EU-REPAIR
VALUABLE BUILT ENVIRONMENT

Toolkit for Sustainable Optimisation of Valuable Built Environment

National Study
Framework for managing and sustainably repairing and refurbishing valuable built environment in Germany

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List of Abbreviations

BauGB	*Baugesetzbuch* - Federal building code
BayDSchG	*Bayerisches Denkmalschutzgesetz* – Bavarian Heritage Protection Law
BbgDSchG	*Brandenburgisches Denkmalschutzgesetz* – Brandenburg Heritage Protection Law
BEG	*Bundesförderung für effiziente Gebäude* - Federal Subsidy for Efficient Buildings
BNB	*Bewertungssystem Nachhaltiges Bauen* - Sustainable Building Assessment System
dena	*Deutsche Energie-Agentur* - German Energy Agency
DGNB	*Deutsche Gesellschaft für nachhaltiges Bauen* - German Sustainable Building Council
DNK	*Deutsches Nationalkomitee für Denkmalschutz* - German National Committee for heritage protection
DSchG	*Denkmalschutzgesetz* – Heritage Protection Law
DSchG BW	*Denkmalschutzgesetz Baden-Württemberg* – Heritage Protection Law Baden-Württemberg
DSchG HA Hamburg	*Denkmalschutzgesetz Hamburg* – Heritage Protection Law
DSchG M-V	*Denkmalschutzgesetz Mecklenburg-Vorpommern* – Heritage Protection Law Mecklenburg-Western Pomerania
EEG	*Erneuerbare-Energien-Gesetz* - Renewable Energy Act
EPBD	Energy Performance of Buildings Directive
EstG	*Einkommensteuergesetz* – German Income Tax Law
GEG	*Gebäudeenergiegesetz* – Building Energy Act
GG	*Grundgesetz* – Basic Law
HDSchG	*Hessisches Denkmalschutzgesetz* – Hessian Heritage Protection Law
ICCROM	International Centre for the Study of the Preservation and Restoration of Cultural Property
ICOMOS	International Council on Monuments and Sites
KAnG	*Bundes-Klimaanpassungsgesetz* - Federal Climate Adaptation Act
KrWG	*Kreislaufwirtschaftsgesetz* - Circular Economy Act

LCA	Life cycle assessment
OZG	*Onlinezugangsgesetz* - Online Access Act
QNG	*Qualitätssiegel Nachhaltiges Gebäude* - Sustainable Building Quality Seal
VBE	Valuable Build Environment
VDL	*Vereinigung der Denkmalfachämter in den Ländern* - Association of State Monument Authorities
WSVO	*Wärmeschutzverordnung* - Thermal Insulation Ordinance

1 Introduction

With the European Green Deal, the EU has set the objective of climate neutrality by 2050 and frames climate action as compatible with economic growth. To stay on track, the EU targets at least a 55% net reduction in greenhouse gas emissions by 2030 compared to 1990 levels, supported by the "Fit for 55" legislative package. The building sector is central to this agenda because buildings account for a large share of EU energy consumption and greenhouse gas emissions. In Germany, buildings account for around one third of final energy consumption, and decarbonizing heat remains a key challenge (BMWSB, 2025a; UBA, 2024)

Existing buildings also matter beyond operational energy. They store a large, embodied resource base. In this context, embodied impacts refer to life-cycle energy and greenhouse gas emissions associated with building materials and components, from production through use, maintenance, and replacement to end of life. Preserving and upgrading existing stock through maintenance, refurbishment, and repair can therefore support climate targets while retaining material value and reducing avoidable replacement impacts (dena, 2022). However, the climate benefit is conditional. It depends on intervention depth, remaining service life, and whether operational savings outweigh additional embodied impacts over the assessment period.

This study focuses on the valuable built environment (VBE). VBE includes officially listed buildings and, in addition, historic buildings older than 50 years with architectural, cultural, or social value, even if they are not formally listed. In this overview, "worthy of preservation" is used descriptively and follows the expert estimates reported in (Wiedemann, 2024). It is not treated as a formal designation or legal status. Germany's residential stock illustrates the scale. In 2022, Germany had nearly 20 million residential buildings, and almost half were completed before 1969, meaning they are over 55 years old and form the age cohort within which VBE candidates are concentrated (zensus, 2022).

Listed buildings represent only a small share of total stock. In 2017, around one million heritage sites were listed in Germany, with 63% being architectural monuments and 37% being archaeological monuments. Architectural monuments include not only individual buildings, but also ensembles and garden monuments. Thus, listed buildings account for approximately 2.9% of the entire building stock in Germany (Liersch & Asef, 2018). This estimate refers to the share of listed buildings within the overall building stock as reported by (Liersch & Asef, 2018) noting that "heritage sites" and "buildings" are not identical categories in all statistics. At the same time, monument conservationists estimate that additional building substance worthy of preservation may account for around 25 to 35% of all buildings in Germany, despite not being formally listed as monuments (Wiedemann, 2024). These buildings are not listed but can still receive privileges if recognized as worthy of preservation and therefore constitute a considerable part of the stock addressed by refurbishment policy.

This overview study proceeds from the hypothesis that achieving climate-neutral and climate-resilient outcomes while preserving cultural value requires a fabric-conserving, repair-first refurbishment logic for VBE, rather than demolition and replacement as the default. Demolition or replacement can remain necessary, where structural safety constraints, irreversible contamination, or disproportionate risk cannot be mitigated through fabric-conserving measures. As defined here, sustainable refurbishment goes beyond improving energy efficiency. It refers to a holistic transformation process that integrates ecological, economic, cultural, and social dimensions and involves relevant stakeholders. In practical terms, this implies prioritizing repair and refurbishment over replacement to support circular economy objectives, meaning retention of material value through reuse, repair, and refurbishment before recycling and disposal, and to preserve embodied value (dena, 2022). It also implies reducing reliance on fossil fuels in heat supply. Currently, more than 50% of flats and residential buildings in Germany are heated with

gas, and including heating oil, around 75% of heating relies on fossil fuels (dena, 2024a). In view of ongoing climate change, sustainable refurbishment must also incorporate climate adaptation goals and integrate risk assessment into planning, where risk assessment is understood as hazard–vulnerability–consequence screening to avoid interventions that increase moisture damage, overheating, or irreversible fabric loss, to identify long-lasting and climate-resilient solutions that avoid unacceptable damage to original building fabric, prioritizing reversibility and conservation compatibility where applicable.

Renovation measures are shaped by a complex network of legal, normative, and financing-related framework conditions at European, national, and regional levels. These conditions significantly influence the feasibility and direction of sustainable refurbishment strategies for VBE, especially where monument protection requirements interact with energy and climate adaptation goals. Against this backdrop, the present overview study provides a structured analysis of the key regulatory and policy conditions currently in place in Germany. Methodologically, the study applies a structured document review with topic-based coding across legislation, standards, and funding instruments. To reflect the structure of this report, the analysis first maps the German legal and administrative framework for heritage protection and energy-related refurbishment requirements, then addresses implementation enablers through digitalization and education, and subsequently synthesizes key funding instruments, stakeholder questionnaire results, and illustrative best-practice cases. Rather than providing an exhaustive assessment across all sustainability dimensions, this report uses these building blocks to identify practical decision constraints, implementation bottlenecks, and transferable lessons for managing VBE refurbishment in Germany. The aim is, first, to provide an orientation framework for VBE repair and refurbishment conditions in Germany and, second, to establish a consistent reference point for international comparison within the EU-Repair project.

2 Methodology and Scope

Objectives and research questions

The study investigates how the VBE is addressed in German law, policy, and practice, with a focus on existing buildings, including listed heritage and other building substance worthy of preservation. For this study, “repair” refers to interventions that restore or maintain function and fabric with minimal replacement, while “refurbishment” refers to upgrades that improve performance beyond the existing state, often including component replacement and system modernization. The analysis is comparative in the sense that it contrasts instrument types (binding law vs guidance), governance levels (EU vs national vs state), and stakeholder group perspectives, and it compares selected state mechanisms against Bavaria as reference. The work combines document analysis, a stakeholder survey and selected case studies. It serves as a foundational component within a broader international project that seeks to compare and disseminate country-specific knowledge related to the refurbishment of culturally significant heritage buildings in a resource-efficient, fabric-preserving, and climate-responsive manner. Against this background, the study addresses the following research questions:

1. How is the VBE currently defined and reflected in European and German legal and policy frameworks?
2. Which instruments (legal, financial, procedural) most strongly influence decisions about preservation, repair and transformation of existing buildings in Germany?
3. How do digitalization, education and evaluation systems support or hinder sustainable interventions in (listed) buildings?
4. How do different stakeholder groups perceive VBE, and where do they see the main gaps and needs?
5. What can be learned from selected best-practice cases for future guidance and tools such as EU-Repair?
6. How is repair operationalised in practice, and which procurement, acceptance and documentation requirements enable, or hinder fabric-preserving repair measures compared to replacement-oriented refurbishment?

Scope of topics and levels

The scope covers multiple levels and instruments that shape how VBE is handled in Germany:

- European level: analysis of directives, regulations and framework documents that influence the treatment of existing buildings, energy performance and heritage.
- National level: review of German federal legislation and policy instruments, including heritage-related law where relevant, building and energy law, and policy documents that affect existing building stock and preservation.
- Standards and norms: identification of DIN, EN and ISO standards that are relevant for sustainable and heritage-related buildings, with a focus on those that are likely to influence planning and evaluation practice, including standards that structure maintenance and repair terminology and execution practice where relevant.

- Financial instruments: overview of financial and fiscal incentives for preservation, repair and sustainable refurbishment, including grant schemes and tax relief where they apply to VBE, with attention to whether instruments support smaller repair measures and preventive maintenance in addition to deep refurbishments.
- Governance and planning: consideration of regional differences (federal states) in planning responsibilities, heritage administration and local planning instruments that affect existing buildings.
- Cross-cutting themes: examination of digitalization, education pathways and evaluation systems for sustainable (listed) buildings, as these shape the capacity to implement policy in practice.
- Practice and perception: analysis of stakeholder perceptions of VBE based on a dedicated survey, and of realized best-practice case studies that illustrate practical approaches to preserving and adapting valuable built environment.

Document and data collection

The study relies primarily on secondary sources: laws, strategies, standards and guidance documents, supplemented by survey data and qualitative case material. At European level, relevant directives and regulations were identified through targeted searches in official EU databases and communications, using combinations of terms such as building stock, energy performance, existing buildings, cultural heritage, renovation and circular economy. At national level, German federal laws and ordinances that directly affect existing buildings, energy efficiency and heritage were reviewed, with particular attention to building and energy law and national strategies that frame the treatment of the existing stock. Selected federal states laws and planning instruments were added where they illustrate regional differences or specific mechanisms that affect the valuable built environment. To capture repair and maintenance as distinct practice fields, searches also included terms such as repair, maintenance, service life, acceptance, defects, procurement, and VOB.

Standards and norms were collected through keyword searches in standard catalogues and cross references in guidance documents. Standards were retained for discussion if they (i) are referenced by laws, ordinances, or common procurement practice in Germany, (ii) provide methods or criteria used in planning, evaluation, or certification practice, or (iii) define terminology or requirements relevant to maintenance, repair, service life planning, or repairability-related decision-making. Funding and fiscal instruments were mapped by analysing information from federal ministries, development banks and federal states portals. The focus was on grant schemes, low interest loans and tax instruments that explicitly target existing buildings, heritage or high-quality refurbishment. Instruments were grouped by scale, federal or state, and by type, direct support or tax-based incentives.

For digitalization, education and evaluation systems, desk research covered online portals for digital building and heritage procedures, degree programs and training offer related to heritage and sustainable construction, and existing building evaluation systems such as sustainability certifications.

The stakeholder perspective was captured through an online questionnaire addressed to planners, heritage authorities, municipal officers, owners and researchers. The survey asked about their understanding of the valuable built environment, perceived barriers and needs, and their experience with current instruments. It also asked respondents to distinguish repair-oriented measures from replacement-oriented refurbishments and to indicate which instruments and capacities support smaller, fabric-preserving interventions. It was distributed via professional networks, mailing lists and project partners. The resulting data was analysed using descriptive statistics for closed questions. Because the sampling

followed a network logic, the findings are treated as indicative perceptions rather than statistically representative results.

Case studies were selected to illustrate practical approaches to preserving and adapting valuable built environment under real constraints. The examples were chosen based on predefined criteria: a clear link to the image or identity of a city or village, documented interventions in existing buildings and sufficient information on process, actors and design decisions. Data for each case was collected from project documentation, trade and professional press, municipal publications, operator websites. Each case was then structured according to a common template that covers identification, problem and claim, measures, evidence, design implications and residual uncertainty. Because the selection emphasizes successful examples, repair-related insights from the cases are interpreted as procedural lessons on implementation under favourable conditions rather than as evidence of routine repair practice across the building stock.

Analytical framework and link to chapters

The analysis follows a consistent logic across the report. Documents and data are not only described but interpreted in terms of how they shape the treatment of existing buildings and the valuable built environment. In Chapter 3, the national legal framework is examined to identify how laws and policy instruments define, enable or hinder preservation, repair, and sustainable adaptation of existing buildings. The chapter distinguishes between binding legal provisions, such as laws and ordinances, and softer instruments such as strategies and guidelines, and comments on their practical implications for projects, including the distinction between public-law triggers and the contracting, procurement and acceptance frameworks that shape repair execution in practice.

Chapter 4 then looks at enabling conditions. digitalisation, education pathways, and evaluation systems are analysed as the infrastructure that determines what practitioners and authorities can realistically do with the legal framework. The focus is on process frictions, capacity gaps, and the degree to which existing tools support or obstruct sustainable interventions in listed and other valuable buildings. Chapter 5 turns to funding and fiscal instruments and maps them in terms of accessibility, target groups, and implicit priorities, for example whether programmes favour deep energy retrofits, heritage compatible repair, or a mix of both.

Chapter 6 presents the stakeholder survey results and uses them to evaluate where the legal, institutional, and financial landscape aligns with perceived needs on the ground and where it conflicts with them. Chapter 7 shifts to realised projects and interprets the selected case studies as concrete manifestations of the framework described in the previous chapters. They show how actors navigate legal constraints, funding conditions, heritage requirements, and local politics when dealing with valuable built environment.

3 National Legal Framework in Germany

A basic understanding of Germany's legal and regulatory framework is important. The first section covers heritage protection, including relevant legislation and administration in the federal states of Germany. This is followed by requirements for energy-efficient buildings. In addition to listed buildings, the law recognizes other building substance particularly worthy of preservation. How this is defined and what requirements apply will be explained. Finally, other topics relevant to the study, such as renewable resources and circular economy, will be put into context.

3.1 Heritage Protection: Legislation and Administration

In Germany, the basic law assigns cultural affairs and its legislation to the individual federal states (Art. 30, 70 GG), meaning each of the 16 federal states has its own heritage protection law. These laws specify, for example, how a monument is defined, as well as its preservation, use and measures, the organisation and responsibilities of the authorities, and the obligations and penalties for non-compliance with the requirements. All of them define (cultural) monuments as objects that are preserved in the public interest because of their historical, artistic or scientific value (e.g. Art. 1 Abs.1 BayDSchG; §4 Abs.2 DSchG HA; §2 Abs. 1 DSchG M-V). Also stated as significant in some federal states are e.g. folkloric, technical and often urban planning factors (e.g. §2 Abs. 1 HDSchG; § 2 Abs. 1 BbgDSchG) (see Table 1). Although the exact definitions vary slightly, most of the federal states differentiate between three main types of monuments: individual monuments (historical buildings), ensembles and ground monuments, as well as sometimes garden, archaeological and movable monuments. An individual monument is a building structure or part of a building structure, including its accessories and inventory if their forming a unit with the monument, which meets the preservable requirements (§ 4 Abs. 2 DSchG HA). Ensembles are defined as groups of building structures, which can be preservable with only one or even without a preservable monument in it, but the appearance of e.g. a street or square forms a significant whole (Art. 1 Abs. 3 BayDSchG). While ground monuments can be moveable or non-moveable monuments that are or were connected to the ground and originate from historical times (Art. 1 Abs. 4 BayDSchG).

Table 1 Named protectable properties of monuments in the different federal states (own summary according to each DSchG)

		Protectable Properties						
		history	art	science	folklore	urban planning	technology	others
Federal State	Baden-Württemberg	x (local)	x	x				
	Bavaria	x	x	x	x	x		
	Berlin	x	x	x		x		
	Brandenburg	x	x	x	x	x	x	
	Bremen	x (local)	x	x		x	x (historic)	
	Hamburg	x	x	x		x (features of cityscape)		
	Hesse	x	x	x		x	x	
	Mecklenburg-Western Pomerania	x	x	x		x	x	shaping cultural landscape; development of working and economic conditions

	Lower Saxony	x	x	x		x		
	North Rhine-Westphalia	x	x	x	x	x		development of working and production conditions
	Rhineland-Palatinate	x	x	x		x		
	Saarland	x	x	x		x		
	Saxony	x	x	x		x		landscape design
	Saxony-Anhalt	x	x	x		x	x (economic)	cult
	Schleswig-Holstein	x	x (cultural)	x				
	Thuringia	x	x	x	x	x	x	maintenance of historic village appearance

Like the definitions, the wording regarding the preservation of and measures taken on monuments, as well as the penalties for non-compliance with the requirements, varies slightly from state to state. However, the following core requirements in the legal texts apply in all federal states. Owners or authorised representatives of listed buildings are generally obliged to maintain them in a manner appropriate to their heritage value within reasonable (financial) limits. This includes restoration, proper treatment and protection from hazards. (Art. 4 Abs.1 BayDSchG; §7 Abs.1 DSchG NRW) The use of listed buildings should correspond as closely as possible to their original purpose (Art. 5 BayDSchG; §8 Abs.1 DSchG NRW).

Measures to be implemented on listed buildings are generally subject to approval by the (lower) monument protection authority. These include the removal or alteration of listed buildings or parts of them, as well as relocation to another location. Permission is also required for the construction, removal or alteration of a structure in the surroundings of a listed building if this measure affects the appearance or substance of the listed building. (Art. 6 Abs.1 BayDSchG; §9 Abs.1 and 2 DSchG NRW)

Expropriation may be carried out if a threat to the form or existence of a listed building cannot be permanently prevented (Art. 18 BayDSchG; §33 Abs.1 DSchG NRW). In addition, fines may be imposed for intentional or negligent violations of the regulations. These include, among other things, the implementation of measures on the monument that deviate from the regulations or have not been approved in advance (Art. 12 Abs.1 BayDSchG; §41 Abs.1 DSchG NRW). In Bavaria, fines of up to five million euros can be imposed (Art. 12 Abs.1 BayDSchG), while in other federal states, such as Hamburg, fines of up to 500,000 euros can be levied (§27 DSchG HA).

All monuments are recorded in monument lists or databases maintained at the level of the federal states, reflecting Germany's federal structure. Each monument must be approved by the federal authority before it is added to the list. (e.g. §5 Abs.1-3 DSchG M-V) The administration is organised in two-stages (e.g. DSchG Hessen) or three-stages (e.g. DSchG NRW), depending on the federal state (see Figure 2). The Lower Monument Protection Authorities at district level are responsible for e.g. advising owners, processing applications and approvals. They receive technical support from the Monument Specialist Authorities, which are based at the regional monument offices. The specialist authority oversees inventorying, i.e. examining and protecting monuments, and allocating subsidies. At the district government level, the Upper Monument Protection Authorities operate, supervising the lower ones. Finally, there are the Supreme Monument Protection Authorities, which are based at the relevant ministry of the federal state. Among other things, they are tasked with technical supervision and funding programmes, and they get involved in cases of disagreement. (DNK, n.d.a; DNK, n.d.b).

For the coordination between the different authorities of the federal states all of them are members in the association of state monument authorities (*Vereinigung der Denkmalfachämter in den Ländern* – VDL). The VDL advises the government in statements for heritage protection and preservation as well as support owners of a monument and inform the society. They also support the national exchange between different stakeholders e.g. architects, crafts, and scientists. (VDL, 2025b) Besides the VDL, the German National Committee for heritage protection (*Deutsches Nationalkomitee für Denkmalschutz* - DNK) also acts at federal level. It belongs to the federal government commissioner of culture and media and serves as an interface between the administration, government and technical levels. The DNK significantly influences the heritage policy nationwide, as it operates as political and technical panel. For society, it communicates heritage protection and preservation. (BKM, 2025a) In different key issues and working groups it addresses topics like "Heritage Protection is active climate protection" (DNK, n. d.c).

