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Research paper

ADAPTIVE REUSE OF TRADITIONAL ARCHITECTURE: A CASE STUDY OF AN OLD HOUSE IN THE RURAL SETTLEMENT OF MUŽINAC

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Abstract *Old houses in rural areas preserve the spirit of past times, materializing tradition, local customs, and construction skills that shape the identity of a place. This paper addresses the issue of adaptive reuse of traditional vernacular architecture through the case study of an old house in the rural settlement of Mužinac, in Municipality of Sokobanja, southeastern Serbia. The aim of the research is to define a sustainable approach to the restoration, reconstruction and revitalization of a vernacular building by proposing structural interventions and identifying an appropriate new function. Field analysis, precise measurements, and documentation were used to assess the existing condition and define appropriate intervention strategies based on the principle of minimal intervention. The results demonstrate that a traditional house can be brought back to life in a relatively simple manner, thereby promoting a sustainable approach to the preservation of rural architectural heritage and the safeguarding of local traditions.*

Key words: *adaptive reuse, restoration, reconstruction, revitalization, traditional rural architecture, Rtanj Tea House*

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1. INTRODUCTION

Old houses in rural settlements, as examples of vernacular traditional architecture, represent valuable heritage that preserves the spirit of past times, embodies tradition and building craftsmanship, and connects new generations with their ancestors [1] [2]. Despite their significant cultural, historical, and ecological value, only a small number of well-preserved old houses remain in Serbia [3] [4]. Most of them are deteriorating due to long-term exposure to harsh weather conditions and careless human interventions [5] [6]. Rural vernacular architecture not only reflects the rich history and traditions of rural communities but also achieves harmony with the natural, cultural, and social context through the use of local natural materials and traditional construction techniques [7] [8].

This paper focuses on the analysis and proposed adaptive reuse of an old house in the rural settlement of Mužinac, Municipality of Sokobanja, southeastern Serbia, examined from architectural, structural, and functional perspectives. Although the building is not designated as a cultural heritage asset [9], it possesses characteristics of vernacular architecture that contribute to the local identity and should therefore be preserved [10]. Accordingly, this study addresses the following research question: "How can adaptive reuse ensure the long-term preservation and sustainable use of vernacular rural architecture?" In order to answer the research question, adaptive reuse was analyzed through three complementary aspects: restoration, reconstruction, and revitalization, applied to the subject building. The aim of this study is to explore the possible solutions that would simultaneously preserve the building's original characteristics and enable its contemporary use in accordance with the modern needs of people. The study also demonstrates the benefits of applying the principle of minimal intervention [11], emphasizing the preservation of existing materials, authenticity, and the avoidance of unnecessary alterations [12] [13].

2. RESEARCH METHODOLOGY

Adaptive reuse is examined through restoration, reconstruction, and revitalization. Restoration is applied to preserved elements requiring repair; reconstruction to missing or severely deteriorated elements; and revitalization to the compatible new function needed for long-term use. Each proposal follows the condition assessment.

Methods included field inspection, precise measurement, technical documentation, and identification of damage to architectural and structural elements. The adaptive-reuse proposal was then developed according to the principle of minimal intervention.

2.1. Existing condition analysis

The house is located in the village of Mužinac (Figure 1a), within the Municipality of Sokobanja in southeastern Serbia. The cadastral area of Mužinac includes part of the Special Nature Reserve Rtanj, which gives the area ecological significance and potential for the development of tourism-related activities.



Figure 1. Location of the house a) in relation to the village of Mužinac b) in relation to immediate surroundings (GeoSrbija, Google Earth, author's processing)

Located in the central part of a rural household in the southern section of the village settlement, the old house opens on its western side toward Dušanke Spajić Street, while within the household there are four additional structures: newer house, old granary and two barns (Figure 1b). The house was built before World War II and was originally used for residential purposes, while today it is used as a storage space. The main reason for the underutilization of the house's potential is the current condition of its architectural elements, which are partially damaged.

