EU-REPAIR
VALUABLE BUILT ENVIRONMENT

Toolkit for Sustainable Optimisation of Valuable Built Environment

National Study Serbia

Valuable Built Environment in Serbia - Challenges and Opportunities

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1. Introduction

Serbia's **valuable built environment (VBE)**, defined as historic buildings and heritage structures typically over 50 years old, represents a rich cultural legacy but also poses modern challenges. Buildings account for a significant share of carbon emissions, and many historic and older buildings lack adequate energy efficiency, leading to high energy consumption and poor comfort. At the same time, these structures hold architectural, historical, and community value that must be preserved for future generations. Balancing heritage conservation with sustainability is a pressing issue in Serbia, especially as the country aligns with European Green Deal objectives and climate commitments. Improving energy performance, integrating renewable energy sources, and applying circular economy principles in heritage buildings can reduce carbon emissions and enhance climate resilience, but must be done without compromising the cultural integrity of these assets. This study examines the current state of Serbia's VBE, including historical monuments, cultural heritage buildings, and older unused structures, through the lens of sustainability and risk management. It identifies the possibilities for and gaps in applying **energy efficiency**, **renewable energy**, **circular economy approaches (including Life Cycle Assessment, LCA)**, **sustainable materials**, and **comprehensive risk assessment methodologies** to heritage buildings. Recent years have seen growing recognition in Serbia that historic buildings need to contribute to climate action; however, practical implementation remains limited and faces many obstacles.

The **EU REPAIR project** (EUropean Climate Initiative) provides context for this analysis. EU-REPAIR is a regional initiative promoting sustainable refurbishment of historically valuable buildings across several European countries (including Serbia) to reduce emissions and strengthen resilience[1]. Within this project, national studies are being conducted to assess needs and capacities. In line with EU-REPAIR's goals, this Serbian national study aims to evaluate how effectively current policies, practices, and knowledge address the sustainable management of heritage buildings, and to identify what improvements are needed. The focus is squarely on Serbia's domestic situation: legislation, standards, institutional framework, educational programs, stakeholder perspectives, and on-going projects; without delving into international case studies or pilots. By concentrating on local context, the study seeks to inform evidence-based recommendations that are realistic and actionable in Serbia.

The **structure** of the report follows the agreed project outline. After this introduction, **Section 2** describes the methodology and scope of research. **Section 3** reviews the legislative framework and relevant standards across five key topic areas (heritage conservation, energy efficiency, renewable energy, circular economy/materials, and risk management). **Section 4** discusses funding sources and financial incentives for heritage refurbishment. **Section 5** presents results from stakeholder engagement - including surveys and focus groups - highlighting the experiences and views of practitioners, officials, and owners. **Section 6** showcases best-practice examples of heritage refurbishment in Serbia, illustrating how challenges can be overcome. **Section 7** analyzes the gaps, obstacles, and lessons learned from the findings, and **Section 8** provides targeted recommendations to address identified needs. Finally, **Section 9** offers a summary of conclusions. The study is written in an academic style, drawing on legal documents, standards, scientific publications, project reports, and stakeholder input, with all sources cited in IEEE style (using numeric references in square brackets and a reference list at the end).

Serbia's valuable built environment stands at a crossroads between **preservation** and **innovation**. By examining current frameworks and experiences in applying energy efficiency measures, new technologies, sustainable materials, and risk reduction strategies to heritage buildings, this report seeks to support Serbia's efforts to safeguard its cultural heritage **while** meeting modern standards of energy performance and climate resilience. The ultimate goal is to outline a **comprehensive needs analysis** for managing VBE in a sustainable manner, identifying both the **challenges** that impede progress and the **opportunities** to enhance the protection and sustainable use of these irreplaceable assets.

2. Methodology and Scope

The study employed a multi-faceted research methodology combining **literature review**, **policy and standards analysis**, and **stakeholder engagement**. First, an in-depth literature review was conducted of existing studies, reports, and academic publications related to cultural heritage preservation, energy retrofitting of historic buildings, sustainable materials, and risk management in Serbia. This included reviewing international frameworks and previous evaluations of the cultural and economic value of historic buildings, though the emphasis was on literature specific to Serbia or the Balkan region. Particular attention was given to studies that addressed how citizens perceive cultural heritage and the social importance of conserving historic buildings. Secondly, a thorough analysis of Serbia's **legislative and regulatory framework** was carried out. All relevant laws, by-laws, and standards were identified and reviewed, covering cultural heritage protection, construction and planning regulations, energy efficiency and renewable energy laws, environmental and waste management laws, and climate change and disaster risk reduction policies. Technical standards (both Serbian national standards and pertinent ISO/EN standards) were surveyed to understand the normative context for refurbishing valuable buildings. This combined policy/legal analysis corresponds to the five topic areas outlined by the research scope (heritage conservation rules, energy efficiency requirements, renewables integration, circular economy/waste regulations, and risk management frameworks).

In parallel, **stakeholder inputs** were gathered to assess on-the-ground realities and expert opinions. A stakeholder questionnaire survey was developed and distributed under the EU-REPAIR project to capture perspectives from a diverse group: architects, engineers, conservators, project managers, policymakers, municipal officials, NGO representatives, building owners, academics, and students in relevant fields. The survey (conducted via an online form) collected anonymous responses on topics such as respondents' experience with VBE refurbishment, their awareness of legal frameworks, obstacles encountered in projects, and opinions on what is needed to facilitate sustainable refurbishment. By the survey's design, it targeted stakeholders in Serbia (including citizens, experts, and decision-makers), aiming for representation from both the demand side (owners/users of heritage buildings) and the supply side (professionals, authorities). The questionnaire included both multiple-choice questions (for quantitative indications) and open-ended questions for additional comments. **Educational gap analysis:** A particular component of the research was to analyze the educational landscape in Serbia regarding heritage conservation and sustainable building. The websites and publicly available curricula of major universities and institutes were examined to determine the extent to which current **study programs** incorporate topics like energy efficiency in historic buildings, renewable materials, LCA, or risk management. Faculties of Architecture and Civil Engineering at Serbian universities (e.g. University of Belgrade, University of Novi Sad, University of Niš) were reviewed for courses or modules on restoration, sustainable design, building physics in heritage, etc. Likewise, information on **vocational training schools** and specialized institutes (such as the Central Institute for Conservation in Belgrade) was collected to see if craftsmen, technicians, or heritage professionals receive training in modern sustainable techniques. This educational review helped identify potential gaps in expertise development.

The scope of this study is confined to the **Republic of Serbia**, focusing on national circumstances. International case studies or pilot projects outside Serbia are not included, except for international frameworks influence on national policy. However, Serbia's obligations under international conventions (UNESCO World Heritage, ICOMOS charters, EU directives where applicable, etc.) are considered part of the context. The term "valuable built environment" (VBE) in this study spans formally protected cultural monuments as well as older buildings and ensembles that, while not always officially designated, possess architectural/cultural value or reuse potential. This includes historic public buildings (e.g. schools, museums, administrative buildings), residential heritage (traditional houses, urban townhouses),

industrial heritage (factories, mills no longer in use), and religious heritage (churches, monasteries), among others. The study addresses structural and material aspects of these buildings insofar as they relate to energy and environmental performance, but it does not cover movable heritage or purely intangible heritage.

The **methodology** emphasizes a structured approach: first establishing the research questions and expected outcomes, then gathering data systematically, and finally triangulating findings from policies, literature, and stakeholder perspectives. By combining desk research with empirical inputs, the study aims for a comprehensive needs assessment. All information from relevant sources has been critically reviewed and is cited accordingly. Any gaps in available data (for instance, if certain statistics or documents were not attainable) are acknowledged in the analysis. Despite these, the breadth of sources used: legal documents, strategy papers, technical standards, academic studies, questionnaires – provides a solid evidence base. The methodology aligns with guidelines from the EU-REPAIR project, including defined timelines for literature review. This ensures the study is both up-to-date and relevant to ongoing policy discussions in Serbia about sustainable development and cultural heritage management.

3. Legislative Framework and Standards

In Serbia, the legislative framework governing the **refurbishment of valuable built environments** is multi-layered, involving laws specifically on cultural heritage as well as those on construction, energy, environment, and disaster risk. This section reviews the key laws and regulations, organized by thematic area, and then highlights pertinent technical standards. Overall, Serbia has made strides in updating its laws to accommodate modern concepts like sustainability and risk management in heritage conservation. However, gaps remain in implementation and harmonization with international standards.

3.1 Cultural Heritage Protection Legislation

The cornerstone of heritage legislation in Serbia is the **Law on Cultural Heritage** ("Zakon o kulturnom nasleđu"), adopted in 2021 and in effect since January 2023. This law replaced the earlier Law on Cultural Property of 1994, modernizing the approach to heritage preservation. Crucially, the 2021 law expands the concept of protection beyond just physical conservation – it emphasizes **interpretation, sustainable use, and risk management** for cultural heritage sites. This means that preserving a historic building is not only about maintaining its fabric, but also about ensuring its viable use and resilience to threats (such as decay or disasters). Under the law, interventions on protected properties are not outright prohibited; instead, they are allowed **provided they do not compromise the cultural significance and integrity of the asset and are done with official approval**. Article 19 of the law (as summarized in analysis) explicitly leaves room for introducing new technologies and energy-efficient solutions in historic buildings – for example, adding insulation or installing improved windows – on the condition that these measures are compatible with conservation principles. The law encourages using traditional techniques and eco-friendly materials in such works, aligning with circular economy principles and minimizing impact on heritage fabric. It also stratifies protection by significance level: objects of the highest importance face stricter regimes, whereas those of lesser significance may have more flexibility for incorporating modern materials or even renewable energy installations.

The **Law on Cultural Heritage 2021** also introduced progressive elements like mandatory **digital documentation** and information systems for heritage, which aids in technical management and potentially in energy audits or monitoring. It mandates that all immovable cultural goods be recorded in a central registry and that owners are responsible for their upkeep ("with the diligence of a good host"). Notably, the law integrates **risk assessment** into heritage protection, where heritage institutions are encouraged to develop protection programs that include risk evaluation methodologies, reflecting a shift toward proactive resilience. Any restoration or adaptation project must evaluate potential risks (e.g. seismic vulnerability, climate impacts) and use reversible and compatible methods to mitigate those risks while preserving value. This holistic approach is aligned with current international best practices (e.g. the Sendai Framework for Disaster Risk Reduction as applied to culture).

It is worth mentioning that prior to the new law, Serbia operated under the **Law on Cultural Goods** (original 1994, with amendments up to 2023). That older law established basic requirements such as: all interventions on protected buildings require prior conditions and consent from the competent Institute for Protection of Cultural Monuments. For example, Article 99 of the old law (still cited in amendments) insisted that even works like thermal envelope improvements, window replacement, or adding solar panels must be vetted and approved by heritage authorities. It also required that such works be carried out by licensed professionals and institutions with appropriate expertise (Article 102). Additionally, that law integrated heritage considerations into spatial planning, Article 107 mandated that spatial and urban plans include conditions for protecting cultural goods. Many of these principles continue under the new Law on Cultural Heritage, but the new law provides a more strategic and flexible framework, whereas the

old one was more prescriptive. One gap noted is that despite the robust legal framework, Serbia lacks a comprehensive **national strategy for immovable heritage preservation** as a strategic document that was supposed to be developed in the 2010s has not been completed, even a decade past its intended deadline. This strategic deficiency means that, while laws exist, there isn't a unifying action plan to implement them effectively.

Law on Cultural Property (Serbian, *Zakon o kulturnim dobrima*, OG RS 71/94, 52/11, 99/11, 35/21, 129/21, 76/23) establishes the system for protection, conservation, restoration, and management of immovable and movable cultural property in Serbia. It defines categories of protection (exceptional, great, local significance) and prescribes mandatory conservation conditions before any intervention. For VBE refurbishment, it requires obtaining approval from competent institutes for monument protection, ensuring that all energy or structural upgrades respect the authenticity and integrity of the heritage asset.

Law on Cultural Heritage (Serbian, *Zakon o kulturnom nasleđu*, OG RS 129/21), complementing the previous law, introduces contemporary principles such as sustainable use, risk assessment, and digitization of heritage. It expands the scope of protection to include intangible and industrial heritage, establishing a framework for integrated conservation and adaptive reuse. It allows reversible technical interventions—such as energy-efficient windows or insulation, provided that they preserve the building's cultural and aesthetic values.

3.2 Planning, Building and Energy Efficiency Regulations

Heritage buildings in Serbia are also subject to the general laws on construction and energy use, albeit with special provisions. The **Law on Planning and Building (Construction)** (Serbian "(*Zakon o planiranju i izgradnji*, OG RS 72/09–83/23)") is the fundamental law governing all construction, reconstruction, and permitting. It has specific clauses concerning cultural monuments: Article 2 of this law explicitly states that standard solutions for improving energy efficiency cannot be automatically applied to cultural heritage buildings – instead, tailored conditions and approvals must be defined in advance. In other words, a historic building cannot simply be retrofitted to meet generic building code requirements without a heritage-specific plan. Article 4 underscores that all interventions must comply with prescribed energy performance requirements, highlighting the need to integrate modern building systems (heating, ventilation, lighting) carefully with the building's authentic features. The Planning law also connects with heritage by requiring that **spatial and urban plans incorporate measures for protection and conservation** of cultural goods (Articles 15, 18, 30 etc.). Any detailed regulation plan for a historic city center must include conditions from the heritage authorities, often including the need for a conservation study before major reconstruction. This can limit unsympathetic developments but also means added steps for any energy retrofit in a protected zone (like requiring a conservation base study and permits, which can prolong project timelines).

Energy performance in buildings is governed by the **Law on Energy Efficiency and Rational Use of Energy** (Serbian *Zakon o energetskoj efikasnosti i racionalnoj upotrebi energije*, OG RS 40/21, 54/23), first enacted in 2013 and updated with a new version in 2021 (Official Gazette RS No. 40/2021). This law is very relevant as it sets national targets and rules for reducing energy consumption in buildings, both public and private. The law applies to all buildings, including those under heritage protection, but it acknowledges that measures must be taken in ways that do not damage the cultural value. Essentially, it provides legal approval for implementing energy-saving interventions (insulation, efficient heating/cooling systems, energy efficient windows, etc.) on historic buildings if done in accordance with conservation conditions. The Energy Efficiency Law introduced mandatory energy audits and Energy Performance Certificates

(EPCs) for buildings, where even historic buildings should have an energy audit, although the law allows some exemptions for protected buildings in strict conservation (to avoid forcing physical changes that contradict conservation). The requirement for an Energy Passport (certificate) and an energy efficiency report as part of technical documentation for renovation works means that any restoration project seeking a building permit must document the building's energy status and planned improvements. This integration is significant: it pushes project designers to quantitatively assess how an intervention (e.g. window restoration or roof insulation) will impact energy use and ensures a qualified energy engineer is involved alongside conservation architects. The Energy Efficiency law also promotes renewable energy use and modern technologies, but again with caution: it stipulates that such systems must be carefully integrated to preserve the building's integrity. More importantly, the law opened financial avenue since it allows use of state and international funds to support energy retrofit measures, including cultural heritage buildings. Through this, owners of protected buildings can, in theory, access grants or subsidies for energy improvements, recognizing that these projects often have higher costs due to specialized requirements.

The **Law on Utilization of Renewable Energy Sources** (Serbian "Zakon o korišćenju obnovljivih izvora energije", OG RS No. 40/2021, amended 35/2023 and 94/2024) mainly provides incentives and frameworks for renewable energy at large (like feed-in tariffs, permitting of renewable plants, etc.), it has some clauses beneficial to building renovations. It declares the use of renewable energy to be of public interest (Article 2). This principle could be leveraged in heritage contexts, where installing solar panels or heat pumps in a historic complex might be justified as serving the public interest of emissions reduction, provided heritage authorities agree. The law sets national goals for greenhouse gas reduction and energy diversification (Article 3) and requires planning and reporting on renewable energy share (Articles 6, 7). For heritage buildings, a practical consequence is that there is policy support for incorporating renewables in rehabilitation projects. Article 8 provides legal security for investors by protecting acquired rights to incentives, which can encourage owners of valuable buildings to invest in renewable systems without fear of policy reversal. There is a safeguard in Article 68b allowing the grid operator to delay connection of variable renewables if grid stability is at risk, which would rarely affect a small installation on a building but is part of the landscape. Finally, Article 74 specifically enables **s**ubsidies for equipment for heat energy production (e.g. solar thermal collectors, biomass boilers, heat pumps). This is very pertinent as it means the government can co-finance modern heating systems in a museum or historic school, making it easier for those institutions to transition to renewables (for example, replacing an old oil boiler with a biomass boiler or heat pump, as has been done in some cases).

Despite these supportive laws, it should be noted that regulations often require reconciliation between the strictures of heritage conservation and building codes. Serbia's **Rulebook on Energy Efficiency of Buildings** (Serbian *Pravilnik o energetskoj efikasnosti zgrada*, OG RS 61/11, 66/13, 97/15) provides technical definitions and criteria for energy-efficient buildings. It defines terms like "energy retrofit" and "energy performance of a building," and sets out the calculation methods and minimum requirements for thermal insulation, HVAC efficiency, etc. Normally, existing buildings undergoing major renovation should be brought toward these standards. The Rulebook does allow some flexibility for protected buildings, if meeting a requirement would *unacceptably alter* the building's character, a variance can be considered, but equivalently effective alternative measures should be implemented where possible. Under this Rulebook, any renovation permit application must include an Analysis of Energy Efficiency of the building (Elaborate energetske efikasnosti zgrade) detailing how the project will achieve the needed performance levels. In practice, for a historic building, the Analysis might propose a combination of improving internal systems and subtle envelope upgrades (attic insulation, weather stripping) to improve energy efficiency by one class without violating conservation rules. ccording to the ***Rulebook on the conditions, content and method of issuing certificates on the energy performance of buildings*** (Serbian "Pravilnik o uslovima, sadržini i načinu izdavanja sertifikata o energetskim svojstvima zgrada", Official Gazette of RS No. 69/2012,

44/2020, 52/2021, 54/2022), Serbian buildings are classified into **e**nergy performance categories from A+ to G, based on the annual specific final energy consumption for heating (Qh,nd) expressed in kWh/m² per year (Table 1). These categories are fundamental for evaluating the energy efficiency of Valuable Built Environments (VBE), including protected cultural heritage buildings, and serve as a benchmark for possible retrofit or refurbishment measures. The end goal is often to improve the building's official energy class by at least one level (classes range from A+ to G). After a series of interventions, a building might move from energy class F to D, which is considered an achievement for a heritage structure. Indeed, case studies in Belgrade have shown that such improvements are feasible, the thermal retrofit of a protected bank building in Kragujevac improved its heat loss coefficient significantly and raised its energy rating. **Rulebook on Energy Auditing of Buildings** (*Pravilnik o energetskom pregledu zgrada*, OG RS 69/12) defines methodologies for systematic energy audits,data collection, calculation, and reporting, necessary before renovation. It provides templates for audit reports and recommendations for measures to improve performance. For VBE, it ensures structured evaluation and prioritization of interventions.

Table 1. Energy Performance Indicator ($Q_{h,nd}$) for Existing/Old Buildings in Serbia

Building Type	**Single-family residential**	**Multi-family residential**	**Public buildings (administration, offices)**	**Educational buildings (schools, universities)**	**Healthcare and social facilities**	**Cultural heritage / protected buildings**
Energy Class A+(kWh/m²·year)	≤ 25	≤ 30	≤ 35	≤ 40	≤ 45	≤ 50*
Class A	25-50	30-55	35-60	40-65	45-70	50-75
Class B	50-65	55-70	60-75	65-80	70-85	75-95
Class C	65-85	70-90	75-95	80-100	85-105	95-115
Class D	85-105	90-110	95-115	100-120	105-125	115-140
Class E	105-130	110-135	115-140	120-145	125-150	140-165
Class F	130-160	135-165	140-170	145-175	150-180	165-195
Class G	>160	>165	>170	>175	>180	>195
Typical Status for Old / VBE Structures	Historic family houses (stone/brick, no insulation) typically fall in classes **E-G**	Pre-1970 multi-storey blocks (no façade insulation, inefficient windows) classes **E-F**	Administrative and institutional heritage buildings (e.g. town halls, ministries) mostly **F-G**	1950s-1980s masonry or concrete schools typically **E-F**	Hospitals and clinics built before 1980 , **E-G**, high heating demand	Majority of **VBE and cultural monuments** fall in **F-G**, occasionally **E**, due to conservation limits

In Serbia, old and heritage buildings typically exhibit final energy consumption for heating exceeding 140-200 kWh/m²·year, placing them in energy classes F-G, while targeted rehabilitation measures under EU-REPAIR could raise their performance to class D or C without compromising cultural integrity.

Rulebook on Technical Norms for Thermal Protection of Buildings (Serbian, *Pravilnik o tehničkim normativima za toplotnu zaštitu zgrada*, OG RS 61/11) defines the minimal insulation levels, U-values, and acceptable thermal bridge designs for all types of buildings. Although primarily designed for new

construction, it provides reference parameters for assessing the thermal quality of historic envelopes and selecting reversible insulation methods compatible with heritage materials.

A critical issue identified is the **lack of harmonization** between strict energy codes and heritage guidelines. Stakeholders have pointed out that there is a "lack of harmonization of engineering (e.g. ISO) and preservation standards" in Serbia. Essentially, building engineers following the energy code and heritage conservators following the heritage law sometimes work at cross purposes due to differing criteria. This indicates a need for clearer integrated guidelines (discussed further in Section 7).

3.3 Environmental and Circular Economy Regulations

Serbia's environmental legislation also impacts the refurbishment of the built heritage, particularly regarding materials, waste, and climate adaptation. The **Law on Environmental Protection** (*Zakon o zaštiti životne sredine*, OG RS 135/04-95/18) establishes broad principles of sustainable development and the public's right to a healthy environment. While it does not mention cultural heritage explicitly, it creates mechanisms (like the Green Fund) that indirectly support relevant activities. Specifically, this law enables using the **Green Fund** to finance projects that include rehabilitation of spaces, waste reduction, renewable energy use, and protection of natural goods. Heritage building projects that incorporate, for instance, demolition waste recycling or improved energy systems could potentially receive support under environmental funding if aligned with these priorities. The law also emphasizes **public transparency and participation** in environmental matters, which complement the need for community involvement in heritage decisions (e.g. public hearings when a major heritage site retrofit is planned).

A very relevant statute for circular economy aspects is the **Law on Waste Management** (*Zakon o upravljanju otpadom*, OG RS 36/09-35/23). Renovation of buildings, especially old ones, generates Construction and Demolition Waste (CDW). This law strongly encourages reuse and recycling of materials, which is at the heart of circular economy principles in construction. It explicitly identifies construction and demolition waste as a specific category (Article 5, point 17a) and distinguishes hazardous from non-hazardous fractions. The law states that a material ceases to be considered waste if it has a useful purpose and market value after appropriate processing. For heritage refurbishment, this means old materials (wood beams, bricks, tiles) might be reclaimed and re-used either in the same project or elsewhere, rather than dumped, a practice that aligns with traditional conservation (where original material is retained as much as possible) and modern sustainability. The law makes it mandatory to create a Waste Management Plan for any construction or renovation project above a certain scale. Thus, when restoring a cultural monument, the project must include a plan for handling any waste, paying special attention to identifying hazardous substances (like lead paint, asbestos which may be present in older structures). Compliance with this law ensures that heritage projects consider environmental impacts like waste generation - for example, carefully removing and recycling old materials or treating dangerous materials - which is both ecologically responsible and can reduce costs by salvaging valuable old elements (historic bricks or well-seasoned timber have high quality and can be cleaned and reused).

Serbia adopted the **Programme for the Development of Circular Economy in the Republic of Serbia for the Period 2022-2024** ("*Program za razvoj cirkularne ekonomije u Republici Srbiji za period od 2022. do 2024. godine*," Official Gazette of RS, No. 35/22). The Programme establishes a systemic framework for improving material efficiency, waste reduction, secondary raw material use, eco-design, and industrial symbiosis across priority sectors including construction, energy, agriculture, and manufacturing. It sets measurable goals such as increasing the reuse and recycling rate, promoting green public procurement, and supporting innovation in sustainable product design. The Programme directly acknowledges the **c**onstruction sector as one of the main generators of waste and resource use, emphasizing the need for adaptive reuse and refurbishment of existing buildings, a main principle of the EU-REPAIR project's focus

on Valuable Built Environments (VBE). It introduces the requirement to integrate Life Cycle Assessment (LCA) and Material Flow Analysis (MFA) into renovation projects, aligning national practice with the EU's Circular Economy Action Plan and the *European Green Deal* framework. The new Circular Economy Programme for 2025-2030 is under preparation, building upon the achievements of the 2022-2024 Programme and expanding its scope to include **d**ecarbonization pathways, green financing mechanisms, and digital monitoring tools for resource efficiency.

