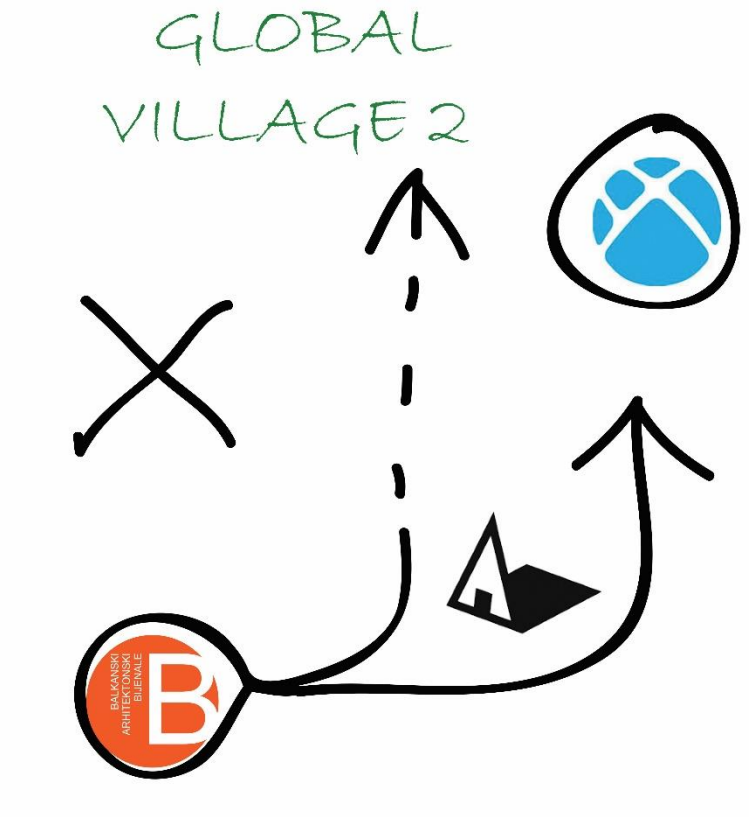

Conference proceedings

GLOBAL VILLAGE - SHELTER FOR RESILIENT LIVING 2

On-line version

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Conference proceedings
21-23th of November 2023.

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PREFACE: GLOBAL VILLAGE – UTOPIA OR REALITY?

res. ass .dr Tatjana Mrdjenovic, Faculty of Architecture in Belgrade
Conference conceptor and Editor in chief

The discussion will start debates about the diverse paradigms of suburban, rural, and urban places in today's global society, and it will do so by comparing these three types of locations. The primary point of contention is whether a Global Village should be categorized as an idealistic utopia or a feasible possibility for the foreseeable future. This debate will explore the advantages and disadvantages of each type of location, considering factors such as population density, infrastructure, and access to resources. Additionally, it will delve into the social, economic, and environmental implications of striving towards a Global Village concept. In the conversation that will bridge hierarchical and network viewpoints, we will investigate the idea of needs. Let's investigate some alternative ways of living to the one we are now accustomed to, on the presumption that we ought to consider the requirements that have been produced. These alternative ways of living may include sustainable communities, eco-villages, and self-sufficient neighborhoods. By considering the requirements that have been produced, we can explore how these alternative living arrangements can address issues such as energy consumption, mobility, built environment, waste management, and food production more efficiently and environmentally friendly. Furthermore, examining the social and economic implications of these alternative ways of living can shed light on the potential benefits and challenges they may bring to individuals and society as a whole. The core beliefs and identities held by people all over the world help to foster the growth of a diversified socio-economic and cultural network that spans a variety of geographic regions. This network serves as the basis for a worldwide community that is referred to as the Global Village. Within the context of our increasingly interdependent global community, this idea stands as a singular example of new communalism. As a result, Global Village would like to draw your attention to the following topics, most of which are also being explored in the thematic sessions of the conference:

1. ARCHITECTURE OF GLOBAL VILLAGE: PATTERNS, FORMS, SYSTEMS
2. PLANNING AND ARRANGING THE GLOBAL VILLAGE: INSTRUMENTS AND MODELS
3. MODERN TECHNOLOGIES IN RISK MANAGEMENT OF TERRITORIES
4. FORMS OF MOVEMENT AND MOBILITY MANAGEMENT IN THE GLOBAL VILLAGE
5. THE ROLE OF URBAN PLANNERS IN MANAGING THE CLIMATE TRANSITION
6. NEW MODELS OF ARCHITECTURE IN TRANSITION
7. RESILIENT CITIES IN THE ERA OF GLOBALIZATION: URBAN INTERVENTIONS TOWARDS A SUSTAINABLE FUTURE
8. HEALTHY city HEALTHY people: designing future cities for "mind body and soul"
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FRAMEWORK FOR THE COMPLEX AND INTEGRATED REFURBISHMENT OF MULTI-FAMILY HOUSING STOCK OF SERBIA USING VOLUMETRIC ADDITIONS

Author: Bojana Lević, Department of Architectural Technologies, University of Belgrade – Faculty of Architecture,SERBIA;
bojana.levic@arh.bg.ac.rs

ABSTRACT

This paper presents the framework for the application of complex and integrated refurbishment to the existing multi-family housing stock in Serbia. The subject of the research is the application of the strategy of complex and integrated refurbishment by adding volumes (increasing usable space) to existing multi-family buildings with the primary goal of achieving higher energy efficiency while remodeling and modernizing residential units and improving vertical building communications. The paper investigates the framework for the implementation of that strategy. The framework encompasses several interrelated aspects for complex and integrated refurbishments, such as determining the energy, spatial, organizational, and functional deficiencies of the building; an analysis of the urban planning parameters; a determination of the stakeholder roles; an analysis of the possibility of volumetric additions; an analysis of the use of environmentally friendly and natural materials; an analysis of the structural capacity of the building; and an analysis of the economic feasibility of the complex refurbishment. The research identified the advantages and limitations of applying the volumetric addition strategy to multi-family residential stock in Serbia.

Key words: complex and integrated refurbishment, framework, methodology, multi-family housing stock, volumetric additions, energy retrofit, energy efficiency, stakeholder roles, economic feasibility

1. INTRODUCTION

This paper focuses on establishing a framework for the implementation of a complex and integrated refurbishment approach to multi-family residential buildings in Serbia. Most of these buildings are characterized by high energy consumption for heating due to the poor thermal performance of the building envelope. Created according to the design regulations valid at the time when they were built, they have major spatial and organizational deficiencies regarding the size of apartments, outdated and inflexible spatial organization, and a lack of elevators. The subject of the research includes defining the steps in the decision-making process for implementing the complex and integrated refurbishment approach in existing residential buildings. Besides energy improvements, it is necessary to enhance the building's functionality. The research goal is to define a framework for decision-making regarding the application of complex and integrated refurbishment of existing multi-family buildings in Serbia through volumetric additions. Complex and integrated refurbishment includes both energy and spatial-functional renovation and enhancement. The approach of renovating existing buildings by adding new structures has significant functional advantages that distinguish it as one of the more important methods for comprehensive building renewal. According to today's energy regulations in Serbia, for the energy refurbishment of an existing building, it is necessary to increase the energy class by one level through the renovation [1]. Significantly higher energy requirements for existing buildings are in the European Union. Through the EU directives, it is foreseen that the long-term strategy of renewing the existing building stock will achieve a highly energy-efficient and decarbonized building stock by 2050 (reduction of carbon gas emissions by 80–95% compared to 1990) [2]. Since the share of existing housing stock is much higher than that of newly designed ones, its renovation is a key factor in the task set by the European Commission [3].

