SUSTAINABLE VERNACULAR RESIDENTIAL ARCHITECTURE IN BOSNIA: LOCAL MATERIALS IN A COMPARATIVE STUDY WITH SLOVENIA

Džana Ahmetović[1*]

[1]International Burch University, Faculty of Engineering and Natural Sciences, Department of Architecture, Sarajevo, Bosnia and Herzegovina
*corresponding author: dzana.ahmetovic@stu.ibu.edu.ba

Paper type: Original scientific paper
Received: 2025-09-01
Accepted: 2025-09-25
Published: 2025-09-30

UDK: 502.131.1:72
DOI: 10.14415/JFCE-921

ABSTRACT:

Old Constructions Technology Conventional construction methods, economic variants though they may be, followed by modernism, have nearly replaced traditional methods. This research investigates the potential for using regional materials and traditional construction processes in the process of achieving sustainability in modern housing design in Bosnia.
The focus of this work is the contribution of traditional local buildings to energy saving environmental protection and culture upholding. The study takes a case study approach with desk studies and expert interviews. The study is grounded in three cases (Hiža Mišljenova in B&H, Hiša MM and Hiša N in Slovenia) and three interviews with experts specialized in the field of architecture and sustainable construction (prof. Sanela Klarić, arch. Vedina Babahmetović, prof. Elša Turkušić Jurić). It presents challenges and opportunities for applying sustainable, local materials and continuing local building traditions in renovation.
It has examined the role of vernacular architectural elements in some of today's buildings to show how integrating these elements into modern construction technology can realize energy efficiency, lower carbon dioxide emission and identity of the culture. The recommendations in the report are directed at policymakers, architects and building managers for sustainable development solutions that both preserve heritage and fulfill the needs of contemporary construction. The report eventually calls for a new way of construction where consideration of local traditions becomes a touchstone for the response to today's environmental issues.

KEYWORDS:

Sustainable design, Vernacular architecture, Environmental sustainability, Energy efficiency, Cultural heritage, Natural materials

1 INTRODUCTION

Building is a key industry to drive sustainable development. In Bosnia and Herzegovina, sustainability is not being integrated enough in current residential building development. Conventional construction techniques, which were once essential to the culture and climate of the nation, are no longer in use. And modern construction methods do not hold any hope; despite providing cheaper, quicker solutions, they don't take into consideration ecological equilibrium and cultural prominence.

Bosnia and Herzegovina has several different geographical et climate areas, which affected the shaping of vernacular architecture in the past, that is the craft and wide use of construction material. From the čardaklija house to the stone houses in Idbar to the urban Sarajevo homes exemplified by Svrzo's House, architecture spoke to response to climate, natural resources and community life. These are reminders of how architecture was once the embodiment of ecological responsibility and cultural symbolism.

Modernization has disrupted this continuity. Building materials are industrial and imported solutions are commonly unsuited for local climate and culture. The end effect is more energy use, greater environmental destruction and flight from heritage.

The main research problem is the disconnect of traditional knowledge and modern building technology. The aim is to examine how construction management can bring back local resources and traditional methods, as a part of strategies for environmentally friendly building in Bosnia and Herzegovina.

Specific goals are:

- To study the contribution of traditional Bosnian building materials in sustainable construction.
- To appraise popular knowledge and traditional use in (guilds) concerning energy and ecology adjustment.
- Comparing case studies of vernacular adaptation in Bosnia and neighboring regions.
- To determine management practices in construction that would serve as vehicles between traditionalism and modern.

2 BACKGROUND AND METHODS

The Dynamic Transformation of Urbanisation: Opportunities and Challenges Due to better lifestyle, amenities and economic opportunities urbanization at a rapid pace has made cities a hub of growth and development followed by population migration. [1]

At the same time, urbanization brings along with it many environmental burdens, such as pollution and resource consumption, and disconnection from nature, which is often worsened by modern forms of architecture that value artistry over sustainability. [2] As cities densified, traditional buildings that work aesthetically with nature and climate were

discarded for high-rise, energy-draining structures, contributing to ecological problems like urban heat, increased energy use and reduced air quality.