The building (Figure 2) is a traditional timber-framed (bondruk) [14] house characterized by a stone masonry basement, timber structural elements, earthen infill walls, wooden floor and roof structures, and largely preserved original joinery. Despite a prolonged period of inadequate maintenance and exposure to external factors, the overall structural condition remains stable. The condition assessment was carried out through an in situ visual inspection and an authorial assessment, based on observable deterioration, material condition, structural stability, and the preservation of individual building elements.

The stone basement walls and primary timber load-bearing elements are well preserved, while the most significant deterioration is visible in the roof covering, where damaged clay tiles and deteriorated battens have led to water infiltration. Additional deterioration is evident in the external wall finishes, where the loss of protective plaster layers has exposed parts of the earthen infill to weathering. Original windows and doors have been retained to a large extent, exhibiting only localized damage and material loss. Overall, the building retains a high degree of authenticity, with most architectural elements remaining intact and requiring primarily conservation, repair, and localized restoration interventions rather than extensive reconstruction.



Figure 2. The old house in Mužinac (author)

The house has a rectangular floor plan, with a ground floor and a basement, both levels having separate entrances on the southern facade. Due to the slope of the terrain, the basement is partially underground and smaller in size than the ground floor. The ground floor consists of four rooms, whose layout is characteristic of the Morava house. On the western side, there is a canopy, later added along the edge of the plot next to the road, which disrupts the harmony of the house's original appearance (Figure 3).

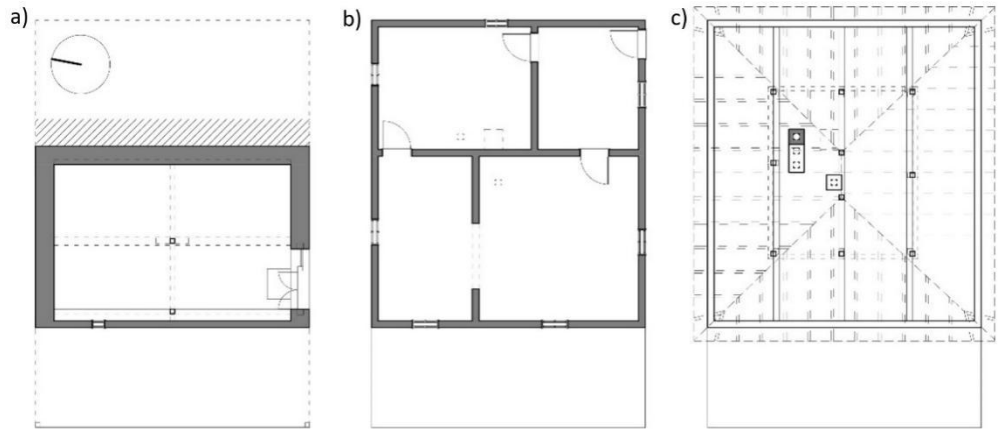


Figure 3. Plans of the old house: a) basement plan, b) ground floor plan, c) roof structure plan (author)

2.2. Restoration aspect of adaptive reuse

Restoration refers to the process of returning the existing fabric of a place to a known earlier state by removing accretions or by reassembling existing elements without introducing new materials [11]. In the case of the subject building, restoration involves the repair and conservation of existing architectural elements rather than their replacement with new ones, while preserving as much original material as possible [15].

Regarding the walls, damaged infill should be restored using traditional techniques such as 'čatma' and 'plet' [14], followed by a traditionally applied lime-plaster finish.

Basement walls require only localized repointing to improve durability and weather protection.

The intermediate wooden floor structure is generally sound; damaged boards should be replaced, after which the floor should be sanded and protected.

The rammed-earth floor requires leveling and consolidation. Although a wooden finish could align it with the other rooms, retaining rammed earth in at least one room would preserve this traditional construction technique.

The attic structure requires removal and repair of deteriorated infill with traditional materials (mud, straw, and twigs), followed by lime whitewashing.

Windows and interior doors should be conserved by reinstating missing glazing, repairing or replacing individual fittings, filling and sanding the timber, and applying protective finishes.