The research problem is the high energy consumption for heating in existing residential buildings. The largest share of Serbia's residential housing stock consists of buildings constructed during the mass construction period from the 1960s to the 1980s (Fig. 1). These buildings typically have poor energy performance. Furthermore, these buildings typically consist of small apartments with rigid and inflexible spatial organization [4,5].

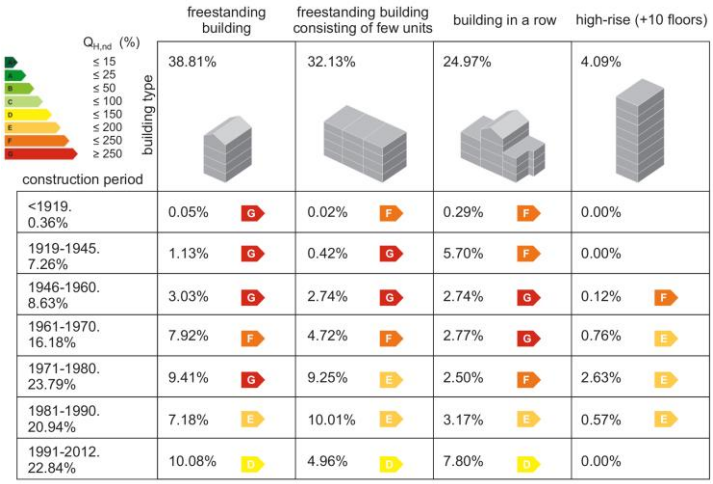

Figure1: *Statistical representation of types of multi-family housing according to time period of construction in Serbia and calculated energy performance classes [4,5]*

2. FRAMEWORK FOR THE COMPLEX AND INTEGRATED REFURBISHMENT

This paper presents the methodology in the decision-making process for implementing complex and integrated refurbishment of existing buildings through volumetric addition.

The first step involves the analysis of the selected multi-family building (Fig. 2). By determining the thermal envelope structure and the applied heating system, the energy required for heating and the energy class of the building are calculated. The second analysis includes an assessment of the spatial, organizational and functional characteristics of the building. It is determined whether the building has any deficiencies or whether they can be improved.

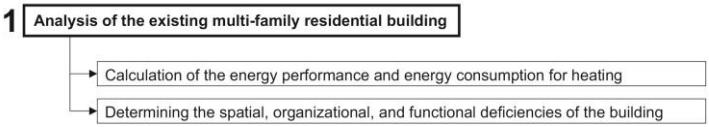

Figure2: *Step 1 – Analysis of the existing multi-family residential building*

The second step involves the analysis of urban planning parameters (Fig. 3). Based on location data, it is determined whether extensive interventions on the building, such as extensions that affect the building's dimensions, floor count, and increased gross floor area, are feasible.

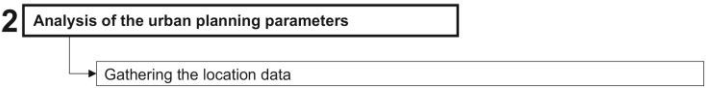

Figure3: *Step 2 – Analysis of the urban planning parameters*

If urban planning parameters allow for more extensive interventions on the building, we move on to the third step - determining the roles of interested parties (Fig. 4). The question of investing in the renovation of multi-family buildings is closely tied to ownership considerations. According to statistical data, 98.3% of homes in Serbia are privately owned [6]. Obtaining the consent of all apartment owners is necessary for building renovation, which can create significant challenges in the renovation process itself. Inadequate regulations, a lack of enforcement mechanisms, and weak government institutions contribute to the deteriorating condition of buildings in Serbia [7]. The social status of households and a strong, united, and resilient residential community play a crucial role in such extensive renovations. In this context, municipal policy support in the form of subsidies and grants is of essential importance [8]. Key challenges in achieving residential building renovation often revolve around conflicting stakeholder interests. Involving apartment owners in the early stages of the design process is important for effective decision-making [9]. Additionally, the accessibility and flexibility of operators in their interactions with apartment owners are crucial for the successful completion of the design and renovation process.