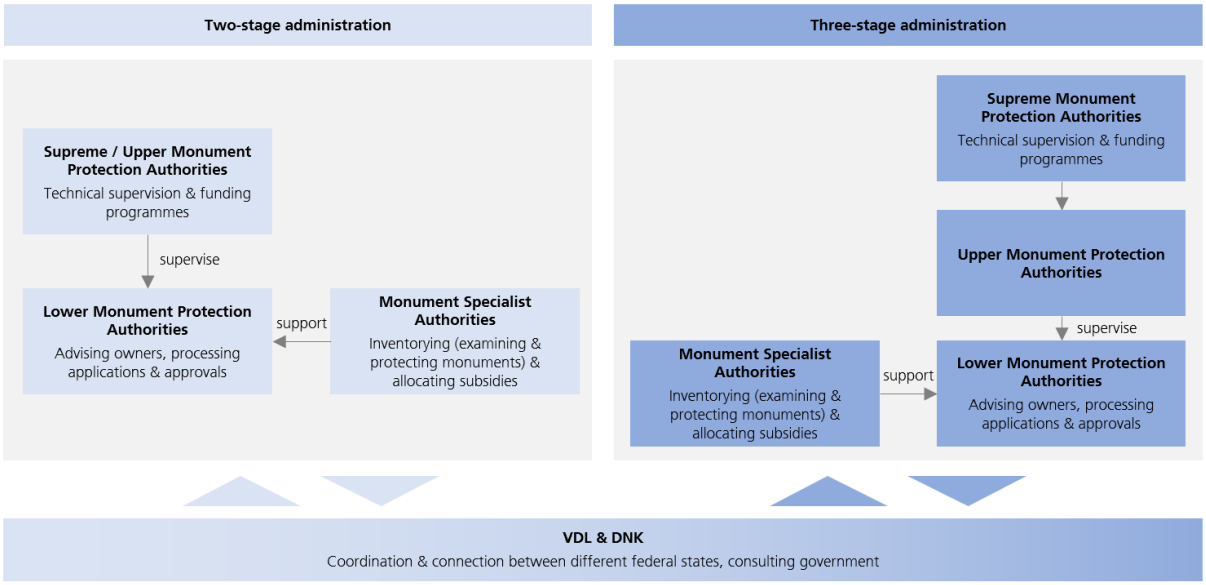


Figure 1 Administrative organisation of public authorities in Germany (own illustration on the basis of (DNK, n.d.a))

In cooperation with the national DNK, VDL, and German UNESCO-Commission, the German International Council on Monuments and Sites (ICOMOS) operates, which additionally collaborates with international organisations such as UNESCO or The International Centre for the Study of the Preservation and Restoration of Cultural Property (ICCROM). ICOMOS advocates the protection and preservation of monuments and cultural heritage at an international level and acts as a non-governmental organisation. The German ICOMOS publish national policy papers on monument preservation, organise colloquiums for monument protection and preservation as well as monitor and inform about the German monuments listed at world heritage. (Icomos DE, n.d.)

Above all the national legislation and administration, the German heritage preservation is strongly influenced by the Venice Charter (Burbat, Mahler, Seithel, & Eßig, 2023). The Charter defines in article 1 a historic monument as an architectural work and its surrounding setting with "the evidence of a particular civilization, a significant development or a historic event" (ICOMOS, 1964, Art. 1), which applies for great artistic achievements and work that gained cultural significance over time. Monument preservation requires the use of all sciences and techniques that support the study and long-term protection of architectural heritage. (ICOMOS, 1964) Furthermore the new Charta of Leipzig serves as a guiding

principle for integrative and sustainable urban development policies in Germany and the whole EU. With the 2020 revision, the focus is also on the common good. It highlights that most cities have unique, historically developed city centres that shape Europe's urban cultural heritage and the identity of their inhabitants. Culture is seen at the core of sustainable urban development, and preserving the built heritage is therefore also considered valuable. (Informelles Ministertreffen Stadtentwicklung, 2020)

3.2 Regulatory Framework for Energy-Efficient Buildings

Energy-related building requirements in Germany are shaped by a combination of federal laws, technical standards, increasingly framed within the overall context of the European Green Deal, the EU Energy Performance of Buildings Directive (EPBD), and national climate targets. German legislation already has a long history in this area. In 1977, the first public law regulation for energy-saving thermal insulation in buildings came into force in Germany, the Thermal Insulation Ordinance (*Wärmeschutzverordnung* – WSVO) (BBR, n. d.). Over the years, the requirements for energy-efficient buildings have continued to increase, which results in a decrease in primary energy consumption (see Development of Energy-saving Construction (Fraunhofer IBP)Figure 3).

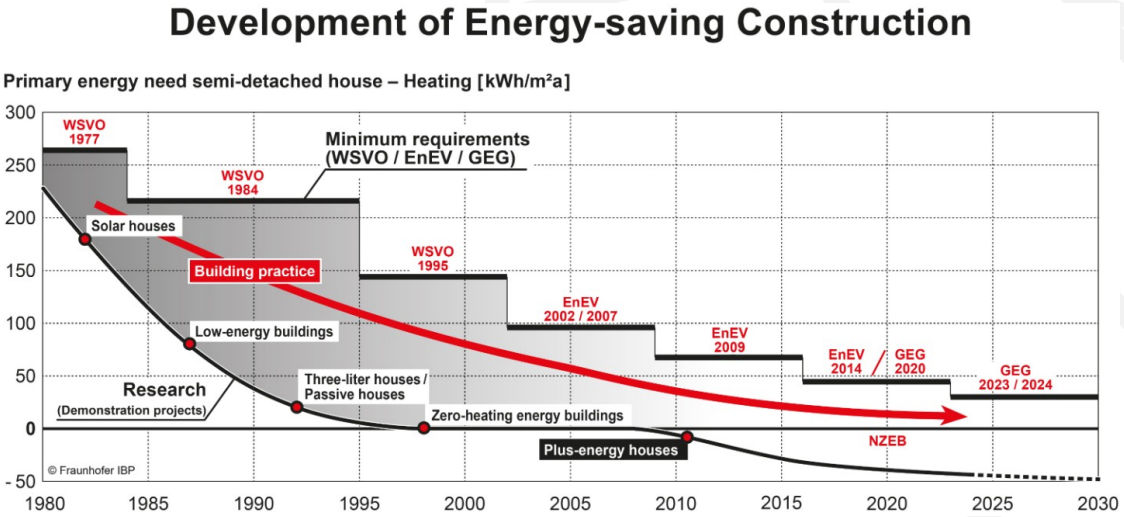


Figure 2 Development of Energy-saving Construction (Fraunhofer IBP)

The Building Energy Act (*Gebäudeenergiegesetz* - GEG), which has been in force since 1 November 2020 and was last updated in 2023, is currently the key legal framework. Its aim is to significantly contribute to national climate protection targets by reducing greenhouse gas emissions and increasing the use of renewable energies or unavoidable exhaust heat (§1 Abs.1 GEG). In section two, the GEG sets standards for buildings to be constructed in terms of minimum thermal insulation, thermal bridges, airtightness and summer heat protection (§ 11-14 GEG). It also distinguishes between the requirements for total energy consumption in residential and non-residential buildings, for example (§ 15, 18 GEG). In addition to new buildings, requirements for existing buildings undergoing renovation, modernisation or extension are also specified in part three. In general, external components must not be altered in such a way that the energy efficiency of the whole building is impaired (§ 46 GEG). Any changes to external components must result in a specified heat transfer coefficient being achieved or not exceeded (§48 GEG). This can be determined based on various DIN standards (§ 49 GEG), namely:

- For components adjacent to the ground
  DIN V 18599-2:2018-09: Energy efficiency of buildings - Calculation of the net, final and primary energy demand for heating, cooling, ventilation, domestic hot water and lighting - Part 2: Net energy demand for heating and cooling of building zones
- For transparent components and curtain walls
  DIN 4108-4:2017-03: Thermal insulation and energy economy in buildings - Part 4: Hygrothermal design values
- For opaque components
  DIN 4108-4:2017-03 in combination with DIN EN ISO 6946:2018-03 Building components and building elements - Thermal resistance and thermal transmittance - Calculation methods (ISO 6946:2017)

Paragraph 47 of the GEG requires retrofitting of existing buildings if the insulation of the top floor ceiling does not meet the minimum thermal insulation requirements according to DIN 4108-2: 2013-02. When extending a building, transmission heat losses must be considered (§ 51 GEG). The GEG also specifies energy requirements for heating, cooling and ventilation systems as well as hot water supply systems for buildings. In general, changes to a building's technical systems should not result in a decrease in its energy efficiency. (§ 57 GEG). In addition, operators are subject to certain obligations, including requirements for maintenance and repair (§ 58-60 GEG). When installing a new heating system, at least 65% of the heat provided by the system must come from renewable energies or unavoidable waste heat (§ 71 GEG).

In section five, § 105 of the GEG specifies the exceptions for listed buildings and “other building substance particularly worthy of preservation” for which deviations from the requirements of the law are permitted. The reasons given for this are impairment of the appearance or substance of the building, or other measures that would result in disproportionately high effort. The term “other building substance particularly worthy of preservation” is not further specified or legally defined in the GEG, so its interpretation is left to the municipalities. Ongoing updates to the GEG are essential, with EU directives playing also a crucial role in this regard. In 2024, the EPDG and the Energy Efficiency directive were amended, for example. They set EU-wide minimum requirements for overall energy efficiency of buildings and must be adopted into national law by April 2026 (dena, 2024b). The EPDG also allows EU member states to make exceptions to the overall energy efficiency requirements for (national, regional or local) officially protected buildings if the implementation of the measures would change their external appearance (Art. 5 Abs. 2 EPDG).

In addition to the standards already mentioned, of which DIN V 18599 is particularly relevant, DIN EN 16883:2017-08 is another important standard regarding listed buildings. It deals with the conservation of cultural heritage and provides guidelines for improving the energy performance of historic buildings. In addition, it supports the decision as to whether an improvement in energy-related performance is necessary. The German Energy Agency (*Deutsche Energie-Agentur* - dena) and the Federal Office of Economics and Export Control publish in the field of building refurbishment, for example on the economic efficiency of refurbishment (BAFA) or on energy balancing in accordance with DIN V 18599 (dena, 2023).

3.3 Other Building Substance particularly worthy of Preservation

While there were still reports in 2020 that the decision on the other building substance particularly worthy of preservation posed major challenges for local authorities (Schwartz, 2020), in 2021 the Federal Ministry of Housing, Urban Development and Construction published a working aid for identifying, recording and evaluating this building fabric (BMWSB, 2021). The term is defined here as follows "Monuments, buildings particularly worthy of preservation and existing structures characterise the appearance of historically grown villages and towns. Most historic buildings are particularly worthy of preservation because these buildings, squares, open spaces and green areas are distinguished by their use of materials, the legibility of regional or local building traditions or their location. Demolition or structural alteration would lead to a loss of the characteristic appearance of the town, city or neighbourhood." (BMWSB, 2021, p. 5)

The term "building substance worth preserving" also appears in the Federal Building code (*Baugesetzbuch* – BauGB), which provides municipalities with instruments to protect also other buildings or areas worthy of preservation. § 35 BauGB regulates building in outdoor areas, in other words, outside built-up areas. Subsection four aims to prevent the emergence and expansion of scattered settlements and to preserve the natural character of the landscape. Here, buildings worthy of preservation receive certain privileges, if the project serves the purposeful use of building fabric worthy of preservation (§ 35 Abs. 4 Nr. 1a), or if the "alteration or change of use of buildings worthy of preservation that characterise the cultural landscape, even if they have been abandoned, if the project serves the purposeful use of the buildings and the preservation of their design value" (§ 35 Abs. 4).

The municipality may also designate redevelopment areas in accordance with § 142 BauGB, in which urban redevelopment measures are to be carried out. These measures should serve the public good (§ 136 Abs.4 BauGB) and may, among other things, aim to "preserve, renovate and further develop existing districts, improve the appearance of the town and landscape, and take into account the requirements of monument protection" (§ 136 Abs.4 Nr. 4 BauGB). In addition, urban restructuring measures may also be announced by the municipality with the aim of ensuring a sustainable urban structure (§171a BauGB. These measures also serve the public and are intended, among other things, to contribute to the sustainable preservation of old buildings in city centres (§ 171a Abs.3 Nr.7 BauGB). Another option for municipalities under the BauGB is to apply the preservation statute (§ 172 BauGB). Here, "local authorities can draw up a development plan or designate areas by means of other statutes in which, in order to preserve the urban character of the area based on its urban design, the demolition, alteration or change of use of buildings requires approval" (§ 172 Abs.1 BauGB).

3.4 Further Legislative and Regulatory Context

Within the scope of the project, besides energy efficiency, the topics of repair and maintenance, renewable resources, circular economy, climate adaptiveness, risk assessment of VBE as well as participation and inclusiveness are of significance. Therefore, the following section briefly presents the legal basis and regulatory requirements in this context.

Repair and maintenance execution framework

This subsection explains how repair and maintenance work on existing buildings is governed in Germany at the level of contracting, execution, acceptance, and recurring duties. It does not provide a complete list of trade-specific repair standards.

Repair and maintenance interventions can trigger public-law requirements, especially under monument protection approvals and energy law refurbishment triggers. These triggers and their requirements are addressed in Section 3.1 and Section 3.2.

The baseline regime for repair works is the German Civil Code (BGB) works contract, including defect rights and limitation periods. For works on a building (Bauwerk), defect claims generally prescribe after five years, and the limitation period starts with acceptance (Abnahme). This makes acceptance documentation and verifiable performance criteria central for enforceable repair outcomes (Bürgerliches Gesetzbuch [BGB], n.d., § 634a).

VOB as contractual regime. In construction practice, the VOB system is a dominant execution framework when it is expressly agreed in the contract. VOB/B governs contractual conditions around execution and acceptance, including defect-related obligations at acceptance ("Deutsches Institut für Normung, 2016, § 12; § 13", 2026)). VOB/C provides the trade-specific technical contract conditions (Allgemeine Technische Vertragsbedingungen, ATVs) used to structure performance specifications, execution rules, measurement, and billing. A cross-cutting baseline within VOB/C is ATV DIN 18299, which applies broadly to “Bauarbeiten jeder Art”, including works for which no specific trade ATV exists (Deutsches Institut für Normung, 2019). For procurement, especially in public contexts, VOB/A provides the procedural rules for awarding construction works (Deutsches Institut für Normung, 2019).

Deutsches Institut für Normung (2018) defines generic maintenance terminology (Instandhaltung) across technical, administrative, and management domains in DIN EN 13306. Deutsches Institut für Normung (2019) defines the fundamentals of maintenance in DIN 31051 and with DIN EN 13306 to support consistent understanding and application of maintenance processes. These two standards should be used as the report’s terminology baseline to keep “inspection”, “maintenance”, “repair”, and “improvement” consistent across the heritage, energy, and circular economy sections.

Core German building compliance texts and VOB do not define “repairability of components” as a mandatory property. Repairability here means the extent to which a component can be accessed, disassembled, and restored or replaced with predictable effort and without unnecessary destructive interventions. If repairability is a project requirement, it must be translated into procurement and acceptance requirements, for example specification clauses and handover documentation deliverables. ISO 20887 provides principles, requirements, and guidance for design for disassembly and adaptability, which can be used as a normative anchor for repairability proxies such as separability, accessibility, reversible connections, and planned replacement. It remains voluntary unless explicitly specified by the client or embedded in contractual documents (International Organization for Standardization, 2020). ISO 15686-1 provides the general principles and framework for service life planning, explicitly including the remaining life cycle for existing buildings, and supports structured planning of inspection, maintenance, repair, and replacement cycles (International Organization for Standardization, 2011).

For the operation phase, building owners and operators carry ongoing duties to maintain safety and functionality, which in practice requires structured inspection regimes and documentation. VDI 6200 provides a widely used technical framework for regular verification of the structural safety of buildings, including criteria and checklists that support planning and prioritisation of maintenance actions in existing buildings (VDI, n.d.). (VDI, 2010). Where repair workflows involve hazardous maintenance activities or work equipment, TRBS 1112 provides requirements for planning and executing maintenance, including risk assessment duties in the occupational safety regime (Bundesanstalt für Arbeitsschutz und Arbeitsmedizin, 2019)

Renewable Resources

General objective of the Renewable Energy Act (*Erneuerbare-Energien-Gesetz* - EEG) in Germany is to achieve a sustainable and climate neutral electricity supply. To support this goal, Germany aims to increase the share of renewable energies in gross energy consumption to at least 80 percent by 2030. (§ 1 Abs. 1 and 2 EEG) Here, for example, the feed-in of solar power from, at or in a building into the public grid is remunerated (§48 Abs. 2 EEG). Buildings are defined as "any independently usable, covered structure that can be entered by people and is primarily intended to serve the protection of people, animals or property" (§ 3 Nr. 23 EEG). Topics relating to other renewable materials are not addressed in either a legal or regulatory context.

Circular Economy

The Circular Economy Act (*Kreislaufwirtschaftsgesetz* – KrWG) in Germany does not apply specifically to the construction sector, but it does call for measures to support the circular economy in general. The measures are to be implemented in the following order: prevention, preparation for reuse, recycling, other recovery (in particular energy recovery and backfilling) and disposal. (§6 Abs.1 KrWG). Additionally, a draft version of a new standard "DIN EN 18177:2025-04: Circular Economy in the construction sector – framework, principles, and definitions" has been published. This is intended to support the transformation of the construction sector towards a circular economy. (DIN e.V., 2025)

Climate Adaptiveness

In Germany, the Federal Climate Adaptation Act (*Bundes-Klimanpassungsgesetz* - KAnG) aims to protect society and infrastructure, among other things (§1 KAnG). The Act also states that the government must present an adaptation strategy every four years, which also includes buildings in the infrastructure cluster (§3 Abs.1 and 2 KAnG). According to Paragraph 12 Ab. 1 and 3 KAnG also areas of municipalities or districts within the federal states must develop local climate adaption concepts based on climate risk analysis. Besides, the German ICOMOS published „Adaptation strategies for monuments in the face of climate change " in this context in 2023 (Bellendorf, Mager, & Prell, 2023).

Risk Assessment of VBE

As part of the research project "Resilience and built cultural heritage", an integrated approach to risk management of cultural heritage in existing urban development was elaborated between 2021 and 2023 (BBSR, 2025). This resulted in a working aid for municipal practice with regard to protecting built cultural heritage from risks and making it resilient (BBSR, 2023a). A shorter version of this is also available in English (BBSR, 2023b). At EU level, there are three noteworthy projects: STORM, Hyperion and ProCultHer. The ProCultHer-project dealt with technical procedures that make it simpler for experts to protect cultural heritage in emergencies. (European Commission, 2023) Among other things, Hyperion aimed to quantify climatic, hydrological and atmospheric stressors in historical areas. They also worked on a hygrothermal tool designed to simulate the heat air moisture transport phenomenon through structural elements.

(Hyperion Project, 2025) STORM used site-specific sensors and damage assessment instruments to investigate the extent to which different materials, structures and buildings are affected by extreme weather events (European Commission, n. d.). Additionally, in 2017, the German UNESCO Commission published a handbook on disaster risk management at World Heritage sites (Deutsche UNESCO-Kommission, 2017).

Participation and Inclusiveness

There is no significant legislation in participation and inclusiveness, but there are survey results on citizens' attitudes towards culture heritage and an EU project on integrated and innovative management strategies for historic urban landscapes. In the 2025 Eurobarometer survey on Europeans' attitudes towards culture, 92% of respondents said that they consider cultural heritage to be very or important (overall important) for their own country, only 7% consider it not very or not at all important (overall unimportant) and the rest do not know. 87% consider culture heritage important for themselves personally and for their local community. Comparing the results from 2025 with the survey results from 2017, there has been a slight increase in the percentage who consider culture heritage important. For example, in 2017, 84% of respondents considered it to be important for their local community, compared to 87% in 2025. In Germany, 78% of those surveyed consider cultural heritage to be personally important, which is below the European average. In addition, 82% of those questioned in 2025 stated that they generally agree (totally or tend to agree) with the statement that living near a culturally significant European location can improve quality of life. In 2017, 10% fewer agreed with this statement. (EU, 2025)

Within the European funding programme for sustainable urban development (URBACT), the “Heritage as Opportunities” (HerO) project developed integrated and innovative management strategies for historic urban landscapes. The main outcome was a guidebook on how to develop such an integrated strategy. On the one hand, the guidebook describes the new approach to managing historic towns and its advantages, including those related to stakeholders. On the other hand, it provides guidance on the elements that should be included in an integrated cultural heritage management plan, how to prepare, develop, implement, and review it. Examples from the nine partner cities in different countries illustrate each phase of the process. (Scheffler et al., 2011)

4 Digitalization, Education and Sustainable Buildings

Topics such as digitalisation and education are also relevant to the further objectives of the project. In addition to the legal framework, the evaluation of sustainable buildings is also important. These topics are presented below in the German context.

4.1 Digitalization in (Listed) Buildings Processes

Digitalisation in heritage related building processes is an extra layer on top of long-standing analogue steps. Owners and planners still must clarify whether a building is listed, negotiate what is permissible, obtain heritage and building permits, secure funding and document works. Digital tools change how information and documents move through these stages, not the legal responsibilities or decision logic. In Germany this happens in a fragmented federal landscape. Every federal state runs its own monument list, its own portals, and its own degree of digitalisation, while national initiatives such as the Online Access Act (*Onlinezugangsgesetz* - OZG) try to push all administrative services, including building permits, towards online availability. (Bundesministerium für Digitales und Staatsmodernisierung, 2025; VDL, 2025a) The process is partly digital, but legal certainty and final judgement still sit with heritage and building authorities.

This chapter is structured along the four points where digitalisation currently touches heritage related building processes most directly. First, it looks at digital access to monument lists and heritage information. Second, it examines digital procedures for heritage permits, focusing on online services and comparable e-government entries in different federal states. Third, it discusses digital building permit procedures that involve heritage authorities. Fourth, it outlines digital applications for financial support for listed buildings.