Both chimneys should be returned to use. On the three-flue chimney, the functional flue should be repaired and the two unused sections dismantled.

2.3. Reconstruction aspect of adaptive reuse

Reconstruction refers to the process of returning a place to a known earlier state but it is distinguished from restoration by introducing new materials into the fabric [11]. Reconstruction is applied where restoration is no longer feasible; in the case of the subject building, it is required for the rebuilding and/or replacement of certain architectural elements in order to restore the building to its original functional condition.

Based on visible damage (Figure 4), it can be concluded that the two exterior walls of the entrance room originally contained arches, indicating that the house belongs to the Moravian architectural style [16]. The arches were later infilled, thereby transforming the porch into an enclosed entrance room.

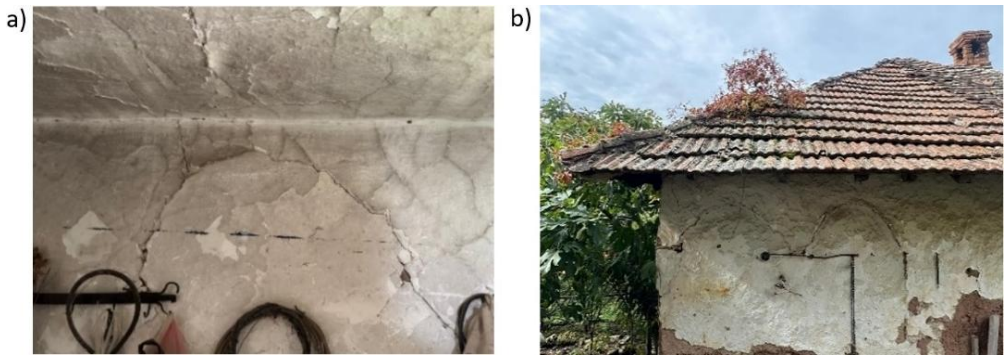


Figure 4. Visible damage within the entrance area indicating the former existence of arches: a) interior view, b) exterior view (author)

One of the elements to be reconstructed is the entrance area, which originally functioned as a porch (trem). It is proposed that this space be restored in accordance with its original form and construction principles, using traditional building techniques. Given that the structural system of the building is preserved, the porch can be re-established by removing the existing infill and reopening the original arched openings. Three arches are planned on the southern side and two more on the eastern side. The

exact positions of these arches correspond to their original locations and can be identified based on semicircular traces and damage patterns preserved on the walls. This reconstruction would reintroduce two entrances through the porch instead of the existing single entrance, thereby restoring the characteristic features of Moravian-style vernacular architecture (Figure 5). The existing entrance doors, which are in poor condition and do not belong to the original architectural concept, should be removed, as the reintroduction of arches in accordance with the original facade design is planned at this location.

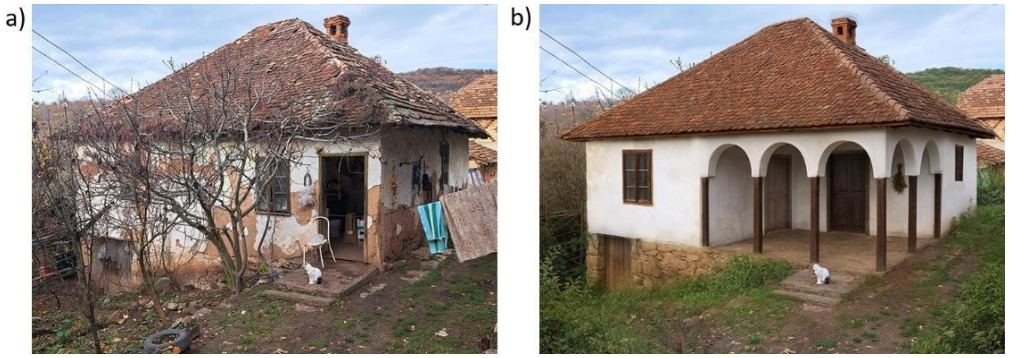


Figure 5. Reconstruction aspect of adaptive reuse: southeastern view: a) existing condition, b) proposed reconstruction (author, author's intervention on the photograph, use of AI and Photoshop)

The canopy located on the western part of the building, which was intrusively added at the end of the last century as a garage space, should be dismantled. This addition significantly alters the original appearance and identity of the house. In order to bring back the building's former architectural expression and achieve a more coherent facade composition, the canopy is to be removed, ensuring that the remaining structure of the building is not affected.