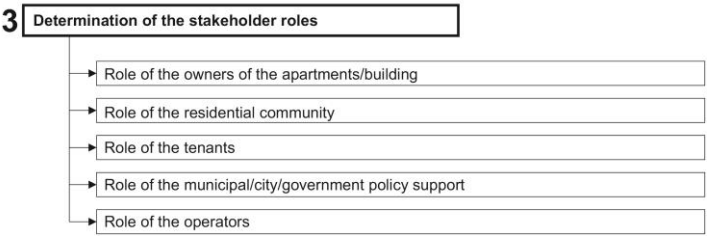

Figure4: *Step 3 – Determination of the stakeholder roles*

By aligning all interested parties, we proceed to the fourth step, where the application of volumetric additions to the building is determined (Fig. 5). This method, apart from changing the thermal characteristics of the envelope changes the shape factor and increases its useful living space, enabling the redefinition of the existing apartments of minimal dimensions and outdated and rigid spatial organization [10]. The functional characteristics of the building, such as inadequate vertical communications, can also be

improved by applying volumetric additions. A vertical volumetric addition on the roof of a building increases its useful living space (Fig. 6)

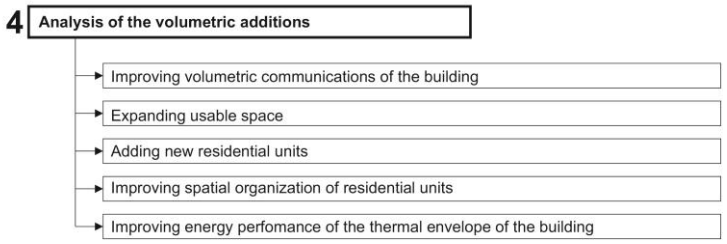

Figure5: *Step 4 – Analysis of the volumetric additions*

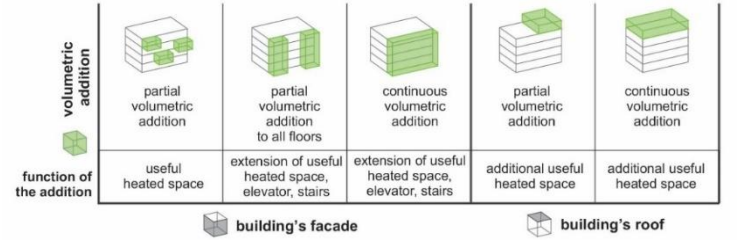

Figure6: *Variants of volumetric additions to an existing building*

By defining volumetric additions to the building, we move on to the fifth step, which involves the use of environmentally friendly materials (Fig. 7). As complex and integrated refurbishment of a building should be time-efficient, the application of prefabrication is suggested. Prefabricated assemblies offer several advantages compared to traditional construction, including time savings, the potential for using more environmentally friendly materials, and reduced financial investment. This research suggests the use of prefabricated wooden panels, both due to the use of natural materials and the lightweight nature of the structure, which should minimize the load on the existing building structure.

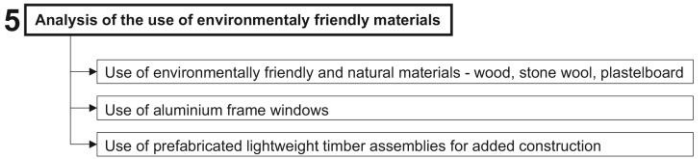

Figure7: *Step 5 – Analysis of the use of environmentally friendly materials*

By determining the type of construction for volumetric additions, we proceed to analyze the static load on the existing building. For this analysis, it is crucial to ascertain the total load on the existing building and perform a structural calculation of the existing building to verify if it can withstand this load (Fig. 8).

