iBRoad

Individual Building
Renovation Roadmaps

How can Member States implement iBRoad?

Barriers and drivers for countries willing to explore the feasibility and replicability of iBRoad

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TABLE OF CONTENTS

I. INTRODUCTION

Currently, approximately 97% of the European building stock is considered as not energy efficient [1]. A highly efficient and decarbonised building stock by 2050 requires the transformation of most buildings to at least a nearly zero-energy building level. This makes renovating buildings a crucial aspect of meeting the European energy efficiency and CO_2 emission reduction targets.

Building owners face multiple barriers when planning an energy renovation, including a lack of knowledge on which renovation measures to implement, and in which order. Other barriers hampering investments are time-consuming planning, unreliable building professionals and uncertainty around the value the renovation will bring.

The iBRoad project aims at reducing these barriers by guiding the building owner through a building renovation process with a tailored step-by-step renovation plan.

i. iBRoad concept

iBRoad (individual Building Renovation Roadmap) is a Horizon 2020-funded project aiming to eliminate barriers to deep (staged) renovation, by developing a renovation roadmap for single-family houses. The roadmap provides a customised renovation plan over a long-term period (10 to 20 years), which considers the occupants' needs and specific situations (e.g. age, financial situation, composition and expected evolution of the household, etc.) and avoids the risk of 'locking out' future renovation solutions due to a lack of foresight.

The renovation roadmap is combined with a building logbook, a repository where all the building-related information can be stored and continuously updated. The type of information stored in the logbook and its functionalities can evolve over time and could range from energy production and consumption to equipment maintenance, as well as insurance, property plans and obligations, energy bills, smart meter data and links to available financing options for renovation projects (e.g. green loans, incentives, tax credits).

ii. Objectives

This report aims to explore the barriers to and enablers of the design and implementation of iBRoad in order to enable the concept to be replicated across Europe, beyond the targeted countries of this project. To date, iBRoad is being tested in Portugal, Poland and Bulgaria. The iBRoad logbook will also be tested in Germany, with a test account (and the handbook[1] explaining it) provided to interested parties who will be able to give their feedback through a questionnaire. We will present the main barriers to designing and implementing the iBRoad concept based on preliminary inputs

[1] *Handbook for Energy Auditors – Guidance and advice on how to create an iBRoad Individual Building Renovation Roadmap and how to use the iBRoad Building Logbook, ifeu, iBRoad*

collected from participating countries as well as non-participating countries that have similar initiatives in place: Germany, France, Belgium/Flanders and Denmark.

Based on a literature review, previous work and inputs collected from all participating countries, we will provide guiding steps for countries interested in implementing the iBRoad concept. This report gives an overview of what those considering integrating the tool in their country need to do, by outlining the barriers to and enablers of successful design and implementation. Upcoming reports will provide more details on specific elements, including policy guidance on how to implement individual building renovation roadmaps and building logbooks, supporting policy instruments, data protection issues, and extending the iBRoad concept to other building types.

II. BARRIERS TO DESIGN AND IMPLEMENTATION OF iBRoad

Experts and stakeholders from the participating countries have indicated the main barriers to the design and implementation of the iBRoad concept across the EU. These include economic viability, technical and legal feasibility as well as human-related restrictions. Identifying and addressing these barriers can allow a successful implementation of the concept across the EU.

i. Economic viability

A common challenge for new instruments is their economic viability, especially how to finance the preparation, design, development, implementation, operational, maintenance and evaluation stages, which all come with costs (see the stages in Figure 1). In addition, a budget is needed to cover things such as activities related to business models and training of auditors. Examples of costs that should be considered within these stages include costs related to developing functionalities, integrating data from existing databases and sources or testing procedures. Operation and hosting costs (e.g. costs for running the servers, for providing backup or for storing data), costs for support (e.g. handling of questions, communication) and maintenance such as licences, bug-fixing fees or technical support should also be considered. The development and implementation of the iBRoad concept across the EU must involve sustainable funding through business models addressing the sources of financing that can come from public, private or mixed sources [2].

Figure 1: Stages when costs should be foreseen

Financial aspects for implementing bodies to consider in developing and maintaining the iBRoad concept

Implementing actors should consider costs related to the preparation and development of the instruments and to keeping them operational. National and EU-funding opportunities, climate funds and funding banks must all be thoroughly explored. In Flanders (Belgium) the funding comes from the regional government, while the model in France is developed primarily by private actors.