The roof requires reconstruction, which includes carefully removing and storing the roof tiles, followed by partial dismantling of the roof structure in order to repair damaged elements. Sound columns and beams should be preserved, while only those elements that are in poor condition and structurally compromised should be replaced. Since the rafters are in a deteriorated condition, they need to be largely replaced with new ones. For certain parts of the structure, it is possible to reuse preserved timber from the dismantled canopy. After the roof structure has been restored, the roof should be re-covered with the preserved original clay tiles, while missing quantities should be supplemented with reclaimed tiles of the same type, sourced from dismantled buildings of the same period in the surrounding area, in order to ensure material and visual consistency of the roofing. As for one of the chimneys, the removed section should be rebuilt and aesthetically integrated with the existing structure.

2.4. Revitalization aspect of adaptive reuse

Revitalization refers to the process of introducing new uses for buildings while minimizing the impact on their original values and characteristics, with the primary objective of extending their lifespan and ensuring their continued use [17].

In order for the building to be revitalized, it is necessary to redefine its function. Several adaptive reuse options were considered, including residential reuse, an ethnographic museum, and tourist accommodation. Considering that a residential building already exists on the plot, it is not advisable to revitalize the old house as another living space. Even with full rehabilitation, the use of original furniture, and the preservation of the traditional spatial organization, such a building would not be able to fully meet the needs of a contemporary user. Tourist accommodation would require extensive alterations and modern sanitary facilities that would compromise authenticity. A conventional ethnographic museum would preserve the building but would provide limited economic sustainability.

Therefore, it is necessary to establish a new function, while the house would retain its authentic appearance, restored and reconstructed through the previously defined interventions that return its original character. Accordingly, the most appropriate and sustainable use of the building is its transformation into an unconventional museum, the "Rtanj Tea House." This concept preserves the architectural heritage while integrating the local identity of the area through the traditional practice of medicinal herb collection, which has long been part of the inhabitants' everyday life, including the owner's household. By presenting this intangible cultural heritage alongside traditional architecture, crafts, and other local values, the proposed function creates tourism potential and supports long-term economic sustainability.

In addition to its museum function, the building would also have the potential to partially function as a small commercial space, a showroom for local products, as well as an environment for rest, tasting, and tourist visits. In this way, the new function would significantly contribute to the sustainability of the entire household.

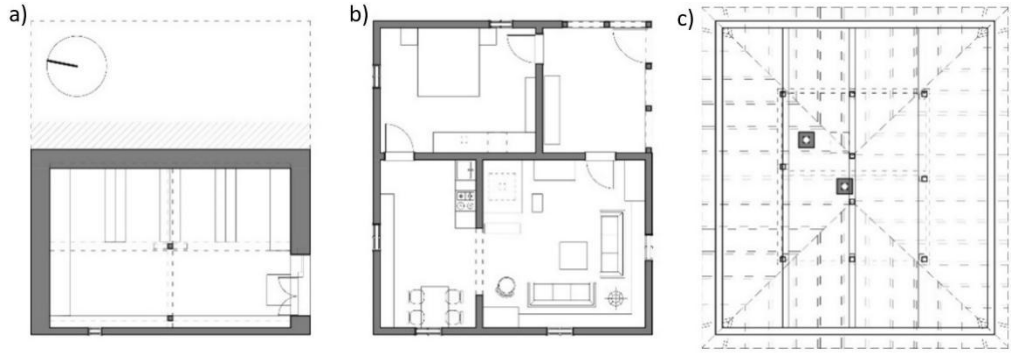


Figure 6. Plans of the revitalized old house: a) basement plan, b) ground floor plan, c) roof structure plan (author)