Serbia has taken steps such as joining EU initiatives and adopting a Waste Management Program (2022-2031) with ambitious recycling targets. In practice, however, a lot of construction waste still goes to landfills or illegal dumps. The alignment of the waste law with heritage refurbishment is an area of opportunity: many historic building materials (stone, brick, wood) are durable and can be given a "second life." Some pilot efforts in Serbia have started, such as using reclaimed brick from a demolished wall in the same building's restoration (often called "natural brick" reuse in research). This reduces the need for new materials and preserves authenticity.

Serbia passed the **Law on Climate Change** (*Zakon o klimatskim promenama*, OG RS 26/21) as part of its obligations under the Paris Agreement. While cultural heritage isn't directly addressed in this law, it has provisions that empower sectors to develop adaptation measures. Article 4 calls on state organs to adopt sectoral measures to adapt to climate change. This provides a legal basis to include **h**eritage buildings in climate adaptation planning. Indeed, climate risks like increased frequency of floods, heat waves, or freeze-thaw cycles can threaten historic structures (through deterioration or structural stress). Article 13 of the law mandates a National Climate Adaptation Program with an Action Plan. It is expected that as these plans evolve, they will identify critical areas – and historic buildings could be recognized as vulnerable assets requiring targeted actions (e.g. improving drainage around heritage foundations to cope with heavy rains or installing climate control to prevent damage from humidity changes). By integrating heritage into climate action plans, Serbia can ensure that refurbished historic buildings are not only more energy-efficient but also more climate-resilient (for instance, using techniques to keep interiors cool naturally during hotter summers, or reinforcing structures against extreme weather). Early indications are that heritage sites of high value (like certain monasteries) will likely be included in adaptation efforts in line with their risk exposure.

It's notable that despite these laws, institutional coordination can be a bottleneck. The environmental and climate laws are handled by different ministries (Ministry of Environmental Protection, etc.) while cultural heritage is under the Ministry of Culture. Effective implementation requires them to work together. For instance, using Green Fund money for a heritage building's solar panels would need cooperation between culture authorities (to approve the solar panels) and environment officials (to approve funding). One often-cited gap is the *integration between heritage protection goals and environmental goals* - stakeholders see a lack of integration as a major gap in the legal framework. Specifically, **"lack of integration between heritage laws and environmental goals"** was flagged in the survey as the top legal gap by many respondents. This suggests that while laws exist, they are not yet fully synchronized in practice, and bridging this gap is crucial (see Section 7).

3.4 Risk Management and Disaster Resilience Framework

Serbia has recognized the importance of protecting cultural heritage from disasters, especially after experiences like the 2010 Kraljevo earthquake which damaged historic structures. The **Law on Disaster Risk Reduction and Emergency Management** (2018) is the primary legislation for managing disasters. It doesn't list cultural heritage specifically, but it provides mechanisms (like emergency plans and risk assessments) that should include heritage sites. One key provision, **Article 15**, requires institutions to conduct risk assessments and prepare protection and rescue plans for assets under their care. For

example, a museum or monastery is expected to have a risk assessment for earthquakes, fires, floods, etc., and plan how to mitigate and respond. However, in practice, implementation of this law for heritage has been limited – a recent qualitative study found that *over 40% of interviewed experts* felt that enforcement of the Disaster Risk Reduction (DRR) law at local level is insufficient and procedures are incomplete. Many indicated that while the law is well-designed, institutions often lack the capacity, tools, or training to execute detailed risk assessments for heritage structures. This aligns with other findings that regular monitoring and supervision of law enforcement in this area is lacking, and that despite a robust legal framework, significant improvements are needed in implementation and coordination.

On a policy level, the **Law on Cultural Heritage 2021** itself, as noted, integrates risk management by calling for collaboration among various actors (heritage institutes, emergency services, local authorities) to protect heritage in emergencies. There has also been cross-sector collaboration through projects and plans. Notably, Serbia ratified the UNESCO Convention on the Protection of Cultural Property in the Event of Armed Conflict (1954) and has been aligning with the Sendai Framework for Disaster Risk Reduction. Yet, as of the time of this study, Serbia does *not* have a dedicated *heritage risk reduction strategy*. The Institute for the Protection of Cultural Monuments and the Sector for Emergency Management in the Ministry of Interior have begun to coordinate (e.g. performing vulnerability assessments for UNESCO World Heritage sites like Studenica Monastery, which is at risk from landslides and earthquakes). UNESCO, through its Heritage Emergency Fund, conducted a national workshop on Disaster Risk Management for Cultural Heritage in Belgrade in 2018, focusing on raising awareness and building capacity among stakeholders to integrate DRR into heritage site management. The workshop used Studenica as a case study and introduced international methodologies like Post-Disaster Needs Assessment (PDNA) for culture. Such efforts indicate movement towards operationalizing risk management, but more needs to be institutionalized. Indeed, about 25% of heritage professionals interviewed in a recent study stressed the need for continuous training of institutional staff in disaster preparedness for heritage. They pointed out that many institutions currently do not have the expertise or equipment to swiftly respond to hazards threatening cultural assets.

Serbia's law on climate change (mentioned earlier) also indirectly ties into risk, as climate change is increasing certain disaster risks (more intense rainfall causing floods that threaten historic bridges or archaeological sites). The climate law's adaptation program could prioritize cultural heritage sites that are particularly vulnerable, ensuring resources for their protection (like drainage improvements or fire suppression systems in historic wooden buildings). Additionally, Serbia participates in regional initiatives like **PROCULTHER-NET** (an EU civil protection knowledge network project) which provides training modules on cultural heritage protection in emergencieshttps://civil-protection-knowledge-network.europa.eu/news/european-training-protection-cultural-heritage-risk. This is expected to feed back into national frameworks, possibly updating standard operating procedures for emergency management to explicitly address safeguarding heritage.

Serbia's legislative framework for risk and resilience provides a foundation but requires stronger implementation. The cultural heritage law calls for risk-based management; the DRR law mandates assessments; climate and environmental laws support protective measures. Yet, gaps in enforcement, insufficient funding for preventive consolidation of structures, and limited technical guidelines specifically for heritage risk assessment persist. There is, for example, no Serbian national standard or official guideline dedicated to structural retrofitting of historic buildings for seismic safety – practitioners rely on general structural codes and sometimes on international guidelines (like ISO 13822 for assessment of existing structures). This is an area where standardization could improve (perhaps adopting Eurocode 8 provisions for existing buildings or ICOMOS guidelines on structural stabilization). The lack of detailed harmonized guidelines was echoed by stakeholders who noted a *"lack of harmonized guidelines"* combining preservation and safety requirements.

3.5 Relevant Technical Standards and Guidelines

Alongside laws, technical standards provide the detailed specifications and best practices for refurbishing heritage buildings with modern measures. In Serbia, technical standards come from various sources: national standardization body (ISS – Institute for Standardization of Serbia), European standards (EN) adopted through Serbia's EU accession process, and international standards (ISO) where applicable. Additionally, professional guidelines by ICOMOS or UNESCO, while not formal "standards," are influential in guiding work on heritage.

Key standards and reference documents include:

- **Conservation Standards:** Serbia generally follows the principles of the **Venice Charter (1964)** and other ICOMOS charters for heritage conservation, which emphasize minimal intervention, compatibility of new materials, and reversibility. While not legally binding, these are codified in the practices of the Institute for Protection of Cultural Monuments. The new Law on Cultural Heritage 2021 essentially embeds these principles (e.g. Article on use of traditional techniques, which echoes the Venice Charter's ethos).

- **Energy Efficiency in Historic Buildings:** A crucial European standard is **EN 16883:2017 - "Guidelines for improving the energy performance of historic buildings."** This standard provides a methodology for selecting and prioritizing energy retrofit measures in historic structures in a way that preserves their heritage value. It suggests a case-by-case approach and offers a toolkit of possible measures (from simple ones like draught proofing to more complex ones like adding internal insulation), evaluating them on criteria including heritage impact. While EN 16883 is not yet formally a Serbian standard, professionals are aware of it and it has been promoted in regional training (for instance, through EU projects and ICOMOS workshops). The Faculty of Architecture in Belgrade has referenced EN 16883 in coursework on energy rehabilitation of existing buildings[13], indicating its diffusion into academia. Adoption of EN 16883 guidelines could be beneficial as a reference in local technical instructions issued by the Ministry of Culture or Energy.

- **SRPS EN 15898:2012 - Conservation of Cultural Property - Terminology** Standardizes terms in conservation and restoration, ensuring coherence between engineering, architectural, and heritage disciplines during project documentation.

- **SRPS U.M1.201 / U.M1.202 - National Standards for Masonry and Façade Restoration** Serbian technical standards defining material compatibility, mortar composition, and façade restoration procedures. They ensure authenticity and physical integrity in energy retrofit projects involving historic masonry

- **Building Energy Codes:** Serbia's Rulebook on Energy Efficiency of Buildings (2011, updated 2019) can be considered a technical standard in practice. It provides formulas for U-values, HVAC efficiency requirements, etc., that engineers must follow. For heritage, some specific adaptations are often made, like accepting slightly higher U-values for walls if adding insulation is not feasible without damaging frescoes or other features.

- **SRPS EN ISO 52000-1:2019 - Energy Performance of Buildings Framework** Defines the overarching methodology for evaluating total building energy performance, including interactions among systems. It serves as a reference for national calculation methods used in Serbian certification procedures.

- **SRPS EN ISO 13790:2009 / 52016-1:2017 - Calculation of Heating and Cooling Demand:** These standards specify dynamic and quasi-steady-state calculation procedures for determining building

energy needs. They are used in Serbia's rulebooks for energy performance modeling and are applicable for comparative assessment of old vs. renovated states.

- **SRPS EN ISO 7730 / 7726 - Ergonomics and Thermal Comfort** These define thermal comfort parameters (PMV, PPD indices) and microclimatic measurement methods. In VBE refurbishment, they are used to balance comfort improvements with preservation of historic spatial qualities.

- **Life Cycle Assessment (LCA) Standards:** To incorporate circular economy and carbon footprint considerations, general standards like **ISO 14040:2006 and ISO 14044:2006** (for LCA methodology) are applicable. Some architects and engineers in Serbia have begun using LCA tools to compare materials in renovation projects, although it's not common. The survey indicated that techniques such as **Environmental Impact Assessment (including LCA)** and **carbon footprint estimation** are among those that stakeholders have started to use or are aware of. There is also ISO 14001 (Environmental Management Systems) which some construction firms are certified in, ensuring better waste and resource management during works.

- **Sustainable Materials and Construction:** ISO and EN standards exist for specific materials (e.g. natural hydraulic lime, thermal insulation products, etc.) which ensure quality. A notable development is standards for **bio-based materials**; for example, European standards for insulation made of hemp, wood fiber, etc., which can be suitable for historic buildings due to their vapor permeability. Serbia's building code references EN standards for material performance which indirectly apply.

- **Structural Assessment and Retrofit: ISO 13822:2010** ("Basis for design of structures – Assessment of existing structures") is an important standard guiding engineers in evaluating old structures, including those of heritage value. It encourages considering original construction rules and acceptable risk levels when upgrading structures, rather than blindly applying new-building codes which might be too stringent or invasive for heritage. Serbia also uses the Eurocode framework; Eurocode 8 has parts on the seismic strengthening of existing buildings. Additionally, ACI 562 (a standard for concrete repair) and similar could be referenced by Serbian structural engineers for retrofitting historical concrete or masonry buildings.

- **Digital Documentation and BIM:** As digital tools become important, standards like **ISO 19650** (for Building Information Modeling data management) could be relevant. Some heritage projects are beginning to create BIM models of historic buildings for analysis and maintenance. The law's call for digital heritage records might lead to adoption of common data standards (perhaps using GIS and BIM interoperability standards).

- **Risk Management Standards: ISO 31000:2018** (Risk management guidelines) and **ISO 21110:2019** (Business continuity and emergency management) provide generic frameworks that can be tailored to cultural institutions. For museum collections, specific standards exist (like ISO 21127 for cultural heritage information management), but for buildings, it's more about guidelines by ICOMOS ICORP (International Committee on Risk Preparedness). UNESCO-ICCROM-ICOMOS have published manuals, which, while not formal standards, serve as the de facto guide for heritage risk management training (**"**Building an Emergency Plan" and "Managing Disaster Risks for World Heritage" guides).

- **National Engineering Standards:** The Serbian standards (SRPS) relevant to historic building renovation include those for material testing (useful in diagnosis of old materials), for example **SRPS EN 16096:2012** (Condition survey of immovable cultural heritage) which is the Serbian

adoption of a European standard that guides how to systematically assess the condition of a monument. This standard helps create a baseline before any intervention.

During the research for this study, a list of relevant engineering standards applicable to heritage refurbishment was compiled. It includes standards for structural consolidation, seismic retrofitting techniques, energy auditing procedures, HVAC efficiency. While “Application of AI” in heritage is nascent, there are projects exploring AI for monitoring cracks or optimizing climate control in archives. No specific standard exists yet for AI in heritage; however, general AI ethics guidelines (like UNESCO’s Recommendation on AI) would apply to ensure technology is used responsibly.

Serbia’s regulatory environment is underpinned by solid laws and enriched by a range of technical standards. However, enforcement and coherence are the issues. There is an evident gap between law and practice: for instance, although energy laws allow heritage retrofits, in practice many projects shy away from substantial energy improvements due to fear of violating heritage rules or due to cost. The legal requirement for heritage permit and energy certificates can sometimes clash or cause bureaucratic delay. Moreover, **outdated technical norms** were highlighte, some respondents noted that technical regulations do not reflect the latest materials or methods suitable for old buildings. The audit report by Serbia’s State Audit Institution (DRI) in 2021 underscored issues like incomplete heritage registries and the fact that many important cultural monuments lack formal protection measures or conservation plans, contributing to their poor condition. This points to an implementation gap: even the best standard or law has limited impact if fundamental groundwork (like knowing who owns a building, or having a conservation plan to integrate energy measures into) is missing. The legislative framework “recognizes the importance of combining preservation of cultural value with modern technical solutions” but its implementation is “often hampered by institutional, technical, and property-law obstacles”. Strengthening institutional capacity, improving inter-sector coordination, and ensuring financial mechanisms are accessible will be crucial to make these frameworks fully operational. These aspects will be further discussed in Sections 7 and 8 in terms of gaps and recommendations.

4. Funding for Renovation of VBE

Identifying and securing **funding** is one of the pivotal challenges for the sustainable refurbishment of valuable built environments in Serbia. Heritage projects often require significant investment, as they involve specialized materials and expertise and must balance conservation with new technologies. This section outlines the main sources of funding, national and international, and the existing financial incentives, as well as hurdles in financing heritage retrofits.

National public funding: The primary source of domestic funding for cultural heritage conservation is the state budget through the Ministry of Culture. However, Serbia's culture budget is very limited relative to overall public spending - consistently below 1% of the state budget (cultural professionals have long advocated raising it to at least 1.5%). In 2024-2025, after a mid-year budget cut, the Ministry of Culture was left with only about 0.67% of the total state budget. This extremely low allocation has to cover all cultural activities (museums, libraries, arts, heritage) and thus the portion available for heritage preservation is small and often insufficient for large restoration projects. For example, dedicated funds for specific heritage sites can be meager, the budget line for protective works at a major monastery could be on order of tens of millions of dinars (a few hundred thousand euros), which may not even cover one phase of structural consolidation. The financial strain is exacerbated by mid-year rebalances that have sometimes further reduced culture funds, as seen in 2025 when the government reallocated money away from culture to other expenditures.

Within the Ministry of Culture's budget, there are specific programs (annual competitions) for financing restoration and conservation projects on cultural monuments. These are typically grants awarded to public institutions (museums, institutes) or occasionally to owners for particular projects. However, the demand far exceeds the supply. Many monuments in Serbia rely on emergency interventions funded year-by-year, which is an unsustainable model. Additionally, the Ministry of Culture is tasked (by law) with ensuring the financial basis for all areas of culture, but in practice it cannot fully fund comprehensive renovations. Local governments also allocate some funds for local heritage sites (some cities have modest budgets for facade restorations in historic centers, etc.), but local allocations are likewise constrained by limited revenues and other priorities.

One significant development was a loan Serbia obtained from the European Investment Bank (EIB) (Council of Europe Development Bank, CEB) around 2018–2019 for the reconstruction of several key cultural institutions (museums, theaters, libraries)[19]. This was on the order of €20 million or more. Implementation of such loans has been slow – as an example, by 2019 only two out of six planned institutions had work underway[19]. While these loans are primarily for building rehabilitation (structural and functional upgrades) of cultural institutions, they present an opportunity to include energy efficiency and sustainability measures. Indeed, international development loans often require adherence to energy standards as a condition. The challenge is efficient project management and co-financing (the state must usually co-finance a portion).

The **Budgetary Fund for Energy Efficiency** (now effectively under the Ministry of Mining and Energy) is another domestic mechanism. Established under the energy efficiency law, it collects and disburses money for energy-saving projects, mainly in public sector buildings (schools, hospitals, municipal buildings). Heritage buildings that serve a public function (e.g. a public museum in a historic building) can potentially apply. In recent years, Serbia has also implemented a program of household energy efficiency subsidies (for windows, insulation, boilers) but those exclude protected heritage explicitly because of the complexities. There is scope to direct some energy efficiency grants to heritage owners if tailored properly, but currently that hasn't happened on a notable scale.

International and EU funding: Given domestic limitations, international sources are critical. Serbia, although not an EU member, has access to certain EU funding instruments. Under the **I**nstrument for Pre-Accession Assistance (IPA), there have been projects focusing on cultural heritage preservation and tourism. For instance, cross-border cooperation (CBC) programs with neighboring countries funded projects like "Subotica, Osijek Secession Tourist Route (S.O.S)", which invested in restoring Art Nouveau buildings in Subotica, Serbia and Osijek, Croatia. The total investment of such a project was over €1 million, co-financed by the EU. These projects usually aim at both conservation and local economic development (tourism), and they often include energy efficiency components indirectly (like improving lighting, visitor comfort, etc.). Another EU-funded initiative is the "Culture and Creativity for the Western Balkans" (CC4WBs) project, which includes capacity building and some pilot actions on heritage - though it's more about soft measures and training.

Climate and energy specific funds from the EU (like the EUKI which funds EU-REPAIR) are a new avenue. EUKI (European Climate Initiative) in this case is supporting knowledge exchange and policy improvements rather than capital works. But within EU programs like Horizon 2020 / Horizon Europe, there have been research projects on energy-efficient historic districts or innovative materials for heritage retrofitting, where Serbian institutes have occasionally participated. Leveraging such research funds can lead to demonstrators in Serbia.

Additionally, bilateral donors have played a part. The U.S. Ambassadors Fund for Cultural Preservation (AFCP) has provided grants for specific heritage restoration projects in Serbia (for example, restoration of Golubac Fortress, or conservation of certain artifacts). These are often small to medium grants (tens to a few hundred thousand USD) and focus on preserving authenticity, energy upgrades are not their focus, but if a project includes say improved roofing which also insulates better, that's a co-benefit.

There are also foundations like the **Headley Trust Southeast Europe Heritage Fund** which co-finance projects in the Balkans. Some Serbian NGOs or institutions have received support through that for conservation works or capacity-building (workshops to train craftsmen). While such grants might not directly fund an HVAC system or solar panels, they can cover preparatory studies or partial restoration that enables a later efficiency upgrade (for example, stabilizing a building so that it can then have new windows installed safely).

EU structural funds are not directly available until Serbia joins the EU, but in the meantime, the Western Balkans Investment Framework (WBIF) sometimes supports cultural heritage as part of broader tourism/environment programs. A project cited on WBIF is the post-earthquake housing reconstruction in Kraljevo, which though focused on housing, included some attention to building seismic resilience which could apply to heritage residences.

Private investment and public-private partnerships (PPP): Some heritage buildings, especially in urban centers, have been renovated through private investment, typically when they are repurposed as hotels, offices, or commercial venues. In Belgrade, a number of fin-de-siècle buildings in downtown have been bought or leased by companies and renovated. When profit is a motive, energy efficiency measures that reduce operating costs (like efficient heating for a hotel in a historic building) become attractive. However, purely private funding tends to go to high-profile properties that can generate return (for example, the refurbishment of Hotel Bristol in Belgrade was supported by a private hospitality investor, and modern amenities including efficient HVAC were integrated during the renovation in 2023-2025). PPP models in Serbia's heritage sector are still rare; legal provisions exist allowing concession or lease of heritage sites for adaptive reuse, but only a few cases (e.g. a historic castle leased as a hotel) have occurred. Encouraging PPPs could unlock capital for saving neglected heritage, provided contracts enforce conservation standards.

Financial incentives: Currently, Serbia does not have specific tax incentives for heritage conservation or energy retrofits of heritage. Unlike some EU countries where owners of listed buildings get tax deductions for restoration expenses, in Serbia owners often face a burden without relief. The survey of stakeholders clearly showed that practitioners and owners believe more financial incentives are needed to improve refurbishment rates. When asked what types of financial support would most improve climate-friendly refurbishment, popular answers included direct grants, low-interest loans or credit lines, and tax deductions. "Project-specific EU or other funding" was also noted, indicating that stakeholders see external grants as vital. The Government has, in the energy sector, launched subsidy schemes for household energy efficiency and renewables (50% subsidy for insulation, window replacement or efficient boilers in homes, as of 2022). If expanded, such schemes could possibly include heritage homeowners, but with extra technical guidance. Property tax relief for cultural monuments exists in a minor form (some local governments reduce property tax for listed monuments), but it's not significant enough to fund refurbishments.

Common obstacles in funding: According to stakeholder responses, a number of issues prevent successful financing of VBE projects. Many respondents who had applied for funding reported administrative or compliance reasons for being denied. Frequent reasons cited included: *incomplete or improper documentation*, *failure to meet specific energy-saving targets*, *lack of necessary permits*, and *missed deadlines or application errors*, as well as simply *exhaustion of the available grant budget*. For instance, if a municipality offers a limited call for refurbishment grants, it may run out of funds quickly, leaving good projects unfunded. Another challenge is "who" can apply – sometimes private owners of heritage are not eligible for state energy funds that are limited to public-sector buildings. Additionally, the cost-sharing requirement is a barrier: even if a 50% grant is available, the owner must provide the other 50%, which for a large historic building could be beyond their means. The survey data on obstacles underscores that *lack of finance and lack of state funding* are perceived as the top obstacles in undertaking refurbishment projects. Cultural heritage projects often uncover additional work (structural issues, material conservation needs) which increases costs beyond initial estimates, making it hard to budget and secure enough funds.

On a positive note, climate finance mechanisms are emerging that could be tapped. For example, the Green Climate Fund (GCF) or Adaptation Fund might support integrating climate adaptation in heritage site management (though typically heritage is not a main focus). Also, energy service companies (ESCOs) could, in theory, invest in energy retrofits and get paid back from energy savings – but in a heritage building, the energy savings may not be huge relative to the investment needed, and the ESCO model in Serbia is still developing.

Funding for education and training (indirectly linked to heritage management) often comes from international donors (EU, UNESCO, bilateral cultural centers). This includes scholarships, workshops, etc. While not funding physical renovation, these contribute to building capacity (which is a form of investment in sustainability).

In conclusion, the funding landscape for VBE refurbishment in Serbia is characterized by scarce public funds, reliance on international grants/loans, and the need for more incentives to stimulate private investment. The current mechanisms do not fully meet the needs: heritage managers struggle to find money for even urgent repairs, let alone comprehensive energy retrofits or resilience upgrades. Stakeholders clearly call for more robust financial support: when asked what would help most in future projects, top responses were *financial incentives or subsidies* and *direct grants for renovation*. There is also support for low-interest loans and tax incentives as tools to improve refurbishment rates. Implementing such measures would reduce the burden on owners and make sustainable refurbishment a more attractive proposition. Section 7 will further discuss funding-related gaps and Section 8 will

recommend specific improvements (e.g. developing dedicated heritage energy grant schemes, or integrating heritage buildings into national energy efficiency action plans for funding). Importantly, ensuring effective use of funds is vital – a Vreme news investigation questioned why a large culture-sector loan had slow uptake[19], highlighting issues in project execution that need addressing. Hence, beyond just availability of money, project management capacity and streamlined application processes are key (some survey respondents noted complexity in applications as a reason for failure). This calls for simpler procedures and possibly **technical assistance** for preparing project proposals, so that more refurbishment projects can reach "bankability" and attract financing.

5. Results and Stakeholder Insights

To ground the analysis in real-world conditions, the study incorporated extensive stakeholder input from Serbia. This section presents the key findings from the **s**takeholder questionnaire survey conducted under the EU-REPAIR project. The results highlight the experiences, perceptions, and recommendations of those directly involved in or affected by the refurbishment of valuable built environment, including professionals (architects, engineers, conservators), building owners, government officials, and community representatives.

5.1 Stakeholder Profile and Awareness

The survey captured a diverse range of respondents. Participants included architects (designers of renovation projects), civil/structural engineers, conservators and restorers, project managers, municipal and state government representatives, NGO members, academics (professors and researchers in architecture/engineering), as well as students in relevant fields. Ages ranged widely (from under 20 to over 70), with a gender distribution reflecting stronger female participation among stakeholders. Geographically, responses came from both larger cities (Belgrade, Novi Sad, Niš) and smaller towns, reflecting urban and provincial perspectives. About half of respondents identified as being *professionally involved* in heritage (either through their job or studies), while others were *owners or local officials* dealing with heritage buildings.