Digital access to monument lists and heritage information

In Bavaria, the Bavarian Monument Atlas is described as the online version of the Bavarian Monument List. it lets users search building and archaeological monuments and ensembles by address, monument number, or coordinates, and shows them on official maps together with short descriptions and exterior photos. (Bayerisches Landesamt für Denkmalpflege, n. d.c; Bayerisches Landesamt für Denkmalpflege, n. d.a) The same data is also provided as municipality-based PDF extracts under “Die bayerischen Denkmäler online – Listenauszüge”, which means that map based and document-based access run in parallel (Bayerisches Landesamt für Denkmalpflege, n. d.b). As a contrast, Hesse offers the DenkXweb system, a digital monument database that exposes large parts of the monument register with descriptions and justifications for individual monuments and ensembles and a map view, while still requiring separate requests where data is not yet online (Landesamt für Denkmalpflege Hessen, n. d.b; Landesamt für Denkmalpflege Hessen, n. d.c). Westphalia-Lippe follows a slightly different model. The LWL GeodatenKultur portal presents selected data on built and landscape heritage as part of a broader cultural landscape information system, while more detailed expert information remains in internal “Denkmalinformationssysteme”. (LWL, n. d.b) A Germany wide overview by the Association of State Monument Offices confirms this federal patchwork: all 16 federal state maintain their own monument lists, many but not all now offer online access via databases, geoportals or PDFs, and almost all portals state that only the authority can give legally binding information (VDL, 2025a).

Digital procedures for heritage permit

For interventions on listed buildings, Bavaria uses the state service portal (BayernPortal) as a digital front end. Owners can submit a "Denkmalschutzrechtliche Erlaubnis" online if their lower monument authority participates in the e-government service; the portal lists only those authorities that currently accept online submissions, so coverage is clearly incomplete. Online procedures exist as well for specific heritage related grants, for example subsidies for archaeological excavations linked to buried monuments (Bayerisches Landesamt für Denkmalpflege, n. d.d; Bayerisches Staatsministerium für Digitales, 2025). Other federal states organise this differently. In Hesse, for instance, the administrative portal explains that where the monument register is not yet online, access to the "Denkmalbuch" still requires a personal or written request and proof of a legitimate interest, which shows that the digital monument database and the permit process are only partially aligned. (Landesamt für Denkmalpflege Hessen, n. d.a; Landesamt für Denkmalpflege Hessen, n. d.c) North Rhine-Westphalia is developing OZG services specifically for monument matters, but currently heritage permits are typically managed inside the same municipal service portals as building and use permits, with digital submission as PDF plus internal analogue processing. (MHKBD NRW, 2025b; Stadtverwaltung Neuss, 2021) Across these examples, digitalisation standardises channels and tracking, while heritage officers still apply the analogue legal criteria case by case.

Digital building permit procedures that involve heritage authorities

In Bavaria, the "Digitaler Bauantrag" allows applicants to submit all common types of building applications and related notifications digitally at participating authorities via online assistants that guide them through the forms and replace the paper application form (Nuber, 2023). When a listed building or ensemble is affected, the lower building authority still involves the heritage authority as a specialist office. The review by heritage experts remains a separate step. Digital procedures change how plans are transmitted and how the participation of specialist offices is organised. (Landkreis Eichstätt, n. d.; Landratsamt Dachau, 2025) North Rhine-Westphalia goes one step further by using Bauportal.NRW as a central, fully digital entry point for building and monument related applications. The state ministry promotes the portal to submit building applications and "Denkmalanträge" completely online, provided the municipality has joined the system, and highlights that both citizens and municipalities benefit from reduced media breaks and automated workflows. (MHKBD NRW, 2025a) Other federal states are adopting similar OZG based solutions for "digitale Baugenehmigung", in which building authorities and external specialist offices work on a common digital case file rather than exchanging separate letters and emails (DBauV, 2021; Landratsamt Oberallgäu, n. d.).

Digital applications for financial support for listed buildings

Funding processes for listed buildings are also moving into hybrid digital-analogue models. The Bavarian State Office for Monument Protection describes a two-step procedure for grants to preserve and secure listed buildings: first a consultation with the lower monument authority, then a formal application, which can now be submitted via online services in the BayernPortal. (Bayerisches Landesamt für Denkmalpflege, n. d.d; Bayerisches Staatsministerium für Digitales, 2025) Some district authorities offer their own online forms for monument grants but still emphasise prior consultation with state heritage experts and often require supporting documents as uploaded PDFs or signed originals (Bayerisches Landesamt für Denkmalpflege, n. d.d; Landratsamt Altötting, n. d.). In North Rhine-Westphalia, the LWL heritage authority complements its funding role with digital documentation and communication tools such as LWL-GeodatenKultur, which make funded projects and cultural landscape information visible, even though the grant decision process itself remains an expert driven, file-based procedure. (LWL, n. d.b) Nationally, monument owners can also access federal tax incentives and cultural funding programmes, but these are

usually triggered via standardised web forms or PDFs and still depend on assessment and confirmation by heritage authorities or tax offices (VDL, 2025a).

4.2 Education for Sustainable (Listed) Buildings

In the area of building culture, monument protection, and monument preservation, around 556,000 people were employed in 2019. These can be divided into three areas, with most being civil engineers (65%), followed by architects (27%) and only a small number of heritage conservation (7%). Within the heritage conservation professions, 61% work as stucco plasterers, 13% in museum and exhibition technology, and only 16% in building maintenance and renovation. In the field of heritage conservation, around half (46%) have completed an apprenticeship as their highest educational qualification. (Weißmann, 2021) Most apprenticeships can be traced back stucco plastering professions, as this is also the largest occupational group within the field of heritage conservation. The following table shows which occupations, for example, are classified as plastering and building maintenance and renovation.

Table 2 Relevant occupational groups with examples (Weißmann, 2021, p. 59)

Occupational group	Examples
Stucco plastering work	Specialist construction worker, plaster sculptor, plasterer, plasterer, marble / sgraffito plasterer, renderer, historic building conservator, restorer in plastering trade
Building maintenance and renovation	Monument technical assistant / technician, bricklayer in old building renovation, old building renovator, building renovation technician, construction technician in monument preservation / in building renovation, building maintenance technician, specialist in building repair / in building maintenance, monument preservationist (architect)

Apart from stucco plastering professions, specific apprenticeships in the field of monument preservation are very rare, but training courses for “monument technical assistants” are offered in Berlin and North Rhine-Westphalia. These courses primarily cover topics such as architectural history, heritage protection law and planning programmes, but also teach various craft techniques. (BR, 2021) Degree programmes in this field are mainly available as master’s degrees. The programme is offered, for example, in Coburg as monument preservation or in Berlin as historical building research and monument preservation (Hochschule Coburg, 2025; TU Berlin, 2025). In combination with the topic of digitisation, Bamberg offers a master's degree in digital monument technologies (Universität Bamberg, 2025) The European University Viadrina in Frankfurt (Oder) also offers a degree programme in the protection of European cultural assets (Europa-Universität Viadrina, 2025).

There are several certified training and continuing education programmes in historic preservation. For example, there are advanced training courses for various trades in restoration or repair work in monument preservation. Architects can receive further training as planners and project managers for old buildings and cultural monuments. In order to work as an energy consultant for energy-efficient monuments for funding from the Credit Institution for Reconstruction (*Kreditanstalt für Wiederaufbau* - KfW), which is explained in the next chapter, a qualification must also be obtained through further training. (LWL, n. d.a)

The German Foundation for Building Culture also offers seminars and certified training courses as part of its Monument Academy. These courses are not only intended for architects, urban planners and government officials, but also for interested private individuals and monument owners. They cover the latest trends and provide information on new research findings and issues (Deutsche Stiftung

Denkmalschutz, 2025a). In addition, the foundation organises an annual Open Monument Day in Germany, which is intended to appeal to all age groups (Deutsche Stiftung Denkmalschutz, 2025b).

A further practical pillar for repair-oriented capacity building in Germany is the landscape of applied training formats that explicitly target fabric-preserving techniques and energy performance in historic buildings. At the Fraunhofer Center for Conservation and Energy Performance of Historic Buildings Benediktbeuern (Fraunhofer IBP and Fraunhofer IRB), the continuing-education programme QualiBene is positioned as an interdisciplinary qualification for engineers, architects, and craftspeople who want to act as generalists in old-building rehabilitation, explicitly linking research-based knowledge transfer with sustainable techniques for day-to-day building practice. (Fraunhofer Academy, 2026; Fraunhofer IBP, 2026)

In Bavaria, the Bauarchiv Thierhaupten of the Bayerisches Landesamt für Denkmalpflege functions as a practice-near hub between research and craft application. It combines an extensive collection of historic building components with seminars, consulting, and specialist workshops (including timber structures, building glass, and mineral building materials), and its programme includes repair-relevant topics such as substanzschonende techniques for the preservation and upgrading of historic glazing and windows (Bayerisches Landesamt für Denkmalpflege, 2026).

In North Rhine-Westphalia, the Akademie des Handwerks Schloss Raesfeld offers a dedicated “Denkmalpraxis” seminar track with hands-on courses that directly address craft repair and restoration tasks, for example historic windows, mortar and plaster technology, and cleaning of historic masonry and plaster surfaces (Weiterbildung Akademie des Handwerks Schloss Raesfeld, 2026a; Weiterbildung Akademie des Handwerks Schloss Raesfeld, 2026b). Together, these programmes address a core obstacle identified in practice. Repair quality depends on scarce cross-disciplinary expertise that integrates monument-compatible craft methods with building-physics reasoning and documentation, rather than on heritage or energy regulation alone.

There are various degree programmes in the field of sustainable buildings. These include, for example, sustainable refurbishment and construction of existing buildings, resource-efficient construction, and resource-efficient and sustainable construction. (HS Rottenburg, n. d.; HTW Dresden, 2025; TUM, n. d.) Association of German Engineers offers a wide range of continuing education courses. In the field of sustainable construction, for example, there are continuing education courses on topics such as renewable energy systems, circular value creation for building design, and a compact course on sustainable design and construction. (VDI Wissensforum, 2025) The German Sustainable Building Council (Deutsche Gesellschaft für nachhaltiges Bauen - DGNB) has its own academy, which provides a platform for the practical transfer of specialist knowledge on everything from sustainable planning, construction and operation of buildings to entire neighbourhoods (DGNB, n. d.d). DGNB will be explained in more detail below.

4.3 Evaluation Systems for Sustainable Buildings

In Germany, there are different options and systems to evaluate the sustainability of a building, some also include listed buildings. A few of them are also accepted in the EU or even worldwide. Besides the following described evaluation systems, the “Building research establishment environmental assessment method” (BREEM) and the “Leadership in energy and environmental design” (LEEAD) are also globally highly recognised systems.

DGNB

The DGNB certification assesses six criteria: environmental quality, economic quality, socio-cultural and functional quality, technical quality, process quality and site quality. It is based on three key concepts which are life cycle assessment, a holistic approach and performance orientation. (DGNB, n. d.a) In the context, the certification criteria are adapted into different schemes, including new construction and renovation of buildings, buildings in use, district development, interior fittings, deconstruction of building stock and construction sites (DGNB, n. d.b). In the case of certification for renovations, the special requirements for listed buildings can also be considered (DGNB, n. d.c). The certification is most widespread in Germany but is also used at EU level and internationally (DGNB, n. d.a).

Sustainable Building Assessment System (*Bewertungssystem Nachhaltiges Bauen* - BNB)

The criteria of the BNB are the same as for the DGNB system and is used in Germany. These criteria can be utilised for four types of buildings, namely office buildings, educational buildings, laboratory buildings and outdoor facilities. (BMWSB, 2025b) Buildings that are listed as historic monuments, are part of an ensemble or have monumental value can also be certified. An accompanying document on monument protection is available for this purpose, which considers the requirements for the building separately in some criteria. (BMUB, 2017)

Sustainable Building Certification (*Qualitätssiegel Nachhaltiges Gebäude* - QNG)

The QNG is a national quality seal that standardises the concept of sustainability in the context of buildings and forms the foundation for the allocation of subsidies. A distinction is only made between residential buildings and non-residential buildings. Residential buildings are also assessed using the five criteria already mentioned by the DGNB and BNB, but four additional criteria are added here. These are comfort and functionality, resource consumption and environmental impact, efficiency as well as cost and long-term value retention, planning processes and management requirements. (BMWSB, 2025c) The QNG is also required for one of the enhanced funding possibilities introduced in the next chapter.

5 Funding Possibilities

In Germany, financial support for interventions on listed buildings and other valuable building substance spans two distinct logics. One set of instruments supports fabric-preserving repair and maintenance, meaning measures that restore or maintain function and substance with minimal replacement. Another set supports performance-oriented refurbishment, especially energy upgrades that go beyond maintaining the existing state. Funding is provided through public programmes, tax incentives, and private foundations, with public funds originating from federal, state, district, and municipal levels. (DNK, n.d.a)

From the government the funding program “Special Programs for the protection of monuments” has already supported several thousands of national important cultural monuments and historical organs with their rehabilitation. Mostly, the funding take over 50 percent of the eligible costs for funding. (BKM, 2025c) Additionally, a separate “Investment Program for Industrial Heritage” were established to encourage the coal regions in Germany in a social sustainable development, to counteract the effects of the coal phase-out. Investment measures for the protection, rehabilitation, restauration as well as accessible modernisation of industry plants are supported. Both fundings are coordinated and processed by the respective federal state. (BKM, 2025b) According to their heritage protection laws, the federal states are obliged to support and promote owners to a certain extent in their conservation measures for listed buildings, with the amount of funding being based on the available budget of the federal state (e.g. BayDSchG Art. 20). Another financing option for local authorities is the Urban Development Support programme. Between 1991 and 2019, urban monument preservation had a separate funding option. During this period, around 700 measures were implemented in nearly 600 municipalities. Since the programme was restructured in 2019, urban monument protection has been represented as a cross-cutting issue in all areas (BMWSB, 2024a). The federal government, the states and the municipalities each contribute one third of the financing. Under certain conditions, for example if the municipality is subject to budgetary supervision, the municipality's share can be reduced to up to 10%. For the funding, the project's goals must focus on one of three key areas. One relevant area is “strengthening the urban planning function of city centres and district centres, with particular emphasis on housing construction and the preservation and maintenance of historical monuments.” (BMWSB, 2024b)

For the energetic rehabilitation on buildings, listed buildings and residential buildings with “other building substance particularly worthy of preservation” the KfW grants loans as part of the federal subsidy for efficient buildings program (*Bundesförderung für effiziente Gebäude* - BEG). In the case of the latter two categories of buildings, “efficiency-house monument experts” are consulted to provide information on permits and develop individual measures for the buildings that are in accordance with monument protection regulations. Projects are eligible for funding if, after renovation, the building achieves an annual primary energy requirement of no more than 160% of a comparable reference building according to GEG. These simplified requirements only apply to listed buildings or “other building substance particularly worthy of preservation”. Stricter requirements apply when granting loans for other energetic rehabilitation. The maximum loan amount is currently €120,000 and €150,000 if additional measures are taken for heating systems based on renewable energies or if the building meets the requirements for the QNG. The local authority is responsible for deciding whether a building is particularly worthy of preservation. (KfW, 2025) To qualify, the building must be located in a redevelopment or conservation area (see § 136, 172 BauGB explained in chapter 3.3), fall within the protection area of an old town charter, be part of an ensemble, or be considered worthy of preservation for other reasons. Other recognised reasons may include “the age of the building or its special (urban) location” or “its specific materiality, design, construction method and architectural appearance as part of regional building tradition”, characterising the town- or landscape. (KfW, n. d.)

Repair-oriented measures are most consistently supported where funding explicitly targets substance preservation rather than performance upgrading. At federal level, the Denkmalschutz-Sonderprogramme focus on Substanzerhalt and restoration in the sense of monument preservation, and the federal share can reach up to 50% of eligible costs, while purely use-driven modernisation measures are generally not eligible (Bayerisches Landesamt für Denkmalpflege, n.d.). Complementary to public funding, the Deutsche Stiftung Denkmalschutz explicitly treats fabric-preserving repair as eligible. It defines eligible measures as work for durable preservation of cultural monuments in their original substance, including fach- and material-appropriate repair or rehabilitation of the building structure and restoration and conservation measures (Deutsche Stiftung Denkmalschutz, n.d.). At state and municipal level, dedicated schemes can directly cover repair and upkeep, for example programmes framed as support for Erhaltung, Unterhaltung and Wiederherstellung of monuments with subsidies that can reach up to 50% of monument-related additional costs, subject to coordination with the competent heritage authority ("Förderdatenbank", 2024). In addition, the tax regime supports repair-like measures on listed buildings through increased depreciation options. § 7i EStG refers explicitly to Modernisierungs- and Instandsetzungsmaßnahmen on buildings that qualify as monuments under state law, which can make incremental repair packages financially viable where grant funding is limited (Einkommensteuergesetz [EStG], n.d., § 7i). A practical obstacle remains that many programmes and administrative pathways are optimised for larger refurbishment projects. Small preventive repairs and cyclical maintenance often face disproportionately high transaction costs in application and documentation relative to grant size, which can delay “repair first” interventions even when they are technically and heritage-wise preferable.

In addition to public funding, there is also private funding from associations or foundations such as the German Foundation for Building Culture, the Wüstenrot Foundation or foundations specifically for church monuments or castles. (DNK, n.d.a) The German Foundation for Building Culture, e.g., is particularly committed to the protection and preservation of historic buildings and promotes repair, renovation, restoration and conservation measures on listed individual monuments (Deutsche Stiftung Denkmalschutz, n.d.). However, the focus here is not on energy-efficient renovation.

Besides public and private funding opportunities, German income tax law (*Deutschen Einkommensteuerrecht* - EStG) provides for depreciation options in § 7h, 7i and 10f EstG, which apply to the costs of construction and maintenance measures on historic buildings (but not on “other building substance particularly worthy of preservation”). This is intended to provide financial balance, as the heritage protection law is expected to result in increased costs for the owner. (DNK, n.d.a) In the year in which the measures are implemented and in subsequent years, the costs can be deducted to a certain extent in accordance with § 7h and 7i of the EstG or tax relief can be claimed in the form of deductions for special expenses in line with § 10f and 10g of the EstG. Section 10f of the EStG refers to historic buildings used for residential purposes, and § 10g of the EStG refers to cultural assets worthy of protection that are used neither to generate income nor for residential purposes. The second section also applies to buildings or parts of buildings that are not listed buildings but belong to a group of protected buildings or complexes under the respective state law. (§ 10g Abs.1 Satz 2).

EU funding opportunities do not normally cover measures directly relating to monuments themselves but rather focus on their significance for cultural identity and as places of dialogue (DNK, n.d.a). One example is the EU's Creative Europe cultural funding programme. However, this focuses on exchanges in the cultural and creative sectors, film and journalism. (Creative Europe Desk KULTUR, 2025)

6 Questionnaire Results

To gain a better understanding of the perception of different stakeholders regarding VBE, an online survey was conducted between September and mid-October 2025. In total 43 people participated in the survey but only 23 finished the entire questionnaire (Interview Guideline see Appendix A). For further evaluation of the results only completed questionnaires will be considered.

The larger share of the participants with fourteen are men, followed by seven women and two did not provide an information about their gender (see Appendix B). Only age groups between 31 and 70 are represented, but the majority is between 51 and 60 years old (see Appendix C). They come from cities with diverse sizes. Half live in a big town, only two in a small town and the remaining seven in a medium-sized town or a rural municipality (see Appendix D). Three-quarters of the participants have a University Degree (Master, Diploma or Magister) as highest educational qualification, followed by three with a promotion and one each, bachelor's degree, and habilitation (see Appendix E). In terms of professional background, they are equally ten architects, engineers and restorer or conservators, and only one academic or professor (see Appendix F). They participate in different tasks or functions during refurbishment or conversion projects (see Figure 4). Most of them function in consulting or planning questions during refurbishment or conversion projects, some of them are representatives of a public authority and even two own a historic or cultural valuable building.

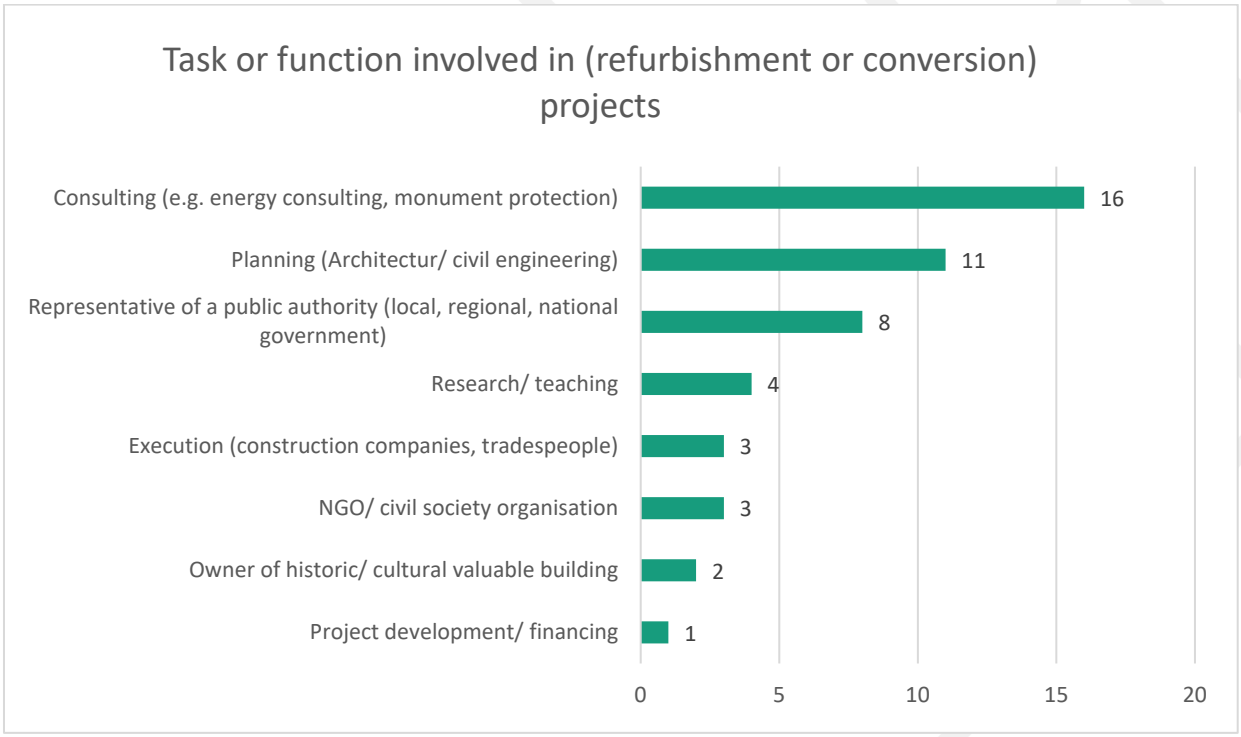


Figure 3 Questionnaire results – Task or function participants are involved in projects

The majority with 17 participants is quite experienced in the field of refurbishment, conversion, or preservation of VBE, because they already supported more than five projects, five people accompanied between one and five projects and only one does not have any experience (see Appendix G). Almost three-quarter of them were directly involved in the refurbishment of VBE (see Appendix H). During the refurbishment of VBE, only a good half (thirteen participants) applied for financial support through public

funding and none for private funding. The remaining ten did not apply for any funding at all (see Appendix I). From the thirteen applications for public funding, five have been approved completely while the rest only received a part of it (see Appendix J).