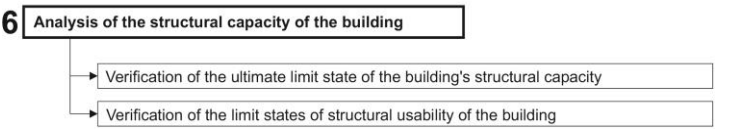

Figure8: *Step 6 – Analysis of the structural capacity of the building*

If Step 6 receives a positive evaluation, we proceed to the final step: the analysis of the economic justification for complex and integrated refurbishment (Fig.9). In this analysis, the total investment renovation costs are calculated. Then, energy savings over a longer period compared to the existing condition are computed. Additionally, the value of the building after renovation is assessed (improvement of the thermal envelope, increased usable space, and the addition of functions). By increasing the number of residential units, the sale of which could cover the initial renovation investments, economic feasibility for complex and integrated refurbishment can be achieved.

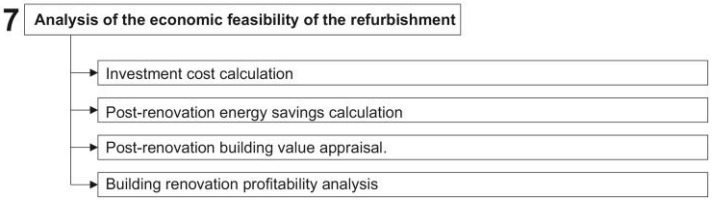

Figure9: *Step 7 – Analysis of the economic feasibility of the refurbishment*

The entire methodological framework is shown in the Figure 10.

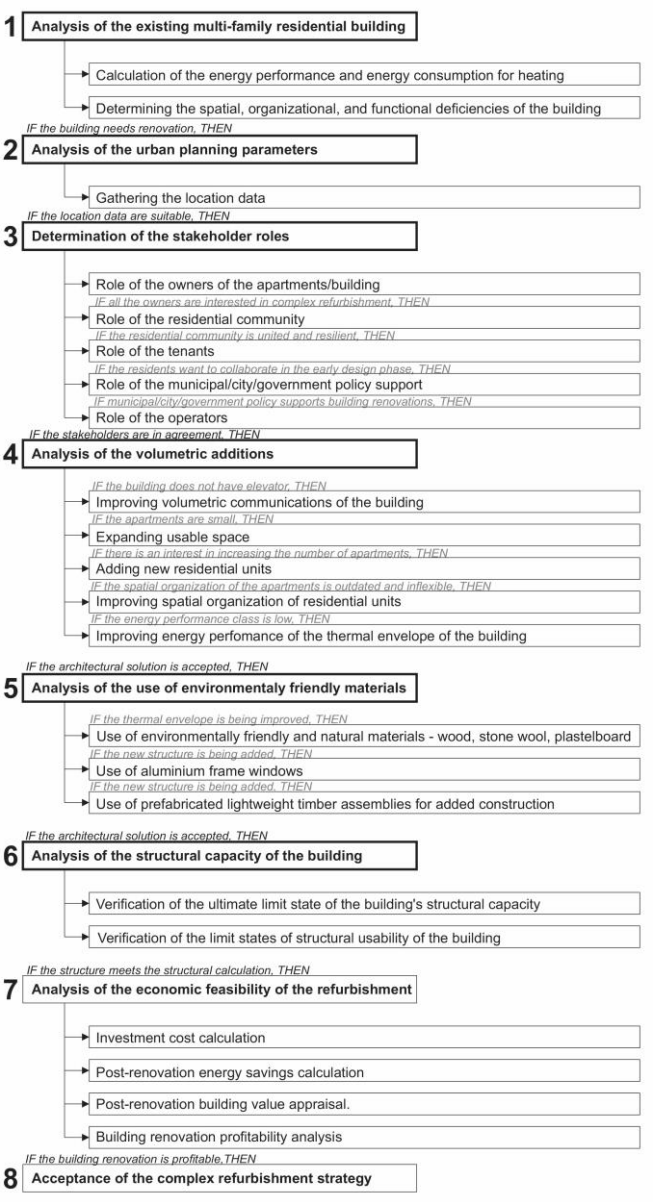

Figure10: *Framework for the implementation of a complex and integrated refurbishment approach to the multi-family housing stock of Serbia*

