Open Living Concept in Barn-House Architecture: Single-Family House Case Studies

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Abstract. 'Barn house' architecture can be presumed as a style or trend in contemporary architecture. The term 'barn-house' refers to a house that architecturally refers to a barn with a simple, longitudinal form with pitched roof. Originally, barns were converted to houses for practical reasons. Later on, the design aspect was getting more important and any house or any barn were not enough, and so it turned to be a style which can be described as 'designed barn-house'. The idea appears to be well-recognized: many built houses and house designs represent that style. Also, several online blogs on that subject have been created and published dozens of examples. We may presume that many contemporary architects have either already designed or are aware of designing a barn-house. The reason for that is mostly simplicity of architecture, and lack of details which are common in contemporary architecture. 3 case studies of barn-type house designs have been presented in the article. All of them have been designed by the authors. All the concepts have been designed using synthetic models: physical and virtual. The open space concept can be recognized in all the three case studies: the interior layout seems to be more important than the exterior in that kind of architecture. The authors conclude that some uniform rules can be recognized in barn-type architecture design. However, many concepts have gone far beyond the original barn-house idea. The question is whether that trend can be presumed as distinctive?

1. Introduction

It is hard to define a barn-house unequivocally. Everyone knows, intuitively, what such a house should look like, but there is no clear definition. It is assumed that a barn-house is a simple angular building covered with a two-sided roof with the roof ridge perpendicular to the longer edge, the hood of which does not project outside the face of the longer side of the wall. Steen Eiler Rasmussen wrote: From the architect's point of view, the appearance of a building is only one of several important factors. An architect studies the plans, cross-sections and façades, because it believes that all those elements must be in harmony in a well-designed building, [1]. The body of a former barn as a utility building is a universal archetype. These structures always look the same. What changes depending on the longitude, is the inclination of the roof. Over the last thirty years, however, we may notice numerous constructions of mixed-use single-family buildings using that archetype. Apart from redevelopment of former barns into residential buildings, there are more and more newly designed buildings based on the assumptions of a former barn.
There are several reasons for conversion of a utility building for residential purposes, from economic factors, through more and more important energy savings, to esthetics and utility factors. Many materials that have been known for years in the construction industry are used in modern barn-houses – assigning them with new meanings, joining not only the utility building with a residential building, but also joining the past with the present [3]. However, the barn-house concept does not exclude applying new solutions, such as roof windows, steel structural elements or the wall and roof insulation necessary in our climate zone.

2. Pioneering Examples of Barn-Houses

Many buildings of that type are currently being constructed. However, the history of architecture knows pioneering implementations which made barn-houses popular among multiple investors.

One of the prototypes of a contemporary barn-house is definitely the Rudin House, designed by Jacques Herzog and Pierre de Meuron. It was erected in 1996-1997 in Leymen, High Rhin in France. Apart from the traditional hood-free forms and clean lines from a barn, the materials applied allow water to freely flow from the roof on the concrete walls, without the need to use a hood or gutters. Besides, the first floor was raised above ground to reduce its decline, like in barns in the past on an inclined area, which makes it above the level of the water flowing from the building to the container situated at the level of one of the terraces. However, the height of the building is very different from a utility building. That is because it consists of two stories, which has not been typical for the original utility buildings which covered the area of the first floor and habitable attic, usually for storing light materials or hay. Iliopoulos Vasileios states that Jacques Herzog and Pierre de Meuron re-invented the archetype for a house [4], but authors believe that it may be a pioneering prototype of a contemporary barn-house.

Another building which has appeared in many publications and is definitely recognizable, is the Balancing barn designed by the MVRDV studio, located near Thorington in Suffolk, England, erected in 2010. The basis for the concept of that house, of leisure character, was combining the traditional form of a barn with maximum openness to the surrounding landscape. That is why, in order to provide the best open view, the building was projected over a slope, and the glass floor in the living room allows you to see the lawn and the children playing under it [5]. The long (almost 30 meters), one-story building, with the façade of only 7 meters, reflects the surroundings and the changes taking place therein, and has definitely consolidated the barn-house model popular nowadays, even though suspension above ground is not commonly used. However, the plan of the building is very universal. The division between the living space consisting of the living room and kitchen, and the bedrooms with bathrooms has been, with small modifications, applied in most barn-house type buildings. What is also frequently applied is the creation of open living space above one story – to reveal the depth of space up to the inclined roof slope, and application of roof windows to provide more light for the living space. The Balancing Barn is an energy-efficient building. It is equipped with a ventilation heat recovery system, which is also an almost obligatory solution in newly designed houses using that type of structure [4], as well as good insulation of external partitions.
Investors are more and more interested in barn-house type residential buildings. The reasons why they use such solutions are varied. The most important ones include:

- Intention to build an energy-efficient house, with low maintenance costs in the future,
- Compact shape of the building to reduce the costs of construction,
- Adaptation of the building to the plot which, due to rising land prices, is more and more often very narrow and long, or with limited access road [8],
- Esthetic aspects of the building, often resulting from fashion or current trends.

After a lot of fascination, mainly in 1989 – 2000, with seemingly catalog models, individual “custom-made” models are becoming more and more popular. For a particular investor, adapted to its individual needs and preferences, as well as financial capacity. Such an approach allows to create internal and external space in a more effective way, and to save money not only during the construction, but also in future maintenance [9]. Also, they are adapted to a specific plot, in order to best use its properties and limit its disadvantages.

Such designs include many barn-house implementations. That is because such buildings allow to meet the requirements of investors in terms of internal space and openness to the surroundings – usually a private garden. The concept of a large, common space for all the residents, is popular in the implemented designs. The space becomes easy to define – it’s the space for everyday life – for leisure, family meetings or meals. Nowadays, more and more often it no longer the space of a quadrilateral room, but the space without clear boundaries, separated from the rest of the house not only with physical barriers, but also mental ones [10], such as different floor or height.