Considering that vernacular architecture represents the highest form of sustainable design, defined as “the creation and responsible management of a healthy built environment based on resource efficient and ecological principles” it has attracted the interest of numerous researchers worldwide. [3]

"Adapting all the positive features of vernacular buildings and implementing them into contemporary architecture, can result in sustainable modern architecture, through the combination of modern construction standards with bioclimatic elements such as local and natural building materials, orientation, location, building form, passive systems of cooling and heating, greenery, and water." [4]

Research considers the vernacular architecture of Bosnia and Herzegovina, i.e., the traditional Bosnian house, as an example of sustainable construction practices. Such integration highlights the ability of vernacular architecture to address modern-day practice and the growth of urban sustainability while also improving the preservation of traditional elements. - "Traditional rural settlements and individual built structures represent an integral component of rural scenery and are increasingly thought to be valuable to the cultural heritage." [5]

2.1 LITERATURE REVIEW

Vernacular architecture is one of the oldest and most sustainable ways to design. It relies on local and natural materials applied to accommodate climatic and geo-morphic features and to reflect cultural identity through construction methods. It is widely accepted that indigenous traditions embody ecological tenets well before sustainability emerges as a concept among humans. The significance of the local knowledge is to be able to respond to the environment wisely and reduce the use of energy and to have a strong cultural link.

Findings from studies worldwide reveal the merits of vernacular architecture in diverse regions. Passive cooling techniques, natural ventilation and shading devices used in monsoon, are implemented in the case of Indian traditional houses. Rural Portuguese stone homes are impractically stout to boast thermal heft and protect from wind through both sheer mass and the use of stumpy shapes. [6]. Studies conducted in China underline the ecological importance of courtyard houses in regulating temperature and in providing spaces for social interaction. [7] Throughout West Africa traditional housing typologies focus on natural ventilation and low technology-building processes that are community-based and grounded to place, reflecting that indigenous practices may in fact lead to a physical and social sustainability. Comparative studies in Serbia and Montenegro also illuminate comparable conflicts between forces of modernization and cultural traditionalism. [8] [9]

The Bosnian environment is an environment of rich cultural layers, materials and shelter development. The Constitutive elements are numerous, but just to name a few: the čardaklija house which is a modular wooden and brick house for agricultural life, the stone houses of Idbar with its durability and ecological side as well as its contextual and landscape integration, to the urban vernacular typology of Svrzo's House in Sarajevo as such in potential

reflecting the family structure or even the social in function. knowledge [10], [11], [4]. These cases show that in Bosnian vernacular architecture functional, ecological and symbolic dimension are connected.

Architects like Juraj Neidhardt and Dušan Grabrijan noted the possibility of traditional Bosnian vernacular traditions better orienting modern design. [12] [8]. In their book Architecture of Bosnia and the road to modernity, they demonstrated how local identity could be compatible with modernist ideas. Their method continues to serve as a point of reference for the current architectural theory in Bosnia.

And while vernacular architecture has many ecologic and cultural benefits, the role of vernacular architecture of Bosnia and Herzegovina has been ignored mainly during the last few decades. Market-oriented construction Industrial production methods and the use of imported materials are the norm, ignoring adaptation to the environment and disregard of tradition. This production migration leads to more energy and environmentally unfriendly housing and a reduction in cultural identity.

Literature consistently asserts that the infusion of vernacular principles into modern building has the potential to address climate issues, foster cultural resiliency, and limit environmental degradation. But those remain very difficult to implement, because of lack of institutional support, lack of education, and weak construction management set-up systems.

2.2 LITERATURE FINDINGS

It has become evident. that the rural architectural structures and building skills are under threat due to these changes and progressive adoption of incompatible, imported building elements.