The participants are most familiar with national regulations regarding refurbishment, which can be explained with their professional background, followed by climate mitigation and climate adaption. Knowledge or familiarity is significantly lower for risk assessment or circular economy regulations (see Figure 5). That could be also connected to the option of the participants on how strong current legislation support the implementation of different topics in VBE-refurbishment. Most supported topics by the current legislation for the implementation of VBE-refurbishment are energy-efficiency and refurbishment, least supported is risk assessment (see Appendix K).

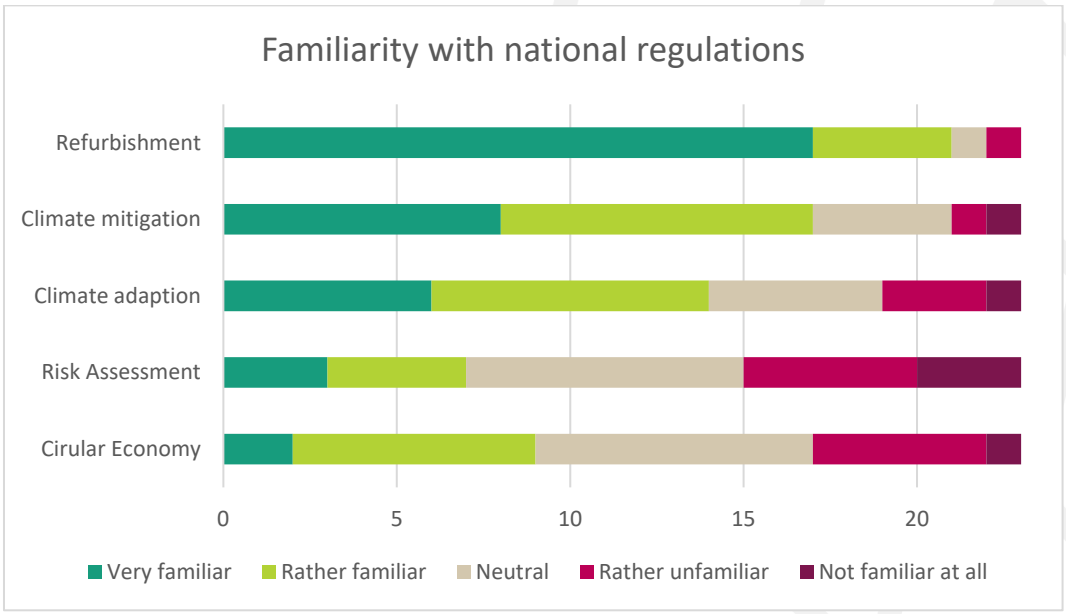


Figure 4 Questionnaire results – Familiarity of participants with different national regulations

Among the most used standards are national regulations and the heritage protection law or VBE-specific legislation, less often applied are DIN-/EN-/IDSO-Standards or local regulations. None of the participants use international standards (UN, UNESCO, ICOMOS) or sustainability certifications such as BREEM or LEAD. Important to mention is that they could only select one answer to this question, not several. (see Appendix L). The biggest gab in the current legislation the participants stated is the lack of connection between monument protection and environmental goals, but also no harmonisation between technology and monument preservation (see Appendix M). In general, the biggest obstacles to implementing refurbishment measures in VBE are complicated communication with authorities, complex approval procedures, high costs and lack of digitalisation (see Appendix N). To implement measures in VBE-refurbishment regarding climate change mitigation and or adaption, the biggest obstacles are lack of government funding, low public awareness or support and lack of technical knowledge or expertise. Often mentioned as biggest obstacles to implementing energy efficiency measures in VBE-refurbishment are lack of technical knowledge or expertise, low public awareness or support as well as lack of financial resources and complicated communication with authorities. Most frequently stated as big barrier to implementation of circular economy principles in VBE-refurbishment is lack of access to appropriate technologies (see Appendix N). Financial incentives or subsidies were most frequently cited by participants as particularly helpful forms of support for successful VBE-refurbishment, but simplified approval procedures, technical training and guidelines were also mentioned. They hardly ever mentioned

access to case studies and best practices, or even digital tools for simulation and risk assessment (see Appendix O). Three-quarters stated that direct grants were helpful financial tools, four cheap loans and only two tax incentives (see Appendix P).

The participants have already implemented various sustainability measures during their VBE-refurbishment projects (see Figure 6). Almost all used energy-efficient windows and insulation, seventeen integrated renewable energy sources and sixteen applied natural ventilation and the use of daylight. Least commonly utilised were water efficiency measures and life cycle assessment (LCA) measures. A good half of the participants assess the project's impact on the environment and its sustainability by the energy efficiency, further ten by the determined carbon footprint of the materials used and eight by an LCA (see Appendix Q). Three do not perform any assessment.

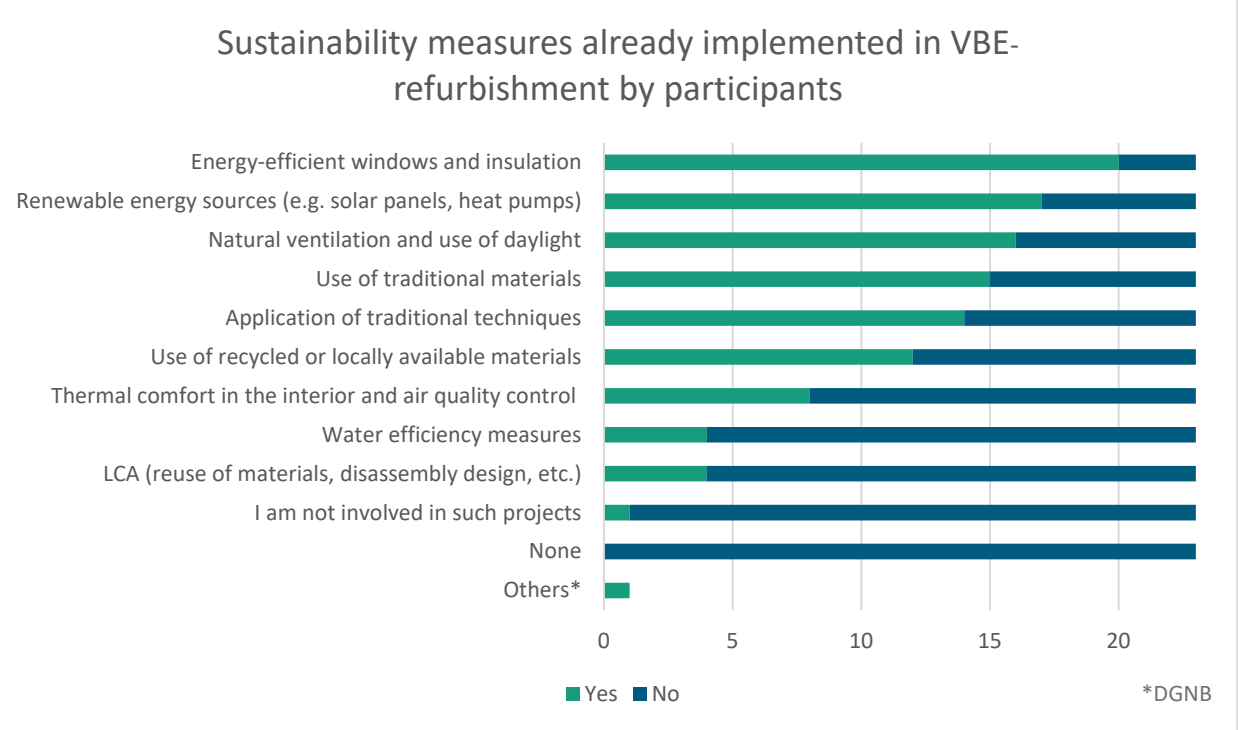


Figure 5 Questionnaire results – Sustainability measures already implemented in VBE-refurbishment by participants

Half of the participants estimate the public interest and support of VBE preservation as positive, nine as neutral and even tree as negative (see Appendix R). Only five participants consider it very important to involve the public in further decision-making processes, while in each case nine consider it important or neutral. (see Appendix S). As most relevant method to support public participation, information events are stated (see Figure 7). Also, workshops or seminars are named often as relevant, compared to online surveys, which are neither relevant nor irrelevant or completely irrelevant. The category "others" was not further specified.

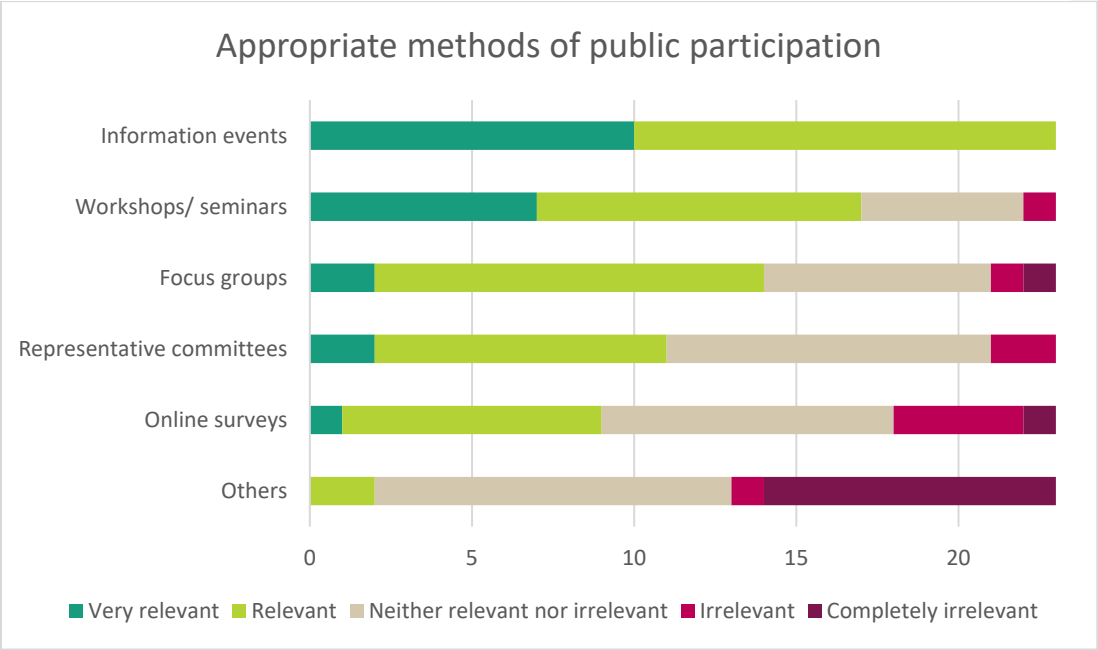


Figure 6 Questionnaire results – Appropriate methods of public participation

The two biggest social challenges in the sustainable refurbishment of VBE are difficult funding options and the lack of knowledge among the population (see Appendix T). Slightly more than half of the participants the half see social challenges in low motivation to participate, challenges posed by an ageing population and restrictions due to heritage protection. Only three referred the lack of suitable technical solutions as social challenge.

For the further implementation of the whole project, the question of useful training opportunities for the participants was also of interest. Fifteen find training opportunities for technical expertise in VBE-refurbishment useful (see Figure 8 next page). Further ten consider LCA trainings helpful and nine risk assessment trainings. Training on laws or standards was mentioned least often.

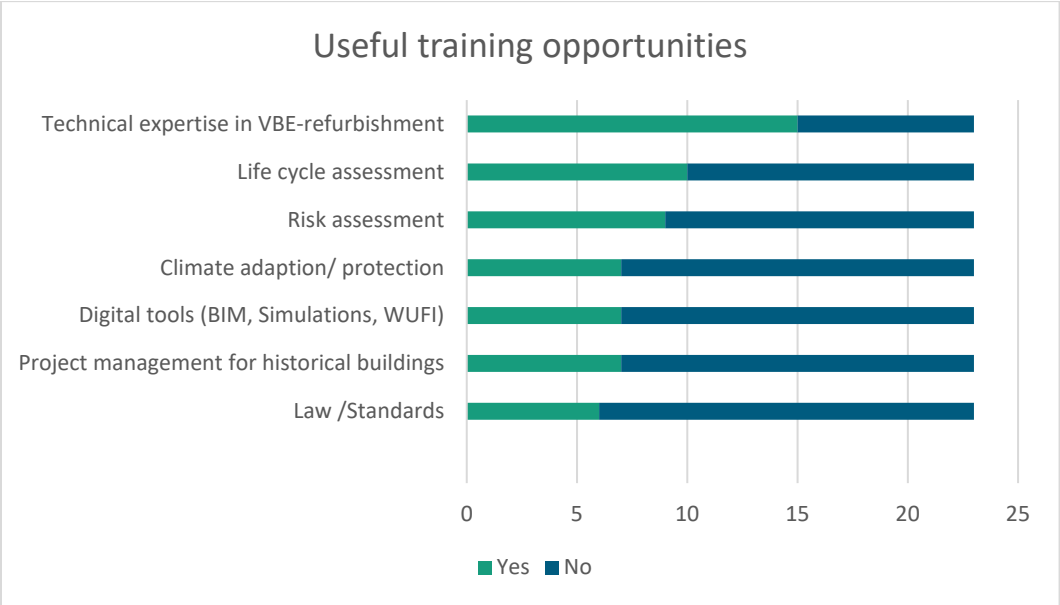


Figure 7 Questionnaire results – Useful training opportunities

The survey results can be used to better evaluate the status quo as the process continues and to make recommendations based on this assessment. In addition, an initial assessment of public attitudes and participation in VBE-refurbishment processes can also be made, for example. The next chapter also presents best practice examples of what public participation in such processes can look like.

7 Best Practices

This chapter present selected best practice examples where renovation or reuse of buildings contributed to preserving or improving the city or village image. It shows how specific design, material, and governance choices at building level support the protection of the city image.

Scope and case selection:

- Existing building or ensemble
- Intervention after 2000
- Clear intention to preserve or improve the city or village image
- Sufficient documentation to understand design and process

Define boundaries:

- Country: Germany
- Building types: heritage, infrastructure, public use, health, sport, culture
- Include both top-down projects and bottom-up citizen initiatives
- Exclude purely technical retrofits without a stated townscape or heritage goal

7.1 Esslingen am Neckar, Baden-Württemberg

First, an example of what ensemble heritage protection can look like and how citizen participation can promote solar panel use on listed buildings. In Esslingen am Neckar, a whole section of the old town is listed as an ensemble under § 19 DSchG BW (see Figure 9). The area was recognized as evidence of preindustrial urban development and an important document of urban planning for the industrial development that was significant for Württemberg. This protects both the external appearance, as seen from the surrounding slopes (see Figure 10), and the internal appearance, characterized by historic buildings along streets and squares as well as water areas, green and open spaces. Any changes to the protected image of the overall layout of the ensemble must be approved by the monument protection authority. (Stadt Esslingen, n. d.) The ensemble was listed in 2001, and since 2015 the following changes have been subject to approval:

- “The construction, alteration and demolition of structures and other facilities and installations within the meaning of the State Building Code, even if they do not require a building permit,
- the construction of other facilities and installations, if they are not only temporary, in public traffic areas,
- exterior wall cladding and roofing, including thermal insulation measures, facing, plaster and paint on buildings, together with façade elements such as doors, windows and shutters, awnings, blinds, advertising installations, vending machines, display cases, antenna systems, outdoor lighting, installations for photovoltaic and thermal solar energy use,
- the alteration of green spaces, open spaces and water areas and the banks of the Neckar Canal” (Stadt Esslingen am Neckar, 2015, p. 2)

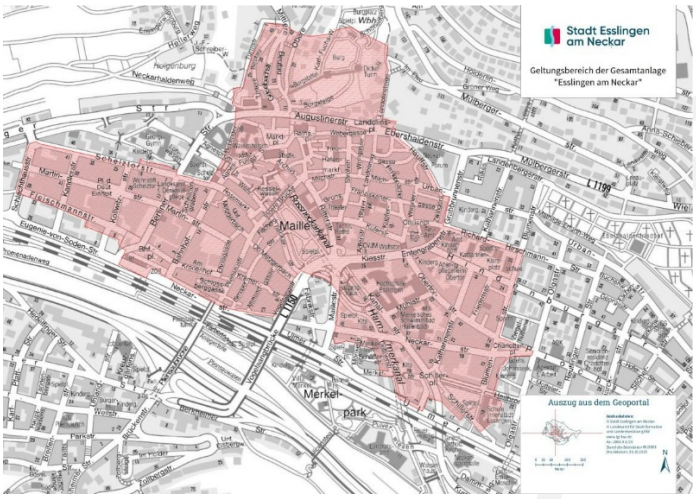


Figure 8 Area of the ensemble in Esslingen am Neckar (Stadt Esslingen, n. d.)



Figure 9 View of the ensemble in Esslingen am Neckar (Stadt Esslingen, n. d.)

In 2023, a group of homeowners and shopkeepers in the historic old town, calling themselves “solar rebels”, submitted a legal expertise against the city's rejection of photovoltaic systems on their roofs. The lawyers' expertise identified significant legal concerns in the city's rejection, which justifies its rejection on the grounds of possible adverse effects on the appearance of the town. The solar rebels believe that heritage protection should be subordinate to the public interest of climate protection and that owners of listed buildings should also be allowed to use low-cost electricity generation, for example through solar modules. (Weiß, 2023) In early 2025, a project to install a solar power system on one roof of the city's protected area was approved after several committees were consulted (Weiß, 2025). The example shows that citizen engagement can be successful and combine climate protection with heritage protection.

A landmark judgement at the end of 2024 may also have been decisive in this regard. The Higher Administrative Court in Münster (North Rhine-Westphalia) ruled in two cases that “when installing solar panels on listed buildings, the public interest in expanding renewable energies regularly outweighs the interests of monument protection” (Oberverwaltungsgericht für das Land Nordrhein-Westfalen:, 2024) Climate protection is also embedded in the DSchG BW. According to § 7 Abs. 2 DSchG BW, measures that contribute to achieving climate neutrality by 2040, i.e. energy saving, energy efficiency and renewable energies, should be given consideration when approving measures on listed buildings.

7.2 Möglhof in Rimsting, Bavaria

Identification

The Möglhof sport performance and therapy centre is operated by Sports Innovated GmbH in a listed former farmstead in Rimsting, Westernacher Str. 5, in the Chiemgau region. The ensemble has a long history as an agricultural holding with cattle stables and ancillary spaces. Classical farming ended in 2015. The building was then modernised and converted from agricultural use to commercial units from 2021 and opened as a sports und sports therapy centre on 1 April 2022. The current use is a high-tech sports and therapy centre for recreational and professional athletes, including diagnostics, rehabilitation and performance training, with about 1 100 m² of specialised infrastructure (see Figure 11). (Sports Innovated GmbH, n. d.; Trummer, 2023)



Figure 10 Façade of Möglhof (Beushausen, 2023)

Problem and claim

The Möglhof sits in a regional context where many traditional farmsteads disappear once agricultural use ceases. This trend weakens the specific village character of the Chiemgau. After farming stopped, the building faced vacancy and loss of use. At the same time, heritage protection defined the Bundwerk façade as relevant for the listing, which severely limited new façade openings. The design team had to reconcile high daylight demand for sports and therapy with strict constraints on altering the external appearance. The explicit goal of the project was to preserve the recognisable farm stead volume and the listed Bundwerk façade as townscape defining elements while giving the building a contemporary, economically viable programme (Trummer, 2023). The architect framed the aim of maintaining the unique charm and identity of local villages at a time when farms are vanishing and treating the Fachwerk façade as a key component of this identity.