3. CONCLUSIONS

The presented framework for the implementation of complex and integrated refurbishment using volumetric additions to an existing building represents the aspects that must be considered in the decision-making process for building renovation. These aspects are presented hierarchically, and further research is needed to delve into each aspect in more detail. The complex and integrated refurbishment that includes energy efficiency improvement and spatial expansion with the improvement of functions can be recognized as an adaptable method for future uses from the perspective of the resistance and adaptability of the already-built context. On an urban scale, this method of retrofitting can be introduced as a strategic approach for improving the energy efficiency of existing buildings in the region.

4. REFERENCES

[1] Ministry of Environmental Protection Government of the Republic of Serbia, Rulebook on Energy Efficiency, 2011, 61.

[2] EUR-Lex, EU Directive 2018/844 of the European Parliament and of the Council of 30 May 2018 amending Directive 2010/31/EU on the energy performance of buildings and Directive 2012/27/EU on energy efficiency, Official Journal of the European Union, L156/75-91, 2018. https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=uriserv:OJ.L_.2018.156.01.0075.01.ENG

[3] European Commission, A Renovation Wave for Europe- Greening Our Buildings, Creating Jobs, Improving Lives, 2020, https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A52020DC0662

[4] Jovanović Popović, M., Ignjatović, D., Radivojević, A., Rajčić, A., Đukanović, Lj., Ćuković Ignjatović, N., Nedić, M., National typology of residential buildings in Serbia, Faculty of Architecture, University of Belgrade, Serbia, 2013, http://eeplatforma.arh.bg.ac.rs/en/publications/national-typology-of-residential-buildings-in-serbia

[5] Jovanović Popović, M., Ignjatović, D., Radivojević, A., Rajčić, A., Đukanović, Lj., Ćuković Ignjatović, N., Nedić, M., Atlas of multifamily buildings in Serbia, Faculty of Architecture, University of Belgrade, Serbia, 2013, http://eeplatforma.arh.bg.ac.rs/en/publications/atlas-of-multifamily-housing-in-serbia

[6] Statistical Office of Republic of Serbia, Census of Population, Households and Dwellings in the Republic of Serbia, Book 25: Dwellings according to the ownership and tenure status of households, 2013, https://publikacije.stat.gov.rs/G2013/pdfE/G201318018.pdf

[7] Mojović, Dj., How to Efficiently Maintain a Residential Building: Modern Concept of Organization, Management, and Maintenance of Condominium Ownership Residential Buildings, Urban Development Program, Belgrade, 2009, https://detelinara.org/wp-content/uploads/2014/03/Kako-efikasno-odrzavati-stambenu-zgradu_Program-za-urbani-razvoj.pdf

[8] OECD, Social housing: A key part of past and future housing policy, Employment, Labour and Social Affairs Policy Briefs, 2020, https://read.oecd-ilibrary.org/view/?ref=137_137578-34brg1nxua&title=Social-Housing-A-Key-Part-of-Past-and-Future-Housing-Policy

[9] Golić, K., Kosorić, V., Lau, S., A Framework for Early Stages of Socially Sustainable Renovation of Multifamily Buildings with Occupants' Participation, Sustainability, 2020, 12(21), 8823 https://doi.org/10.3390/su12218823

[10] Ćuković-Ignjatović, N., Ignjatović, D., The possibility of extension in the longitudinal and transverse direction, in Jovanović-Popović, M. (ed.), Energy optimization of buildings in the context of sustainable architecture - Part 2, (pp. 115-132), Faculty of Architecture Belgrade, 2005.