Architectural sustainability is not only an environmental or technological set of issues but also involves safeguarding the intangible cultural heritage that can be found in the buildings themselves.

Research offers valuable knowledge into the complicated structure in architectural growth, and it shows the multivalent nature of architectural identity, which consists of cultural, aesthetic, and humanistic content.

Inter-heirs' disputes preempt regular maintenance and restoration, and there is no one held accountable for decay.

Sustainable aspects of traditional construction are discussed in some publications and include material-based environmental evaluation as well as more integrated socio-cultural and environmental perspectives.

Research in natural building materials has educational potentials and is a way of interweaving into the present how traditional knowledge can be incorporated in contemporary practice.

Traditional architecture must not be seen as outdated but as a repository of sustainable ideas and endurance, playfully appropriate for both education and responsible design.

There is a conflict between traditional respect and modern needs by which raw old elements must be often refashioned and brought up to date for modern use.

2.3 RESEARCH METHODOLOGY

The present study is conducted using qualitative research design, since studying phenomena as complex and context specific as the influence of construction management practices on architectural sustainability requires a flexible and interpretative method. The choice of qualitative research may contribute to better understanding of perceptions, mediating factors, and lived experiences concerning the nexus of sustainable, cultural heritage and construction practices. [13] It also encourages the discovery of unexpected viewpoints, which is especially important in culturally specific and practice-based issues, such as vernacular architecture and sustainable building.