Relevance for the study

The Möglhof illustrates how an individual heritage building can support village image protection when three conditions align. Townscape critical elements such as volume, roof form and façade rhythm are treated as non-negotiable. Building physical interventions concentrate on less visible surfaces, here the roof and interior, to deliver daylight and energy performance without major façade change. A high intensity sports and therapy programme anchors regular activity in the historic fabric instead of moving it to the settlement edge. The case links surface level decisions on façade, roof and materials directly to perceived village character and to programme choice, which is central for an evaluation system that connects urban surfaces, comfort and image. (Trummer, 2023)

Measures and design choices

The physical interventions focus on keeping the external appearance stable and shifting most changes into the roof and interior. The overall building volume and roof form remain unchanged, although the roof had to be opened for a continuous daylight strip and structurally corrected for a longitudinal slope of about 20 cm. The listed Fachwerk and Bundwerk façade is preserved. In agreement with the heritage authority, every second timber board was removed to increase daylight penetration while keeping the original pattern legible. Inside, the historic timber structure is cleaned and retained (see Figure 12). Local strengthening of the floor structure with steel beams and partial new intermediate floors along the sides create enclosed therapy rooms. The centre of the building remains an open atrium with a visible roof truss that recalls the stable's former spatial character (see Figure 13)



Figure 11 The historic timber structure (Beushausen, 2023)



Figure 12 The newly created atrium (Beushausen, 2023)

A continuous skylight band about 19.2 m long, consisting of 16 triple glazed modules with solar control glass and a UW value of 0.79 W/m²K, is installed along the ridge on the north facing roof slope (see Figure 14). It supplies diffuse daylight without strong solar power, and five modules are motorized to support natural ventilation. The south facing roof slope carries a photovoltaic array. A narrow metal ridge strip separates the PV field from the north side skylight so that both systems read as a calm, coherent roof in the village roofscape (see Figure 15). The roof structure is upgraded by doubling the height of the rafters, adding a variable vapor control layer and cellulose insulation, and re-roofing with tiles in line with local practice. The material palette overall follows the regional vocabulary. Timber, plastered masonry, tile roofing and modest metal profiles at the skylight keep the external expression close to the original farm stead.



Figure 13 The roof opening for the new skylight (Beushausen, 2023)



Figure 14 The new skylight in the roof (Beushausen, 2023)

Nonphysical measures frame and stabilize the design logic. The building is listed, with the Bundwerk façade explicitly recognized as heritage relevant. This constrains façade interventions and steers the design team towards roof and interior solutions. The owner and architect are the same person. This concentrates responsibility for both heritage protection and project economics and simplifies decision making. The future operator, Sports Innovated GmbH, joined the process early. Its functional requirements as sports and therapy centre informed the spatial and technical concept before structural measures were fixed. Detailed negotiation with the lower heritage authority defined how far the Bundwerk fields could be opened and supported the decision to solve daylight demand through skylight with solar control glass instead of larger façade windows.

The operator positions the centre as a regional hub for performance training and rehabilitation. This reinforces its function as a visible public anchor within the existing village fabric rather than as a hidden, specialized facility.

Design implications

Lesson 1. Prioritise non-negotiable townscape elements

The Möglhof treats farmstead volumetry, roof form and Bundwerk façade as non-negotiable identity carriers. For similar buildings, planners should first map façade zones and roof segments that must remain almost untouched to preserve the village streetscape. Based on this, they can define a limited catalogue of acceptable modifications, such as small-scale board removal or discreet infill glazing, instead of starting from a blank design field.

Lesson 2. Use roof-based daylighting to protect façades

The continuous skylight band on the north side, combined with photovoltaics on the south side, provides deep daylight and energy generation without cutting large new openings into the façade. For other listed buildings, default strategies should consider roof-based daylighting on less solar exposed slopes, with solar control glazing and, where needed, external shading, before proposing major changes to heritage façades. This reduces the conflict between comfort, energy, and townscape protection.

Lesson 3. Link heritage protection with intensive contemporary use

The project demonstrates that a listed farmstead can host a high intensity performance hub with year-round use. This keeps people and services in the historic fabric and raises awareness of the building, instead of turning it into a low intensity or purely symbolic object. Municipalities that want to protect village image can use this logic to actively seek operators with strong public or semi-public programs for heritage buildings, rather than defaulting to residential or occasional uses.

Lesson 4. Embed governance into design from the start

The integrated role of owner architect, the early involvement of the operator and the ongoing coordination with the heritage authority conflict and enable targeted solutions such as limited board removal and a skylight band. For planning frameworks, early three-way dialogue between owner, heritage authority and future operator should be treated as a basic condition for comparable conversions. This reduces redesign cycles and increases the chance that both townscape and functional requirements are met.

Residual uncertainty

The case leaves several relevant questions open. There are no surveys published or interviews on how residents, visitors or users perceive the converted building and its contribution to the village image. Claims about improved perception remain plausible but untested. There is no monitored data on energy consumption, indoor thermal conditions, daylight metrics, or occupancy patterns. The performance of the skylight band and the photovoltaic system under heat waves and their contribution to reduced artificial lighting demand and thermal comfort are therefore not quantified. The solution also depends on contextual factors. a moderate roof pitch that can accommodate the chosen skylight system, a north facing roof slope, an active sports and therapy operator and a Bavarian rural heritage framework that values Bundwerk façades. There is no systematic evidence that the same combination of design rules and governance arrangements would work in different climates, settlement types, or regulatory regimes. For your evaluation system this means that the Möglhof can inform rules about protecting townscape critical

surfaces and prioritizing roof-based interventions, but it cannot, on its own, justify universal thresholds or transferability assumptions.

7.3 Talvogtei in Kirchzarten, Baden-Württemberg

Identification

Today's “Media library Kirchzarten” is located on Talvogtei Str. 5, Kirchzarten, next door to and connected by a glass bridge to the administration building (Talvogtei Str. 2a). Kirchzarten is in the district of Breisgau-Hochschwarzwald, Baden-Württemberg. (Staatsministerium Baden-Württemberg, 2022) Both buildings are former barns and are listed buildings. The eastern barn (see Figure 16 left and Figure 17 right building) was part of the “Schurhammi Mill”. Today, it is used by the municipal administration and houses a community hall on the upper floor. The western barn opposite (see Figure 16 right and Figure 17 left building) originally belonged to the “Stöcklemühle Mill” and is now used as a media library, library and café. Both renovations were completed in 2017 and covered a gross floor area of approximately 1,690 m². (sutter³ GmbH & Co. KG, 2024) Both barns are located near the “Talvogtei”, a moated castle that is now used as the town hall. Talvogtei consisted of two farm estates (Schurhammi and Stöcklemühle) in the settlement of Schalampi in Kirchzarten, each of which had a barn built around 1830. The barns were built for agricultural purposes and were later used only as storage facilities. They are an important example of local building culture and were long unused or used occasionally for village festivals. In the 1960s, the municipality of Kirchzarten acquired the barn of the Stöcklemühle, now the media library. The decision to renovate the two listed former barns was made in 2012. (Süppel, Sutter, & Manz, 2021) For this purpose, the municipality purchased the second barn of the Schurhammi, which is now used as the administrative building (Staatsministerium Baden-Württemberg, 2022).



Figure 15 View from the north of the renovated barns (Süppel et al., 2021)



Figure 16 View from the south of the renovated barns (sutter³ GmbH & Co. KG, 2024)

Problem and claim

The extensive renovation of the whole historic Talvogtei area in Kirchzarten was implemented between 2011 and 2022 as part of an Urban Development Support programme. Measures primarily focused on preserving and developing the two barns, but public and privately used buildings were also renovated, and paths were redesigned and expanded to be barrier-free. The overall goal was to improve the living environment and infrastructure for community purposes. (KommunalKonzept Sanierungsgesellschaft mbH, n. d.) The renovation saved the two long-unused barns from decay. Taking into account the historical

building fabric, the aim was to make them usable for the citizens of Kirchzarten. (Staatsministerium Baden-Württemberg, 2022)

Importance of the case study

The renovation of the Talvogtei area, particularly the media library and administrative building in Kirchzarten, is an example of how the history of the region can be linked to social needs nowadays. During the project, care was taken to make as few changes to the building as necessary, especially to its appearance. An additional working group was also set up for the project, with representatives from all stakeholders, including architects, future users, administrators, and municipal authorities. This meant that not only were the interests of the community considered in the planning process, but also the needs and requirements of other parties involved, whose feedback on the proposals was also considered. (Süppel et al., 2021) This also makes it a project for participation and inclusiveness.

Measures and design choices

To make the entrance area more open and accommodate the flow of visitors, the initial idea of extending the barn was rejected, as this would have required changes to the building structure. The implemented variant now includes an additional volume that clearly differs from the old structure. The new structure is made of steel and was inserted into the two-storey section that formerly served as an entrance, but it extends significantly further. All that was required for this measure was to remove the old barn door. Upon entering the building, visitors now have an unobstructed view of the fully preserved roof truss. The choice of raw steel means that the inserted volume will age and blend in with the building over time. (Süppel et al., 2021)

The interior was designed in consultation with the building authorities in Kirchzarten, using locally sourced silver fir wood. This was used as solid structural timber and for interior fittings such as flooring (see Figure 18). (sutter³ GmbH & Co. KG, 2024) Great importance was also attached to accessibility in the interior design, and there are two disabled parking spaces available in front of the building. All three floors are accessible and feature a guidance system for blind people, which helps those with visual impairments to find their way around (see Figure 19). In addition, a PC with special hardware and software is available, as well as magnifying glasses and adjustable, mobile light sources. In 2022, the media library also received a certificate as “barrier-free certified”. (Mediathek Kirchzarten, n. d.) An easily accessible floor covering suitable for wheelchairs was chosen for the outdoor area. The entrance door opens and closes automatically. Furthermore, the interior of the building has no doors whatsoever. This was a conscious decision to make the rooms accessible to everyone. Fire safety was achieved by adding an additional escape route on the upper floor via the glass bridge to the Administration Building. A elevator was also installed. (Süppel et al., 2021) Inside, a reading café invites visitors to linger, and the library is equipped with modern library technology. New materials, e.g. concrete and steel, and old material, e.g. historical wall constructions as well as weathered plastering, are perfectly harmonised, as Süppel et al. (2021, p. 129) describe the interior as follows “History and modernity are present together, complementing each other, accepting each other’s value, standing side by side in friendly and respectful companionship. The visitor experiences the combination of things old and new not as a contradiction, but as a synthesis.”



Figure 17 Interior design with silver fir flooring (sutter³ GmbH & Co. KG, 2024)



Figure 18 Blind guidance system on the floor (Mediathek Kirchzarten, n. d.)

The entire Talvogtei project was supported by the Urban Development Support programme. Overall, the project received €4.4 million in financial support, with €2.2 million coming from the federal government. This money was used to renovate the two barns and several other private and public buildings, such as the kindergarten. (Staatsministerium Baden-Württemberg, 2022)

Evidence and indicators

Before and after pictures are available for the descriptive documentation of the renovation process of the administrative building (see Figure 20 to Figure 23), as well as pictures of the interior work of the media library. In 2022, the media library was honoured by Black Forest Building Culture (Baukultur Schwarzwald) in “New Building in the Black Forest and South Baden” (sutter³ GmbH & Co. KG, 2024).



Figure 19 Administration building and community hall before renovation, north (KommunalKonzept Sanierungsgesellschaft mbH, n. d.)



Figure 20 Administration building and community hall after renovation, north (KommunalKonzept Sanierungsgesellschaft mbH, n. d.)



Figure 21 Administration building and community hall before renovation, south (KommunalKonzept Sanierungsgesellschaft mbH, n. d.)



Figure 22 Administration building and community hall after renovation, south (KommunalKonzept Sanierungsgesellschaft mbH, n. d.)

Compared to the old library in the school centre, the new media library in the former barn has almost twice as many active users, and the borrowing rate rose from 50,000 to 64,500 in 2019. The media library Kirchzarten has 25,000 visitors annually (Süppel et al., 2021). This may serve as an indicator that the new media library is more appealing and that people enjoy spending time there.

Design implications

Lesson 1. Combining the old and the new

The municipality's goal was twofold: to preserve important buildings that are significant to the town's identity, and to revitalise the town centre (Süppel et al., 2021). With the project to renovate the old barns, they have given new life to the community. Good communication via the Internet and the local newspaper helps to spread the word about the Media Library's offerings and provide information about services, events and other activities (Süppel et al., 2021). By consciously coordinating the old substance with the newly used materials, a harmonious overall picture can be created. The newly added steel volume provides sufficient space to accommodate all the media library's functions and the café. Its thoughtful architectural use allows it to blend perfectly into the overall picture.

Lesson 2. Centralise participation and inclusiveness in planning process

In addition to the interests of the client, the planning process should also consider the interests of the community and, above all, the future users. This ensures that all stakeholders can contribute and that the project is successful and widely used after the implementation. Today, the media library in Kirchzarten is actively used by the local population to spend valuable time in a non-commercial environment (Süppel et al., 2021). The involvement of the monument protection authority is important, and even after a proposed measure has been rejected, an alternative must be found together. Accessibility and renovation in listed buildings is possible if certain obstacles, such as fire safety, are carefully considered and there is a willingness to make listed buildings accessible to everyone.

Residual uncertainty

The increased borrowing rate may be an indicator that the new media library is more popular than the old one, but there are no surveys or other opinion polls on the extent to which the use of the old barns and their historical value contribute to this. Nor is there any indication of whether the media library strengthens people's connection to their local identity. The implementation serves as a good example of how old and new can be combined and how important participation and inclusiveness are in the planning process. However, there is no detailed documentation on exactly how and how often stakeholder

meetings and discussions took place, making it challenging to transfer the model to other projects. The complete renovation of the barn into the media library Kirchzarten cost €2,800,000 (Süppel et al., 2021). This would probably not have been possible without Urban Development Support programme, which underlines the importance of such support programmes.

8 Discussion and Research Findings

Finally, the results and findings are discussed, and the research questions are answered. In the context of the sustainable repair and refurbishment of VBE, identified gaps, obstacles and lessons learned are identified and recommendations are given. The limitations of the study are briefly discussed at the end.

8.1 Gaps, obstacles, and lessons learned

National legal framework

The term VBE, as defined within the EU-Repair project and this study, does not exist in this form in either European or German legislation or policy. A more advanced form of VBE generally exists in the form of cultural heritage and monuments at the international level or through heritage protection laws in Germany. Heritage protection in Germany primarily provides extensive protection for three different categories: individual monuments, ensembles and ground monuments. Monuments are protected due to public interest, and primarily because of their historical, artistic, or scientific value. In the case of ensembles, entire groups of building structures can be placed under protection, even if only one or none is considered a preservable monument. If a building, a part of a building or ensemble is listed as a heritage site, state laws ensure that it is properly maintained and renovated and that any measures may only be carried out in consultation with the heritage protection authorities.

In Germany, the closest thing to the definition of VBE is “other building substance particularly worthy of preservation”, which is recognised in the Building Energy Act in addition to listed buildings. This term is not defined further in legal terms and is subject to interpretation by the local authority district. It gives local authorities a certain amount of flexibility, especially when it comes to financial support for owners undertaking energy-efficient refurbishment of valuable buildings within the KfW funding. However, it can also present local authorities with the challenge of determining the criteria for classifying a building as particularly worthy of preservation. The “Local Authority Working Aid for Building Culture – The Building Substance Particularly Worthy of Preservation in the Integrated Urban Development: Identifying - Recording - Evaluating Buildings”, published in 2021, is intended to address this issue (BMWSB, 2021). However, there are no indications that the working aid helps local authorities in making a clear decision about these buildings. Municipalities also can grant special privileges to buildings worthy of preservation through the Federal Building Code. The decision regarding buildings worthy of preservation within the Building Energy Act and the Federal Building Code, however, requires substantial knowledge on the part of the municipality and the responsible authorities. There is no data on how often authorities make decisions regarding building substance worthy of preservation, in how many cases this is successful, and in how many cases, for example, preservationists consider the rejection unjustified. Under the EU directive EPDG, member states are also allowed to make exceptions for the energy efficiency requirements of nationally, regionally, or locally officially protected buildings.

The Building Energy Act most significantly influences energy efficient building renovation in Germany to contribute to climate targets. It establishes minimum requirements for, e.g. thermal insulation and overall energy consumption of newly constructed buildings, as well as guidelines for renovations of existing buildings. The use of renewable energy and unavoidable waste heat to generate heat is also required by the Building Energy Act when a new heating system is installed in a building. Some national and international standards are available for calculating the energy efficiency of buildings or specific building components. Notably, there is also a Europe-wide standard (DIN EN 16883:2017-08) for the conservation of cultural heritage, which also relates to improving the energy efficiency of historic buildings.

When looking at the other relevant topics of this study, a clear gap in the legislative and regulatory framework becomes apparent. For renewable energies, alongside the GEG requirements for heating, there is the Renewable Energy Act. This generally sets targets for sustainable electricity generation and mentions buildings as a solution for the implementation of solar systems, but it does not provide specific guidelines. There are also no requirements for the use of renewable materials. Additionally, the Circular Economy Act is not building specific. The upcoming EU-wide standard could provide a benchmark here. Regarding climate adaptation, there is also a general law in Germany (Federal Climate Adaptation Act) that requires the government to present adaptation strategies for various clusters, including infrastructure with buildings. In the areas of risk assessment and participation and inclusiveness, the largest gaps exist, as there are no legislative requirements, only guidelines published within the framework of research projects.

Repair and maintenance is another area where gaps become visible between policy ambitions and enforceable practice. In Germany, repair of existing buildings is not governed by a single “repair law”. Instead, it is shaped by public-law triggers and by private-law and technical contracting practice that defines how repair work is specified, executed, documented, and accepted. The baseline private-law regime is the German Civil Code (Bürgerliches Gesetzbuch [BGB], n.d., § 634a). For works on a building (Bauwerk), defect claims generally prescribe after five years, and the limitation period starts with acceptance (Abnahme) (Bürgerliches Gesetzbuch [BGB], n.d., § 634a). In practice, enforceability depends on procurement and acceptance documents. The VOB framework is widely used when contractually agreed, with VOB/B governing execution and acceptance and VOB/C providing the trade-specific technical contract conditions, while DIN 18299 provides cross-cutting general rules for construction works (Deutsches Institut für Normung, 2019; ("Deutsches Institut für Normung, 2016, § 12; § 13", 2026;). A key obstacle is that “repair-friendly” intent does not become binding unless it is translated into tender clauses and measurable acceptance deliverables. Core compliance texts and VOB do not define “repairability” of components as a mandatory property. Repairability, understood as accessibility, separability of layers, reversible connections, and planned replacement, is mainly addressed through voluntary standards such as ISO 20887 and through service-life planning frameworks such as ISO 15686-1 (International Organization for Standardization, 2011; International Organization for Standardization, 2020). A practical lesson learned is therefore to operationalize repairability as a specification module in the toolkit, including a repairability annex that municipalities can attach to procurement documents and that requires as-built documentation (product identifiers, fixing methods, and disassembly steps) at acceptance ("Deutsches Institut für Normung, 2016, § 12; § 13", 2026). Where repair workflows involve hazardous maintenance activities or work equipment, additional planning and risk-assessment duties apply, for example under TRBS 1112 (Bundesanstalt für Arbeitsschutz und Arbeitsmedizin, 2019).

Digitalization

Digitalisation of heritage-related building processes in Germany is still marked by gaps and friction points that limit how far tools can plug into practice. Coverage is uneven: in Bavaria, for example, only a subset of lower monument authorities and building authorities currently participate in the online services for heritage permits and the digital building application, so whether an owner can apply online depends on the municipality, not just the legal framework. Online monument lists and geoportals exist in all kinds of formats. Interactive systems such as the Bavarian Monument Atlas, DenkXweb in Hesse or LWL-GeodatenKultur in Westphalia-Lippe expose part of the data, but frequently with the explicit caveat that they are “for information only” and that legally binding status must still be confirmed by the authority. Many e-government solutions introduce new portals without removing old channels, so owners navigate a fragmented landscape of state portals, municipal websites, PDFs and email uploads, often re-entering the same information in different formats. Internally, building and heritage authorities are only gradually moving from paper files to shared digital case systems. Projects like Bauportal.NRW and the OZG “digitale

Baugenehmigung" reduce media breaks for participating municipalities, but they still must integrate specialist offices, archives and long-term documentation practices that were designed for analogue workflows. For toolkit, this means that data access is inconsistent, machine-readable interfaces are rare, and any output must be designed to survive export into PDFs and human review, rather than assuming clean, end-to-end digital pipelines.

Education

In 2019, only 40,980 people worked in the field of monument preservation, with only 16% of these working in the field of building maintenance and renovation (Weißmann, 2021). Considering that there are far more architectural monuments (660,000 according to Liersch and Asef (2018)) and other building substance particularly worthy of preservation (estimated at around 1/3 of the building stock according to Wiedemann (2024)) or VBE in Germany, there is a significant shortage of trained specialists in this field. This poses a problem for the proper renovation of VBE now and in the future.

The majority of those employed in heritage conservation have trained as stucco plasterers (Weißmann, 2021). Specific training courses in monument preservation are rare. However, there are several master's degree programmes that specialise in monument preservation. There are a few training courses specifically for tradespeople or architects in connection with cultural heritage, as well as further training as an energy consultant for energy-efficient monuments within the framework of KfW funding. General degree programmes in sustainable construction are much more common, as are continuing education courses.

The training, study and further education programmes offered provide a good foundation for the most part, particularly in the areas of energy-efficient, sustainable renovation and general cultural preservation. However, the number of people trained in this field is too low and other topics such as circular economy, renewable resources, and especially risk assessment, climate adaption, participation and inclusiveness are underrepresented.

Evaluation Systems

In addition to the globally recognised BREEM and LEED rating systems, three further systems are used in Germany: DGNB, BNB and QNG. These promote a uniform basis for the assessment and requirements of building sustainability, even after renovation. DGNB and BNB also offer the option of certifying listed buildings, for which some criteria have been adapted. None of the systems explicitly assesses other building substance that is particularly worthy of preservation or any other VBE; the same criteria apply here as for "standard" buildings. This could be a barrier to obtaining VBE certification for sustainable buildings and, in the case of building substance worthy of preservation, to obtaining the higher subsidy rate under QNG, as the same requirements apply to them as to "standard" buildings.

