023.

Fig 26: Mills and stupas on Bregava river in Stolac (Geographic coordinates: 43°05′22.18″N, 17°57′43.76″E, Elevation 74 m)

Small stupas ('trlice') are simple 'devices' for obtaining fibers from hemp and flax that almost all rural households in Bosnia and Herzegovina had until the middle of the 20th century. The device worked with simple movements of the leg (or hand) on the toothed elements over a bundle of dried hemp or flax stalks where the stalks broke and the fibers remained. Later, the fibers were spun into threads that were used to make cloth for clothing (Figure 27).

Source: Private photo archive

Fig 27: Traditional processing of flax ('trlica'), Godjenje village in Bosnia and Herzegovina (Geographic coordinates: 43°59′47.12″N, 19°05′47.86″E, Elevation 880 m)

'Bucnice' are custom-made devices that use the powerful energy of water jets and water turbulence in a basket in which coarse 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 booms can still be found today on the Bregava river in Stolac and on the forks of the Una river in Martin Brod near Kulen Vakuf (Figure 28).

Source: Author (June 16, 2013)Author (June 16, 2013)

Fig 28: 'Washing machine regulator' in the house complex of Dimitrije-Miro Reljic in Martin Brod (Geographic coordinates: 44°29′14.02″N, 16°08′39.26″E, Elevation 356 m)

Conclusion

Craftsmanship (Turkish: sanat; Arabic: صَنْعَة = ṣan'a) is an activity that deals with the production, repair or maintenance of objects of general use. Masters who 'learned the trade' made their product from start to finish. In the process of craft production, the path from the raw material (from the immediate natural environment, mostly) is relatively short, 'visible and understandable' for both the craftsman and the 'side observer'. For this reason, craftsmanship products are perceived as 'real and warm', close to human nature.

The industrial production process is relatively long, where the path from the raw material from the natural environment (sometimes very far from the place of its use) to the final product involves many stages, more or less burdened by complex technological processes that use a lot of energy. The final product is serial, usually made in a large number of identical copies. Due to its 'sophistication', the industrial product is perceived as 'distant and alien' for the 'ordinary man'. While craft production is characterized by a 'one-to-one' relationship between the producer and the object of use, in industrial production the 'conveyor belt', automation and the use of robots are the basic features that generate the mass and typification of products. This feature can significantly reduce the price of the final product compared to artisanal production.

Although craft production is suppressed from industrial production (which is a 'natural' historical process), some social circumstances (of which war is an extreme example), where the individual man and his communities are necessarily brought into dependence on the natural environment and the resources it offers, man turns to traditional patterns of production in order to survive. The author of this work witnesses such a situation in besieged Sarajevo during the 1992-1995 war, where people, for example, grew vegetables on apartment terraces and in flower vases and created various useful objects in fascinatingly inventive ways. Hence, the preservation of craft production is extremely important for all of humanity, for objective and

purposeful reasons of its character and for cultural and historical reasons. Many crafts have died out to this day, and many have been placed under the protection of UNESCO as a universal value of humanity.

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