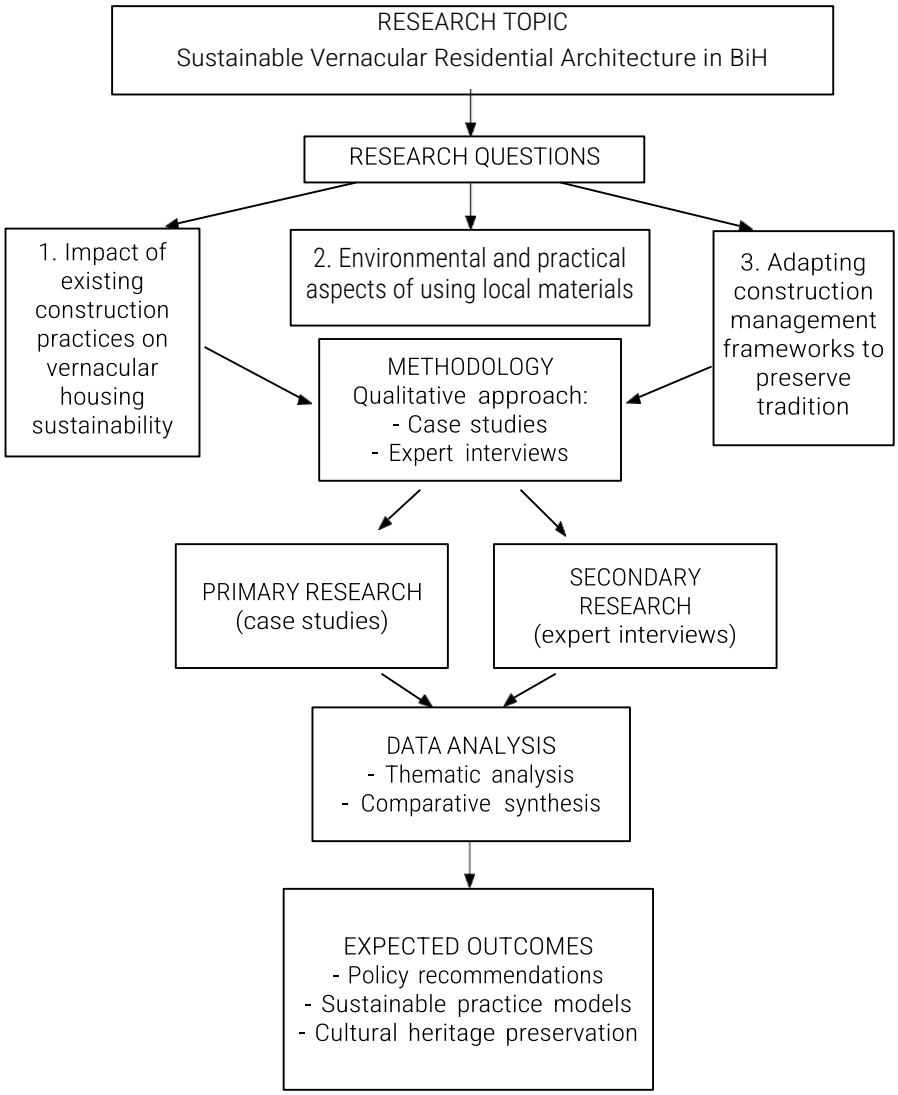

Figure 6: Research design diagram

The three case studies were chosen as they represent similar yet different climatic and cultural context in Bosnia and Slovenia. The other three examples in their particular characters show the conservation of Bosnian vernacular tradition in Hiža Mišljenova, adaptive reuse within Central European conditions in Hiša MM, and Mediterranean solutions as such applicable to Herzegovinian reality in Hiša N.

Three semi-structured interviews were performed with acknowledged experts in the field of architecture and sustainability (Prof. Sanela Klarić, Arch. Vedina Babahmetović, Prof. Elsa Turkušić Jurić). Experts of vernacular and sustainable building from practice and teaching were the participants in the study. The interviews took face to face and by email, and interviews ranged from 30–45 minutes in response length, informed consent was provided.

Data analysis was thematic: (1) transcribing and coding of interview data; (2) identifying themes that recurred (materials, obstacles, opportunities, education); (3) triangulation with case studies and literature review.

2.4 METHODS OF DATA COLLECTION

2.4.1 Desk Research

To validate the theoretical premise of this thesis, desk research technique was employed in the manner of systematic review and analysis of chosen case studies. The purpose of this approach was to bridge the gap between conceptual arguments on sustainable and vernacular architecture and how they are practiced in real-world projects today. Through an examination of some examples selected, the analysis provides an evidence-based platform that proves how sustainability strategies are practiced within the regional architectural heritage context.

Desk research involved a systematic review of the documentation supplied, such as descriptions of the projects, architectural drawings, and photographic record where available. Three main factors determined the selection of case studies: geographical variation, diversity in materials used, and level of documentation obtained.

The results obtained from the desk research not only acted as stand-alone findings but also as a basis of comparison with the results of expert interviews. In doing so, case study analysis strengthened the interpretation of professional views and underlined convergences or divergences between theory and practice in sustainable vernacular construction.

Case studies used in this research were selected as typical examples of sustainable and vernacular building traditions in the region of Western Balkans and neighbouring Slovenia.

Hiža Mišljenova (Zenica, Bosnia and Herzegovina) is the closest modern-day representation of the Bosnian house tradition. It shows how earlier types and locally available resources can be reinterpreted to suit the needs of the present and still maintain cultural continuity. It is therefore the closest and regionally specific example of vernacular sustainability for Bosnia and Herzegovina. In addition to that, two Slovenian projects were selected due to

comparable climatic conditions, geographical position, and cultural heritage that render them comparable to Bosnian and Herzegovinian vernacular practices meaningfully.

Hiša MM (Domžale, Slovenia) is closer to Bosnian conditions due to material choice and rehabilitation ideas that focus on reuse of the existing built form and extension of the life span of traditional stock housing.

Hiša N (Slovenian coast), within Slovenia's Mediterranean area, provides significant comparisons to Herzegovinian landscape and climate. Its adaptive reconversion of a stone structure into a terraced environment and its integration with vegetation highlight strategies that apply to Herzegovina's Mediterranean vernacular environment. Through looking at these three projects simultaneously, the thesis constructs a comparative basis that respects regional variation but also highlights analogous strategies of sustainable vernacular architecture.