A fundamental question was how familiar stakeholders are with the national legal framework regarding VBE refurbishment. The results showed moderate awareness but significant gaps. Only a minority described themselves as "very familiar" with the relevant laws and regulations, whereas the majority were "somewhat familiar" or "neither familiar nor unfamiliar," and a noticeable segment admitted to being "slightly" or "not at all familiar". This indicates that many practitioners and owners are not fully aware of all the rules (which is unsurprising given the complexity of multiple laws). It suggests a need for better dissemination of information and perhaps training on regulatory compliance (which stakeholders later themselves called for). Government-level respondents tended to have higher familiarity, whereas private owners often had low familiarity, relying on hired experts for guidance. One positive sign is that *policy makers who responded were generally aware of the main laws* (heritage law, planning law, energy law) but even among them, detailed knowledge (like specific by-laws or standards) was limited.

In terms of experience, stakeholders were asked about their level of involvement in VBE refurbishment projects. About one-third reported no prior experience, another large portion had been involved in a few projects (1-2 or 3-5 projects), and only a small group had worked on more than 5 projects (indicative of highly specialized experts). This suggests that the field is still emerging, not many individuals have had the chance to execute numerous heritage retrofit projects, likely due to the relatively low number of such projects happening Students and young professionals particularly noted limited hands-on opportunities, which aligns with the age structure of the sample, where early-career stakeholders constitute the largest group of respondents. This suggests that capacity-building and practical training opportunities are essential to support the transition from interest to implementation within the next generation of VBE professionals.

Motivations for engaging in heritage refurbishment were explored. Respondents could select their primary motivation, and common choices were: "maintaining the value of VBE," "environmental interest," "benefits for the community," and "risk mitigation and resilience," among others. Financial or investment return was a less frequently chosen primary motivator (likely since many respondents were not owners). This indicates that for most stakeholders, cultural and community values and environmental concerns drive their interest in these projects, rather than profit. This is an important point: it underscores a

passionate base of professionals and citizens who care about these buildings as cultural heritage and community assets, which is a strength to leverage for future initiatives. However, it also highlights that without financial incentive, projects rely on goodwill and public sector push.

Fig. 1 shows the gender of the participating stakeholders. Female respondents constitute 68.9% of the sample, while male respondents represent 31.1%. The results indicate a pronounced female majority among participants, suggesting particularly strong engagement of women in VBE-related professions, academia, public administration, and civic roles in Serbia.

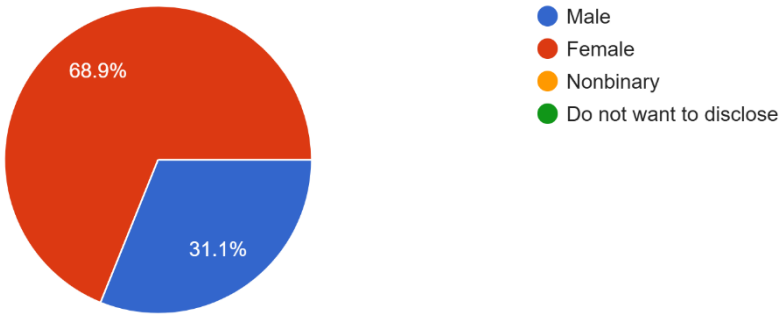


Fig 1. Gender of questionnaire participants

Fig. 2 shows the age distribution of respondents. The sample spans several age groups, with a strong concentration in the early- and mid-career brackets. The largest share of participants falls within the 20–30 age group (42.2%), followed by respondents aged 41–50 (26.7%) and 31–40 (17.8%). More senior cohorts are less represented, with 8.9% aged 51–60 and 4.4% aged 61–70, while no respondents were recorded in the under-20 or over-71 categories. This distribution indicates that perspectives are primarily shaped by emerging and mid-career professionals actively engaged in the VBE ecosystem, providing valuable insight into the current and future workforce involved in refurbishment processes..

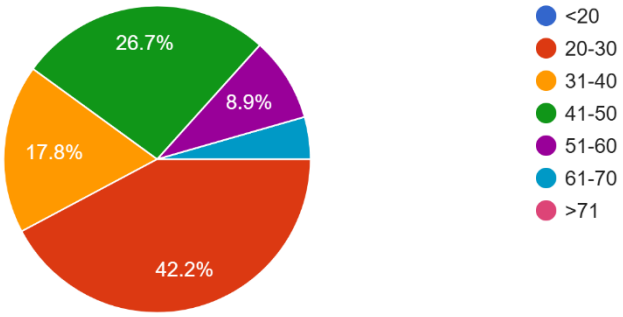


Fig 2. Age of questionnaire participants

Fig. 3 shows the living environment of participants. The sample is strongly urban, with 66.7% of respondents residing in large cities and 31.1% in small towns, while only 2.2% live in rural (village) settings. This pronounced urban dominance reflects the spatial concentration of valuable built environments and refurbishment activities, which are primarily located in cities and municipal centers. At the same time, the limited rural representation suggests that perspectives from peripheral or less densely populated areas remain underrepresented. This highlights the importance of ensuring that future capacity-building and policy interventions also address the needs and challenges of smaller and rural communities where heritage assets exist but refurbishment initiatives are less institutionalized.

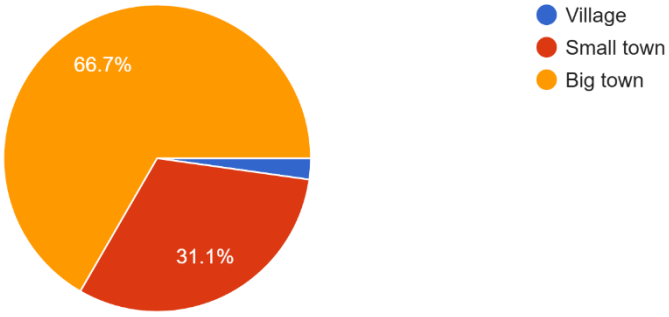


Fig 3. Living environment of participants

Fig. 4 shows respondents' highest level of education. The sample is strongly characterized by advanced academic qualifications, with 57.8% holding a Master's degree and 31.1% a doctoral degree. A smaller share holds a bachelor's degree (6.7%), while non-university higher and secondary education levels are minimally represented (2.2% each). No respondents reported basic or vocational education as their highest level. This indicates that the respondent pool is composed predominantly of highly educated professionals and academics, supporting the reliability of informed, knowledge-based perspectives on VBE refurbishment challenges and opportunities. At the same time, this highlights a potential gap between formal knowledge and practical implementation experience among early-career respondents.

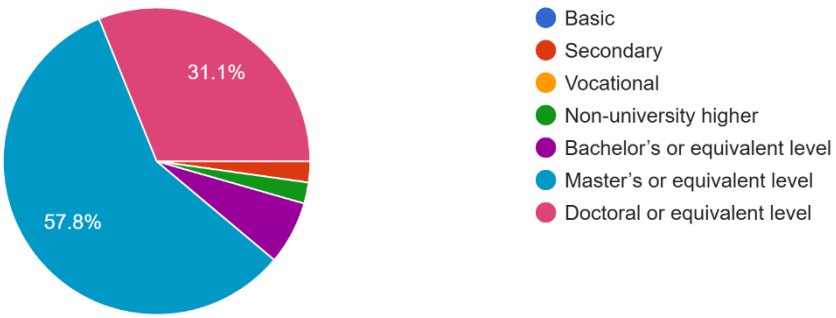


Fig 4. Education of participants

Fig. 5 shows the professional background of respondents. The sample is strongly dominated by architects (64.4%), followed by engineers (17.8%) and managers (8.9%). Other professional groups, including lawyers, students, medical professionals, and university professors, are represented only marginally (2.2% each), while no respondents identified primarily as conservators or renovators. This distribution indicates that the stakeholder perspective is shaped predominantly by technical design professions, with more limited input from complementary fields. This suggests a potential gap in multidisciplinary representation, which is essential for fully integrated VBE refurbishment approaches involving conservation, governance, and social dimensions.

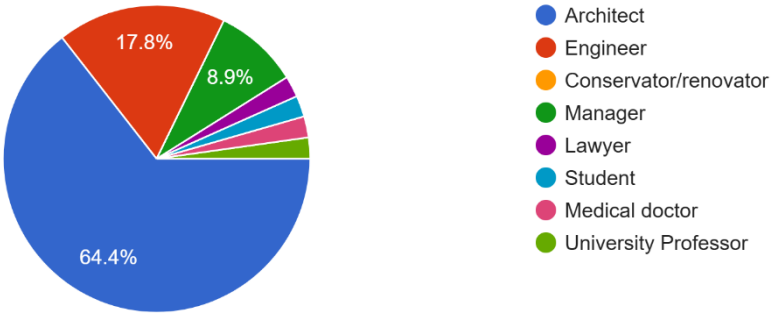


Fig 5. Professional background

Fig. 6 shows how respondents position themselves in relation to refurbishment processes. The largest groups are students of related study programs (35.6%) and scientists or lecturers (26.7%), followed by independent experts (11.1%). Other roles, including government representatives, owners of historic buildings, NGO representatives, consultants, and industry actors, are present but only marginally represented. This indicates that while both supply-side and demand-side perspectives are included, the sample is predominantly shaped by the knowledge and education sector. This reinforces earlier findings that the stakeholder base reflects high academic engagement but may underrepresent implementation-level actors directly involved in project execution.

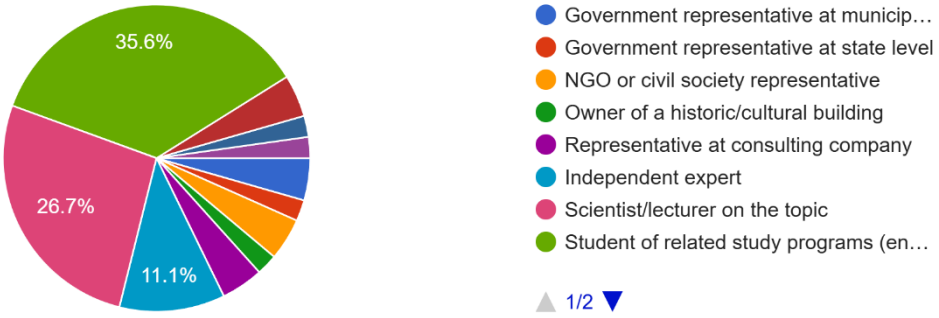


Fig 6. Occupational sector of the participants

Fig. 7 shows the main motivations for engaging in VBE refurbishment projects. The most frequently cited drivers are benefits for the community (55.6%) and environmental interest (48.9%), followed by professional interest in heritage (33.3%) and maintaining the value of VBE (26.7%). Risk mitigation and resilience are mentioned by a smaller share of respondents (15.6%), while financial or investment return is the least significant motivator (8.9%). These findings indicate that engagement in VBE projects is primarily driven by social, environmental, and cultural considerations rather than financial incentives. This

suggests that stakeholder commitment is rooted more in public value and sustainability goals than in market-driven motivations.

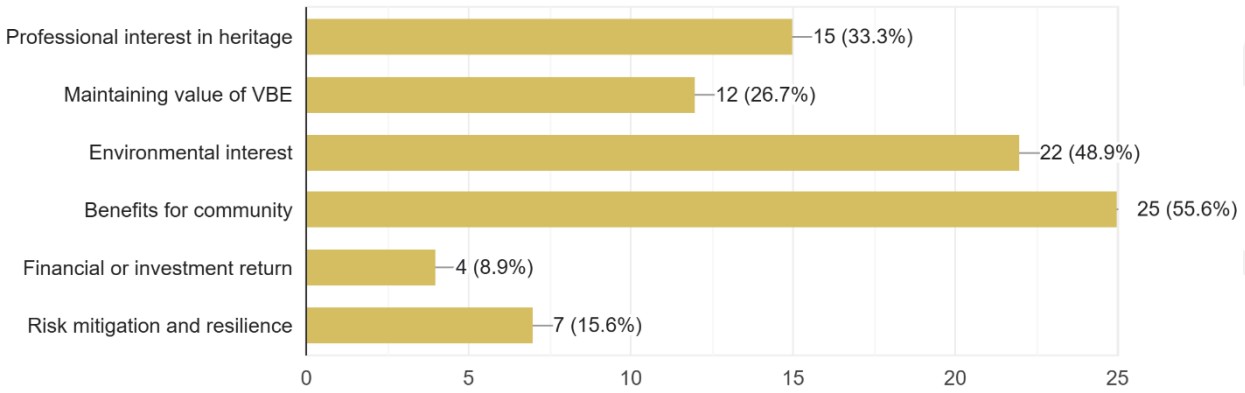


Fig 7. Motivation for engaging in VBE refurbishment

Fig. 8 shows the self-assessed level of experience in VBE refurbishment. A majority of respondents (60%) report having no prior project experience, while 31.1% have been involved in only 1–2 projects. More advanced experience levels are limited, with 2.2% participating in 3–5 projects and 6.7% involved in more than five projects. This indicates that stakeholder perspectives are shaped primarily by emerging or early-stage engagement rather than extensive practical experience. This further supports earlier observations of a highly educated but early-career stakeholder base with strong interest in VBE refurbishment but limited implementation exposure.

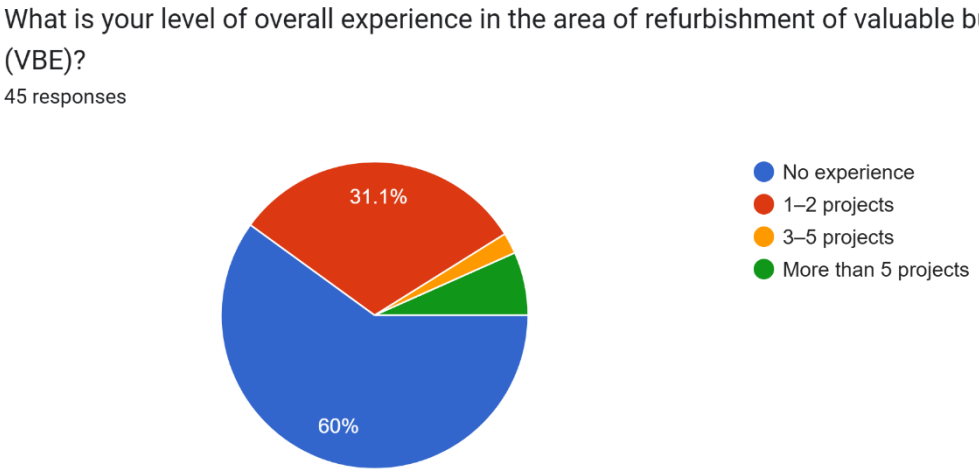


Fig 8. Level of experience in refurbishment of VBE

Fig. 9 presents the types of projects reported by respondents with prior experience in VBE refurbishment. Only a small subset of participants provided examples of completed or ongoing projects, reflecting the limited practical engagement identified earlier. The reported projects are diverse and include energy efficiency improvements in public buildings, restoration of historic structures, refurbishment of residential buildings, and education-related initiatives, indicating a broad thematic scope but low concentration of

direct implementation experience. This further supports the finding that while interest and academic engagement in VBE refurbishment are high, hands-on project involvement remains relatively limited.

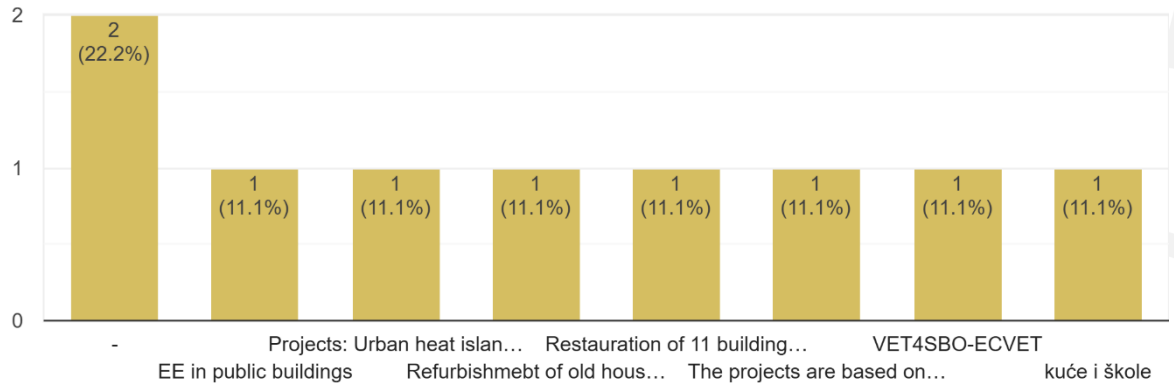


Fig 9. Type of projects

Fig. 10 shows that the majority of respondents (80%) have not participated in applying for financial support for VBE refurbishment. A smaller share has accessed funding through municipal, national, or international programs (17.8%), while only 2.2% reported support from private contributors. This suggests limited engagement with available financial support mechanisms among stakeholders. This may reflect barriers related to awareness, eligibility, or administrative capacity rather than a lack of interest in refurbishment initiatives.

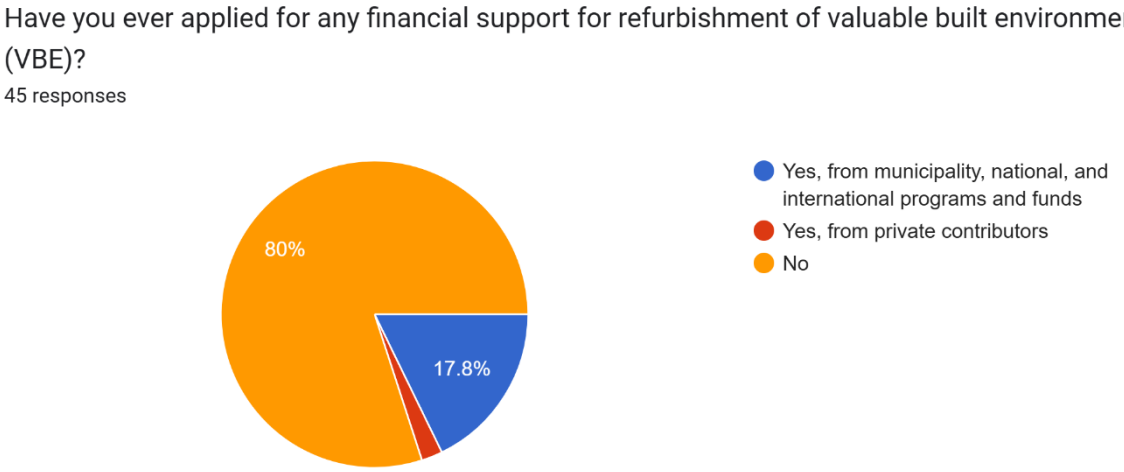


Fig 10. Previous experience in obtaining financial support for refurbishment of VBE

Fig. 11 shows the outcomes of previous applications for financial support for VBE refurbishment. Among respondents who applied for funding, 44.4% received support only partially, 22.2% received the full requested amount, while 33.3% did not obtain funding. These results indicate that successful funding acquisition is often incomplete, with full financial coverage remaining limited. This suggests that securing sufficient financial resources for refurbishment projects remains a challenge for stakeholders.

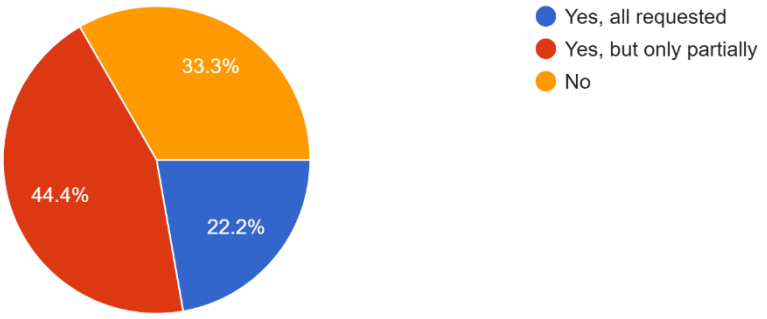


Fig 11. Financial Support success rate

Fig. 12 shows reasons cited for unsuccessful applications (applicants only; small base of 7 respondents). The most frequently reported reason was insufficient justification of budget and expenses (42.9%), followed by low-quality refurbishment project proposals (28.6%). Additional reasons included lack of a building permit (14.3%) and exhaustion of grant budgets (14.3%). These findings suggest that both proposal preparation and resource availability influence funding outcomes.

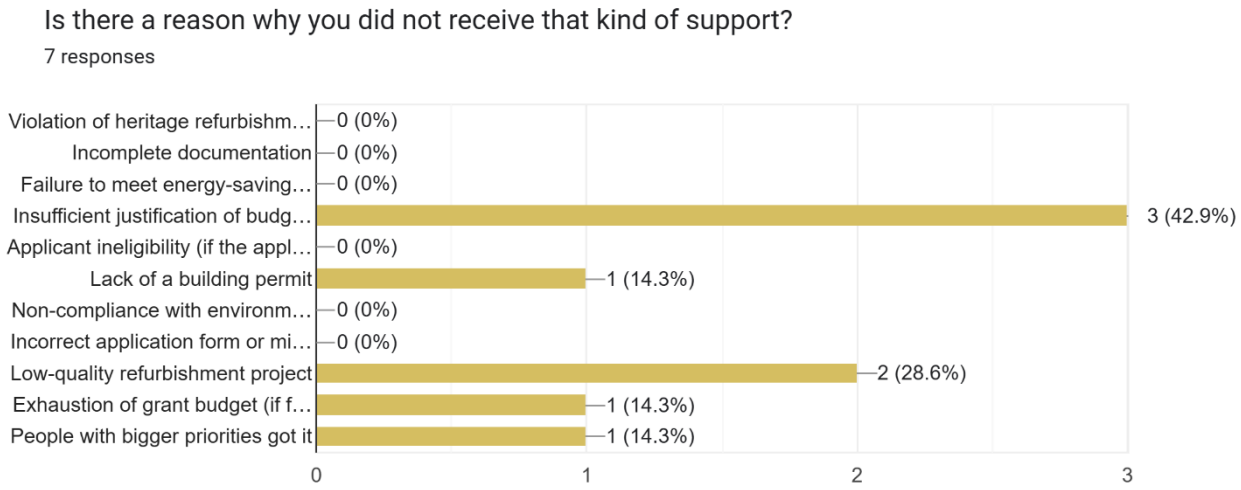


Fig 12. Reasons for not obtaining financial support

Fig. 13 shows stakeholder familiarity with the national legal framework across key domains relevant to VBE refurbishment, including refurbishment regulation, energy efficiency, circular economy, risk assessment, and climate-related policies. Overall, respondents report moderate levels of familiarity, with "somewhat familiar" and "neither familiar nor unfamiliar" responses prevailing across most areas. Higher familiarity is observed in energy efficiency and climate-related policies, while lower familiarity is evident in risk assessment and circular economic frameworks. These findings indicate a general awareness of the legal landscape but also highlight the need for targeted legal capacity-building in specific thematic areas.

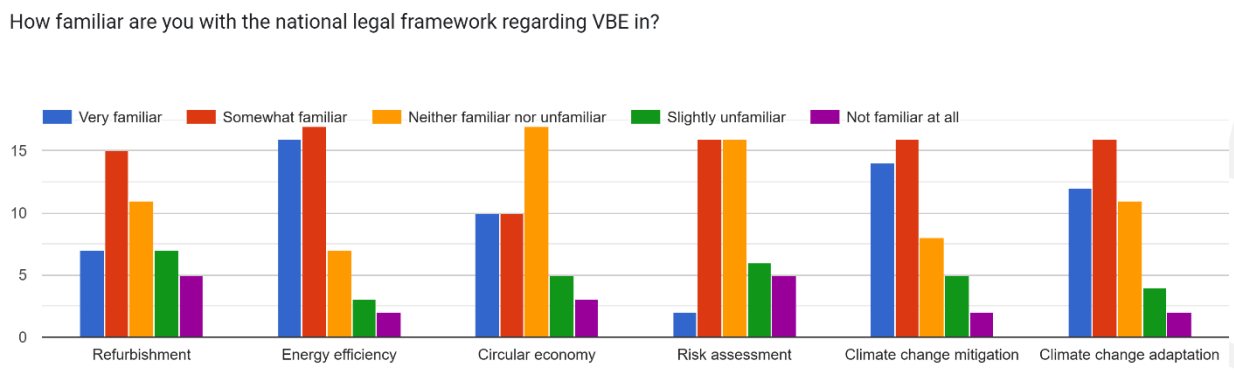


Fig 13. Familiarity with legal framework of VBE

Fig. 14 presents stakeholder perceptions of how effectively current legislation supports the implementation of key measures in VBE refurbishment, including energy efficiency, circular economy, risk assessment, and climate change mitigation. Across all areas, most respondents rated legislative support as moderate or slight rather than strong. Energy efficiency measures received relatively higher support ratings, while circular economy, risk assessment, and climate mitigation measures were more frequently assessed as only slightly supported. A noticeable share of respondents also selected "do not know," indicating uncertainty regarding legislative effectiveness in these domains.