The space of the living room, often with an open kitchen, often takes up about 40% space of the whole building, without taking into account utility rooms and garages. However, as that space is open higher than the other rooms (usually with a mezzanine with a view from the story above), its cubic capacity comprises almost 50% of the whole house (without taking into account utility rooms and garages). A view open of the surroundings is one of the leading requirements from investors. The changing times of day, week and year, in which that zone is constructed, almost completely excludes the possibility to provide light only from one side. Therefore, the glazing elements in the living zone are located in the corners, through and through or from every side, [11]. However, usually, apart from the view of the garden from the sofa – the center of the living zone, in a way – is to be supplemented with a view of a TV screen or a fireplace, and often preference is placed on eye contact with a person in the kitchen area. Those requirements were met in all of the following cases.
3.1. Wonky – Poles Barn House

A single-family house of the area of 132 m², designed in 2007 in the town of ŁanyWielkie. Design authors: Tomasz Bradecki, Barbara Uherek – Bradecka.

The design was prepared for a longitudinal plot of the dimensions of 18x71 m, with entry from the south. Two-sided hood-free roof with the angle of inclination of 30°.

The living zone is open to the west and north-west. It is extended with a partly covered terrace. The aesthetics is determined by oblique and asymmetric poles supporting the protruding roof which protects not only against the rain, but also against excessive solar radiation and overheating [12]. The utility space includes the first floor and the attic which may be utilized due to raised knee walls.

![Figure 4. Wonky – Poles Barn House, Łany Wielkie, 2017, view](image)

![Figure 5. Wonky – Poles Barn House, Łany Wielkie, 2017, cross-section](image)

The two-story living space, of the height of 6.7 m at the top, with a mezzanine, results from the concept of open space connected with the kitchen, which constitutes the heart of the house. It is additionally lit due to the large glazing on the garden. Apart from that, in the first floor there is a studio, a utility room and a bathroom. The whole private area, including a bedroom, a children’s room and a bathroom, is located in the attic [8].

![Figure 6. Wonky – Poles Barn House, Łany Wielkie, 2017, first floor plan, draft](image)

![Figure 7. Wonky – Poles Barn House, Łany Wielkie, 2017, attic plan](image)

3.2. Barn House in Tychy

An individual design of a single-family house of the area of 200 m², by Tomasz Bradecki and Julia Swoboda. Designed for a narrow, trapezoid plot of the dimensions of 16x73x83x19 m, with entry from the north. The living zone is open to the south with a projecting roof, supported on extended external walls, providing cover for the terrace [12]. An analogical, but a little smaller roof, was designed over the entrance zone and over the partly protruding garage. The home space includes the first floor and habitable attic.
Like in the previous case, the living zone consists of two stories with a mezzanine that provides a view of the first floor from the attic. The height of the living zone is 7.5 m at the top, and decorated with the visible structural elements of the roofing. The whole private zone is located in the attic [13] and includes a bedroom with a walk-in closet, a bathroom with a laundry room and two additional bedrooms.

3.3. Barn’o’house
Design of a single-family house, prepared as an individual order, located in Szalša near Gliwice, of the area of 166 m². Authors: Tomasz Bradecki and Barbara Uherek – Bradecka. The design was implemented in 2016, on a rectangular plot of the dimensions of 20x40 m, with entry from the west.
The living zone and terrace are open to the south. The proper placement of the house on the plot allowed to create a large terrace while at the same time keeping it away from the border of the plot, as required by regulations. The highly protruding roof covers the garage and the car station. The original concept of raising the roof over the living space was changed during implementation – the investors resigned from raising the wall in the living room and from introducing the element of flat roof – making the decision to have a two-sided roof over the whole building.

The arrangement of the house is a little different, longitudinal – both the living and private space is located on the first floor. However, the private zone, consisting of a hobby room, 3 children’s rooms and a bedroom, is situated behind the living zone, and they are connected with a long, straight corridor ending in the glazing that allows to enter the garden on the other side – directly from the private zone.

4. Conclusions

The obvious common elements of those buildings are: hood-free roof, compact shape, terrace as an integral part of the living space, and clear distinction between the living and private zones. The case studies presented above allow us to realize, however, that there are many possibilities to transpose a classical utility building to residential needs.

That is because there exist both single-story and two-story (ground floor + habitable attic) buildings, with completely open or partly separated kitchen, with or without a covered terrace. However, if we compare them, we will notice that there are more elements that distinguish barn-houses from classic single-family houses. One of the most important ones is the presence of large glazing in the living zone, understood as the living room with the kitchen. In a traditional house, the ratio of glazing to the area of the living zone must be at least 0.125 of floor space. In practice, with the application of balcony windows, that ratio amounts to ca. 0.167. In the designed barn-houses that ratio is much higher and similar in all three designs. It is presented in the table 1 below.

| Table 1. Barn houses comparison |
|----------------------------------|
| Wonky – poles barn house | Barn House | Barn’o’house |
| Area of the living zone | 44m² | 46.87 m² | 43.22 m² |
| Glazing in the living zone | 21.89 m² | 20.4 m² | 20.4 m² |
| Glazing to living zone area ratio | 0.5 | 0.45 | 0.45 |

Although only 3 buildings were analyzed, even such a small sample allows to state that the living zone of a barn-house is much more open, with glazing, than in the case of traditional architecture.
Although the surfaces of the living zone are of average area, with increase cubic capacity upwards and a lot of glazing, such houses are spacious and bright. And maybe this, together with the above-mentioned reasons, makes those designs more and more popular and more and more constructed.

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