2.4.2 Expert Interviews (Open-Ended)

A last step in data gathering is the completion of open interviews with a select group of professionals from the construction management, sustainable architecture and cultural heritage domain. This collection of interviews aims to inform research questions on the possibilities, outcomes, and obstacles of sustainable construction in Bosnian architectural discourses.

Consistent with the qualitative research paradigm, in this study, semi-structured open-ended interviews were used to obtain in-depth information about the role, obstacles, and feasibility of sustainable construction activities within the concept of vernacular architecture in Bosnia and Herzegovina from experts. This method was employed for investigating research questions from the perspective of experts who work in the fields of architecture, construction management, sustainability, and heritage conservation. Through allowing the specialists to speak in detail about their experiences, perspectives and knowledge freely, the open-ended interview maximizes the richness of the qualitative data, and thus the interpretation of the theory-practice relations under real-life contexts.

Eight open-ended questions were prepared beforehand to conduct the expert interviews. The questions covered the major issues pertinent to the research, such as:

- the choice and utilization of indigenous materials for traditional and sustainable building.
- the degree of their usage in modern projects.
- benefits and limitations of industrial materials.
- the effect of contemporary construction management practice on vernacular architecture.
- examples of best practice in Bosnia and Herzegovina.
- knowledge transfer through education or professional training.
- recommendations for future professionals.
- and commentaries on projects with sustainable or vernacular aspects.

The analysis was aimed at several key dimensions:

- Relevance and applicability of sustainable construction practices to existing architectural and construction paradigms in Bosnia and Herzegovina.

- Challenges linked to the reconciliation of sustainability and cultural heritage preservation, with an emphasis on the strategies and tactics suggested by the professionals for their improved implementation.
- Specific strategies and recommendations presented by professionals on how to enhance the application of local materials and introduce sustainable practices into modern construction processes.
- Within this process, thematic analysis also enabled the detection of contradictions, inconsistencies, and context-specific sensitivities, not only shared patterns.

3 RESULTS AND DISCUSSIONS

3.1 CASE STUDY RESULTS

Table 3 Comparative overview of case studies

Case	Main Materials	Approach to Adaptation	Ecological Contribution	Cultural Contribution
Hiža Mišljenova (BiH)	Brick, wood, stone	Reuse of local resources, typological continuity	Reduced footprint through recycling, energy efficiency	Strong link to Bosnian vernacular tradition
Hiša MM (Slovenia)	Brick, stone, wood	Adaptive restoration, combination of old and new	Extension of building lifespan, resource reuse	Reflects continuity with Central European rural housing
Hiša N (Slovenia)	Stone, vegetation	Reconversion into terraced structure, landscape integration	Ecological adaptation via microclimate and vegetation	Mediterranean heritage continuity

The comparative study of Hiža Mišljenova (Bosnia and Herzegovina), Hiša MM (Slovenia), and Hiša N (Slovenia) indicates how different sustainability and vernacularity strategies operate under one climatic and cultural context. Each of the three projects aims to preserve existing buildings and keep them as a foundation for contemporary life, but with different emphasis. Although Hiža Mišljenova is strongest continuity with Bosnian folk practices through typological retrieval and large-scale reuse of local material, Hiša MM signals adaptive restoration with evident layering of old and new material, and Hiša N signals embedding into Mediterranean habitat, reliant on land and vegetation as primary agents of sustainability.

Material-wise, Hiža Mišljenova and Hiša MM show clear ecological strategies by recycling brick, wood, and stone, thereby reducing the environmental footprint and ensuring cultural

continuity. Hiša N, while retaining the stone core, does not reflect as much proof for environmentally conscious material strategies, so its ecological value rests on landscape adaptation more.

Together, they demonstrate that sustainable and vernacular principles can be achieved in a few ways, but success is dependent upon the degree of convergence between material, traditions, and ecological issues.