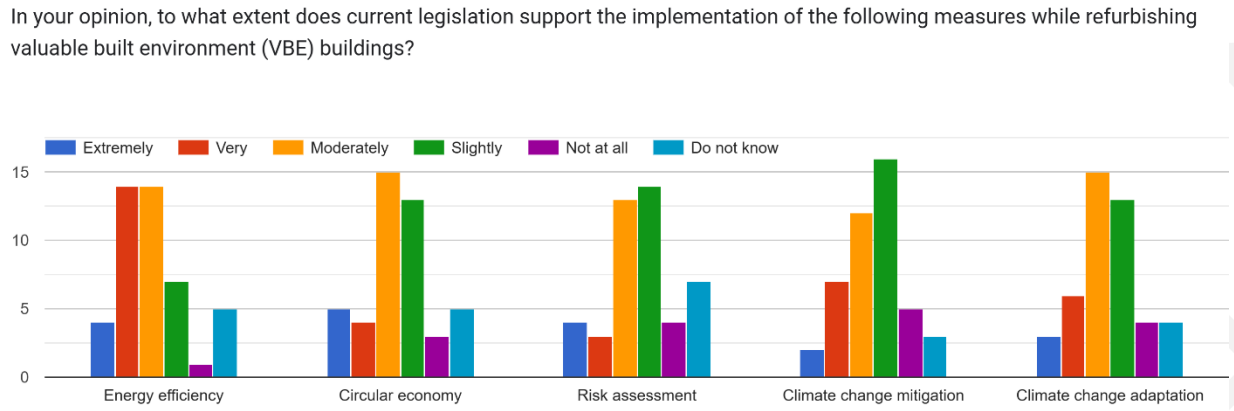


Fig 14. Current legislation support to implementation of measures for refurbishing valuable built environment (VBE) buildings

Fig. 15 shows the standards and norms most frequently applied by respondents when working on VBE refurbishment. National codes are the most commonly used (40%), followed by local municipal codes (28.9%) and EU Directives (26.7%). International standards (22.2%), cultural heritage–specific guidelines (20%), and sustainable building certification schemes (17.8%) are also applied to varying degrees. Notably, 40% of respondents indicated that they do not directly apply any standards, reflecting the limited practical involvement identified earlier.

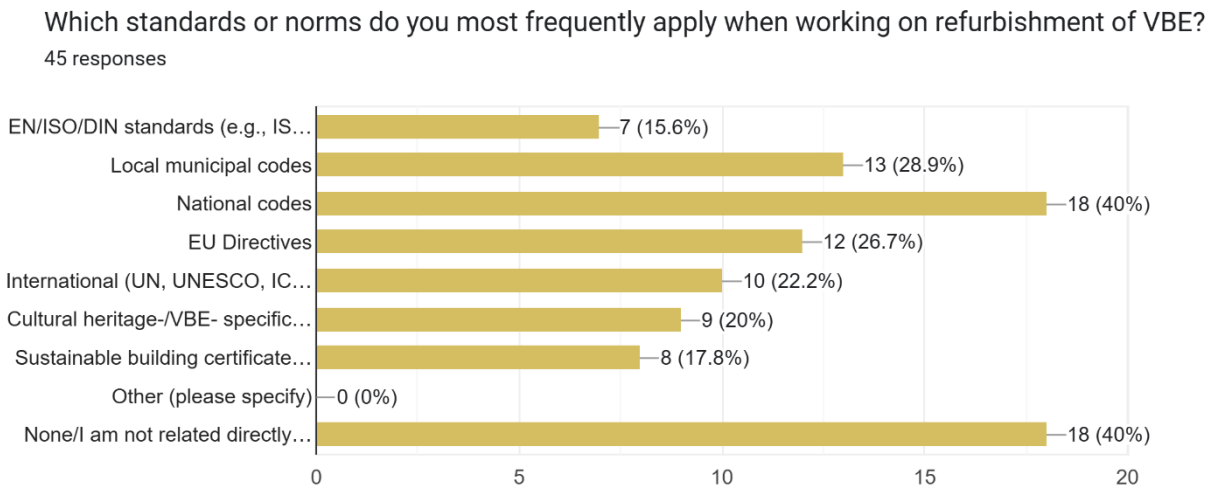


Fig 15. Standards and norms applied on refurbishment of VBE

Fig. 16 shows respondents' perceptions of the main gaps in the legal framework governing VBE refurbishment. The most frequently identified issue is the lack of integration between heritage protection laws and environmental or energy objectives (37.8%). This is followed by unclear or conflicting responsibilities between institutions (22.2%) and the absence of harmonized technical guidance (15.6%). Additional concerns include outdated technical standards and limited alignment between engineering and preservation requirements. These findings point to structural coordination challenges as key targets for policy refinement.

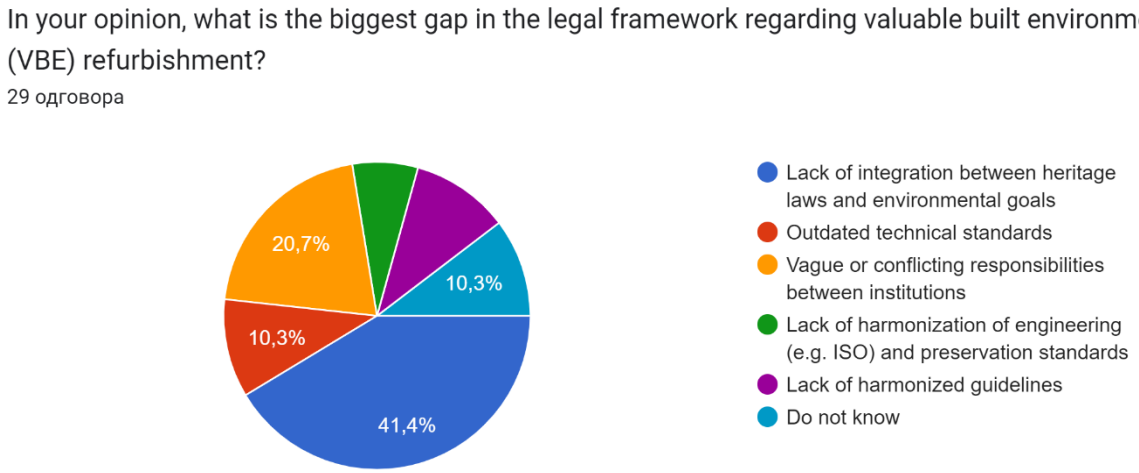


Fig 16. Gap assessment in legal framework of VBE

Fig. 17 shows the frequency of perceived obstacles in VBE refurbishment projects across several dimensions. Financial constraints emerge as the dominant systemic barrier, reflected in both lack of finance and insufficient state funding. Administrative and institutional challenges, such as complex permitting procedures, also rank highly. In parallel, respondents identify capacity-related barriers, including lack of technical knowledge and skills, as well as limited public awareness and support. Together, these findings indicate that financial, regulatory, and knowledge-related constraints jointly shape implementation difficulties.

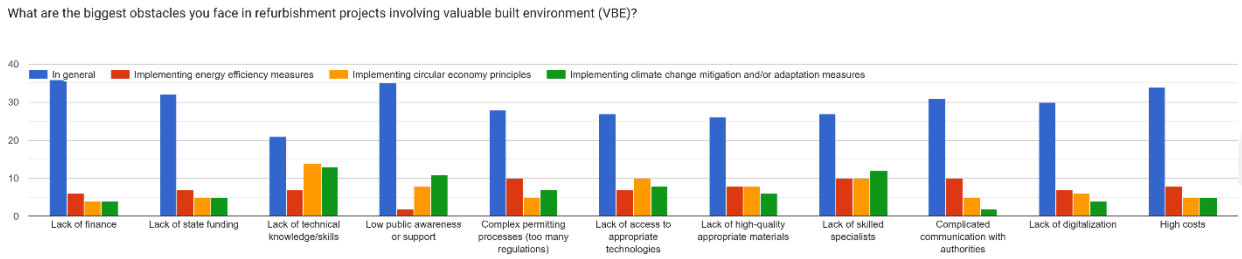


Fig 17. Biggest obstacles faced in refurbishment of VBE

Fig. 18 highlights the types of support perceived as most helpful for enabling sustainable and climate-friendly VBE refurbishment projects. Technical training and clear operational guidelines are identified as the highest priority (66.7%), followed by financial incentives or subsidies (60.0%). Access to case studies and best practices (51.1%) also ranks highly, while procedural support such as easier permitting (35.6%) and digital tools for simulation and risk assessment (33.3%) are recognized as important enabling factors. These findings emphasize the need for both capacity-building and financial mechanisms to accelerate implementation.

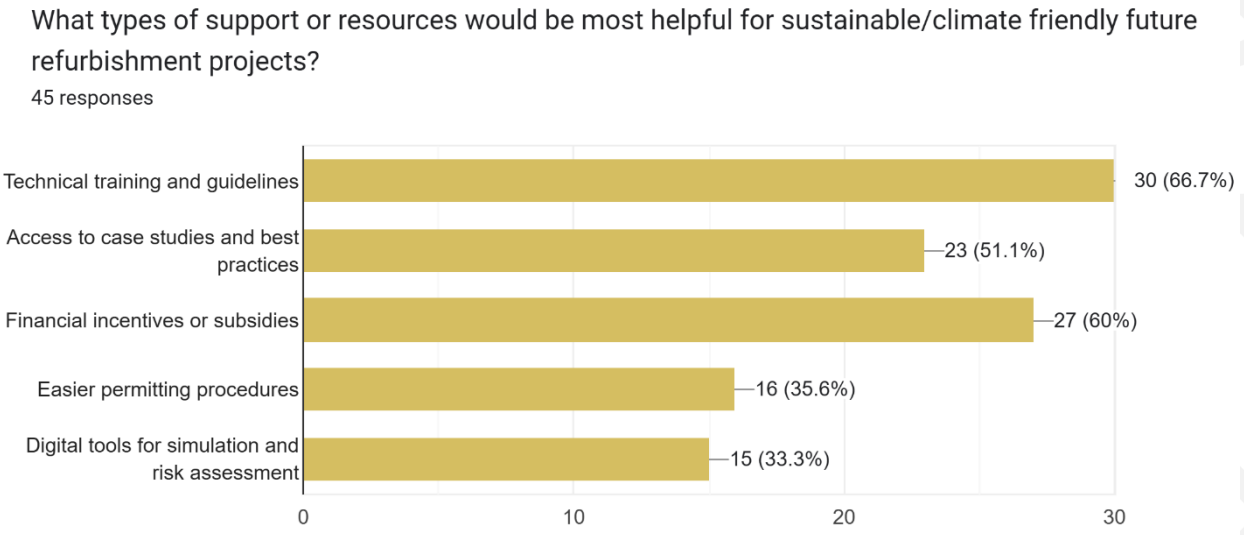


Fig 18. Types of helpful support and resources

Fig. 19 presents the financial support mechanisms perceived as most effective in accelerating sustainable and climate-friendly VBE refurbishment. Direct grants for renovation are clearly identified as the most impactful instrument (77.8%). This is followed by project-specific EU or other funding (53.3%), indicating the importance of structured public investment schemes. Low-interest loans or credit lines (28.9%) and tax deductions or incentives (22.2%) are viewed as supportive but secondary measures. Overall, respondents prioritize upfront financial support over indirect fiscal or credit-based mechanisms.

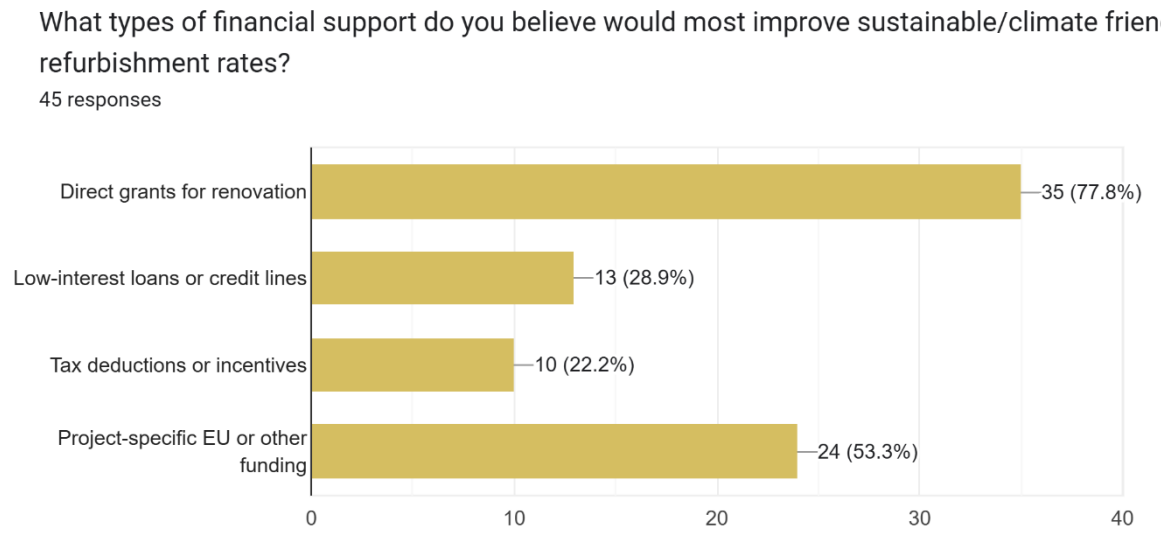


Fig 19. Types of financial support that would improve sustainable/climate friendly refurbishment rates

Fig. 20 presents sustainability strategies previously applied in VBE refurbishment projects. Energy-efficiency measures related to the building envelope (e.g., windows and insulation) are the most commonly implemented (55.6%), followed by integration of renewable energy systems (46.7%) and passive design approaches such as natural ventilation and daylight use (37.8%). Traditional materials (33.3%) and techniques (20%) also remain relevant, reflecting conservation-sensitive practices. Indoor thermal comfort improvements are moderately represented (24.4%), while circular economy approaches and recycled/local materials (both 15.6%) appear less frequently adopted. Overall, results indicate strong emphasis on energy performance improvements, with circular and resource-efficiency strategies still emerging in practice.

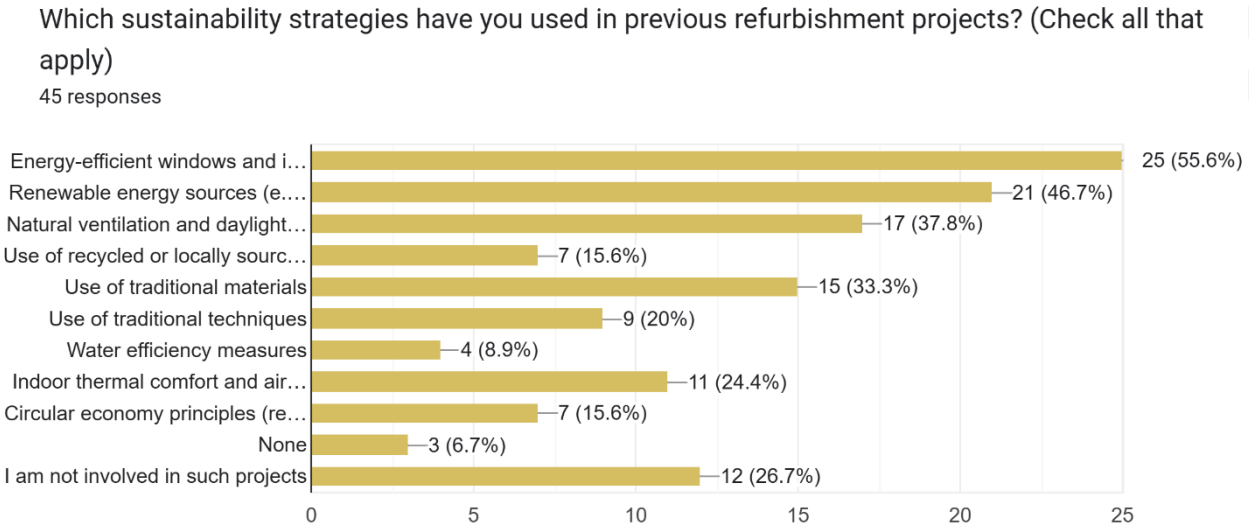


Fig 20. Sustainability strategies previously used

Fig. 21 presents the techniques used to assess the impacts of refurbishment projects. Energy efficiency assessment is the most commonly applied method (53.3%), reflecting its alignment with regulatory and funding requirements. Environmental impact assessment approaches such as LCA are used by 17.8% of respondents, while carbon footprint estimation is applied by 20%. Risk assessment appears rarely (6.7%). Notably, 40% of respondents report not using any formal evaluation technique. This distribution suggests that while energy performance evaluation is relatively mainstreamed, holistic impact assessment methods such as LCA and carbon accounting remain underutilized, highlighting the need for broader methodological integration in VBE refurbishment practice.

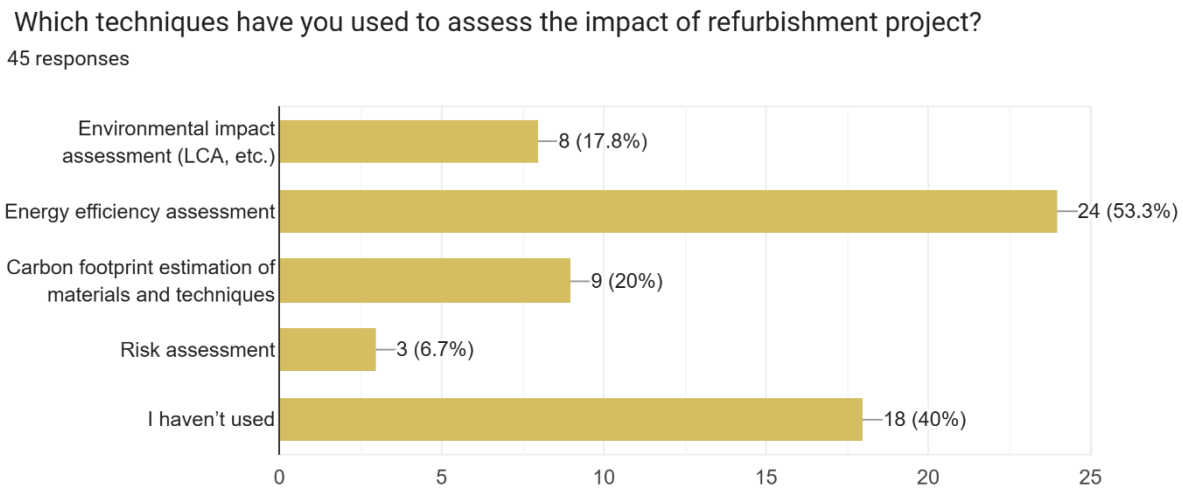


Fig 21. Previously applied techniques

Fig. 22 illustrates perceptions of how citizens view the preservation of valuable built environment (VBE). The distribution leans predominantly toward neutral-to-positive attitudes, with 44.4% perceiving public views as neutral and 44.4% as positive or very positive. Negative perceptions remain limited (11.1%), and strong negativity is rare. These findings suggest that while public resistance is not a dominant barrier, a substantial share of neutral perceptions indicates untapped potential for strengthening societal support through targeted awareness initiatives, communication strategies, and demonstrative good-practice examples.

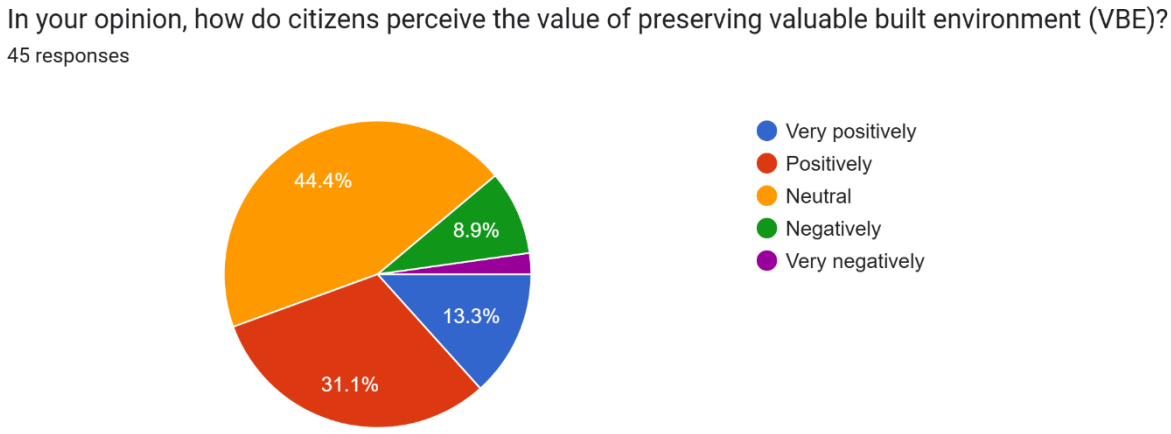


Fig 22. Citizen perception of value preserving VBE

Fig. 23 presents perceptions of the importance of community involvement in refurbishment projects. A clear majority (73.3%) consider community participation to be very important, with an additional 20% viewing it as somewhat important. Only a small minority express neutral or low importance. These findings highlight strong recognition of the role of participatory approaches and co-creation processes in supporting the successful implementation of refurbishment initiatives, particularly within valuable built environments.

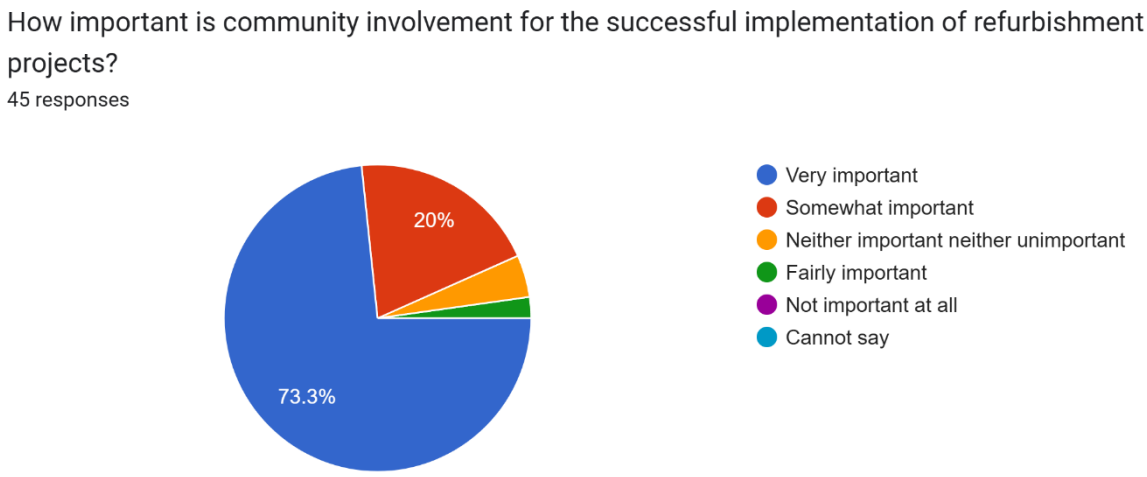


Fig 23. Importance of community involvement

Fig. 24 presents respondents' relevance ratings for different methods aimed at increasing public interest and participation in preserving valuable built environments. Seminars and workshops are most frequently rated as very relevant, indicating strong support for interactive learning and engagement formats. Representatives' committees and focus groups also receive high relevance ratings, suggesting a preference for participatory and dialog-based approaches. In contrast, online surveys are less frequently considered very relevant, implying that more direct and collaborative forms of engagement may be more effective in fostering public involvement.

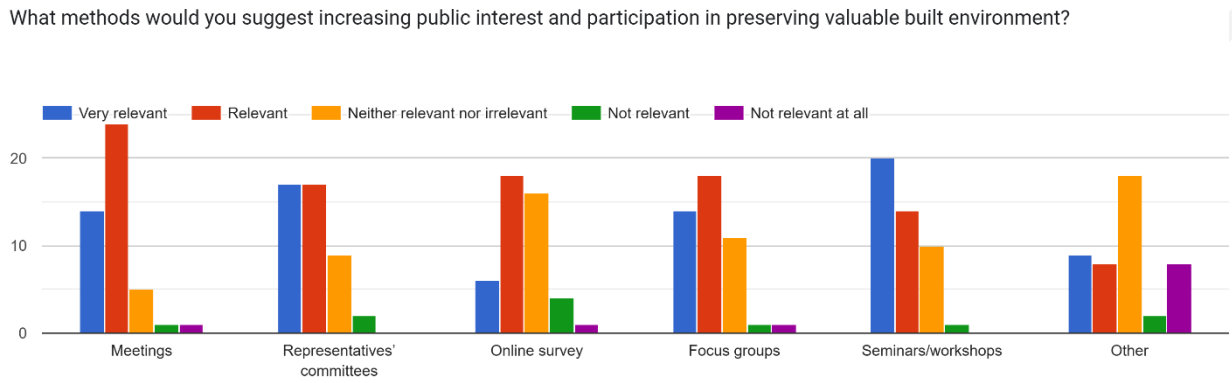


Fig 24. Methods for increasing public interest and participation in preserving VBE

Fig. 25 presents the main perceived social challenges associated with refurbishing valuable built environment (VBE) buildings in a more sustainable manner. Financial constraints emerge as the dominant barrier, followed by limited awareness and insufficient motivation among stakeholders. Additional challenges include resistance linked to heritage protection requirements, limited availability of ready-to-

use technical solutions, and demographic pressures such as an aging population. Importantly, these challenges appear to interact rather than operate independently, suggesting the need for integrated policy and support measures.