Funding Possibilities

There are several useful funding opportunities in refurbishment of (listed) buildings, depending primarily on the scale of the project, the type of owner and the main objective. For large projects, federal funding is available, either for the general protection of historical monuments or, for example, specifically for industrial heritage. At the municipal level, there is the Urban Development Support Programme, in which the municipality must contribute one-third of the financing, but entire neighbourhoods are eligible for funding. Large publicly funded projects are predominantly long-term and require a high level of communication between the various stakeholders and good project documentation, which is associated with increased time consumption. Private funding is also available for locally limited heritage conservation projects.

Owners of listed buildings who are undertaking necessary renovation work to preserve them can apply for financial support from the respective federal states or reduce costs through tax relief. To take advantage of tax relief, you either need to be well versed in the field yourself or hire a tax advisor, which means additional time and money. KfW funding offers the most extensive support for owners who want to make their buildings more energy efficient. The funding is available for "normal" buildings, listed buildings and even the other building substance particularly worthy of preservation. For this purpose, experts must be consulted to determine which measures are possible on the listed building or the building substance worthy of preservation. On the one hand, this ensures that the measures do not alter the protected features or character of the building, but on the other hand, it also increases the effort required to obtain such funding.

In general, the focus here is once again on energy efficiency and thus climate protection or the general preservation of buildings. KfW funding also provides extra support for renewable energies for heating. Topics such as the circular economy, climate adaptation and risk assessment are not addressed in the funding possibilities.

Questionnaire Results

The online survey received a small number of responses and is not representative. This limits external validity and increases self-selection bias, so results should be treated as indicative signals rather than population estimates. Future data collection should reduce respondent burden and increase response probability through shorter instruments and higher-yield formats such as intercept surveys and semi-structured interviews.

First, funding uptake appears limited. Only 13 of 23 respondents applied for funding, which may indicate low awareness of available schemes and/or perceived barriers such as complex eligibility criteria and administrative burden (see Appendix I). Second, knowledge and perceived regulatory support cluster strongly around national refurbishment regulations, while circular economy and risk assessment remain weakly covered (Figure 5, Appendix K). This pattern suggests an implementation gap. Key actors do not perceive clear, actionable requirements or guidance for circular economy and risk assessment in VBE-refurbishment at present, which aligns with the absence of identified standards in Chapter 3.4. Third, the dominant governance gap is the missing link between monument protection objectives and environmental or climate goals. Twenty of 23 respondents flagged this as the largest gap in the legal framework, alongside insufficient harmonization between technical requirements and heritage protection (Appendix M). This indicates a coordination failure rather than a lack of generic guidelines.

Respondents report friction concentrated in three areas. Administrative complexity arises from burdensome approval procedures, difficult communication with authorities, and complex regulations. (Appendix N). Insufficient technical knowledge and limited availability of specialized expertise for certain topics, particularly circular economy and assessment methods. Economic constraints include high costs and limit or uncertain government funding, particularly for climate mitigation and adaptation measures. (Appendix N). Technology access also emerged as a specific barrier for circular economic implementation, which may reflect cost barriers and/or limited competence to apply methods such as LCA, supported by the low reported use of LCA in practice (Figure 6).

The survey signals that stakeholders prioritize structural enablers that reduce transaction costs. financial support and simplified administrative procedures (Appendix O). However, low spontaneous mention of digital tools or case-study access should not be interpreted as low need. It may reflect limited awareness or low confidence in tool usability. The safer conclusion is that the project should prioritize capacity building and actionable guidance, while designing any digital components to fit current workflows and to survive low digital maturity conditions. Training demand reinforces this, as respondents requested

technical expertise in VBE-refurbishment and explicitly identified LCA and risk assessment as priority training subjects. (Figure 8). Therefore, the project should treat circular economy and risk assessment as underdeveloped competencies with clear demand, and translate them into practical, heritage-compatible procedures and templates rather than additional high-level principles.

Best Practices

The best practice examples presented in Chapter 7 offer valuable insights for future guidance and tools within the EU-Repair project and general refurbishment of VBE, listed buildings and ensembles. First, Esslingen am Neckar is an example of how an entire district can be designated a historic monument ensemble in Germany. This could serve as a model for other countries where this type of monument protection does not exist. Solar panels were installed on the houses in the protected old town on the initiative of citizens. This enables monument protection and climate protection to be combined using renewable energies.

From the second example, the Mögelhof in Rimsting, suggests that non-negotiable elements of the townscape should be prioritized to preserve the identity of the place. The use of roof skylights can help protect the façades while also meeting energy requirements. Furthermore, the integration of heritage protection with intensive use shows that historic buildings can remain alive and increase their significance for the community. Involving the administration from the beginning of the design process is crucial for effective cooperation between owners, planners and heritage protection authorities.

Third, the project in Talvogtei also emphasises that participatory and inclusive approaches should be integrated into the planning process to address community needs and ensure project acceptance. In addition, the thoughtful use of new or modern materials can also create a harmonious overall picture to meet the requirements for future use.

8.2 Recommendations

To ensure the sustainable refurbishment of VBE in Germany, several issues should be advanced, particularly from the government or ministry side. Currently, there is a clear focus on the energy efficiency of building. However, there should also be more explicit regulations and guidelines regarding the circular economy and renewable materials in the building sector. It is particularly important to achieve synergies between heritage protection or VBE and environmental goals. Additionally, guidelines related to climate adaptation, risk assessment, and participation and inclusiveness would be helpful for successfully and sustainably implementing measures in the long run.

Repair and maintenance should be strengthened as an explicit policy field alongside energy renovation, because “repair first” does not become enforceable unless it is embedded in procurement and funding requirements. Repairability should be treated as measurable properties. Accessibility, separability of layers, reversible connections, and planned replacement. Funding and public procurement should therefore require a standardized as-built handover package for repair measures (product identifiers, fixing methods, disassembly steps) and incentivize reversible detailing where compatible with heritage protection, while collecting data on repair versus replacement outcomes to build an evidence base for future regulation.

The working aid for municipalities provides good orientation for identifying other building substance particularly worthy of preservation. Though, there are no studies to determine whether the working aid assist in making appropriate decisions. A survey within municipalities could help evaluate the effectiveness of the working aid. Based on the findings, an additional (digital) tool could be developed to support decision-making as needed.

Digitalization should be expanded, and bureaucracy should be reduced nationwide. All federal states should be included to prevent significant disparities between them. This also relates to simplifying communication with the respective authorities and when submitting funding applications, where standardized procedures should be implemented. More funding opportunities with fewer requirements and lower grant amounts could help facilitate smaller repair measures for VBE and ensure the long-term functionality of the buildings.

To secure trained specialists in this field now and in the future, the training and continuing education offerings should be expanded and potentially financially subsidized. A starting point could be to specifically train civil engineers and architects in sustainable renovation of VBE.

The approach to heritage protection in Germany can serve as a model for other countries. With its extensive regulations and protections, it ensures the preservation of historical, artistic, and scientific heritage. Moreover, the fact that municipalities can independently decide on other building substance particularly worthy of preservation is unique, granting them the freedom to give special privileges to this building substance compared to "general" buildings.

For the next steps in the EU-Repair project and the development of the toolkit, several findings can be used to derive recommendations. In Germany, the focus is on the energy-efficient refurbishment of buildings. Within the project, repair measures with lower costs, time, and effort should be prioritized. To achieve this, the terms "repair" and "refurbishment" must be clearly differentiated. When it comes to repair measures, the circular economy is already partly involved. Before an entire building is demolished and rebuilt, components are replaced to restore functionality. In the future, topics such as material recycling could also be considered in this context. Additionally, LCA should be addressed here, as there is a knowledge gap in this area.

In principle, digitalization should always be taken into consideration.

When developing the toolkit, it should be ensured that individuals from various educational backgrounds are addressed, as participants come from trades, university education, or governmental bodies. Alternatively, a clear focus on a specific target group could provide clearer direction. The toolkit should provide both technical training and guidelines while also empowering users to independently decide on individual, appropriate sustainable (repair)measures on VBE. In this context, the sustainability of measures should be made measurable, or decision aids and criteria could be provided. Based on this, various aspects can be considered in the planning and well-founded decisions can be made. Therefore, existing evaluation systems for sustainable buildings could be referenced and combined with the key topics of the project. Here, it is important to highlight the relationships and especially the synergies between the various topics:

- Environmental quality: Energy efficiency, circular economy, renewable resources (energies and materials)
- Economic quality: Cost-efficiency, climate adaption
- Socio-cultural and functional quality: Participation and Inclusiveness

Within the EU-Repair project, the toolkit can contribute to the sustainable renovation of valuable built environments (VBE) by promoting the repair of buildings instead of their demolition. This approach conserves resources, helps achieve climate targets, and supports the climate neutrality of all of Europe.

8.3 Limitations

The study has several inherent limitations that need to be kept explicit. First, its geographical focus is Germany. European level instruments are covered only insofar as they directly affect the national context, and there is no systematic comparison with other member states. Second, within Germany the analysis does not treat all sixteen federal states in equal depth. Bavaria serves as the primary reference case throughout the study. Examples from other selected federal states are used selectively to illustrate specific mechanisms or differences, not to provide a complete or systematic overview of regional practice. In addition, repair and maintenance are addressed primarily at the level of regulatory and standardization frameworks and reported stakeholder experience. The study does not systematically evaluate real-world repair decision-making, specification quality, or post-intervention performance over time, so findings on "repair-first" should be read as indicative rather than evidence of typical practice.

Third, the review of standards and norms is selective. The aim is to highlight standards that are relevant for sustainable and heritage related building practice or for evaluation systems, not to catalogue all technical norms that might apply to buildings. Similarly, the overview of funding instruments is high level. It reflects the situation at the time of writing in a rapidly changing funding landscape, and individual program conditions may have evolved since.

Fourth, the stakeholder survey relies on convenience and network-based sampling. It targets relevant professional groups but does not produce a statistically representative sample of all stakeholders involved in the VBE. The results are therefore interpreted as structured insights into perceptions and experiences, not as population level facts.

Finally, the case studies focus on positive or at least successful examples. This introduces a preference towards projects that managed to reconcile heritage, sustainability and local acceptance. Failed or contested projects and everyday routine cases are underrepresented. As a result, the lessons drawn from the cases should be read as evidence of what is possible under favourable conditions, not as proof that such outcomes are currently typical. Together these limitations mean that the study is best understood as a structured scoping exercise that maps the current landscape, identifies gaps and suggests directions for further work, rather than as a definitive or exhaustive account of building heritage and the valuable built environment in Germany.

9 Summary

The national study of Germany within the EU-Repair project explores the legal, regulatory, and practical aspects of preserving and refurbishing VBE within the national and European context. With the EU aiming for climate neutrality by 2050, significant emphasis is placed on the building sector, which contributes substantially to energy consumption and greenhouse gas emissions.

Germany has extensive monument protection laws at the state level, which ensure protection and proper maintenance by the authorities. The Building Energy Act promotes energy-efficient renovations, allowing exceptions for listed buildings and "other building substance particularly worthy of preservation." The decision regarding these buildings worthy of preservation lies with the respective municipality. Municipalities can also grant privileges to buildings worth preserving through the Federal Building Code.

Repair and maintenance are not governed by a dedicated “repair law” in Germany. In practice, they are shaped by works contract law and by contracting and execution frameworks used in construction procurement, especially VOB when contractually agreed, and by trade-specific technical rules. As a result, a “repair-first” approach depends less on high-level policy statements and more on how repair measures are specified, documented, and accepted in procurement and funding processes, including requirements for as-built documentation that supports future interventions.

Digitalization is highlighted as an area needing improvement, as current systems are fragmented across states. Education and training programs for professionals involved in heritage conservation are partly insufficient, resulting in a shortage of qualified specialists. There is various financing mechanisms focused on increasing the energy efficiency of individual buildings or revitalizing entire urban areas.

Stakeholder surveys reveal that while there is familiarity with some national regulations, especially energy efficiency, knowledge gaps exist concerning risk assessment and circular economy principles. Participants identified the disconnect between heritage protection and environmental goals as a significant barrier.

The best practice examples, such as the renovation of historic buildings in Rimsting or in Kirchzarten, demonstrate effective community engagement and innovative design approaches that harmonize heritage preservation with modern needs. Overall recommendations emphasize the need for clearer definitions, better integration of environmental goals, enhanced digitalization, and expanded training opportunities.

Overall, the study serves as a comprehensive analysis of the current landscape of VBE management in Germany, identifying gaps and proposing recommendations to facilitate the sustainable repair and refurbishment of VBE within the EU-Repair project.

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Appendix A - Interview Guideline

EU-REPAIR Stakeholder Questionnaire

Funded by European Climate Initiative (EUKI) project "Toolkit for Sustainable Optimisation of Valuable Built Environment" – EU-REPAIR aims to drive sustainable building refurbishment in Estonia, Germany, Lithuania, North Macedonia, and Serbia, reducing carbon emissions and strengthening climate resilience. The project focuses on valuable buildings - valuable built environment (VBE).

VBE - historical buildings (older than 50 years) possessing architectural and cultural value.

For the project outcomes, it is important to know the perceptions of potential stakeholders regarding the topic. Therefore, we ask you to participate in the survey below.

Survey is anonymous and results of the survey will be used only for the purpose of EU-REPAIR project's needs and scientific publications/presentations. By starting to fill in questionary, you express your consent to participate in the survey. You can quit the survey at any stage of answering questions. If you have any query regarding the survey, please contact milica.muegge@ibp.fraunhofer.de.

Thank you!

1. Section 1 - Stakeholder identification

1. Your gender:

   ☐ Male

   ☐ Female

   ☐ Nonbinary

   ☐ Do not want to disclose.

2. Your age:

   ☐ <20

   ☐ 20-30

   ☐ 31-40

   ☐ 41-50

   ☐ 51-60

   ☐ 61-70

   ☐ 71 and more

3. You live in:

   ☐ Village

   ☐ Small town

☐ Big town

☐ Other (please specify)

4. Your education:

   ☐ Basic

   ☐ Secondary

   ☐ Vocational

   ☐ Non-university higher

   ☐ Bachelor's or equivalent level

   ☐ Master's or equivalent level

   ☐ Doctoral or equivalent level

5. Your professional background:

   ☐ Architect
   ☐ Engineer
   ☐ Conservator/renovator

   ☐ Manager

   ☐ Other (please specify)

6. In relation to refurbishment of the buildings you are:

   ☐ Government representative at municipality level

   ☐ Government representative at state level

   ☐ NGO or civil society representative
   ☐ Owner of a historic/cultural building

   ☐ Representative at consulting company

   ☐ Independent expert

   ☐ Scientist/lecturer on the topic

   ☐ Student of related study programs (engineering, construction, cultural heritage, material science, etc.)
   ☐ Other (please specify): _____

7. What is your level of overall experience in the area of refurbishment of valuable built environment (VBE)

   ☐ No experience
   ☐ 1–2 projects

☐ 3–5 projects
☐ More than 5 projects

8. Have you had experience specifically with refurbishing valuable built environment (VBE) and related facilities?

   ☐ Yes
   ☐ No

9. If yes, please indicate the project(s) briefly:

10. Have you ever applied for any financial support for refurbishment of valuable built environment (VBE)?

    ☐Yes, from municipality, national, and international programs and funds

    ☐Yes, from private contributors

    ☐No

If yes, have you received the financial support you applied for?

    ☐Yes, all requested

    ☐Yes, but only partially

    ☐No

If not, is there a reason why you did not receive that kind of support?

    ☐Violation of heritage refurbishment requirements

    ☐Incomplete documentation

    ☐Failure to meet energy-saving objectives

    ☐Insufficient justification of budget and expenses

    ☐Applicant ineligibility (if the application is targeted at a specific target group)

    ☐Lack of a building permit

    ☐Non-compliance with environmental regulations

☐Incorrect application form or missed deadlines

☐Low-quality refurbishment project

☐Exhaustion of grant budget (if funding is limited)

☐Other (please specify)

11. What is your main motivation for engaging in projects for refurbishment of valuable built environment (VBE)?

☐ Professional interest in heritage

☐ Maintaining value of VBE
☐ Environmental interest
☐ Benefits for community
☐ Financial or investment return

☐ Risk mitigation and resilience

☐ Other: _____

2. Section 2 - Policy and legal framework awareness

12. How familiar are you with the national legal framework regarding VBE in?

	Very familiar	Somewhat familiar	neither familiar neither unfamiliar	Slightly unfamiliar	Not familiar at all
Refurbishment					
Energy efficiency					
Circular economy					
Risk assessment					
Climate change mitigation					
Climate change adaptation					

13. In your opinion, to what extent does current legislation support the implementation of the following measures while refurbishing valuable built environment (VBE) buildings?

	Extremely	Very	Moderately	Slightly	Not at all	Do not know

Energy efficiency						
Circular economy						
Risk assessment						
Climate change mitigation						
Climate change adaptation						

14. Which standards or norms do you most frequently apply when working on refurbishment of VBE
    ☐ EN/ISO/DIN standards (e.g., ISO 15392:2019)

    ☐ Local municipal codes

    ☐ National codes
    ☐ EU Directives

    ☐ International (UN, UNESCO, ICOMOS, etc.)
    ☐ Cultural heritage-/VBE- specific acts (national)

    ☐ Sustainable building certificates (BREEAM, NABERS, LEED, etc.)

    ☐ Other (please specify)
    ☐ None/I am not related directly with refurbishment of VBE

15. In your opinion, what is the biggest gap in the legal framework regarding valuable built environment (VBE) refurbishment?
    ☐ Lack of integration between heritage laws and environmental goals
    ☐ Outdated technical standards
    ☐ Vague or conflicting responsibilities between institutions

    ☐ Lack of harmonization of engineering (e.g. ISO) and preservation standards
    ☐ Lack of harmonized guidelines

    ☐ Other: _____

    ☐ Do not know

3. Section 3 - Practical challenges and opportunities

16. What are the biggest obstacles you face in refurbishment projects involving valuable built environment (VBE)?

	In general	Implementing energy efficiency measures	Implementing circular economy principles	Implementing climate change mitigation and/or adaptation measures
Lack of finance				
Lack of state funding				
Lack of technical knowledge/skills				

Low public awareness or support				
Complex permitting processes (too many regulations)				
Lack of access to appropriate technologies				
Lack of high-quality appropriate materials				
Lack of skilled specialists				
Complicated communication with authorities				
Lack of digitalization				
High costs				

17. What types of support or resources would be most helpful for sustainable/climate friendly future refurbishment projects?
    ☐ Technical training and guidelines
    ☐ Access to case studies and best practices
    ☐ Financial incentives or subsidies
    ☐ Easier permitting procedures
    ☐ Digital tools for simulation and risk assessment
    ☐ Other (please specify): _____

18. What types of financial support do you believe would most improve sustainable/climate friendly refurbishment rates?

    ☐ Direct grants for renovation

    ☐ Low-interest loans or credit lines

    ☐ Tax deductions or incentives

    ☐ Project-specific EU or other funding

    ☐ Other: _____

4. Section 4 – Sustainability measures (Energy efficiency, renewables, circular economy, risk assessment, climate change mitigation/adaptation)

19. Which sustainability strategies have you used in previous refurbishment projects? (Check all that apply)
    ☐ Energy-efficient windows and insulation
    ☐ Renewable energy sources (e.g., solar panels, heat pumps)
    ☐ Natural ventilation and daylight use
    ☐ Use of recycled or locally sourced materials

    ☐ Use of traditional materials

    ☐ Use of traditional techniques
    ☐ Water efficiency measures

☐ Indoor thermal comfort and air quality control

☐ Circular economy principles (reuse of materials, design for disassembly, waste classification etc.)

☐ None

☐ I am not involved in such projects
☐ Other: _____

20. Which techniques have you used to assess the impact of refurbishment project?

☐ Environmental impact assessment (LCA, etc.)
☐ Energy efficiency assessment

☐ Carbon footprint estimation of materials and techniques

☐ Risk assessment
☐ Other

☐ I haven't used

5. Section 5 - Public perception and community engagement

21. In your opinion, how do citizens perceive the value of preserving valuable built environment (VBE)?

☐ Very positively

☐ Positively –
☐ Neutral

☐ Negatively –

☐ Very negatively

22. How important is community involvement for the successful implementation of refurbishment projects?

☐ Very important
☐ Somewhat important
☐ Neither important neither unimportant
☐ Fairly important

☐Not important at all

☐ Cannot say

23. What methods would you suggest increasing public interest and participation in preserving valuable built environment?