The ground floor is designed in such a way as to preserve the existing circular flow of rooms. The porch in the southeast becomes a visitor information space, from which one enters the southwestern room arranged as a living area with displayed products and items of cultural value. The chimney is used to form a hearth, "ognjište", assumed to be an original element of the house, where visitors can learn about tea preparation and taste the products. In the northwest, there are displayed products and a small auxiliary kitchen for tea preparation. The northeastern room offers an experience of

sleeping on a straw mattress accompanied by the scents of indigenous medicinal herbs and has access to the porch. No bathroom or toilet is planned within the house, in accordance with the preservation of its original character, as these facilities were traditionally located outside the house. If required, such facilities could be provided in an existing auxiliary building within the household or through a new discreet secondary structure designed according to conservation principles. The basement is arranged to serve as a storage area for products (Figure 6).

3. RESEARCH RESULTS

Table 1 summarizes the condition of the main building elements, the proposed measures, and intervention intensity established by in situ visual inspection and authorial assessment. Low, medium, and high intensity correspond respectively to damage affecting up to 20%, 20–50%, and more than 50% of an element. Low- and medium-intensity interventions are treated as restoration; high-intensity interventions require reconstruction because they introduce new material or structural components.

Restoration is proposed for basement and ground-floor walls, floors, doors, intermediate and attic structures, windows, and one chimney. Reconstruction is required for the severely deteriorated roof, porch, and partly collapsed chimney, while the intrusive canopy is removed.

Table 1. Comparative overview of architectural elements, proposed restoration and reconstruction measures, and intensity of required interventions

Building element	Existing condition	Intervention type	Intensity
Ground floor walls	Structurally sound and stable, with local infill damage	Restoration: repair of masonry infill and lime mortar finishing	Medium
Basement walls	Stable, partially washed-out joints	Restoration: repointing of joints	Low
Intermediate floor structure	Functional, with partial deformations and infill damage	Restoration: replacement of damaged floor sections, impregnation of timber	Medium
Attic structure	Main wooden elements stable, infill damaged	Restoration: repair of damaged infill sections, lime mortar finishing	Medium
Floor	Uneven, partially damaged	Restoration: repair, leveling and consolidation of rammed earth	Low
Windows	Partially damaged but functional	Restoration: repair, sanding, and protective coating application	Medium
Doors	Minor damage	Restoration: improvement of current condition, sanding and protective coating	Low

Roof structure	Roof covering and some structural elements damaged	Reconstruction: repair of individual structural elements and reinstallation of roof tiles	High
Chimney 1	Stable and partially damaged	Restoration: repair of the damaged sections	Medium
Chimney 2	Partially collapsed	Reconstruction: replacement of the collapsed section	High
Porch	Traces of a former porch on the walls	Reconstruction: full reconstruction of the porch	High
Canopy	In conflict with the rest of the building	Removal and dismantling of a later intrusive addition	High

Revitalization introduces the sustainable 'Rtanj Tea House' within the preserved Moravian-house framework, combining tourism, local products, heritage presentation, and education about medicinal plants. The proposal thus restores the original architectural character while assigning a viable contemporary use.

Adaptive reuse supports long-term preservation by combining minimal intervention, traditional techniques, and compatible local, reused, and natural materials with a viable new function. Limiting work to necessary repairs or replacements preserves the house's form, spatial organization, authenticity, and heritage values, while locally available resources reduce costs and the 'Rtanj Tea House' concept ensures continued use.

4. CONCLUSION

This study highlights that adaptive reuse can ensure the long-term preservation and sustainable use of vernacular rural architecture by balancing heritage conservation, material authenticity, and the integration of appropriate contemporary functions. It emphasizes the importance of preserving rural houses as part of both tangible and intangible cultural heritage, with particular attention to the use of traditional, locally sourced, and environmentally sustainable materials. The proposed model can serve as a guideline for the restoration of similar vernacular houses in southeastern Serbia and beyond, encouraging further research into traditional techniques, the involvement of local communities, and the development of sustainable usage programs.

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