3.2 EXPERT INTERVIEW RESULTS

After conducted three open-ended interviews with the experts in field of architecture and sustainable building in Bosnia and Herzegovina- Prof. Dr. Sanela Klarić, Arch. Vedina Babahmetović, and Prof. Dr. Elša Turkušić Jurić, I tried to investigate how they look at their local materials, what is the effect of modern construction on the vernacular, and what they think could be done, both educationally, and in practical terms, better.

All the interviewees stressed the importance of local materials in green buildings. The materials cited most often are wood, stone, brick, clay, wool, straw and lime, selected according to climatic region – stone in Herzegovina, wood in hilly areas, brick in flatlands. There is clay—already used for centuries—and wool and straw, precious as insulation.

Local products are questionable, and if used in modern projects, only rarely as industrial material due to cost, effort and durability-additional factors. But now a crop of younger architects and smaller contractors is expressing interest in it.

While interviewees acknowledged the benefits of using local materials — including sustainability and tradition protection — they also cited challenges such as the lack of skilled labor or a market demand for such work.

It would be helpful to engage local communities in projects, inform through education, and move certification metrics into designs. Academic institutions, construction companies and local communities need to cooperate in preserving traditional residential architecture in Bosnia and Herzegovina, while providing for sustainable development.

4 DISCUSSION

The results show that vernacular architecture provides:

- Passive environmental strategies (orientation, natural ventilation, shading, thermal mass).
- Healthier living environments through natural materials.
- Stronger cultural identity embedded in architecture.

However, for these practices to expand, construction management must integrate policies, education, and economic incentives. Without systemic support, vernacular sustainability will remain limited to isolated projects.

The diagram describes how theoretical insights, case conclusions and expert interviews are synthesized and how they feed in the conclusion and recommendations.

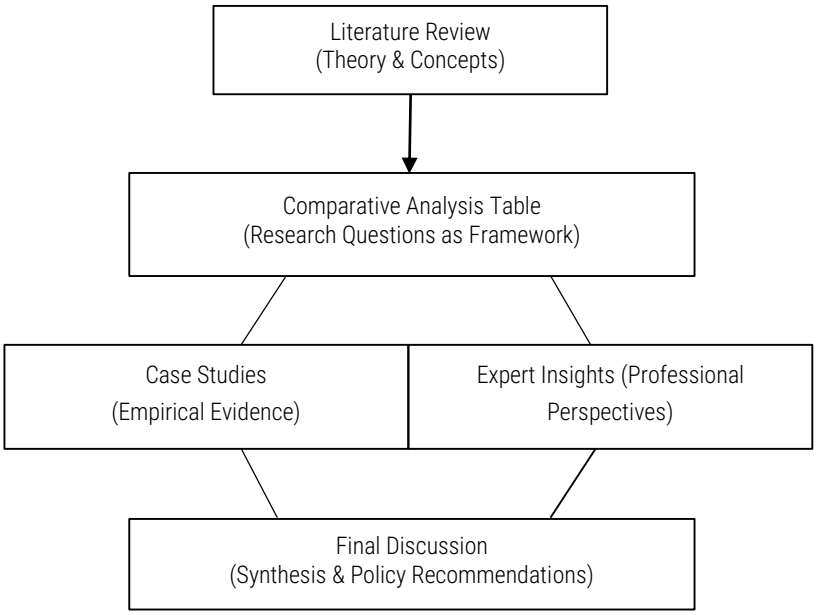

Figure 7: Integration of Theory, Case Studies, and Expert Insights

5 CONCLUSIONS

Researchers have found that sustainable traditional practices are totally consistent with and complementary to the forward-looking advantage, supported by documentation and innovative design using local materials. But there is a dearth of system support, which is usually based on few influential victims rather than collective efforts. Expert perceptions pointed out the necessity of co-operation between architects, decision makers and society, stating that sustainability in vernacular construction requires both cultural acceptance and law support. This paper provides evidence that Bosnian future sustainable architecture will be based on hybrid models which connects innovation and tradition, seeing sustainability as an environmental as well as a socio-cultural concept. The study concludes with recommendations for enhanced policies, education, and financing for local architects to become more adept at using indigenous architecture in modern practice.