	Very relevant	Relevant	Neither relevant nor irrelevant	Not relevant	Not relevant at all
Meetings					
Representatives' committees					
Online survey					
Focus groups					
Seminars/workshops					
Other					

24. What are the main social challenges of refurbishing VBE buildings in a more sustainable manner?

☐ Lack of adequate finance
☐ Lack of awareness
☐ Lack of motivation
☐ Lack of adequate ready to use technical solutions in the market
☐ Opposition to the heritage protection restrictions
☐ Aging society
☐ Other (please specify)

6. Section 6 - Future needs

25. What training or capacity-building measures regarding VBE would benefit stakeholders the most?

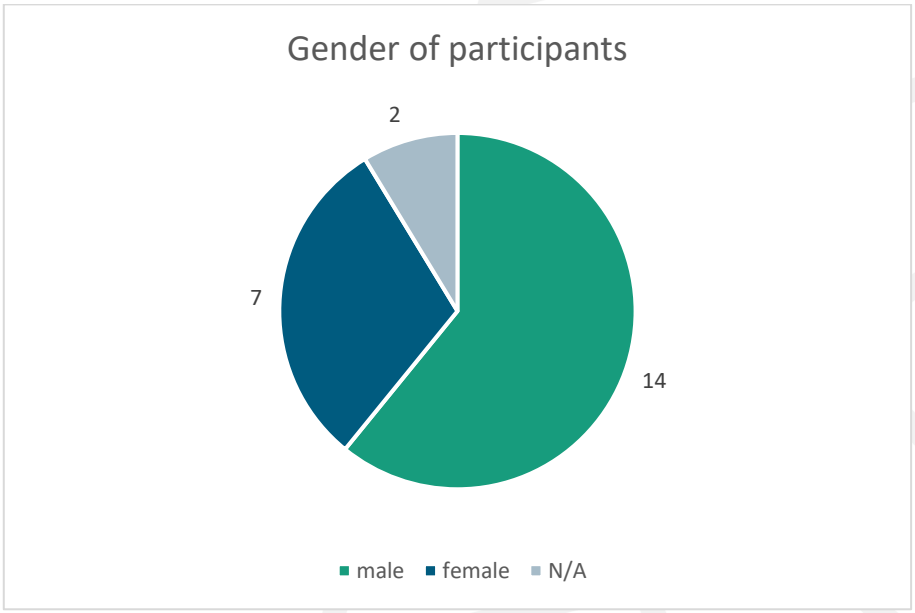
☐ Technical skills in refurbishment of valuable built environment (VBE) buildings
☐ Legal and regulatory compliance workshops
☐ Project management for heritage objects and sites
☐ Digital tools and simulation methods (e.g., BIM, risk assessment, Dynamic annual simulations, WUFI)
☐ Environmental impact assessment (LCA, carbon accounting)
☐ Risk assessment
☐ Circular economy principles
☐ Climate change mitigation and adaptation
☐ Other: _____

26. Would you be willing to participate in further activities (focus groups, interviews, or project co-design sessions, workshops) on environmentally/climate friendly refurbishment of valuable built environment (VBE), particularly?

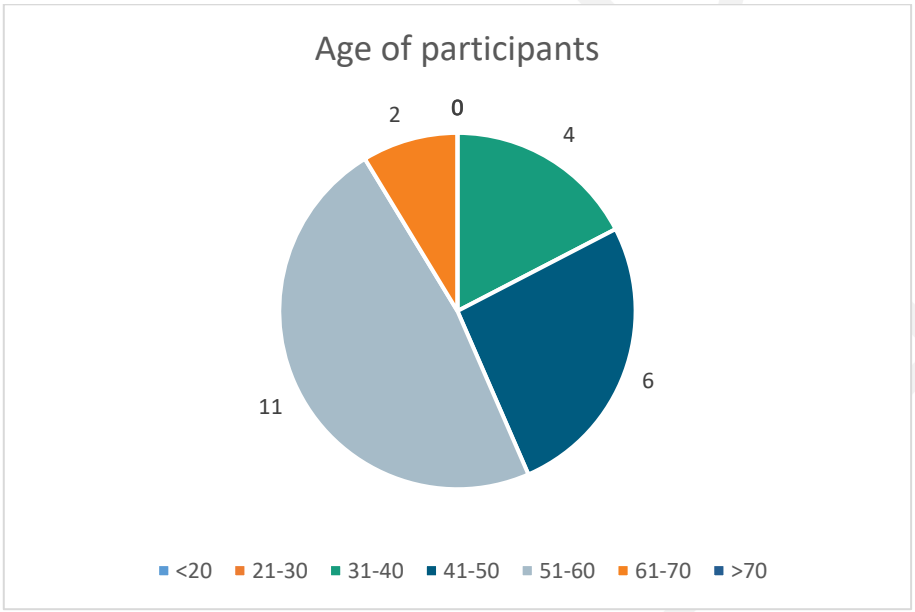
	Yes	Maybe	No	Do not know
Technical skills in preservation of VBE buildings				
Legal and regulatory compliance workshops				
Project management for heritage objects and sites				
Digital tools and simulation				
Environmental impact assessment (LCA, carbon accounting)				
Circular economy principles (local, recycled, recyclable, renewable materials, techniques)				
Climate change mitigation and adaptation				

27. If you would like to be contacted for upcoming events and/or information, please provide your email here

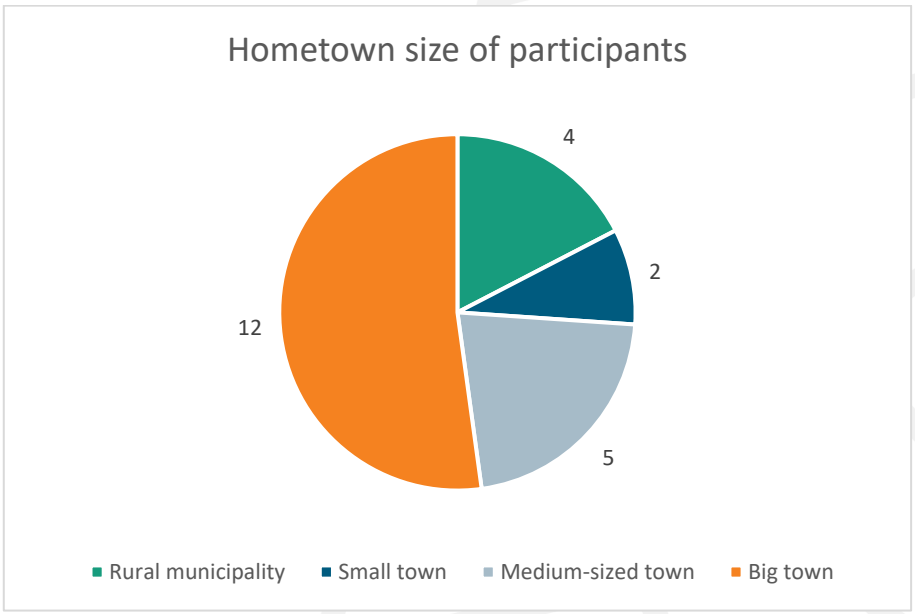
Appendix B: Questionnaire results – Gender of participants



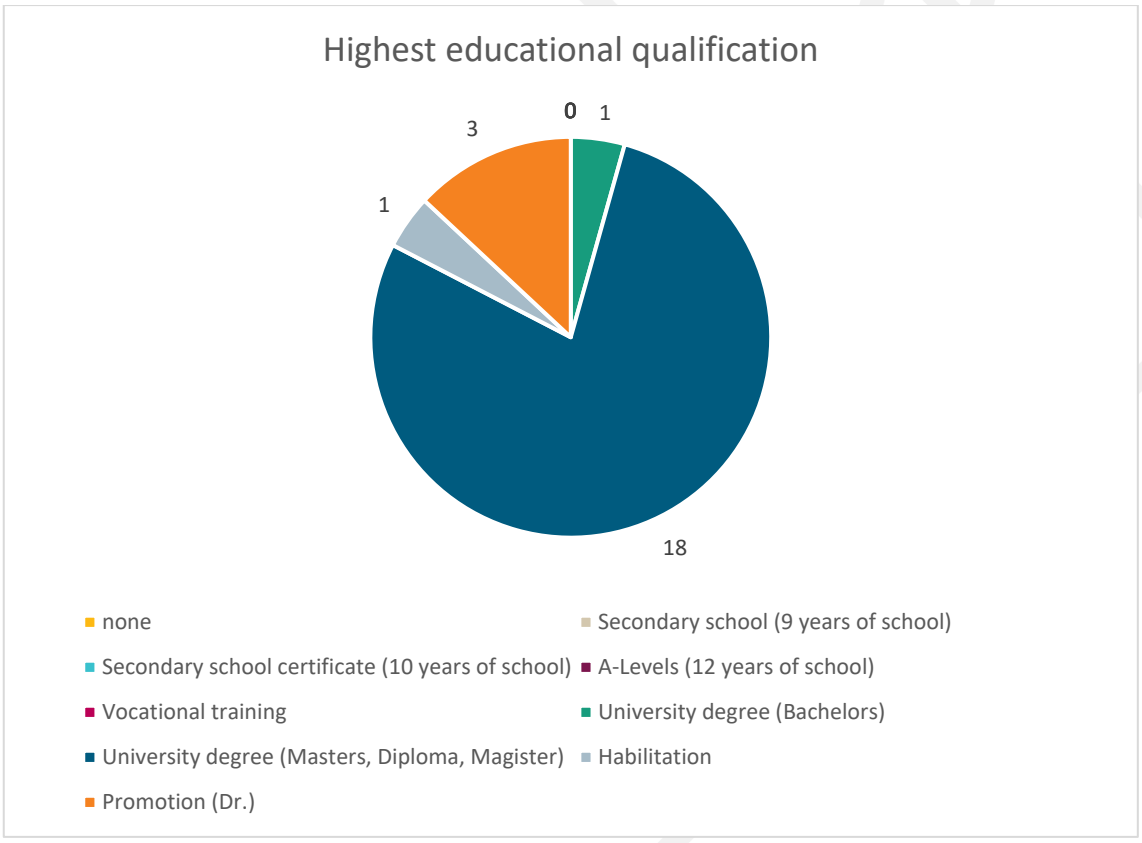
Appendix C: Questionnaire results - Age of participants



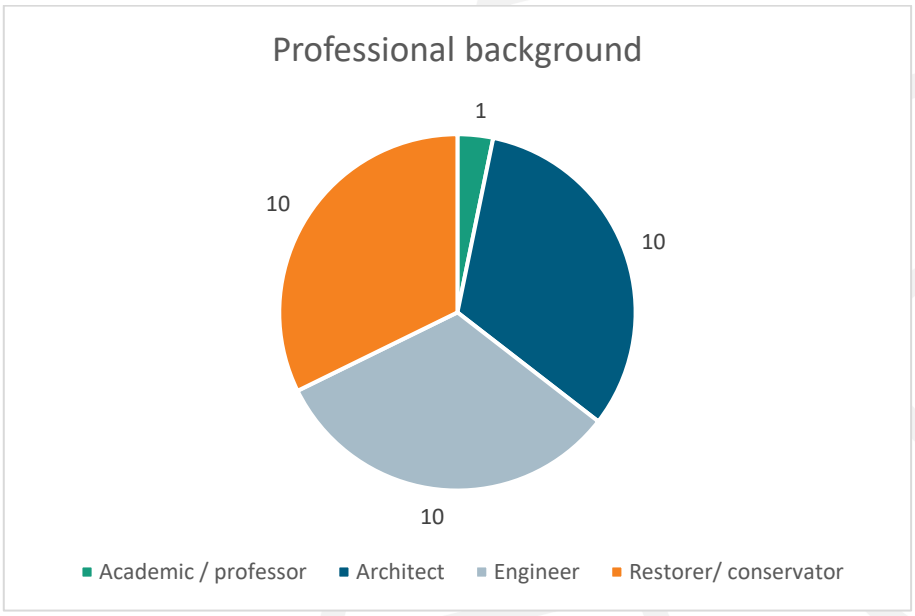
Appendix D: Questionnaire results – Hometown size of participants



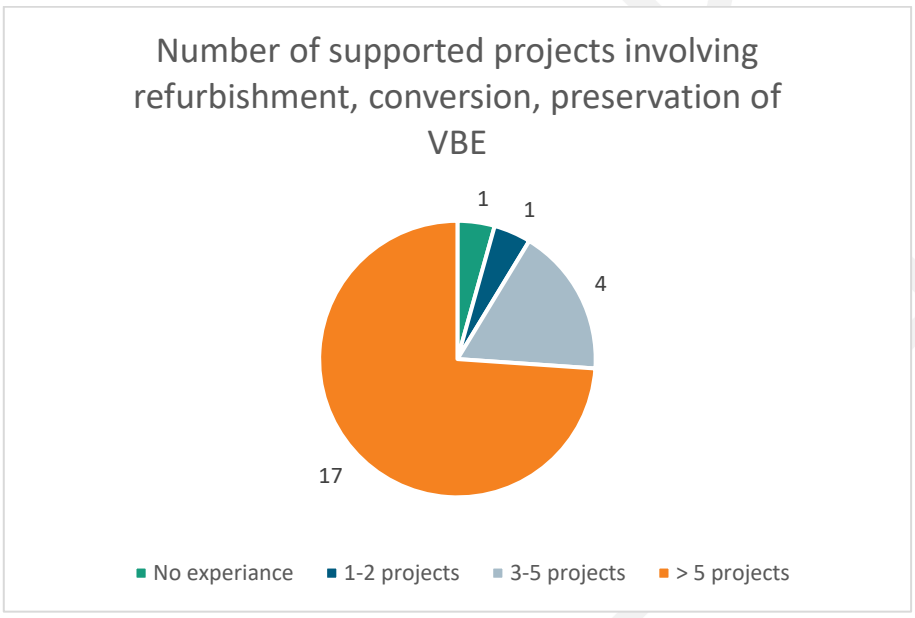
Appendix E: Questionnaire results – Highest educational qualification of participants



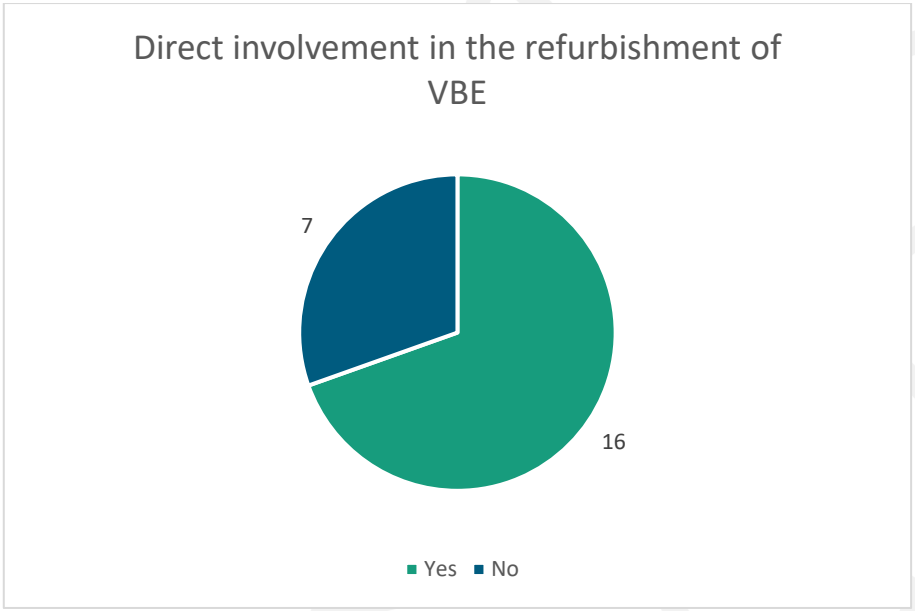
Appendix F: Questionnaire results – Professional background of participants



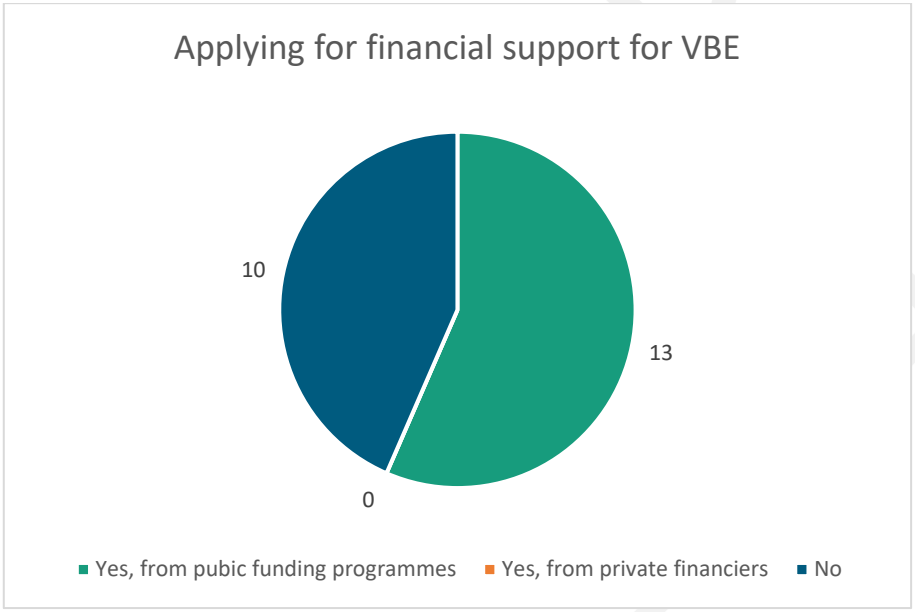
Appendix G: Questionnaire results – Number of supported projects by the participants involving refurbishment, conversion, preservation of VBE



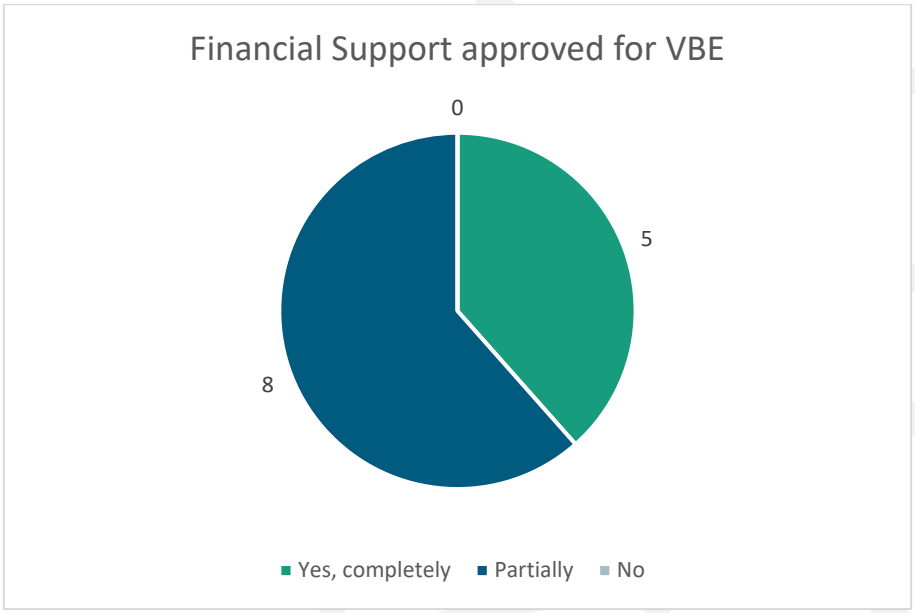
Appendix H: Questionnaire results – Direct involvement of the participants in the refurbishment of VBE



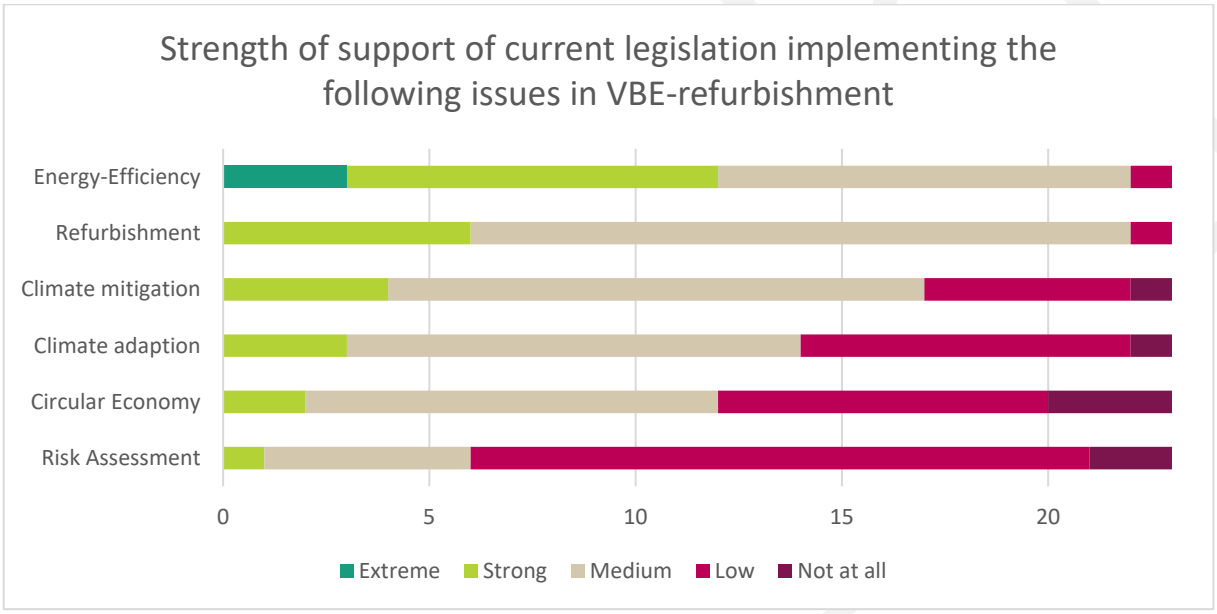
Appendix I: Questionnaire results – Application of participants for financial support during VBE refurbishment