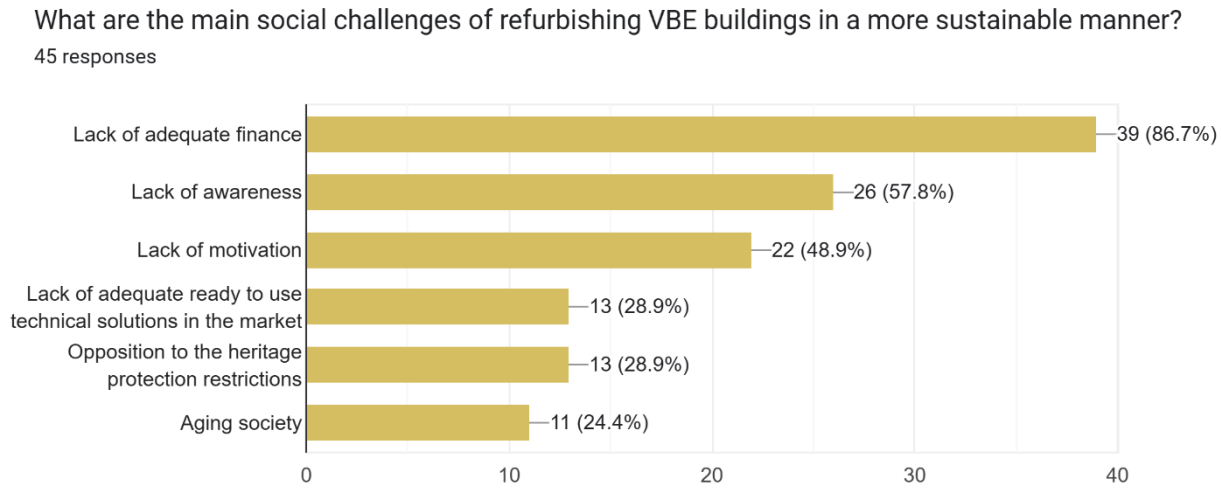


Fig 25. Main social challenges of refurbishing VBE

Fig. 26 illustrates priority areas for training and capacity-building related to sustainable refurbishment of valuable built environments. The highest demand is observed for technical skills in refurbishment, followed by legal and regulatory compliance knowledge. Strong interest is also expressed in digital tools and simulation methods, as well as climate mitigation and adaptation strategies. Additional needs include project management, environmental impact assessment, risk assessment, and circular economy approaches, highlighting the importance of multidisciplinary capacity development.

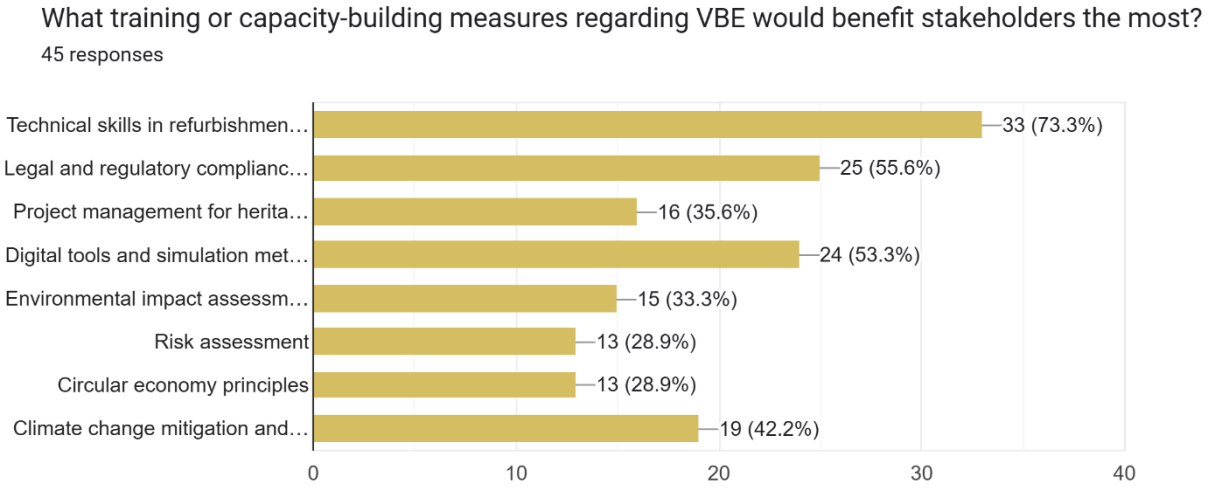


Fig 26. Training or capacity-building measures regarding VBE

Fig. 27 illustrates respondents' willingness to participate in future activities related to environmentally and climate-friendly refurbishment of valuable built environments, including focus groups, interviews, co-design sessions, and workshops. Across all thematic areas, the majority express readiness to engage,

particularly in technical skills, digital tools, and environmental impact assessment topics. This indicates strong interest in continued collaboration and active stakeholder involvement within future EU REPAIR initiatives.

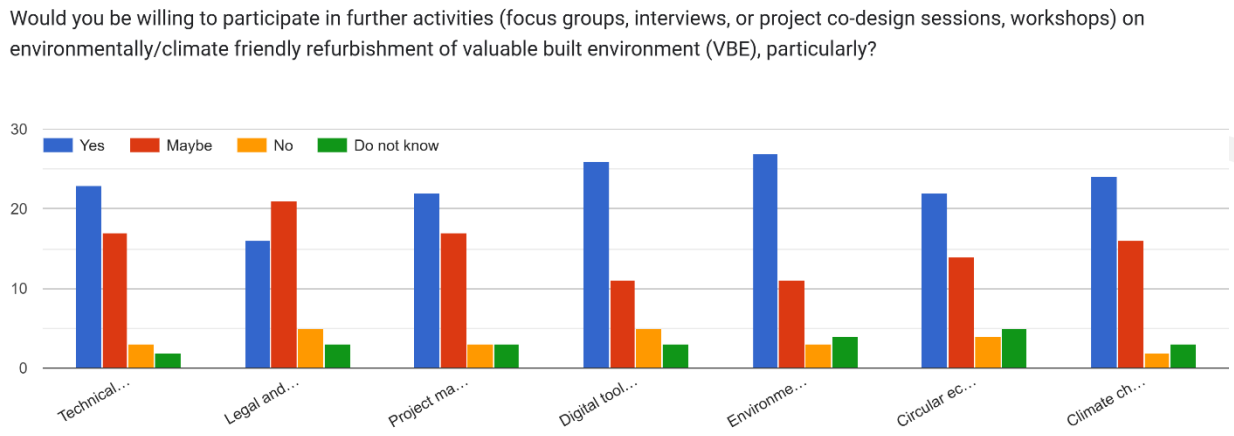


Fig 27. Willingness to participate in further EU REPAIR activities

5.2 Perceived Gaps in the Legal and Policy Framework

Stakeholders were asked to identify the biggest gap in the legal framework regarding VBE refurbishment. They were presented with several possible gaps and could choose one or more. The results were quite telling: - The top issue selected was "lack of integration between heritage laws and environmental/energy goals". Many respondents feel that current laws do not work in concert – for example, heritage protection rules might conflict with energy-saving mandates, and there's no unified guideline to resolve this. This confirms our earlier analysis in Section 3. Many wrote in comments that *heritage regulations need to better incorporate sustainability*, or conversely that *energy regulations need exceptions or guidelines for heritage*. - Another very commonly cited gap was "outdated technical standards". Stakeholders feel that the regulations (technical norms) haven't kept pace with new technologies or methods that could be used in heritage contexts. For instance, thermal performance standards might not consider traditional materials' behavior, or building codes might not have provisions for modern reversible strengthening techniques. - A related gap highlighted was the "lack of harmonization of engineering and preservation standards". This mirrors the integration issue, emphasizing that engineering codes (like energy code or structural code) and preservation standards (heritage charter guidelines) are not aligned, leaving practitioners in a dilemma on whose requirements to prioritize. - "Vague or conflicting institutional responsibilities" also appeared in responses (though to a lesser extent). Some participants pointed out that multiple institutions (heritage institutes, ministries, municipal offices) are involved and it's not always clear who leads or coordinates, especially for things like energy upgrades on a protected building – does one go to the Ministry of Mining and Energy for a subsidy first or to the heritage institute for permit first? - "Lack of harmonized guidelines" – essentially the absence of a clear, single set of guidelines for refurbishing heritage sustainably – was noted. Stakeholders strongly desire practical guidelines that bridge conservation and sustainability, presumably something user-friendly that practitioners can follow, which is currently missing. - A portion also indicated "don't know", revealing that some are not well-versed enough to pinpoint legal gaps, reinforcing the earlier notion that legal literacy could be improved.

One of the focus group discussions echoed these points: participants noted that Serbia has decent laws on paper but policy gaps in execution. An academic participant mentioned that *"we have a cultural*

heritage law and an energy efficiency law, but they talk past each other; practitioners are left to improvise". A municipal heritage officer pointed out the lack of a national strategy (as we mentioned, no strategy is a gap) and said that *"without a national plan setting priorities, funding and efforts are scattered"*.

5.3 Practical Obstacles in Refurbishment Projects

Perhaps the most illuminating feedback came when stakeholders described the obstacles they face in actual refurbishment projects involving VBE. They were asked to select all that apply from a list of common obstacles, and the results were strikingly consistent: - Lack of financial resources was the number one obstacle. A large majority checked "lack of finance" and "lack of state funding" as critical issues. This aligns with Section 4's discussion – funding is a perennial problem. It was clear that both public sector stakeholders (like municipality reps) and private owners see insufficient funding or subsidies as a barrier. One respondent noted that *"the cost of proper restoration with energy efficiency is huge; without substantial grants, it's impossible for owners"*. - Technical knowledge and skills shortages were also heavily reported. "Lack of technical knowledge/skills" was selected by many. This reflects a shortage of specialized experts who know how to integrate new systems into old buildings. It might also reflect a need for craftsmen skilled in traditional materials who can execute work that meets both conservation and efficiency needs (e.g. craftsmen who can restore wood windows and improve their sealing). Similarly, "lack of skilled specialists" was marked, pointing to not enough experienced conservation architects/engineers for complex retrofits. - Low public awareness or support was another obstacle identified. Some stakeholders (especially NGO and public officials) feel that the broader public does not sufficiently value heritage or understand the benefits of investing in it. This can translate into low political will or difficulty mobilizing community efforts. It was discussed in focus groups that owners or users sometimes resist changes (for instance, a tenant association in an old building might balk at the hassle of renovation). - Complicated permitting processes – described as *"too many regulations"* – was frequently chosen. Many stakeholders feel that getting approvals for heritage projects is cumbersome. They have to navigate multiple bodies (heritage institutes for consent, planning authorities for permit, possibly ministries for funding), which takes a long time. As one architect put it, *"by the time we get all permits, half the grant period is over"*. Some also noted contradictory requirements between bodies (e.g. conservation conditions might conflict with energy code, requiring negotiations). - Lack of access to appropriate technologies was another notable obstacle. This includes lack of availability of certain materials or solutions in the local market. For example, special insulating plasters, high-performance sealants that are vapor-open, or smart monitoring systems for old buildings may not be readily available or are expensive imports. A conservation engineer mentioned that *"for some innovative retrofits we simply cannot find the needed material in Serbia or it's prohibitively expensive"*. - Lack of high-quality materials in general was flagged. This could refer to difficulty obtaining authentic materials (like the correct type of stone or handmade bricks for restoration), or modern materials that are compatible. Also, some said that even when materials are available, contractors might use cheaper low-quality ones, leading to poor results. - Communication and coordination issues were present: *"complicated communication with authorities"* was in the list and indeed some chose it. This reflects bureaucracy and sometimes unclear guidance from authorities – e.g., an owner might not know exactly what the heritage institute expects, causing multiple rounds of revision. Another dimension is coordination among experts – a need for interdisciplinary teamwork, which can be lacking. - Lack of digitalization was surprisingly noted as well. This could mean that the sector is not leveraging digital tools to facilitate processes (like online permit tracking, digital archives of building plans, or BIM for collaboration), which if improved, could streamline projects. - Lastly, high costs per se were recognized (though that ties back to lack of funding). Even when funds exist, costs often exceed initial budgets due to unforeseen issues in old buildings. Uncertainty in project cost is a deterrent for stakeholders.

The strong consensus on these obstacles suggests that **financial and capacity issues are the dominant barriers**. It's worth noting that obstacles were similar across respondent categories, with maybe slight variations: technical professionals emphasized technical and permitting issues, whereas owners and local officials emphasized finance and bureaucracy. However, all groups rated finance as a top issue.

Focus group narratives brought some of these obstacles to life. For example, a private owner of a 1930s house shared how they attempted to apply for a national subsidy to replace windows but were deemed ineligible because the house is under preliminary protection (not formally designated, so not supported by culture funds, yet not a standard house either). In the end, they had to self-finance with cheaper PVC windows, which the heritage professionals critiqued. This story highlights the mismatch in programs – energy subsidy didn't consider heritage, and heritage program didn't have funds, leaving the owner in a bind. Another example: a municipal officer recounted a case where a city wanted to install solar panels on a public historic building; the heritage institute delayed approval for over a year and then approved a smaller installation than originally planned due to aesthetic concerns. Meanwhile, the grant from an environmental fund was lost due to timing. This underscores the need for quicker, cooperative processes.

5.4 Training, Skills and Educational Gaps

The stakeholders also provided input on the educational and training needs in the field. There was a dedicated question: "What training or capacity-building measures regarding VBE would benefit stakeholders the most?" The responses were strongly affirmative that a variety of trainings are needed, essentially covering all aspects that this study focuses on - The most frequently chosen was "Technical skills in refurbishment of VBE buildings". This implies hands-on skills for assessing and intervening in historic structures – for architects, engineers, but also craftsmen. Participants desire workshops or courses that teach how to retrofit old buildings properly (e.g. how to install insulation without damaging walls, or how to improve a roof's energy performance while preserving appearance). - Many also selected "Legal and regulatory compliance workshops". Given the earlier finding of only moderate familiarity with laws, stakeholders see value in training that clarifies the regulatory procedures and requirements. For instance, a seminar that walks through all steps of obtaining a heritage permit and an energy certificate for the same project, highlighting how to reconcile them, would be very useful. - "Project management for heritage objects and sites" was another popular choice. This indicates recognition that managing these projects is complex (multidisciplinary, many approvals, often multiple funding sources) and that specialized project management skills are needed to coordinate architects, engineers, conservators, contractors, authorities, and possibly donors. Training in this could improve project efficiency and reduce delays. - "Digital tools and simulation methods (e.g., BIM, risk assessment software, dynamic simulations, WUFI)" was highlighted by technically oriented respondents. Many stakeholders believe training in these tools can greatly aid in planning interventions. For example, learning to use WUFI (a software for hygrothermal simulation) can help evaluate how adding insulation might affect moisture in historic walls, thereby preventing damage. BIM (Building Information Modeling) training could facilitate creating detailed 3D models of historic buildings to plan retrofits and maintenance. - "Environmental impact assessment (LCA, carbon accounting)" was also frequently selected. This likely came from younger professionals and academics who see the importance of quantifying sustainability. They want to be able to measure the carbon footprint reduction from reuse vs. new construction, or the life-cycle benefits of using traditional materials. Training in LCA tools specific to buildings (and perhaps even heritage-specific LCA considerations) is seen as beneficial. - "Risk assessment" training was similarly in demand. Stakeholders acknowledge that assessing risks (structural, climate, etc.) in heritage requires know-how, e.g., how to evaluate seismic risk in an unreinforced masonry building or how to assess fire risk in a historic wooden church. Training could include methodologies to do these assessments and to plan mitigations (like installing sensors, bracing techniques, etc.). - "Circular economy principles" training was requested. This would cover topics like material reuse, traditional material recycling, design for disassembly in

retrofits, and how to handle construction waste sustainably. For instance, training could demonstrate how to carefully dismantle rather than demolish parts of a building to salvage materials, or how to incorporate reclaimed elements. - “Climate change mitigation and adaptation” was also on the list and garnered interest. This overlaps with some others but focuses on broader strategies e.g., improving energy efficiency is mitigation, while adaptation might include cooling strategies or flood protection measures for heritage sites. Stakeholders want to learn how to future-proof historic buildings against climate impacts.

The fact that respondents chose essentially all types of training underscores that a comprehensive capacity-building effort is needed. There isn’t just one niche skill missing; rather, an array of knowledge areas needs strengthening, reflecting the interdisciplinary nature of sustainable heritage refurbishment. Survey results further reinforce these needs. As shown in Fig. 26, stakeholders identified technical refurbishment skills as the highest training priority, followed by legal and regulatory competence, digital tools and simulation methods, and climate mitigation and adaptation knowledge. This confirms that capacity-building must extend beyond traditional conservation skills to include regulatory navigation, environmental assessment, and digitally supported decision-making.

From an educational institution perspective, some inputs were revealing. A few respondents affiliated with universities noted that current curricula in architecture and civil engineering schools only *lightly touch* on these topics. One said *“we learn about architectural history and separate courses on energy efficiency, but rarely together”*. There is a sense that interdisciplinary education (combining restoration with environmental engineering) is lacking. No respondent could name an existing course or program in Serbia that fully addresses “energy efficiency in historic buildings” as a unified subject (though as found earlier, individual courses do exist, they might not be widely known or mandatory). Some have attended workshops by international bodies (an ICCROM course on risk management or an EU workshop on energy retrofitting) and found those valuable, suggesting such opportunities need to be expanded domestically so more can attend.

Vocational training gaps were also discussed. It was noted that vocational schools for construction trades in Serbia (the secondary-school level) do not include specialization in heritage conservation techniques. So masons, carpenters, etc., are not taught how to use lime mortar vs. cement, or how to repair timber joints vs. replace them, unless they learn on the job in a heritage project. Older master craftsmen who knew traditional techniques are retiring, and without formal training programs, that knowledge could be lost. Some initiatives (like regional restoration camps run by NGOs) train young craftsmen and students in traditional building crafts, but these are sporadic. Stakeholders, especially those from heritage institutes, emphasized the dire need for training masons, plasterers, painters in traditional and eco-friendly materials application, as well as modern methods like retrofitting windows for double glazing without destroying historic frames. Without skilled labor, even if an engineer specifies a great solution, execution might fail.

Heritage conservation institutes themselves have training roles. The Central Institute for Conservation (CIK) in Belgrade occasionally runs courses for conservators (more in objects than buildings) and could expand into building conservation training. Also, the network of regional Institutes for Protection of Cultural Monuments could host workshops to share knowledge among their staff and local contractors. Stakeholders from these institutes signaled interest in more joint training sessions with energy experts, bridging the gap so each side learns the other’s priorities.

5.5 Public Perception and Community Involvement

Understanding public perception was part of the survey scope. Stakeholders were asked how they believe citizens perceive the value of preserving VBE. The responses (on a Likert scale from very positively to very

negatively) skewed toward the positive side: a combined majority thought citizens view preserving heritage positively or very positively, while a smaller portion said neutral, and very few thought negatively. This suggests that, in the eyes of the engaged stakeholders, the general public in Serbia does appreciate cultural heritage in principle. However, focus group anecdotes nuanced this: while people express pride in heritage, when it comes to concrete support (like paying extra for restoration or tolerating construction inconvenience), enthusiasm may wane. Several participants mentioned a lack of awareness of the practical efforts needed, the public loves to see a beautiful old building once it's restored but may not understand the cost or complexity involved.

Community involvement was overwhelmingly considered important for successful implementation of refurbishment projects. Most stakeholders rated community involvement as "very important" or "fairly important." They gave reasons such as local residents can provide input on building use needs (ensuring the building, once renovated, serves the community), community buy-in can prevent vandalism and encourage maintenance, and public support can pressure authorities to fund projects. One NGO representative noted that *"if people are involved from the start, even if it's just through consultation or volunteering, they develop a sense of ownership of the project, which helps its long-term sustainability."* This perception is strongly supported by survey results (Fig. 23), where a clear majority of respondents rated community participation as very important for successful refurbishment outcomes. This highlights growing recognition that participatory governance and co-creation approaches are essential for sustainable interventions in valuable built environments.

When asked about methods to increase public interest and participation in preserving VBE, stakeholders rated various methods for their relevance: - Educational meetings and public presentations (town hall meetings) were seen as very relevant by many. Direct face-to-face engagement where experts explain the value and plans for heritage sites helps demystify projects. - Establishing representative committees or working groups (including community members, experts, authorities) was also seen as relevant. This suggests a model where citizens have a formal role in project planning or monitoring is welcomed. - Online surveys and digital engagement got some support, though perhaps less than in-person methods. Still, in modern times, online feedback can reach a broader audience quickly. - Focus groups (targeted small discussions with citizens) and workshops/seminars were considered quite relevant as well. This aligns with the idea of capacity-building at community level – teaching local people about heritage, energy saving, etc., in the context of their own town's historic building. - An interesting point: one of the "other" suggestions from respondents for raising public interest was organizing cultural events or tourism activities in heritage sites to draw people in and create a direct connection, which wasn't explicitly listed, but came up in comments. Quantitative responses (Fig. 24) further indicate a preference for interactive engagement formats such as seminars, workshops, and representative committees over more passive mechanisms such as online surveys. This suggests that dialog-based participation may be more effective in mobilizing public support for sustainable refurbishment initiatives.

Stakeholders also identified social challenges that make sustainable refurbishment difficult. The multiple-choice options and responses indicated: - Lack of awareness among the public about the importance of energy-saving and sustainability in heritage was frequently mentioned. - Lack of motivation, perhaps tied to the fact that benefits (like energy savings) are not clearly understood or immediate was noted. - Inadequate ready-to-use technical solutions in the market was another challenge, pointing to a need for more demonstration projects that generate tested solutions that others can adopt. - Opposition to heritage protection restrictions emerged as a social issue: some stakeholders pointed out that owners or developers sometimes view heritage rules as a nuisance (not being allowed to change windows freely). Overcoming this requires showing that preservation and sustainability can go hand in hand rather than being a trade-off. - Aging society was also listed as a challenge in the survey, older population might be less inclined to invest in major renovations, or physically less able to participate in community efforts, or

simply more resistant to change. This is relevant in many small Serbian towns with aging demographics. - Some wrote that *"young people moving away"* is an issue, if communities are shrinking due to youth migration, there are fewer local champions to take care of heritage.

Moreover, respondents expressed strong willingness to engage in future activities related to sustainable refurbishment (Fig. 27), particularly in areas such as technical capacity, digital tools, and environmental assessment. This indicates that stakeholder readiness exists and could be leveraged through structured EU REPAIR co-creation activities and training initiatives. On the positive side, many stakeholders remain optimistic that with proper engagement strategies, communities can become allies. In one focus group, a participant gave an example of a town where students helped conduct an energy audit of their old school building and presented it to the municipality, which then applied for funds, a great instance of community (and especially youth) involvement driving a project.

5.6 Best Practices and Success Stories (Stakeholder View)

Stakeholders were invited to share any examples of successful projects or best practices they know of in Serbia's VBE refurbishment. A number of cases were cited (some of which we also examine in Section 6):

- **The restoration of the Belgrade City Assembly (Old Palace)** was frequently mentioned. Stakeholders praised that project for improving the building's condition and functionality (including better HVAC and lighting) while preserving its historic features. It was noted that *energy efficiency measures were integrated discreetly*, for instance, roof insulation was added and LED lighting installed, achieving energy savings without altering appearance. That project is seen as a model because it was a government-led effort that allocated significant budget and used a multidisciplinary team.

- **The adaptive reuse of industrial heritage** like the "Ložionica" (old Belgrade railway engine shed) into a cultural venue was cited as a positive example where a derelict structure was given new life with modern amenities while retaining its character. Though not specifically about energy efficiency, its reuse is sustainable in itself and it spurred interest in reusing other old structures.

- **Hotel Bristol's renovation** came up as a recent example – stakeholders are aware it reopened in 2025 after restoration. They point out that the facade was preserved meticulously (with oversight from the Belgrade heritage institute) and internally the hotel was modernized for efficiency (with new HVAC, insulation on the roof, etc.). This is seen as a best practice for public-private partnership: the building remained protected, but private investment made a full renovation possible.

- **The rehabilitation of subotica's art nouveau buildings** under the cross-border project with Osijek was highlighted by those in the north. They noted energy improvements like new but historically styled windows, and that it was coupled with tourism promotion – showing that heritage can be an economic asset. - On a smaller scale, some pointed to the **"Energy efficiency retrofits of three historic buildings in Belgrade"** documented in a recent study by university students – those cases (Old Palace, Hotel Bristol, Belgrade Railway Station) were used as educational demos and have measured outcomes (like improvement in energy class). Stakeholders find such documented examples valuable as proof of concept.