To protect sustainable vernacular architecture in Bosnia and Herzegovina, we need few concrete measures:

Ministries and municipalities need to offer smallish grants and pilot projects for the us of local materials.

Professional chambers and universities should provide educational programs and basic technical guides for craftsmen and young architects.

Construction companies need to support local communities in transferring know-how and certification of natural material.

The article strongly emphasizes a renewed interest in the development of hybrid architectural models—combining innovation and tradition—and understanding that sustainability represents a value not only ecological but also a socio-cultural value. Future work should look for larger sample sizes, use quantitative performance indicators and, ideally, should follow buildings over time to judge their actual environmental and cultural performance.

REFERENCES

[1] A. Rogers and J. G. Williamson, "Migration, urbanization, and third world development: an overview," Economic Development and Cultural Change, vol. 30, no. 3, pp. 463-482, 1982.

[2] C. Day, Places of the soul: Architecture and environmental design as a healing art, Routledge, 2017.

[3] R. Tomovska and A. Radivojević, "Environmental features of building materials of traditional Ohrid house and their contribution to its human design," in In Keeping up with technologies to make healthy places: book of conference proceedings/[2nd International Academic Conference] Places and Technologies, Nova Gorica, Slovenia, 2015.

[4] S. Martinovic and N. Zecevic, "Energy efficiency features of vernacular house in Bosnia and Herzegovina: A case study of Svrzo's house complex," Heritage and Sustainable Development, vol. 5, no. 1, pp. 77-98, 2023.

[5] S. Kosanović, B. Folić, S. Kovačević, I. Nikolić and L. Folić, "A study on the sustainability of the traditional Sirinić houses in the Šar Mountain Region, the South-Western Balkans," Sustainability, vol. 11, no. 17, p. 4711, 2019.

[6] J. Fernandes, R. Mateus, L. Bragança and J. Correia da Silva, "Portuguese vernacular architecture: The contribution of vernacular materials and design approaches for sustainable construction," Architectural Science Review, vol. 58, no. 4, pp. 324-336, 2015.

[7] C. Yu, C. Xu, S. N. Kamaruzzaman and N. M. Aziz, "A systematic review of green building development in China: Advantages, challenges and future directions.," Sustainability, vol. 14, no. 19, p. 12293, 2022.

[8] L. Džumhur and A. Idrizbegović-Zgonić, "Syncretism in regionalist modern architecture of Bosnia and Herzegovina-models of syncretic processes and formations on the example of the workers' house by Juraj Neidhardt.," in AIP Conference Proceedings, 2023.

[9] M. Stanimirovic, M. Vasov, M. Mancic, B. Rancev and M. Medenica, "Sustainable vernacular architecture: The renovation of a traditional house on Stara Planina Mountain in Serbia," Buildings, vol. 13, no. 4, p. 1093, 2023.

[10] M. Halilovic, "Vernacular architecture sustainability principles: A case study of Bosnian stone houses in Idbar village," Periodicals of Engineering and Natural Sciences, vol. 8, no. 4, pp. 2564-2574, 2020.

[11] A. Hadrovic, "Bosnian Chardaklia House: Abazovic Family House in Donja Koprivna Near Cazin," Journal of Smart Buildings and Construction Technology, vol. 4, no. 1, pp. 15-27, 2022.

[12] D. Simonović, "Neidhardt's vernacular-modernist glossary of Bosnia and Herzegovina's architecture and urbanism," In international conference on Contemporary Theory and Practice in Construction/Међународна конференција Савремена теорија и пракса у градитељству, vol. 15, pp. 256-266, 2022.

[13] K. Fross, D. Winnicka-Jasłowska, A. Gumińska, D. Masły and M. Sitek, "Use of qualitative research in architectural design and evaluation of the built environment," pp. 1625-1632, 2015.