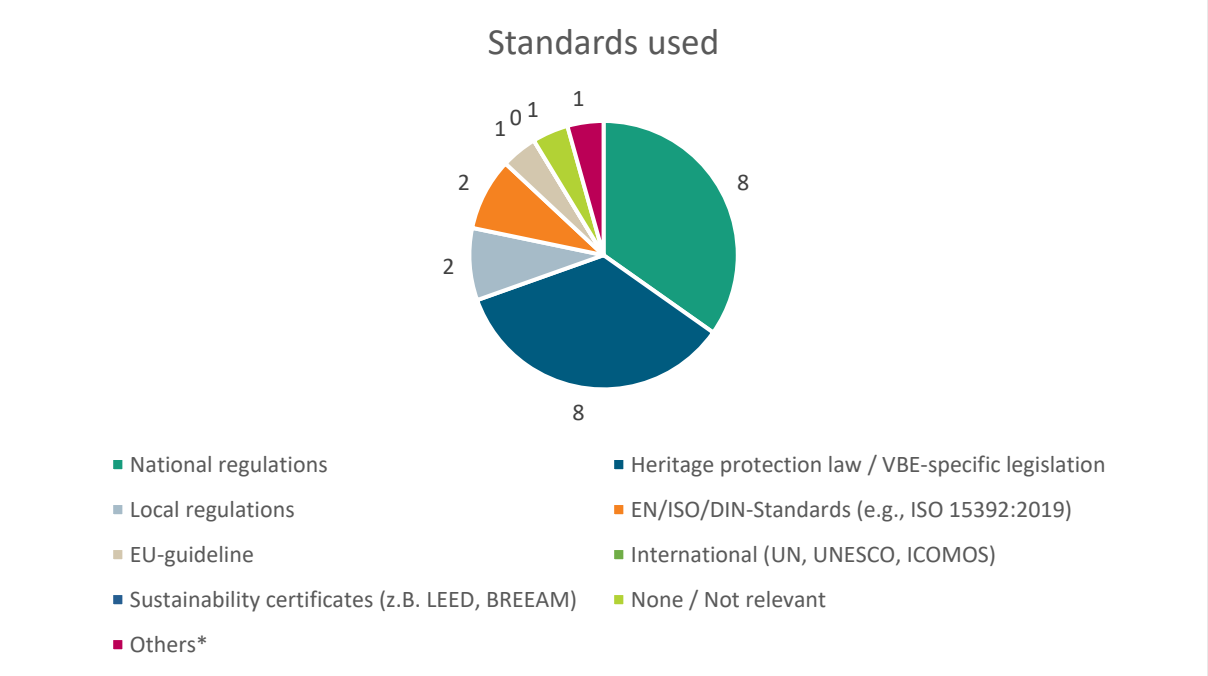
Appendix J: Questionnaire results – Approved financial support for VBE refurbishment



Appendix K: Questionnaire results – Strength of support of current legislation implementing the following issues in VBE-refurbishment

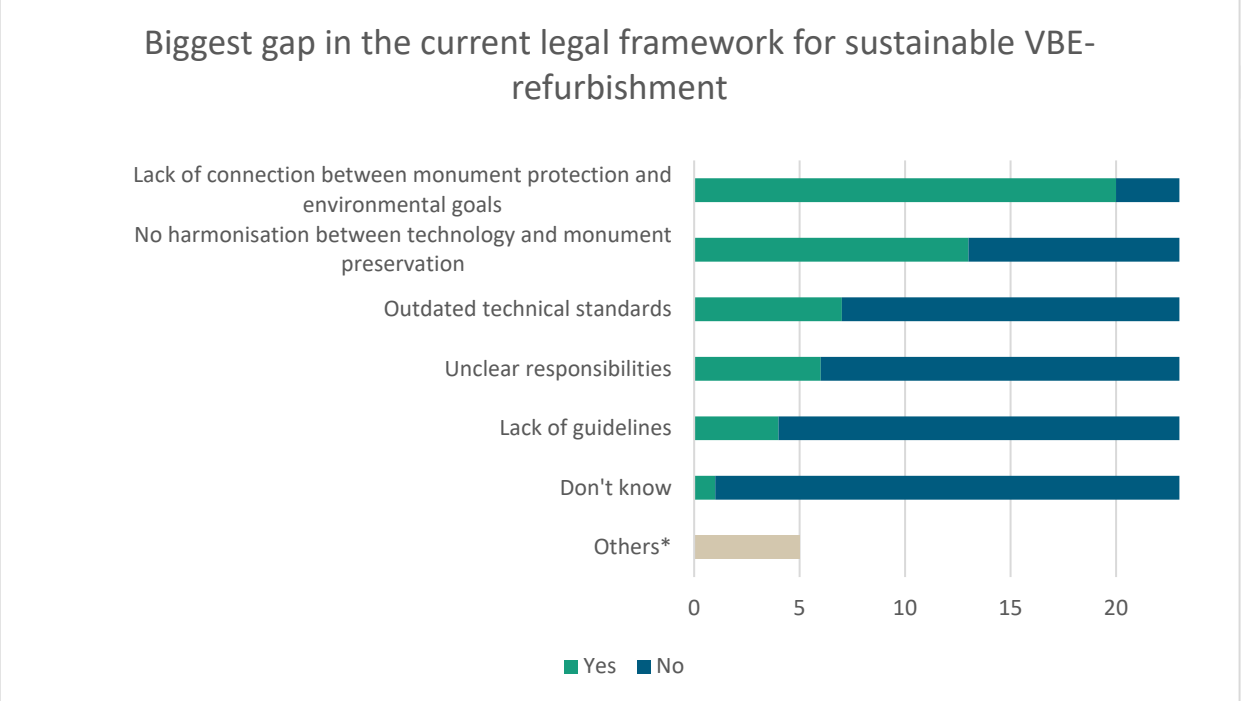


Appendix L: Questionnaire results – Standards used by the participants



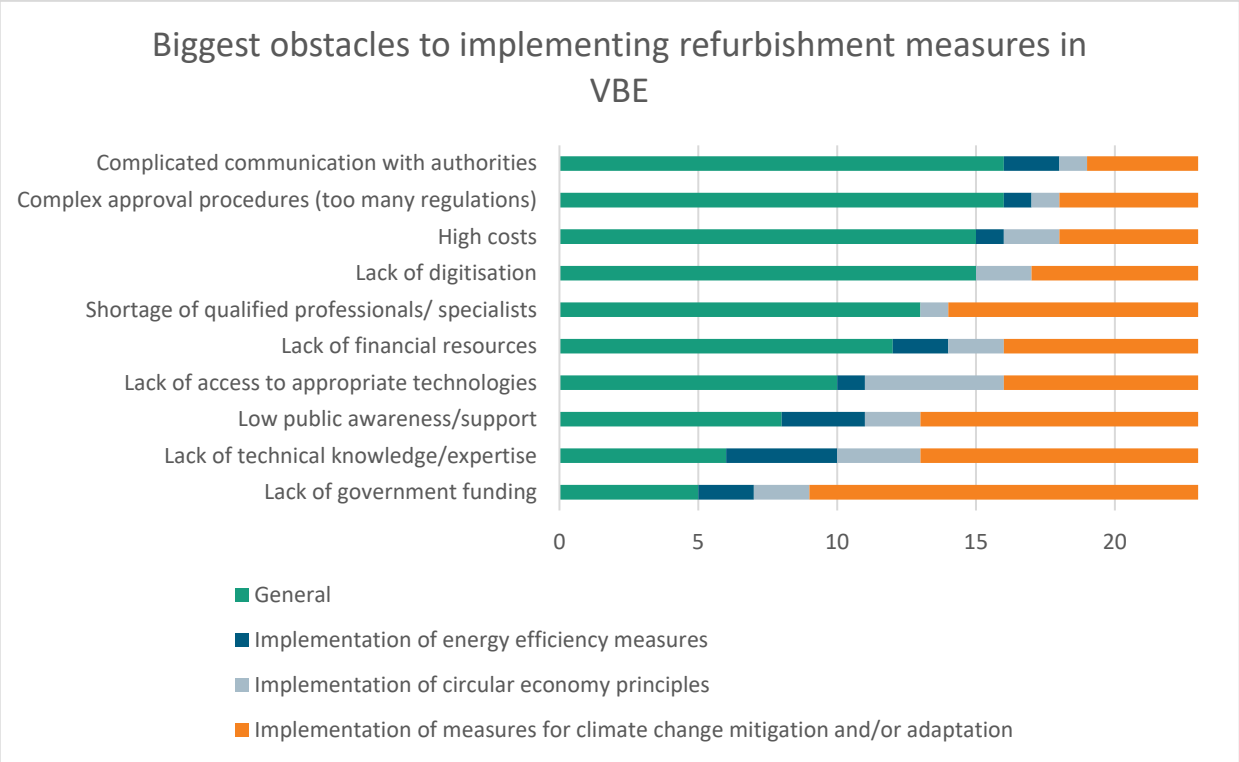
* Specifications that go beyond the given ones and are individually adapted to the respective project

Appendix M: Questionnaire results – Biggest gap in the current legal framework for sustainable VBE-refurbishment

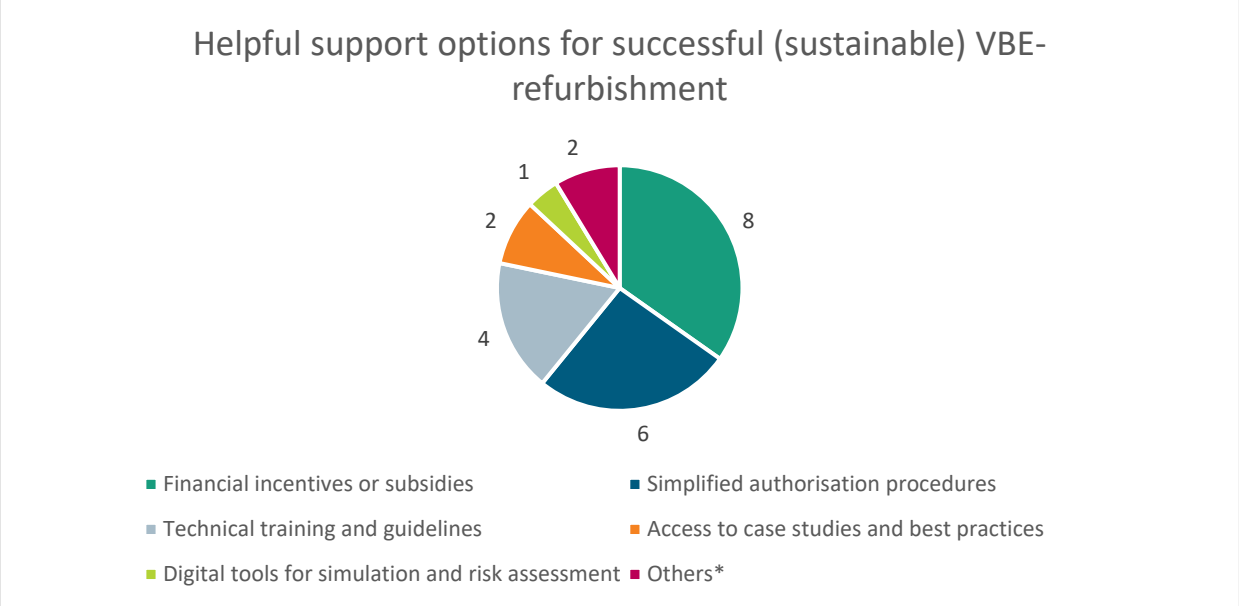


* LCA and eLCA; Limited subject-specific planning skills; Funding procedure too complicated; Digitalization; Lack of demolition permit

Appendix N: Questionnaire results – Biggest obstacles to implementing refurbishment measures in VBE

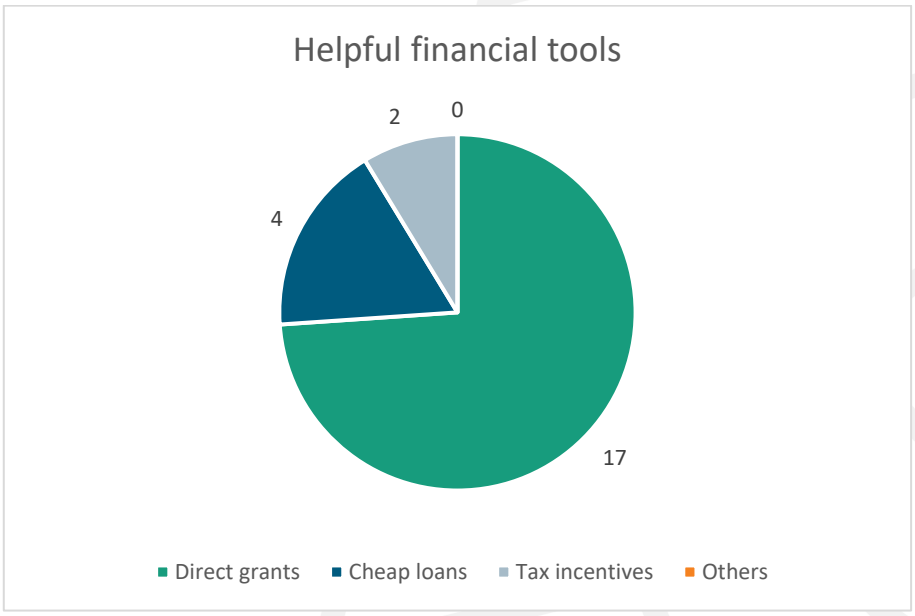


Appendix O: Questionnaire results – Helpful support options for successful (sustainable) VBE-refurbishment

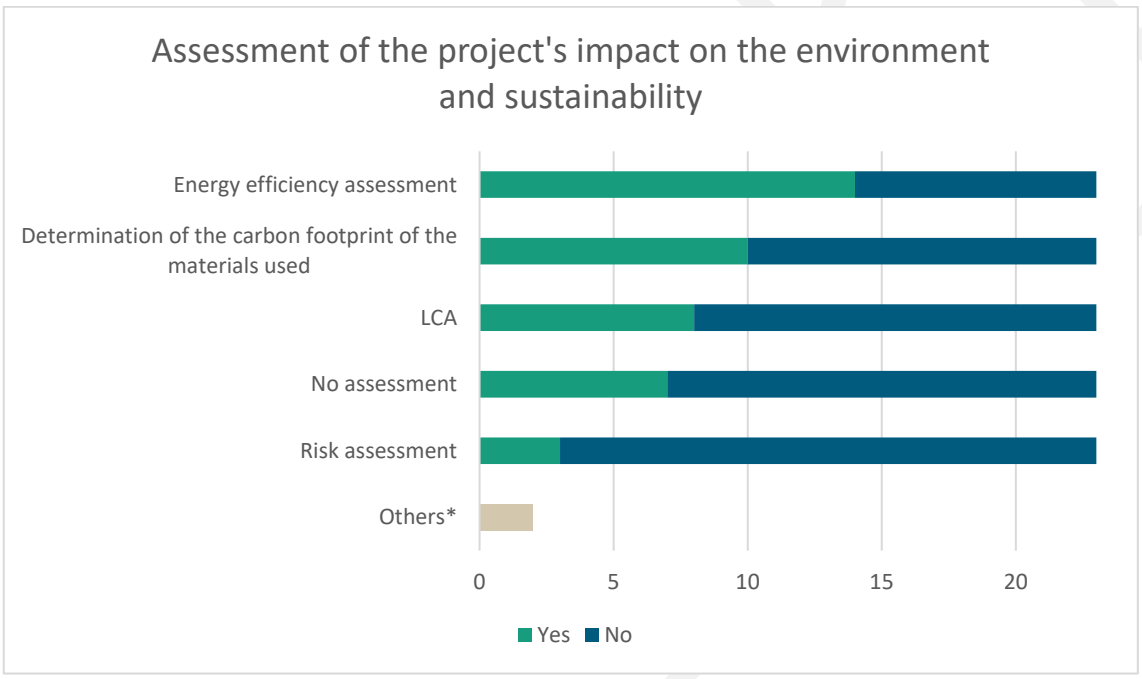


* Public Information; Introduction demolition permit

Appendix P: Questionnaire results – Helpful financial tools

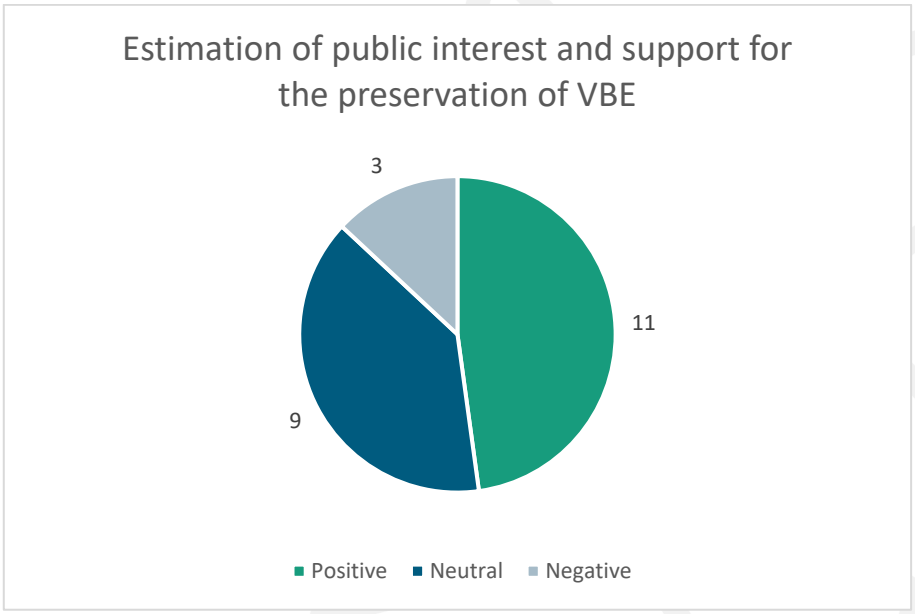


Appendix Q: Questionnaire results – Assessment of the project's impact on the environment and sustainability by participants

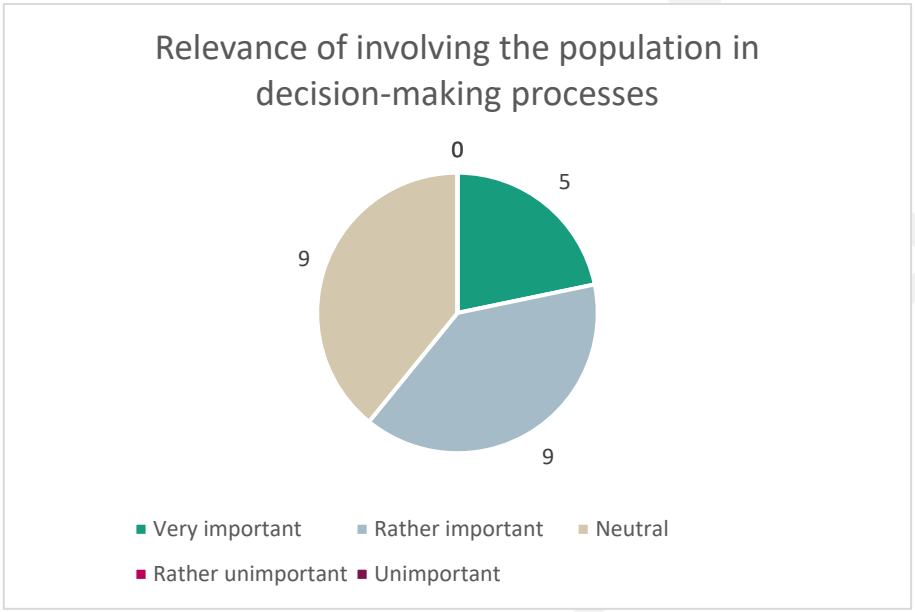


* QNG; Empirical values

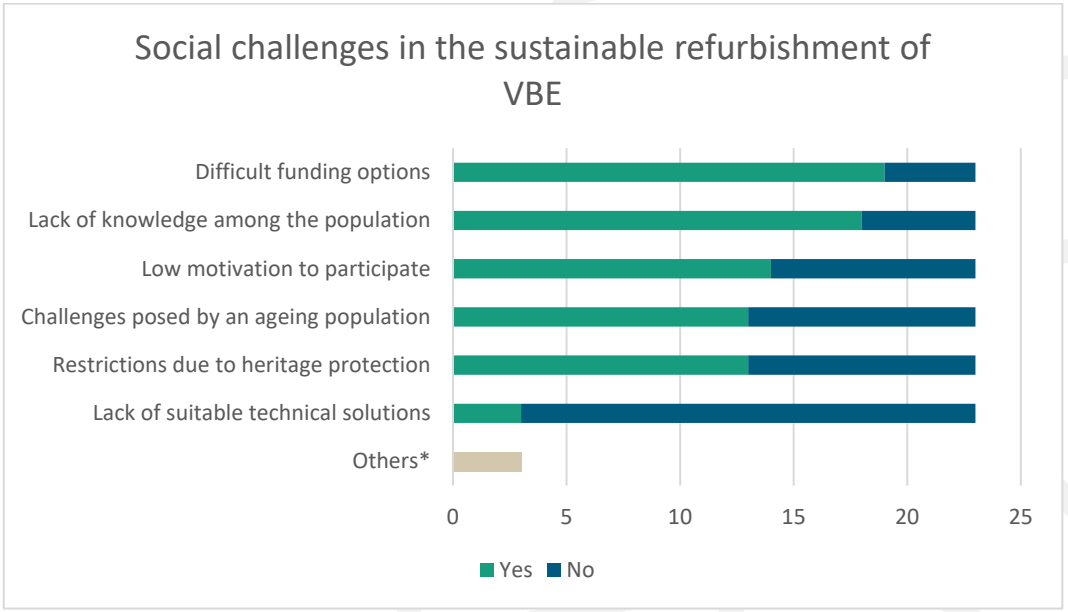
Appendix R: Questionnaire results – Estimation of public interest and support for the preservation of VBE by participants



Appendix S: Questionnaire results – Relevance of involving the population in decision-making processes



Appendix T: Questionnaire results – Social challenges in the sustainable refurbishment of VBE



* Disregard by political decision-makers; Restrictions due to spatial conditions; Requirements imposed by laws/regulations/DIN standards

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