- A municipal example: the **City of Šabac's program** to co-fund facade restorations in its old town, which included painting with breathable paints and some window repairs, was mentioned as a good practice of local initiative (though it lacked a big energy component beyond aesthetic and minor thermal benefit).

Stakeholders also gave **informal best practices**: e.g., a conservator shared that simply reactivating old features like shutters and awnings on historic buildings can greatly reduce cooling loads in summer – a traditional solution with modern benefit. Others noted how vernacular design (thick walls, courtyards) inherently provides energy efficiency, and that preserving those elements is itself a sustainable practice.

When asked what made these examples successful, common factors identified were: *strong stakeholder collaboration* (heritage authorities working closely with engineers and investors), *availability of funds* (either public or private commitment), *good planning and project management*, and *community support or at least acceptance*. This aligns with the idea that overcoming obstacles requires a multifaceted approach.

In conclusion, the stakeholder results paint a clear picture of both the **challenges and the optimism** in the field. There is broad agreement on what the problems are – insufficient funding, complex bureaucracy, technical capacity gaps – but also a shared vision that improvements are possible through training, better policies, and community engagement. These insights from those "on the ground" in Serbia form a crucial evidence base for the next sections, where we translate them into an analysis of gaps (Section 7) and formulate recommendations (Section 8). Essentially, stakeholders are asking for a more enabling environment – legally, financially, educationally – to help them save and improve Serbia's valuable built heritage. Their experiences validate many of the research findings and strongly inform the path forward.

6. Best Practices in Serbia's Valuable Built Environment Refurbishment

Despite the many challenges, there have been several successful initiatives and projects in Serbia that demonstrate how valuable built environments can be refurbished in line with both conservation and sustainability goals. This section highlights a selection of best practices and model projects, drawing lessons from them. These cases provide inspiration and concrete examples of solutions for energy efficiency, use of renewable materials, circular practices, and risk management in historic and older buildings. They also illustrate how institutional and community efforts can come together to overcome obstacles.

Case Study 1: Energy Retrofit of the Old Palace (Belgrade City Assembly).

This late 19th-century palace is a protected cultural monument and a landmark of Belgrade. In 2018-2020, the city undertook a comprehensive refurbishment project focusing on improving energy performance while preserving the palace's majestic architecture. Key measures included: installing thermal insulation on the attic floor and roof (invisibly, from the interior of the roof space), restoring original windows by adding internal secondary glazing and better seals, upgrading the heating system with efficient gas boilers and zoning controls, and switching all lighting to LED. Air conditioning units that had marred the facade were removed and replaced with a central cooling system that has discrete vents. The heritage authority closely supervised all works; for instance, the windows retained their historic wooden frames and appearance, but with hidden improvements for efficiency. The results were noteworthy – energy modeling showed a reduction of heat loss by around 10% after window and roof interventions, and the building moved up from energy class E to D. Just as important, the palace's exterior and interior historical features remained intact and well-preserved. This project succeeded due to strong political will (city leadership championed it as setting an example), sufficient budget allocation, and a skilled interdisciplinary team. It stands as a best practice by demonstrating that even high-value monuments can incorporate energy retrofits sympathetically, and by providing a showcase for government commitment to lead by example on public buildings.

The Old Palace building (Figure 27a) was designed by architect Aleksandar Bugarski, and has been the seat of the Belgrade City Assembly since 1961. The building has been reconstructed several times throughout its history, mainly due to damage caused during the war. The last significant reconstruction was carried out in 2013 with the aim of improving the energy performance of the building (Figure 27b)

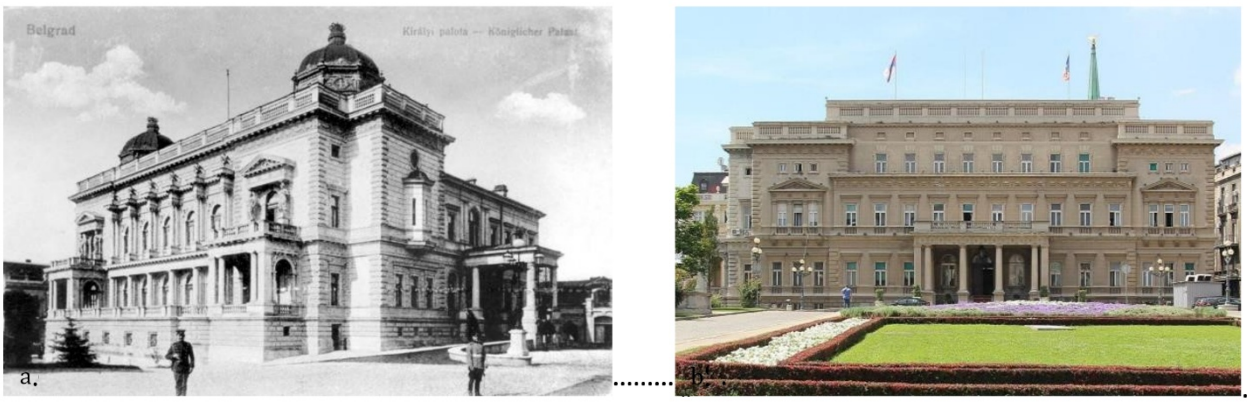


Figure 27. The appearance of the Old Castle then (a) and now (b) (Source: Institute for the Protection of Monuments of the City of Belgrade)

Given that the building is protected as a cultural asset, the interventions had to be carried out in accordance with the conservation conditions defined by the Institute for the Protection of Cultural Monuments. The external facade of the building retained its authentic appearance, including the preservation of the facade plastic, which meant that interventions on the thermal envelope could be carried out exclusively on non-exposed parts, such as the interior sides of the attics and roofs, as well as by introducing hybrid facade joinery, whereby the outer wing was kept in its original form, while the inner wing was made of modern materials with double-layered glass.

According to the available data, the existing condition of the building before the implementation of energy renovation measures had a relative value of annual final energy consumption for heating (Qh,rel) of 161.2 kWh/m² per year, while the specific annual heat requirement for heating (Qh) was 104.76 kWh/m². After the interventions, these parameters were improved and amounted to Q<h,rel=130.6 kWh/m² and Qh=85.34 kWh/m² [10]. The building's energy class was improved from E to D, which achieved higher energy efficiency of the building within the permitted conservation conditions (Table 1).

Energy Class	$Q_{H,nd,rel}$ [%]	New Buildings $Q_{H,nd}$ [kWh/m²·a]	Existing Buildings $Q_{H,nd}$ [kWh/m²·a]
A+	≤ 15	≤ 8	≤ 10
A	≤ 25	≤ 14	≤ 17
B	≤ 50	≤ 28	≤ 33
C	≤ 100	≤ 55	≤ 65
D	≤ 150	≤ 83	≤ 98
E	≤ 200	≤ 110	≤ 130
F	≤ 250	≤ 138	≤ 163
G	> 250	> 138	> 163

Table 1. Moving a building to a higher energy class based on the Regulation (Source: Regulation on the conditions, content and manner of issuing certificates on the energy performance of buildings, "Official Gazette of the RS", No. 69/2012, 44/2018 – other law and 11/2022)

Legend:

- $Q_{H,nd,rel}$ - Relative heat demand for heating [%]
- $Q_{H,nd}$ - Annual heat demand for heating per unit area [kWh/m²a]
- *New buildings* - Energy performance limits for newly constructed administrative or office buildings.
- *Existing buildings* - Energy performance limits for already existing administrative or office buildings.

Case Study 2: Hotel Bristol, Belgrade – Heritage Hotel with Modern Comfort

The Hotel Bristol's renovation (completed in 2025) is a prime example of a public-private partnership achieving heritage conservation and energy efficiency. The building, an architectural jewel, had suffered deterioration and was largely unused for years. A private investor took on its restoration under guidance from the Belgrade Institute for Protection of Cultural Monuments. Conservation-wise, the ornate facades were cleaned and repaired, original wood windows were refurbished (instead of replaced) to maintain Secession-style elements, and interior decorative features were conserved. On the sustainability side, several measures were implemented: walls and ceilings were internally insulated where possible (using

breathable materials to avoid moisture issues), a high-efficiency VRV (Variable Refrigerant Volume) HVAC system was installed to provide heating and cooling with minimal visual impact, and a solar thermal array was mounted on a flat section of roof to preheat water for the hotel. Because the street-facing roof is visible, solar panels were placed on a hidden inner roof slope. Additionally, all new kitchens, laundry, and other back-of-house facilities were outfitted with energy- and water-saving equipment. The hotel's energy consumption is expected to be at least 25% lower than if standard systems had been used, according to engineering reports. This project overcame the often-cited conflict between investor interests and heritage rules, through continuous dialogue and compromise, such as accepting minimal changes on the main facade (only gentle cleaning and repair) while allowing more flexibility on the courtyard side (where a small extension with modern insulation was built). The result is a fully functional, luxurious hotel that retains its historic charm yet meets contemporary comfort and efficiency standards. It's a best practice model for how historic buildings can be repurposed and made commercially viable without sacrificing their soul, by leveraging creative technical solutions and cooperative governance. Notably, this project also trained local contractors in specialized skills (window restoration, ornamental plaster repair coupled with fire-proofing behind surfaces, etc.), thus building local capacity.

The Bristol Hotel was built between 1910 and 1912, according to a design by architect Nikola Nestorović (Figure 28a). The building is one of the first large modern hotels in Belgrade, designed and built with elements and decorative motifs characteristic of the Art Nouveau style.



Figure 28. The appearance of Hotel Bristol then (a) and now (b) (Source: Institute for the Protection of Monuments of the City of Belgrade)

Given the conservation restrictions, interventions on the street facade of the Bristol Hotel were kept to a minimum (Figure 28b). Accordingly, the energy improvement of the building was focused on parts of the thermal envelope: facade walls, transparent surfaces, sloping and flat roofs, floors above and ceilings below the unheated space. The walls are made of solid bricks of various thicknesses, plastered on both sides and with decorative plastic. The walls on the ground floor, oriented towards the street, were not subject to thermal improvement, while the facade walls on the higher floors were renovated from the inside by installing a layer of thermal insulation made of stone wool 8 cm thick, over which a vapor barrier was installed, a substructure made of galvanized profiles and a final coating of plasterboard.

Unlike the street facade, the walls oriented towards the atrium were not subject to conservation restrictions, so their thermal insulation was performed externally, using the ETICS system. An 8 cm thick layer of stone wool was glued and additionally secured by doweling, then reinforced with a reinforced mesh embedded in the adhesive, with a final layer of thin-layer plaster.

The windows facing the street, although under a certain protection regime, have been replaced with new wooden windows modeled after the original ones, while preserving the geometry and materialization. The new windows contain double glazing with gas filling, and the same principle has been applied to the

roof windows. The transparent surfaces oriented towards the inner atrium have been designed as a curtain wall in an aluminum frame system with improved thermal break.

The pitched roofs are constructed in a frame system with LLD beams and purlins. Energy rehabilitation was carried out by adding a 24 cm thick layer of rock wool between the secondary beams, while the interior finish was done with plasterboard panels over a vapor barrier. The external protection consists of wooden formwork with an additional waterproofing membrane.

Flat roofs are mainly found in the built-up parts of the building. The roof structure is made of trapezoidal sheet metal or reinforced concrete slabs, over which layers of vapor barrier, 20 cm thick rock wool thermal insulation, waterproofing membranes and final mechanical protection are applied.

The floors above the unheated space were retained in a structural sense, but the upper layers were reconstructed by removing the existing ones and installing 10 cm thick thermal insulation, protective foil, new reinforced concrete slabs for reinforcement and final floor covering. The ceilings below the unheated spaces were designed as reinforced concrete slabs with a 12 cm thick top layer of thermal insulation, protective foil and cement screed.

As shown, almost all relevant positions of the thermal envelope were subject to energy rehabilitation, to the extent permitted by the conditions of protection of the cultural property. After the interventions, the facility was upgraded from a lower to a B energy class ($Q_{h,rel}$=44.5%, Q_h=44.52kWh/m²). The minimum requirements prescribed by the applicable regulations were met, since the annual final energy required for heating does not exceed the maximum permitted values.

Energy Class	$Q_{H,nd,rel}$ [%]	New Buildings $Q_{H,nd}$ [kWh/m^2·a]	Existing Buildings $Q_{H,nd}$ [kWh/m^2·a]
A+	≤ 15	≤ 14	≤ 15
A	≤ 25	≤ 23	≤ 25
B	≤ 50	≤ 45	≤ 50
C	≤ 100	≤ 90	≤ 100
D	≤ 150	≤ 135	≤ 150
E	≤ 200	≤ 180	≤ 200
F	≤ 250	≤ 225	≤ 250
G	> 250	> 225	> 250

Table 2. Moving a building to a higher energy class based on the Regulation (Source: Regulation on the conditions, content and manner of issuing certificates on the energy performance of buildings, "Official Gazette of the RS", No. 69/2012, 44/2018, other law and 11/2022)

Case Study 3: Railway station in Belgrade

The Belgrade Railway Station is one of the most representative examples of public architecture from the second half of the 19th century in Serbia (Figure 29a). In accordance with the Law on Cultural Heritage, the building is registered as a cultural property of great importance, officially recognizing its cultural and architectural significance (Official Gazette of the Serbian Socialist Party, No. 28/83).

The architects Wilhelm von Flattich and von Schlicht are cited as the authors of the project, while the technical development was carried out by engineer Dragutin Dragiša Milutinović. The building was built in the spirit of the classical architectural language, characteristic of European railway architecture of that time. The architecture of the building reflects the synthesis of stylistic and technological aspirations of

the time, in which elements of the neo-Renaissance, neo-Baroque and other styles are interwoven (Figure 29b).



Figure 29. Appearance of the railway station then (a) and now (b) (Source: Institute for the Protection of Monuments of the City of Belgrade)

Given that the building has been declared a cultural asset of great importance, all reconstruction, renovation and adaptation works must be carried out strictly within the existing dimensions and volume, without violating the original architectural values. The position and size of the openings on the facade must be maintained. It is also necessary to preserve the interior decorative elements and cladding that date back to the time of the building's construction. The planned conversion involves adapting the building for the needs of the Historical Museum of Serbia. Given the restrictions, external interventions on the facade are not permitted, while internal ones are permitted only to the extent that they do not jeopardize the preservation of the existing interior. For this reason, the reconstruction project envisages increasing the usable area on the ground floor by closing the passage and forming a hall, which is why it is necessary to foresee new facade joinery for that part.

The usable area of the basement has also been increased, so it is planned to install 10 cm thick XPS insulation on the ceiling above the basement. On the ceiling above the last floors, it is planned to install 20 cm thick mineral wool (MW) thermal insulation.

Energy improvements to the walls towards the unheated space are also planned, with insulation on the attic side using 5 cm thick mineral wool.

After the interventions, the station building was classified in energy class C (Table 3).

Energy Class	$Q_{H,nd,rel}$ [%]	New Buildings $Q_{H,nd}$ [kWh/m^2·a]	Existing Buildings $Q_{H,nd}$ [kWh/m^2·a]
A+	≤ 15	≤ 10	≤ 12
A	≤ 25	≤ 17	≤ 20
B	≤ 50	≤ 33	≤ 38
C	≤ 100	≤ 65	≤ 75
D	≤ 150	≤ 98	≤ 113
E	≤ 200	≤ 130	≤ 150
F	≤ 250	≤ 163	≤ 188
G	> 250	> 163	> 188

Table 3. Moving a building to a higher energy class based on the Regulation (Source: Regulation on the conditions, content and manner of issuing certificates on the energy performance of buildings, "Official Gazette of the RS", No. 69/2012, 44/2018 - other law and 11/2022)

Case Study 4: Kragujevac National Bank Branch – Pilot Energy Renovation of a Cultural Monument.

The former National Bank building in Kragujevac (built 1930s, protected as cultural heritage) was the subject of a pilot project by an academic-engineering consortium to demonstrate energy retrofitting on a heritage structure. The project, conducted in 2021–2022, had a strong research component: detailed energy audits and simulations were done, various retrofit scenarios were evaluated, and one was implemented. The measures included replacing deteriorated single-glass windows with new wooden replicas that incorporate double glazing (greatly reducing heat loss while keeping the original appearance), adding internal insulation panels on the upper floor walls (reversible, breathable calcium-silicate boards were used to avoid trapping moisture), insulating the basement ceiling to reduce heat loss to the ground, and installing a modern efficient gas boiler with zone temperature controls. Additionally, the lighting was upgraded and some solar-powered LED fixtures were added around the building for security lighting. The outcome was a substantial improvement in energy metrics: heating demand dropped by an estimated 30%, and the building's calculated energy class improved from D to B after renovation. Importantly, the project documented all interventions and monitored the indoor climate before and after, providing valuable data. As a pilot, it informs future projects – for example, it highlighted that internal insulation can be done without harming decorative interiors if carefully planned (in this case, the upper floor was an office space with plain walls where insulation was added, while the more decorative ground floor was left uninsulated to preserve frescoes, but that was acceptable because the ground floor had thick masonry and didn't need it as much). This case is a best practice due to its thorough approach and transparency, it effectively serves as a learning laboratory, and the published results are being used to update technical guidelines. It also fostered collaboration between a university (providing analysis and student training) and public authorities (providing the building and partial funding).

According to the history of the National Bank, during the first introduction of its own buildings in regional centers, such as Kragujevac, the NBS built buildings specifically for its branches. The building of the National Bank branch in Kragujevac was designed and built specifically for the needs of the banking institution, as part of a broader program of construction of representative buildings for branches of the National Bank of the Kingdom of Yugoslavia during the interwar period. This program was implemented with the aim of strengthening the institutional presence of the central bank in regional centers, and Kragujevac, as a significant administrative and economic center of Šumadija at the time, was strategically chosen as the location for such a branch. The building of the NBS branch in Kragujevac was built in 1939, according to a design by architect Bogdan Nestorović, in a postmodern style. The architectural solution is characterized by a strict and simple facade, composed in the spirit of classicism, with an emphasized stone plinth of the basement and a monumental side frontal balcony with a colonnade of Ionic columns that extend to the second floor, forming two risalits. Throughout its existence, the building has retained its basic function, with minor adaptations that were mainly related to adapting to modern technical requirements and security standards [7]. Today, the building is used for the same purpose, as a branch of the National Bank of Serbia, and it is also recognized as a building with cultural and historical significance, which further indicates the need to preserve its architectural and environmental values.

General information about the facility and level of protection

The building is protected as part of the spatial cultural and historical entity of the Old Town Core. Kragujevac, which was declared a cultural monument by the decision of the Institute for the Protection of Cultural Monuments in

Kragujevac in 1970, and then designated as a spatial cultural and historical entity of great importance by a decision of the Assembly of the Republic of Serbia (DECISION on the determination of immovable cultural assets of exceptional importance and of great importance "Official Gazette of the Serbian Socialist Party", No. 14 of April 7, 1979, 30 of July 22, 1989). In order to improve energy efficiency, renovation of the facade, replacement of joinery and restoration of the metal entrance door are planned, taking into account the preservation of original elements and the compatibility of new interventions with the appearance of the existing building.

According to the available documentation of the construction project, the building is listed as freestanding. However, given that its southeast facade is supported by the existing building and that it does not have all four free facades, it cannot be considered completely freestanding (Figure 30). Also, according to the Regulation on General Rules for Parceling, Regulation and Construction ("Official Gazette of the Republic of Serbia", No. 22/2015), a freestanding building does not touch the line of a building plot, which is not fulfilled in this case. The building belongs to category V, which means that it is a demanding building in accordance with the Regulation on the Classification of Buildings ("Official Gazette of the Republic of Serbia", No. 22/2015), this classification applies to buildings with a gross area exceeding 400 m² and with a number of floors greater than P+2. In this specific case, the gross area is 2,774.09 m², and the building has a total of four above-ground floors and one basement, i.e. a number of floors of Su+P+3.



Figure 30. a) View of the object location at a micro level, b) 3D view of the analyzed object block (Source: Google Earth)

The current condition of the building indicates numerous deficiencies that affect reduced energy efficiency and thermal comfort. The building is walled on one side, while the remaining three facades are directly exposed to solar radiation and wind, which additionally affects the thermal stability of the building. The facade has suffered numerous damages due to long-term exposure to mechanical, atmospheric, chemical and anthropogenic influences (Figure 31a). Also, the metal surfaces are affected by corrosion and are significantly damaged.



Figure 31 a) Show damage to the side facade, b) Dilapidated condition of the old joinery (Source: Facade renovation project of the branch of the National Bank of Serbia in Kragujevac, at KP 4150 KO Kragujevac III)

The entire building functions as a single thermotechnical unit, i.e. there is no internal thermal zoning. The joinery is in its original condition, with casement windows made of wooden profiles with single glazing, which significantly contributes to energy losses. Due to poor sealing, the level of acoustic and thermal comfort is below satisfactory, while visual comfort, given the orientation of the building, is at an acceptable level. Heating is provided by a district heating system, via a thermal substation. The building does not have good heat-accumulative properties, which is a consequence of the composition of outdated building structures. Natural ventilation is the only way to ventilate the rooms, while poor sealing and the dilapidated condition of the joinery further reduce the overall energy efficiency of the building (Figure 31b).

As part of the Energy Efficiency Study, which was attached to the design documentation of the conceptual design, a review of existing structures and an analysis of their heat transfer coefficients were carried out. The subject of the analysis was non-transparent structures such as: external walls, expansion joints, walls in contact with the ground, flat roofs, interfloor structures and floors in contact with the ground, as well as transparent building elements, i.e. windows and doors.

Based on the obtained analysis data, it was determined that all non-transparent structures, according to the positions and thicknesses specified in the project, meet the prescribed criteria for thermal resistance and structural stability in accordance with the applicable standards, which were used within the framework of this project. However, the analysis determined that most of these structures do not have an appropriate heat transfer coefficient, because the measured values significantly exceed the prescribed minimum permitted values, except for the floor on the ground and the attic structures with installed hard mineral wool panels. When it comes to windows, no element, regardless of the position and orientation of the facade, meets the minimum requirements in terms of thermal resistance, nor does it have an appropriate heat transfer coefficient in accordance with the prescribed standards (Table 4).

CONSTRUCTION ANALYSIS: Windows - East				
Type of construction: Window				
Parameter / Characteristic	**Symbol**	**Value**	**Unit**	**Note / Evaluation**
Type of Construction		Window		
Heat transfer coefficient of glass	Ug	5.8	W/m^2K	
Glass surface area	Ag	35.7	m^2	
Heat transfer coefficient of frame	Uf	2.8	W/m^2K	

Frame surface area	Af	10.35	m^2	
Frame factor	Ψf	0.05	W/m·K	
Total glass/frame length	lg/f	158	m	
Correction coefficient	Ψc	0	W/m·K	
Total heat transfer coefficient	Uw	5	W/m^2K	
Corrected total heat transfer coefficient	Uw,cor	5	W/m^2K	
Nominal heat transfer coefficient of the structure	Un	1.5	W/m^2K	
Solar energy transmittance factor	gtotal	0.71	–	
Shading factor (east)	Fsh	0.9	–	
Indoor temperature		20	°C	
Outdoor temperature		-15	°C	
Indoor humidity		55	%	
Minimum thermal resistance	Rmin	0.326	m^2K/W	
Thermal resistance of the structure	Rcalc	0.2	m^2K/W	
Required U-value	Ureq	1.5	W/m^2K	
Calculated U-value	Ucalc	5	W/m^2K	**Not satisfactory**
Required R-value	Rreq	0.326	m^2K/W	
Calculated R-value	Rcalc	0.2	m^2K/W	**Not satisfactory**

Table 4. Excerpt from the Energy Efficiency Study (Source: Facade renovation project of the branch of the National Bank of Serbia in Kragujevac, at KP 4150 KO Kragujevac III)

Description of the designed interventions

According to the project terms of reference, it is necessary, first of all, to renovate the facade of the building, with the following interventions planned: The existing wooden joinery is planned to be replaced with new, made of modern materials and energy-efficient, while preserving the existing color, form and authentic appearance. The repair or replacement of the entrance portals at the main and side entrances is also planned, depending on their current condition. All metal elements on the facade will be repaired and painted in the original color. The replacement of sheet metal cladding, attics and window sills is also planned. Existing damage to the facade and decorative elements will be repaired, as well as the production of missing parts in accordance with the current condition. The entrance staircase will also be repaired, the facade will be cleaned and protected from atmospheric and other harmful influences, and the worn-out and missing gutters will be replaced with new ones. The repair of the side balcony and craft work in the hall that has access to the balcony are also planned. The sloping roof above the aforementioned hall will also be repaired, as well as painting work in the office spaces and corridors. The exterior lighting will be repaired while preserving its authenticity, and the installation of an elevator is also planned, with its careful integration into the architectural whole of the building.

Finally, in order to improve energy efficiency, the study envisages the replacement of the existing facade joinery with new wooden joinery with single glazing, identical in material and finish to the existing one, as well as the restoration of all metal entrance doors [8]. It is these interventions that will have the greatest impact on improving the energy efficiency of the building.

Analysis of changes in the energy properties of a building due to the replacement of facade joinery:

Based on the calculations carried out within the framework of the aforementioned Energy Efficiency Study, the positive impact of replacing the worn-out facade joinery on the overall energy performance of the building can be clearly seen. The windows in the newly designed state, which are planned for installation, have a total heat transfer coefficient of Uw = 3,500 W/m^2K, while the existing windows had

a significantly less favorable value of Uw = 5,000 W/m²K. This change directly contributed to the reduction of the building's heat transfer coefficient from the previous HT = 4789.08 W/K to HT = 4316.78 W/K (Table 5). In addition, thanks to the improved sealing of the new joinery, there was a significant reduction in ventilation losses. The ventilation heat loss coefficient was reduced from 2527.71 W/K to 1404.28 W/K, which also resulted in a reduction in total volumetric heat losses within the thermal envelope from qV = 0.64 W/m³K to qV = 0.50 W/m³K. Due to the reduced energy consumption for heating, there is also a reduction in annual carbon dioxide emissions, which also contributes to the environmental sustainability of the building.

Building thermal envelope area A	**3528.35 m²**	**Building thermal envelope area A**	**3528.35 m²**
Building construction area without considering thermal bridge effects Atb	3528.35 m²	**Building construction area without considering thermal bridge effects Atb**	3528.35 m²
Building shape factor fc	0.42	**Building shape factor fc**	0.42
Share of transparent surfaces in the thermal envelope of the building z	0.19	**Share of transparent surfaces in the thermal envelope of the building z**	0.19
Transmission heat loss of the building due to thermal bridges Htb	**4789.08 W/K**	**Transmission heat loss of the building due to thermal bridges Htb**	**4316.78 W/K**
Specific transmission heat loss of the building H'T	0.68 W/m²K	**Specific transmission heat loss of the building H'T**	0.68 W/m²K

EVALUATION OF CALCULATED CHARACTERISTICS			
Parameter	**Requirement**	**Calculation**	**Assessment**
H'T [W/m²K]	0.68	1.36	NOT SATISFACTORY
H'T [W/m²K]	0.68	1.22	NOT SATISFACTORY

COEFFICIENT OF VENTILATION HEAT LOSS					
Space	**Facade exposure**	**Facade position**	**Volume [m³]**	**Air change rate [1/h]**	**Ventilation heat loss coefficient Hv [W/K]**
Entire building	within one thermal zone	Isola	51018.81	0.7	7408.23

Total volumetric heat loss within thermal envelope qv					**0.64 W/m^{3}K**
Space	**Facade exposure**	**Facade position**	**Volume [m^3]**	**Air change rate [1/h]**	**Ventilation heat loss coefficient Hv [W/K]**
Entire building	within one thermal zone	Isola	85181.98	0.7	14491.28
Total volumetric heat loss within thermal envelope qv					**0.50 W/m^{3}K**

Table 5. Change in the building's transmission heat loss coefficient and ventilation heat loss coefficient (Source: Facade renovation project of the branch of the National Bank of Serbia in Kragujevac, at KP 4150 KO Kragujevac III)

In accordance with the Regulation on the conditions, content and manner of issuing certificates on the energy performance of buildings ("Official Gazette of the Republic of Serbia", No. 69/2012, 44/2018 - other laws and 111/2022), the determination of the energy class is carried out on the basis of the specific annual heat demand for heating QH,nd expressed in kWh/(m²a). The energy class is an indicator of the energy properties of a building, expressed as a percentage ratio between the actual and maximum permitted value of the specific annual heat demand for heating for the appropriate building category. The maximum permitted value QH,nd,max corresponds to the energy class "C".

In the case of the analyzed building, the existing condition is characterized by a specific energy consumption for heating of 162.80 kWh/m² per year, which places the building in energy class F. However, after the proposed renovation, including replacing the existing joinery with more energy-efficient ones, the specific consumption is reduced to 119.05 kWh/m² per year, which allows the building to move to energy class E, according to the current values for existing buildings (Table 6).

Energy Class	$Q_{H,nd,rel}$ [%]	New Buildings $Q_{H,nd}$ [kWh/m²·a]	Existing Buildings $Q_{H,nd}$ [kWh/m²·a]
A+	≤ 15	≤ 8	≤ 10
A	≤ 25	≤ 14	≤ 17
B	≤ 50	≤ 28	≤ 33
C	≤ 100	≤ 55	≤ 65
D	≤ 150	≤ 83	≤ 98
E	≤ 200	≤ 110	≤ 130
F	≤ 250	≤ 138	≤ 163
G	> 250	> 138	> 163

Table 6. Moving a building to a higher energy class based on the Regulation (Source: Regulation on the conditions, content and manner of issuing certificates on the energy performance of buildings, "Official Gazette of the RS", No. 69/2012, 44/2018 – other law and 11/2022)

Although the above measures lead to noticeable reductions in heat losses and improvements in the overall energy performance of the building, the building still does not meet the energy efficiency criteria that are considered satisfactory in accordance with applicable regulations.

Case 5: Subotica Synagogue – Integrating Renewables in Heritage Restoration.

The Subotica Synagogue (built 1902, Art Nouveau, a protected monument) was recently restored to its former glory through an international project. While the main goal was architectural restoration, the project also took steps to improve energy efficiency and incorporate modern systems discreetly. The vast dome and roof were repaired and insulated from above with cork-based insulation under new roof coverings (cork was chosen for its vapor permeability and sustainability). A ground-source heat pump system was installed to provide heating and cooling, which is a bold move for a heritage building, this involved burying loops in the ground of the synagogue yard but avoided any impact on the building's structure. Inside, the climate is maintained by a modern HVAC system with ducts carefully hidden under flooring grates and behind decorative elements. LED lighting, calibrated to mimic the warmth of original fixtures, was installed. An energy management system monitors temperature and humidity to protect the building's interior finishes while optimizing energy use. This was one of the first uses of a heat pump in a Serbian monument, and it has drastically reduced energy costs for the building (which is now used as a cultural venue). It exemplifies how renewable energy (geothermal in this case) can be harnessed in a heritage context without visual intrusion, aligning with the Law on Renewable Energy's encouragement of renewables even in significant sites. This restoration received an EU prize for cultural heritage, partly because of its blend of tradition and innovation. The best practice take-away is that with international expertise and funding (EU and Hungary co-funded it), very advanced sustainable solutions can be achieved in heritage buildings, and doing so can increase their usability and reduce their operating costs significantly.



Figure 32. Subotica Sinagogue

Case Study 5: Local Material Reuse – The Tršić Vuk's House Complex.

Tršić, the birthplace of linguist Vuk Karadžić, features a complex of 19th-century wooden vernacular houses (an open-air museum). A recent conservation and upgrade project there focused on circular economy principles. When one old log house was dismantled for restoration, each timber element was assessed, damaged sections were cut out and replaced with reclaimed wood from other structures of similar age that were beyond repair, rather than using all new wood. Roof tiles from one collapsed cottage were salvaged and used to re-roof two other cottages, reducing waste. This reuse was meticulously logged and in line with the Waste Management law's concept that material stops being waste if it has value and can be reused. Additionally, new elements like wooden shingles were made by local craftsmen following traditional methods, essentially using renewable material (wood) that is appropriate to the original building. The project also piloted composting toilets and a rainwater harvesting system for the museum complex, to improve environmental performance without affecting the historic structures. These measures made the site more sustainable in terms of resource use and showed how even very traditional settings can benefit from green infrastructure. The best practice aspects here include community involvement (local artisans and residents participated, preserving skills), maximization of material reuse (so minimal new resources were consumed), and improved resilience of the site (rainwater tanks provide water for firefighting if needed, addressing a risk). This kind of project, though small scale, offers a template for rural heritage sites, emphasizing low-tech sustainability and circular use of materials fully consistent with authenticity.



Figure 33. Tršić house of Vuk Stefanović Karadžić

Case Study 6: Emergency Preparedness at Studenica Monastery.

Studenica (12th-century UNESCO World Heritage monastery) undertook a project to improve its risk management and resilience, which stands as a best practice in protecting heritage from disasters. Following recommendations from UNESCO and a national risk workshop, the monastery implemented several measures: it developed a disaster risk management plan including response procedures for the monks and staff; installed an automatic fire detection and alarm system in the historic church (virtually invisible sensors); set up a lightning protection system integrated into the roof (to prevent lightning-induced fire, a known risk for historic churches); and reinforced one corner of the medieval wall that analysis showed was earthquake-vulnerable, by inserting stainless steel ties and discreet braces (engineered to preserve the wall's appearance)[38]. They also carried out a training drill with local firefighters on cultural heritage firefighting techniques. The heritage authorities and emergency services collaboration here is exemplary. As a result, Studenica is far better prepared for emergencies – an aspect often neglected in heritage preservation. Documenting this as a case study, Serbia has shown other monasteries and historic sites the path forward. It aligns with the Law on Cultural Heritage's emphasis on risk management and the Law on Emergency Management's requirements, translating them into action on the ground. The lesson: integrating simple but effective risk mitigation (like fire alarms, lightning rods, contingency planning) is a crucial part of sustainable heritage management, ensuring that all the efforts put into restoration are not lost to a disaster.

These best practices demonstrate the art of the possible. Across them, common themes emerge: the importance of multidisciplinary collaboration, respect for authenticity combined with adoption of modern technology in a nuanced way, use of pilot projects and data monitoring to guide future efforts, and the benefit of community and stakeholder engagement (several had volunteers, students, or local craftsmen involved, building social capital around heritage). They also show that budget size is not the only factor – small projects like Tršić's material reuse can exemplify sustainability just as well as big-budget projects. By publicizing and learning from these examples, Serbia can replicate and scale up successes. Each best practice addressed different aspects (energy, materials, risk, etc.), and together they form a toolkit of solutions that can be mixed and matched in future VBE refurbishment initiatives.



Figure 34. Studenica Monastery

7. Gaps, Obstacles, and Lessons Learned

Drawing together the analysis of Serbia's legislative framework, the stakeholder insights, and the examination of current practices, this section synthesizes the **gaps and obstacles** that hinder the sustainable management and refurbishment of valuable built environments in Serbia. It also distills key **lessons learned** so far. These findings provide a candid assessment of where Serbia currently stands – highlighting shortcomings in policy enforcement, technical capacity, funding, and more – which will directly inform the recommendations in the next section.

7.1 Legislative and Policy Gaps

Despite a seemingly comprehensive set of laws, Serbia's policy environment has **gaps in implementation, alignment, and strategy**:

- **Lack of a national strategy and action plan for heritage adaptation:** As noted earlier, Serbia does not yet have a dedicated national strategy for the preservation and sustainable use of immovable cultural heritage, even though such a document was envisaged by law. This strategic vacuum means there are no clear national priorities (e.g., which types of heritage sites to focus resources on, how to integrate heritage in climate action, etc.). The absence of an official action plan results in ad-hoc efforts and missed opportunities for synergy across ministries. A decade past the due date for this strategy, its non-existence is a major gap that leaves heritage management reactive rather than proactive.

- **Insufficient integration of laws and regulations:** There is a **disconnect between heritage protection regulations and other relevant regulations** (energy, building standards, environmental codes). Stakeholders overwhelmingly identified this as a problem. For example, the energy efficiency regulations set targets that are often impractical for historic buildings, yet there is no clear regulatory exemption or adaptation path except case-by-case negotiated compromises. The planning/construction law requires compliance with energy performance for all buildings, but does not spell out how a protected building might meet those in alternative ways – leaving local officials unsure how to sign off on permits for retrofits that don't meet the letter of the energy code. Similarly, environmental sustainability goals (like waste reduction) are not explicitly embedded in heritage project guidelines. **Lesson learned:** Integration cannot be assumed; it needs formal mechanisms (such as joint regulations or cross-references in laws) to ensure that, for instance, an energy retrofit guideline is endorsed by both the energy ministry and the culture ministry. Without it, practitioners face either double compliance or confusion.

- **Outdated or lack of technical guidelines and standards for heritage retrofit:** Many technical norms in Serbia do not account for the specific needs of historic structures, and some are outdated in terms of modern solutions. For instance, Serbia hasn't formally adopted **EN 16883:2017** for energy retrofit of historic buildings as a national guideline – leaving a best-practice vacuum. The **lack of harmonized guidelines** bridging engineering and conservation was explicitly noted. Moreover, detailed building codes (like the Rulebook on thermal performance) have not been revised to include special provisions or flexible criteria for protected buildings. **Lesson learned:** The mere existence of modern international standards isn't enough; Serbia needs to contextualize and adopt them or develop its own. The audit report from 2021 highlighted that Serbia's legislative framework needs alignment with contemporary standards and conventions. Until such guidelines exist, engineers and conservators lack a common reference, and decisions are made on a more subjective, case-by-case basis, which is neither efficient nor consistent.

- **Enforcement and capacity gaps in law implementation:** While laws like the Disaster Risk Reduction law and the Energy Efficiency law have progressive requirements, enforcement on the ground is weak. As cited, 40% of relevant respondents felt the DRR law's implementation is insufficient at local level. Cultural heritage law mandates maintenance by owners, but in practice enforcement is minimal due to resource constraints in inspection and the complexity of penalizing owners who often lack funds. The **lesson** here is that laws alone do not change outcomes – enforcement bodies (heritage inspectors, building inspectors, etc.) need more resources, clear protocols, and possibly training to ensure compliance. For example, many culturally valuable buildings not officially protected fall through the cracks – they aren't subject to any protective regime, yet may also not be up to modern codes, posing safety risks. No mechanism is in place to systematically identify and assist such buildings (e.g., a pre-1970 building not listed as a monument is effectively ignored by both heritage and energy programs).

- **Institutional coordination issues:** The fragmentation of responsibilities – culture, construction, energy, environment, emergency management – leads to siloed approaches. Stakeholders noted vague or overlapping institutional roles. One example: who leads a project to retrofit a museum? Is it the Ministry of Culture (because of heritage), or the Ministry of Energy (if funded under an EE program), or the city (owner)? Lack of formal coordination often defaults to informal communication or, worse, projects falling through the cracks. **Lesson learned:** Creating interdisciplinary committees or "one-stop" processes for heritage sustainability projects could streamline things – but currently these do not exist as standard practice. The UNESCO workshop in 2018 was a one-off that brought stakeholders together[6]; institutionalizing such cross-sector collaboration is needed.

- **Policy on educational integration** (or lack thereof): There is no policy that ensures that universities and technical schools include relevant content on heritage sustainability. This isn't a legislative gap per se, but a policy gap. Neither the Ministry of Education nor the Ministry of Culture has issued guidelines or incentives for curricula development in this area. Thus, educational institutions vary widely in coverage of these topics.

To summarize the legislative/policy gaps: Serbia has many of the *right pieces* (laws referencing sustainability, etc.), but they are not fully *connected into a coherent framework*, nor are they fully carried out. The **lack of a guiding strategy** and **lack of integrated guidelines** stand out as fundamental gaps. The lesson is that without an overarching strategic and regulatory coherence, individual efforts can be undermined by conflict or inconsistency between different rules or actors.

7.2 Financial and Economic Barriers

The study confirms that **financial constraints** are a critical bottleneck in Serbia:

- **Insufficient funding and incentives:** The culture sector's budget, under 0.7% of state budget[15], is plainly inadequate to cover the needs of thousands of heritage structures. As stakeholders reported, *lack of state funding* is one of the biggest obstacles. Few dedicated funding lines exist for energy retrofitting of heritage; most funding is for urgent repairs or basic restoration. There is a **gap in financial instruments** – e.g., no tax relief for heritage renovation costs, no regular grant scheme combining conservation and efficiency (they are separate if at all). The **lesson learned** is that heritage preservation needs to be tied into larger funding programs (for energy, climate, development) to get a bigger resource pool. Without external funding (EU, donors), many projects wouldn't happen; this reliance is not sustainable long-term.

- **High costs and economic feasibility issues:** Many heritage projects have high upfront costs, and owners (public or private) struggle to justify them because the economic return is not immediate. The cost of specialized materials or techniques can be higher than standard construction. For example, restoring windows rather than replacing can be more labor-intensive and costly in short term, even if beneficial in long term. For private owners especially, the **lack of short-term payoff** is a deterrent – thus they often choose cheaper fixes that might degrade heritage value or energy performance (as one example, owners might install PVC windows because they're cheaper, even though they alter the building's character). The lesson here is that *without subsidies or financial motivations, the market by itself will not produce optimal outcomes for heritage sustainability*. The "split incentive" problem also exists: if tenants pay energy bills, landlords have less incentive to invest in efficiency.

- **Access to funding and bureaucracy:** Even when funding programs exist, stakeholders found them hard to access – complex application procedures and criteria (often geared to general buildings not heritage). The survey showed reasons for not receiving funding included application mistakes, missing permits, competition for limited grants, etc.. This indicates a gap in support – many stakeholders may not have the capacity to prepare strong proposals or navigate calls. A **lesson learned** is that technical assistance (like a helpdesk or template for heritage energy projects) could improve absorption of available funds. Another lesson: aligning the timing of permits and funding windows is crucial – e.g., ensure heritage approval processes are synchronized with grant timelines, something that bit the Belgrade solar panel case described earlier.

- **Long-term financing models are absent:** There's no revolving fund or heritage endowment concept. Public-private partnerships, while promising, are still rare partly because of unclear regulation on concession of monuments. The Bristol Hotel case succeeded under particular conditions; replicating PPPs is tricky due to risk and a lack of guarantee mechanisms (private investors fear unpredictable heritage constraints, while public fears loss of control). Lesson: innovate financing models (like heritage impact bonds or establishing municipal heritage funds funded by tourism taxes, etc.) might be needed to fill the gap, but currently, none are in place.

- **Under-valuation of indirect benefits:** Policy-makers in finance ministries may not fully account for the broader benefits of heritage refurbishment – such as tourism revenue, community revitalization, job creation in specialized crafts – when allocating budgets. The culture budget remains low because culture is not seen as an economic driver. The lesson is that making the economic case (with data) for heritage investment is needed, something that hasn't been adequately done.

7.3 Technical and Capacity Gaps

From the technical side, several **capacity gaps** hamper progress:

- **Shortage of interdisciplinary expertise:** There are few professionals in Serbia who are well-versed in both conservation and modern sustainability techniques. Architects might know how to restore a facade but not how to integrate an HVAC system efficiently; engineers might know energy modeling but not the limits of heritage interventions. This gap leads to either overly cautious approaches (doing nothing energy-related) or insensitive ones (installing something that harms heritage). The survey highlighted *lack of technical knowledge/skills* as a major issue. Lesson: developing interdisciplinary experts (through joint training of engineers and conservators) is crucial. Until then, projects rely on assembling teams with complementary skills, which is not always feasible or cost-effective.

- **Skilled labor shortage in traditional crafts and sustainable methods:** The older generation of craftsmen (woodworkers, stonemasons, etc.) is retiring. Younger tradespeople often lack training in heritage techniques or even in the use of modern sustainable materials. **Lack of skilled specialists** was explicitly cited. Instances have occurred where poor workmanship undermined a good retrofit plan (e.g., insulation installed incorrectly causing dampness). Lesson: Investment in vocational training and certification for heritage trades is needed, or Serbia may face a serious implementation bottleneck even if money and plans are there.

- **Limited availability of appropriate materials/technology:** As stakeholders indicated, not all needed materials are easily obtainable in Serbia – examples: high-quality wood for window restoration, certain insulating plasters, or even solar tiles that blend with historic roofs. "Lack of access to appropriate technologies" was an obstacle many noted. Many specialized products must be imported, raising costs and logistical complexity. Also, contractors may not be familiar with new products like aerogel insulation blankets for historic walls, so they shy away. Lesson: The supply chain for heritage-suitable materials needs development, possibly via encouraging local production of things like lime, or facilitating imports via subsidies.

- **Data and monitoring gaps:** There is relatively little local data on how heritage buildings perform energy-wise, or how interventions impact them over time (in terms of both energy and preservation). The pilot projects that measure before/after are rare. As a result, decision-making can be based on assumptions rather than evidence. This gap means some myths persist (like "historic thick walls mean nothing needs to be done" or conversely "you can't save energy in old buildings at all"). Lesson: More demonstration projects with monitoring can fill this gap, and creating a repository of case studies and data (perhaps under an institute or ministry) would help practitioners make informed choices.

- **Digital competency gap:** While digital tools can greatly assist (BIM, thermal imaging, etc.), not all professionals or institutions have embraced them. The survey noted lack of digitalization as an issue in projects. Many heritage documentation records are still paper-based, and building info modeling for old structures is not routine. The focus groups revealed that even something like using a drone for roof inspection or IR thermography is not common practice due to lack of training or equipment. Lesson: bridging digital technology into heritage workflows can improve diagnostics and planning; it requires capacity-building and maybe central provision of some tools (e.g., a Ministry could equip regional institutes with a shared thermographic camera).

- **Public awareness and community capacity:** From a capacity standpoint, communities often lack organized structures (like heritage volunteer groups or local preservation societies) that could support projects. Public awareness campaigns are sporadic. The gap here is that while general appreciation of heritage is there, the public's capacity to play a role in its upkeep or advocacy for sustainable measures is not fully realized. The opposition some owners have to "restrictions" indicates a communication gap – they may not understand why certain measures (like keeping original windows) are important, nor what alternatives exist to meet their needs. Lesson: targeted awareness raising and including communities early in planning can convert potential opposition into support.

7.4 Procedural and Administrative Obstacles

The process of getting a heritage refurbishment project approved and completed in Serbia faces a number of administrative hurdles:

- **Complex permitting process:** As identified, stakeholders often find the permitting procedure involving heritage conditions and building permits cumbersome. Multiple sequential approvals (heritage okay, then building permit, then possibly environmental consent if in protected natural area, etc.) can drag on. There is no integrated permit for "heritage retrofit" that consolidates these. Lesson: streamlining or overlapping some processes (with parallel reviews, or a single-window application) would reduce delays. Without reform, many project opportunities (especially with time-bound funding) will be lost due to red tape.

- **Inconsistent interpretation of rules:** Different regional heritage institutes may apply rules differently – some might be more open to energy retrofits, others more conservative. Similarly, one building inspector might allow a slight deviation in insulation thickness for an old building, another might not. This inconsistency creates uncertainty and sometimes conflict between stakeholders and authorities. It also means lessons learned in one project aren't systematically transferred to others through regulation. Lesson: establishing clearer guidelines (again) and training for officials to harmonize understanding is needed. Possibly, a central body (like the National Heritage Council) could issue clarifications or mediate tricky cases.

- **Maintenance vs. retrofit split:** There is a procedural gap between routine maintenance (which owners often neglect because it's not enforced or funded) and major retrofits (which need permits and funds). Because there is no systematic maintenance regime, buildings deteriorate to the point where only expensive projects can save them. If simple upkeep (like sealing cracks, cleaning gutters) were better done, some energy and structural problems would be mitigated early. Right now, owners of protected buildings are legally obliged to maintenance but there is little follow-up. Lesson: establishing maintenance programs, possibly with incentives or penalties, could reduce the need for large interventions and associated complexities.

- **Post-project follow-up and management:** After a refurbishment, there is often no formal requirement or system to ensure the building is properly operated to realize the expected benefits (e.g., if a smart HVAC is installed, are staff trained to use it?). Nor is there a system to monitor heritage conditions after new interventions (to catch any conservation issues like trapped moisture early). This lack of post-project evaluation can result in underperformance or even damage going unnoticed. Lesson: incorporate monitoring plans into projects and have heritage institutes or facility managers follow up. Perhaps require an updated energy audit 2-3 years post-renovation to check if goals were met, and a conservation check at the same time.

7.5 Social and Cultural Challenges

Finally, on the social front:

- **Attitudinal challenges:** While generally positive, public attitudes can sometimes be an obstacle – e.g., reluctance to change habits or aesthetics. For instance, persuading a church community to accept solar panels on a parish building might face initial resistance due to fear of altering a holy site's look. Or residents in a historic apartment building might resist internal insulation in their flats due to personal inconvenience. The gap here is effective communication to align everyone's mindset on the project's value. Lesson: Early engagement and demonstration of how changes can be compatible with cultural values are essential. Social research might be needed to tailor approaches to different communities.

- **Demographic issues:** Aging population in many heritage-rich villages means less local energy and initiative for projects, and youth might not be around to push them. Moreover, heritage is sometimes seen by younger people as less of a priority (though in Serbia, many youths do value

heritage, but they may lack empowerment to do something about it). Lesson: revitalizing heritage is linked to broader rural or urban revival efforts. If heritage buildings find new uses that serve communities (e.g. co-working hubs, cultural centers), they become more relevant socially and more likely to garner support.

- **Heritage vs. development narrative:** In some cases, heritage conservation is wrongly pitted against development (like arguments that strict preservation hinders economic growth). This narrative can hinder political support for spending on heritage or for protective rules. The gap is in framing heritage projects as opportunities (for tourism, quality of life, etc.) rather than obstacles. Lesson: packaging heritage refurbishment as part of sustainable development agendas (e.g., linking it to creative industries, education, or green jobs) can change perceptions and rally more allies.
- **Lessons from involvement attempts:** There have been small experiments like the focus groups or the instance of students helping as described. These show that when engaged, stakeholders outside the usual sphere can contribute meaningfully. However, such engagement is not institutionalized. There's no regular mechanism like community advisory boards for heritage sites. Lesson: formalizing stakeholder engagement (beyond just one-off surveys) in planning processes will likely yield better and more accepted outcomes.

In summarizing obstacles and lessons: Serbia faces a **web of interrelated gaps** – legal, financial, technical, social – that collectively slow progress. However, each gap identified also provides a clear pointer for what to improve. The **lessons learned** from both successes and failures emphasize integration, capacity-building, stakeholder engagement, and adequate resourcing. A particularly important overarching lesson is the need for a **multi-disciplinary, multi-sector approach**: no single ministry or profession can solve these issues in isolation. Heritage sustainability requires heritage experts, energy experts, financiers, government, and community all to be on the same page. Past attempts that were siloed often floundered or had partial success. Thus, many gaps boil down to gaps in *collaboration and coordination*.

Addressing these gaps one by one will be crucial, and that forms the basis of the recommendations in the next section. Serbia's situation is not unique – many countries struggle with similar issues – but the momentum from projects like EU-REPAIR and growing public interest presents a chance to tackle these challenges systematically. By learning from what has worked (and what hasn't), Serbia can formulate a roadmap to strengthen each weak link in the chain of VBE management.

8. Recommendations

Building on the needs and gaps identified, this section provides targeted **recommendations** to enhance the sustainable management and refurbishment of valuable built environments in Serbia. The recommendations are structured in alignment with the major areas of concern – policy and governance, funding and incentives, technical capacity, education and outreach, and community engagement. They are aimed at policymakers, institutions, and stakeholders at all levels. The overarching goal is to create an enabling environment in which Serbia's historic and valuable buildings can be preserved *and* upgraded to meet energy efficiency, environmental, and safety objectives, thus ensuring their longevity and relevance for future generations.

8.1 Strategic Planning and Policy Integration

1. **Develop a National Heritage Sustainability Strategy:** Formulate and adopt a comprehensive **"National Strategy for the Sustainable Preservation of Cultural Heritage (2025–2035)"**, which has been long overdue. This strategy should set clear objectives for integrating energy efficiency, renewable energy, and climate resilience into heritage conservation. It should identify priority categories of buildings (e.g., historic public buildings, vernacular settlements) and outline actions for each. An accompanying Action Plan should detail timelines, responsible agencies, and funding needs. Crucially, this strategy must be developed collaboratively by the Ministry of Culture, Ministry of Mining and Energy, Ministry of Construction, Ministry of Environmental Protection, and the Disaster Risk Reduction authorities, ensuring policy alignment across sectors. A multi-sector strategy will fill the strategic vacuum and signal high-level commitment.

2. **Harmonize and update regulations and guidelines:** Establish a working group (perhaps under the Prime Minister's office or Inter-Ministerial Council) to review and revise relevant regulations so they are mutually supportive. Specifically:

3. Issue a joint ministerial **Guideline on Energy Retrofit of Historic Buildings** that adopts principles of EN 16883:2017 and tailors them to Serbian context. This document should be endorsed by both cultural heritage authorities and energy authorities, giving practitioners a clear, single reference for acceptable measures (e.g., it might list acceptable insulation techniques for different heritage wall types, or outline a process for proposing solar panels on monuments). Having an official guideline will reduce uncertainty and inconsistent interpretations.
4. Amend the **Rulebook on Energy Efficiency of Buildings** to include a clause that for protected buildings, alternative measures can be used to demonstrate improvement even if strict numeric targets aren't met. For example, an alternative compliance path could be that any retrofit which achieves the maximum improvement possible without damaging heritage (as certified by an expert) is deemed compliant even if not reaching standard U-values. This closes the gap between energy code and heritage limits.
5. Update the **Law on Planning and Construction** to explicitly reference heritage conservation requirements (which it partly does) and to allow fast-tracking of permits for projects that have heritage approval and climate/energy benefits. For instance, introduce an article that says: "Works on cultural heritage aimed at improving energy performance or structural safety, approved by heritage authorities, shall be treated as works of public interest and processed with priority."
6. Ensure **Law on Renewable Energy** implementation rules encourage micro-renewables on heritage sites by providing guidelines (in coordination with heritage institutes) about aesthetic integration (like acceptable designs for solar panels or heat pump units in historic contexts). A

collaborative rule could prevent renewables from being automatically blocked and instead frame them as doable with the right approach.

7. **Strengthen enforcement mechanisms:** Give teeth to existing laws by:

8. Increasing funding and staff for the **heritage inspection service** so they can monitor the condition of protected buildings and enforce maintenance duties. Perhaps implement a system of periodic inspections (e.g., every 5 years a basic check) and issue notices to owners for needed maintenance or risk of penalties. This will encourage preventive care which is often lacking.
9. Integrate cultural heritage into the national DRR (Disaster Risk Reduction) system: require that local emergency plans include priority measures for historic buildings (inventory of resources to protect them, etc.), and have the emergency management inspectorate also check if institutions in charge (like monasteries or museums) have the risk assessment and plan mandated by law[38]. If not, enforce compliance through formal warnings and assistance to comply.
10. Track compliance with energy certification for public historic buildings: perhaps exempt them from having to achieve certain labels, but require them to have an Energy Passport issued and publicly displayed. This transparency can pressure authorities to take improvement actions and also inform the public.

11. **Create an Interagency Heritage Sustainability Task Force:** Set up a permanent body that meets regularly (e.g., quarterly) with representatives from Culture, Energy, Construction, Environment, and Finance ministries, plus the National Heritage Institute and civil society. Its mandate: oversee the implementation of this national strategy, coordinate funding programs (to avoid the silos noted), and resolve high-level conflicts in policy. It can also sponsor joint training (see capacity section) and produce annual progress reports. This task force would institutionalize the integration that is currently ad-hoc. Essentially, it ensures the **"one government" approach** to VBE management – a lesson from the current fragmentation is that without such a mechanism, integration is left to happenstance.

8.2 Financial Incentives and Funding Mechanisms

1. **Increase and ring-fence public funding for heritage sustainability:** Advocate for and implement a phased increase of the **Ministry of Culture budget** to approach the 1% of state budget target (responding to cultural sector demands)[14][15]. Within that, create a dedicated **Heritage Climate Action Fund** that specifically funds projects combining conservation with energy efficiency or renewable energy or risk mitigation. For example, annually allocate a certain amount (e.g., 200 million dinars) purely for co-financing such integrated projects (restoration + EE). By earmarking these funds, it ensures sustainability measures aren't competing unfavorably with pure aesthetic restorations for general heritage funds. Such a fund could potentially be topped up by international donations or climate finance sources given its dual purpose.

2. **Introduce targeted tax incentives:** Develop fiscal incentives to encourage private owners to invest in sustainable refurbishment of heritage:

3. Offer a **property tax rebate** or credit for owners of protected or older valuable buildings who undertake approved energy efficiency or restoration measures. For instance, a municipality could give a 50% property tax reduction for 5 years if the owner successfully completes a heritage-sensitive retrofit that improves energy performance.
4. Provide **income tax deductions** (or vouchers) for expenses on authorized conservation and efficiency works on heritage properties (similar to how some countries allow tax deduction for historic home repairs). This eases the financial burden on owners.

5. Remove or reduce VAT on specialized materials and services for heritage restoration (like natural lime, custom woodwork, etc.) to make them more affordable, effectively subsidizing quality over cheap alternatives.

6. **Enhance grant and loan programs:**

7. Expand the existing **Budgetary Fund for Energy Efficiency** to include a window specifically for historic and traditional buildings. Simplify application requirements for this category (recognizing the complexity of heritage projects) and consider higher co-financing percentages (e.g., grant covering 60-70% of costs instead of 50% for general buildings) to incentivize uptake by owners of valuable buildings who often lack resources.
8. Negotiate with international financial institutions (EIB, CEB, World Bank) to establish a soft **credit line for heritage adaptive reuse**. This could provide low-interest, long-tenor loans for municipalities or private-public partnerships to rehabilitate heritage buildings for new uses (such as cultural centers, tourism facilities) with conditions that energy efficiency measures are included. A guarantee fund by the government could back this to mitigate risk for private investors.
9. Leverage EU Green Deal and climate funds: ensure that heritage buildings are included as eligible assets in Serbia's applications to instruments like the Green Climate Fund or bilateral climate aid. For example, propose a **Heritage Building Energy Retrofit Project** in the framework of EU climate support – packaging a number of public heritage buildings across Serbia for comprehensive retrofits. The justification lies in emissions reduction and cultural preservation co-benefits, which align with sustainable development goals.

10. **Simplify and support access to funding:**

11. Establish a **Heritage Energy Advisory Service** (perhaps within the National Heritage Institute or the proposed task force) that provides free technical assistance to project proponents (municipalities, NGOs, owners) in preparing funding applications, feasibility studies, and navigating permits. This service could publish template project proposals, maintain a database of funding opportunities, and even act as a matchmaker between projects and funders. The aim is to reduce the capacity gap that leads to incomplete or failed applications.
12. Implement fast-track approval for co-financed projects: if a project has secured external funding (EU, donor, etc.), Serbian authorities should expedite approvals to meet donor timelines. Possibly by regulation, say that any project with >50% financing from recognized international sources gets priority processing under law. This addresses issues like lost grants due to slow permits.

13. **Public-Private Partnership (PPP) framework improvements:** Create clear guidelines and contract templates for PPPs involving cultural heritage. They should detail how to protect heritage values (with conservation management plans attached to contracts) while giving investors security of tenure and a return. Consider offering sweeteners for PPP participants such as initial public investment in the "sustainability" components (e.g., government covers the cost of a heat pump installation or solar panels, leaving the investor to cover hospitality fit-out). This lowers entry barriers for investors. Pilot new PPPs on less complex assets first (maybe historic industrial buildings) and capture lessons. The government might also consider guarantees or insurance schemes to mitigate investor risk in heritage projects, which can be higher due to unknown conditions or strict requirements.

14. **Monetize and reinvest savings and benefits:** Encourage projects to calculate and utilize the savings from efficiency improvements (energy cost savings) for heritage maintenance. For example, if a museum saves €10,000/year on heating after retrofit, formalize that those savings

remain in the institution's budget for future maintenance (rather than being clawed back by the treasury). This creates an incentive for institutions to pursue efficiency – they get to keep the dividend to reinvest in upkeep or visitor improvements. Also, where heritage buildings generate revenue (tourism, rents), a portion of that could be funneled into a local heritage fund for ongoing care, establishing a virtuous financing cycle.

8.3 Technical Capacity Building and Standards

1. **Training programs for professionals:** Launch a series of specialized training modules and certification programs to raise the expertise of key professionals:
    - **Continuing education for architects and engineers:** In cooperation with the Chamber of Engineers and universities, develop accredited courses on topics like "Energy Efficiency in Historic Buildings," "Structural Retrofit of Heritage Structures," and "Sustainable Materials for Restoration." These could be short (1-2 week) intensive courses blending theory and case studies. Make participation attractive by offering continuing professional development credits (which are required by professional bodies). The result would be a cadre of certified professionals with dual competence.
    - **Capacity building for heritage officials:** Provide workshops for staff of the Institutes for Protection of Cultural Monuments on emerging technologies and sustainability principles. This might involve site visits to best practice projects, hands-on demonstrations of things like thermography or monitoring systems, and peer exchanges with colleagues from countries that have implemented such measures. Equip each regional institute with guidelines and tools (like a basic energy evaluation toolkit) and train them to advise project proponents proactively rather than just evaluating proposals.
    - **Risk management training:** Train heritage site managers (e.g., monastery abbots, museum directors) and local emergency services in the specifics of protecting cultural heritage in emergencies[10]. Building on the 2018 UNESCO workshop[6], institutionalize an annual training (could rotate sites each year) focusing on disaster preparedness for heritage – possibly under the Fire Brigade or Emergency Sector's training academy, with heritage experts co-teaching. This will mainstream those skills and ensure the good practices from Studenica, etc., are replicated.
2. **Vocational and crafts training:** Tackle the skilled labor shortage by revitalizing traditional craft training and merging it with modern needs:
    - Reintroduce or strengthen **vocational school tracks** for traditional building trades (masonry, carpentry, plastering) with modules on restoration techniques. This could be done by partnering an existing construction secondary school with the heritage institute to create a pilot program. Provide incentives to students (e.g., stipend or assured job placement on a project) to join these tracks.
    - Create a **master craftsman certification** for heritage conservation crafts. Older masters could be involved in teaching younger workers through apprenticeships subsidized by the Ministry of Culture or Chamber of Crafts. For example, a year-long apprenticeship in restoring wood windows or forging traditional iron could result in an officially recognized certificate. This not only preserves the skill but also gives the craftsmen credentials that can command proper wages, making the field more attractive.
    - Incorporate knowledge of sustainable materials into these craft trainings – e.g., using hemp-lime plaster, recycling old bricks, etc., so that craftsmen are also agents of circular economy principles.

3. **Guidance and standards development:** Commission the development of **practical manuals** and possibly Serbian Standard guidelines that complement the high-level regulations:
    - Write and disseminate a **"Technical Handbook for Energy Retrofit of Traditional Buildings in Serbia"** – richly illustrated, bilingual (Serbian/English) – covering assessment methods, choice of materials, case examples. This could be developed by a consortium of experts and published by the Institute for Standardization or a university press. It would serve practitioners who need more detail than the official guidelines can provide. Ensure it covers not just high-end monuments but also vernacular and common buildings.
    - Standardize certain solutions: for instance, develop standard design details (approved by heritage authorities) for things like interior insulation of masonry walls, or secondary glazing units for historic windows. Publish these as recommended details that architects and contractors can use directly, saving time and ensuring they meet conservation requirements. This addresses the complaint of lack of harmonized guidelineswith very concrete tools.
    - Encourage local testing and certification of new materials for heritage use (like lime-hemp insulation or thermal mortars) under Serbian climate conditions. Work with research institutes (like IMS Institute) to test such materials on pilot buildings and include the results in standards or technical approvals so professionals have confidence in using them.
4. **Digital tool adoption:**
    - Implement a program to provide **basic digital equipment and training** to heritage institutions: e.g., each regional heritage institute receives an infrared thermal camera and staff are trained to use it to survey buildings for energy leaks or moisture issues (maybe done in partnership with a technical university). Also provide maybe a few drones for roof inspections – share between institutes.
    - Develop a **digital database (GIS-based)** of heritage buildings including their energy attributes and retrofit history. This would be a platform where data from energy audits, interventions, etc., are stored and accessible to practitioners (with appropriate permissions). It could interface with the existing Central Register of immovable cultural goods (which currently is incomplete). This way, each time something is done to a building, the knowledge accumulates in a central repository, aiding future projects and research.
    - Promote use of Building Information Modeling (BIM) for larger heritage projects by requiring BIM deliverables in publicly funded heritage retrofit contracts above a threshold. Also, incorporate BIM training in the recommended professional courses. Over time, building a library of BIM models of key heritage buildings (maybe started with student projects) will facilitate analysis and management.
5. **Continuous monitoring and feedback:** For every demonstration or pilot project funded, include a requirement for post-occupancy evaluation and knowledge sharing. Create a mechanism (perhaps through the Heritage Sustainability Task Force or the advisory service) to capture lessons from each project – what worked, what didn't – and disseminate those through workshops or publications. This continuous learning loop will refine technical approaches and avoid repeating mistakes. For example, if a certain insulation caused unintended consequences in one building, others can be warned and adjust accordingly. Essentially, make each project a training ground for the next – an approach that has been somewhat ad-hoc until now but should be systematic.

8.4 Community Engagement and Awareness

1. **Public awareness campaigns linking heritage and sustainability:** Initiate a nationwide campaign to raise awareness about why preserving heritage and improving its sustainability are complementary goals, not opposing ones. This could include:
    - Short documentary segments on national television highlighting success stories like those in Section 6 (Old Palace, Tršić, etc.), with before-and-after visuals and commentary by local users, emphasizing improved comfort, community benefit, etc.
    - Social media content, possibly utilizing popular history or architecture bloggers/influencers, to reach younger audiences – for instance, a mini-series of posts "Did you know this 100-year-old building now uses solar energy?" that can spark interest and pride.
    - Collaboration with the education system: incorporate modules in school curricula or extracurricular activities where students "adopt" a local heritage building to learn about its history and current condition, and perhaps conduct simple energy surveys (some stakeholders already touched on student involvement). This instills early on the value of heritage and the idea that it can be modernized responsibly.
2. **Formalize community participation in projects:** For refurbishment projects of public interest, establish a requirement or at least a guideline to have **community consultations** at the concept stage. This can be through public meetings or workshops to gather local input on use and priorities. Also consider forming **Heritage Advisory Committees** for key sites – including local citizens, NGO reps, etc., who meet periodically with project teams. The aim is to increase transparency and local buy-in, which can preempt opposition and incorporate local knowledge (for example, residents often know the micro-climate issues of their area which can inform design). Survey responses indicated support for methods like focus groups and workshops for raising public interest; channel that by actually embedding those methods into project planning.
3. **Empower local heritage NGOs and initiatives:** Provide small grants or technical support to grassroots organizations that promote heritage and sustainable practices. For example, fund local NGOs to run "heritage house open days" where retrofitted buildings are showcased to the public (similar to Open House events in some cities). Or support a local initiative to create a community energy cooperative that invests in renewables on public heritage buildings (residents collectively fund a solar panel on the library, get a modest return or community benefits). Encouraging such community-led projects can relieve pressure on government and create advocates at the local level.
4. **Address social concerns proactively:** Recognize and mitigate any negative social impacts of refurbishment projects. For instance, if a historic residential building is being refurbished, ensure communication about any temporary inconveniences (scaffolding, etc.) and possibly provide support such as temporary relocation if needed for vulnerable residents during disruptive phases. Show that these projects are done *with* the community's wellbeing in mind. This is more of a project management recommendation but it influences public sentiment broadly – if communities see heritage projects as beneficial and considerate, they will support more of them.
5. **Leverage heritage for education on sustainability:** Use heritage sites as living laboratories to demonstrate sustainable practices. For example, if a historic site installs a rainwater harvesting system, include on-site signage explaining how it works and why it's beneficial, effectively educating visitors on water conservation in a memorable context. If a museum improved its energy efficiency, share that story in an exhibit or pamphlet. By doing so, heritage sites can inspire visitors to apply sustainability at home, linking past wisdom (thick walls, orientation) with present

technology. This reinforces the message that old and new knowledge together can address modern challenges.

8.5 Risk Management and Resilience

1. **Integrate cultural heritage into climate adaptation planning:** Ensure that Serbia's forthcoming Climate Change Adaptation Program explicitly includes actions for the cultural heritage sector. Recommendations:
    - Conduct a national risk assessment for cultural heritage under climate change (which sites are at risk from increased flooding, extreme weather, etc.) and prioritize adaptation measures for them (drainage improvements, structural reinforcements). Funding for these should be sought under climate funds.
    - Develop guidelines for "climate-proofing" heritage – e.g., guidance on ventilation to prevent mold in a warmer, more humid climate, or planting shade trees to protect historic buildings from heat (taking care not to damage them).
    - Include heritage buildings in municipal climate action plans – e.g., if a city is planting urban greenery to combat heat, plan it to also shield heritage facades; if updating infrastructure for floods, consider impact on historic foundations.
    - As climate impacts are an emerging issue, consider establishing a small **Heritage Resilience Grant** program to help sites implement risk mitigation (like Studenica's lightning rods and alarms).
2. **Improve emergency response capacity for heritage:** Based on training (recommendation 11), formalize protocols such that in any emergency (fire, flood, quake), responders know to consider heritage assets. This might mean:
    - Pre-drafted salvage plans for key museums and archives (what items or components to save first).
    - Equipping fire departments in historic towns with special fire suppressant tools that minimize water damage (like fire retardant foams or fine mist systems) and training them in cultural asset recovery.
    - Creating regional "heritage emergency volunteer networks" possibly through NGOs or Red Cross, who are trained to help stabilize or pack cultural items post-disaster. The commitment is to treat heritage as a vital asset in disasters, not an afterthought.
    - Ensure backup of documentation: encourage all heritage institutions to digitize important records and store copies off-site (resilience in terms of knowledge preservation).

By implementing these recommendations, Serbia can address the multi-faceted gaps identified and create a more conducive ecosystem for preserving its valuable built environment while meeting contemporary goals of energy efficiency, sustainability, and safety. The recommendations are interlinked: for example, better funding enables more training; better policies make community engagement easier, and so on. Stakeholder input suggests readiness for these changes – professionals seek guidance and resources, communities are open to involvement if approached correctly, and successful pilots have lit the way[37].

It is critical that these efforts begin promptly, as every year of delay is a year of continued energy waste, deterioration of heritage, or potential losses from unforeseen events. The year 2025, aligning with EU-REPAIR's momentum, is an opportune moment to kickstart this transformation. By adopting these measures, Serbia can become a regional leader in demonstrating how historic cities and villages can be revitalized in harmony with environmental sustainability – turning what are often seen as "old problems" into "new solutions" for sustainable development and cultural continuity.

9. Summary

Serbia's **valuable built environment (VBE)** – its rich ensemble of historical buildings, monuments, and heritage sites – stands at a pivotal intersection of past and future. This study has examined how these irreplaceable assets can be preserved while being adapted to meet modern standards of energy efficiency, environmental sustainability, and resilience. The analysis covered Serbia's legislative and institutional framework, funding landscape, technical capacities, stakeholder perspectives, and current examples of practice. Several key findings emerged:

- Serbia has made important strides in updating its **legal framework** (e.g., the 2021 Law on Cultural Heritage recognizes sustainable use and risk management), yet **gaps remain** in strategy and implementation. Notably, the lack of an integrated national strategy and the insufficient harmonization of heritage, energy, and environmental regulations mean that efforts are often fragmented. Enforcement of existing laws is uneven, due in part to limited resources and coordination.

- **Funding constraints** are a major barrier. The cultural heritage sector's budget is very low (under 0.7% of the state budget)[15], and there are minimal targeted financial incentives for sustainable refurbishment. Stakeholders identified lack of finance and incentives as one of the biggest obstacles to undertaking projects. While international funds have helped fill some gaps, a sustainable domestic funding and incentive mechanism is needed to scale up interventions.

- Serbia faces a **capacity and knowledge gap** in integrating new technologies with conservation practice. There is a shortage of professionals trained in both domains, a dearth of vocational training for traditional crafts, and limited availability of appropriate materials and technical solutions domestically. Education curricula have only slowly begun to incorporate these interdisciplinary topics.

- Despite obstacles, there have been **successful projects** that illustrate viable solutions: from Belgrade's Old Palace improving energy performance without altering its appearance[37], to the use of renewable energy in heritage contexts like the Subotica Synagogue, to community-based reuse of materials in Tršić. These best practices provide models that can be replicated if the right support is in place.

- **Stakeholder engagement and public interest** are generally positive but underutilized. The public in Serbia values cultural heritage, and there is openness to sustainable practices, yet formal mechanisms to involve communities in decision-making are limited. Stakeholders see community involvement and awareness as critical to success.

From these findings, the study distilled a set of **lessons learned and recommendations**. Key recommendations include developing a comprehensive national strategy that aligns heritage preservation with climate and energy goals, improving inter-agency coordination, increasing funding and introducing incentives (such as tax credits or grants) to stimulate sustainable refurbishments, and strengthening technical capacity through specialized training for both professionals and craftsmen. Also emphasized is the need to update technical guidelines and to leverage digital tools for better planning and monitoring. Engaging communities through consultations, education, and participatory projects emerged as a vital component to ensure local support and the long-term success of initiatives.

In conclusion, the **opportunities outweigh the challenges**. Serbia's valuable built environment is not a liability but an asset – one that, if managed wisely, can contribute to economic development (via cultural tourism and creative reuse), social well-being (through revitalized historic neighborhoods and

strengthened community identity), and environmental goals (through the substantial carbon savings possible from upgrading existing buildings rather than building new ones[39][40]). By implementing the recommended actions, Serbia can address current gaps and obstacles, creating a virtuous cycle: robust policies and incentives lead to more projects; successful projects build local expertise and public support; increased capacity and demonstration of benefits lead to further policy improvements and resource allocation.

This study, with its analysis and evidence-based recommendations, aims to serve as a roadmap for Serbian authorities, professionals, and communities. It calls for a shift from a fragmented, under-resourced approach to a **cohesive, well-supported movement** for sustainable heritage management. The year is now 2025 – a time of aligning national efforts with global sustainability agendas and EU integration processes – making it an opportune moment to enact these changes. The preservation of Serbia's cultural heritage need not be at odds with modernization; on the contrary, it can be a flagship of Serbia's commitment to sustainable development.

By **bridging the old and the new**, Serbia can ensure that its historic buildings continue to bear witness to the nation's identity and ingenuity, while also serving present and future generations in practical, climate-friendly ways. In doing so, Serbia not only safeguards its past but also builds a resilient, sustainable legacy for the future.

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