According to experts from Flanders, financial feasibility could include exploring public–private partnerships to fund new instruments and business models where future value (benefits and income) of data is used to fund set-up costs. For example, a bank that insures houses might provide funding as a more complete historical record of installations and house condition will enable it to better assess risk. This could allow the insurer to be more competitive on the market, get better profits and offer lower premiums on the insurance. How exactly the value flows through the model, who is involved and what rules are in place are topics that require further understanding and development.

Necessary economic aspects for homeowners

A survey study of 1502 households from three countries where the iBRoad concept will be tested (Bulgaria, Poland, Portugal) found that most respondents would be interested, but almost half would not be willing to pay for the service (44%-54%), while around a quarter would be interested and willing to pay (20%-32%). It is therefore a crucial challenge for public authorities to incentivise people to invest in energy renovation[3]. This could be done through targeted awareness campaigns, informing homeowners about the many benefits of energy renovations such as increased comfort, lower energy bills or increased asset value.

In addition, homeowners should be made familiar with available financing options, such as grants, eco-loans or tax credits. In many countries such as Greece and Portugal, access to finance is essential to increase the rate of renovation. In Bulgaria there is a tradition of grant financing, with homeowners in multifamily buildings offered 100% grants. However, this has discouraged those in single-family homes from renovating at their own expense. The links between renovation and taxes should be explored: in Bulgaria, for example, renovation leads to an increased tax level, which explains people's unwillingness to renovate.

A reliable energy performance certificate (EPC) framework could make the link clearer between the building's performance and the property value, as has been done in Denmark, Flanders and Portugal. This encourages homeowners and potential buyers to invest in energy renovations, as some of the cost is recouped through the increased value of the building.

Vulnerable groups such as infants and elderly, sick, disabled and unemployed people spend great amounts of their time at home and are especially exposed to cold and unhealthy indoor climates and poor housing conditions. Elderly people in particular are among the most exposed to energy poverty as they are likely to have lower incomes than the working population and to need higher indoor temperature. They are also more prone to diseases, need more social assistance and are less willing to invest in renovating their homes[4]. For social houses and low-income families, a more holistic approach combining energy and social measures may therefore be needed. The iBRoad concept is

based on a dialogue between the occupant and the auditor which considers these aspects. A key feature of the concept is understanding and integrating the occupant's needs.

Business case for energy auditors

The economic assessment of the business case for energy auditors should include the costs of training, audits, registrations and the use or purchase of calculation/simulation software programs and tools. These must be financed by either public or private funds to allow a smooth roll-out of the iBRoad concept. According to the feedback collected from qualified experts, there are countries where the price for an energy audit is too high compared with the total renovation cost, while the communication with individual owners is time-consuming and not always rewarding and successful. For this reason, auditors prefer investing their time and effort on larger projects.

Training of auditors, on technical aspects as well as on how to approach building owners, is important for the successful deployment of iBRoad. Communication with the owner is key to identifying the most suitable customised renovation options, as well as for gathering detailed inputs into the software.

The demand for energy audits must be increased alongside iBRoad. This could be done through regulation or subsidy schemes (e.g. Germany: subsidy for energy audits, Flanders: premium for energy auditors[5]), or with products that interest the user (e.g. BetterHome model in Denmark[2]). Energy auditors ought to be qualified according to a national quality framework and ensure that information provided is reliable.

The iBRoad digital application could minimise the extra work for the auditor. For example, the Danish BetterHome model outlines each step for the energy auditor, from the first contact to the finalisation of the project. The auditor is equipped with simple checklists on the state of the building, information which is fed into the online application to calculate energy savings and indoor air improvements depending on different packages of measures. Auditors can easily extract a renovation proposal based on the information gathered.

ii. Technical feasibility

The technical feasibility should be evaluated before launching a renovation roadmap, to assess the viability of the technical aspects and risks. In the iBRoad project, we examined the technical aspects related to the renovation roadmap and the logbook. The technical feasibility study should also assess if specific building types and contexts (e.g. district heating) are suitable for this specific concept.

[2] *www.betterhome.today*

Renovation roadmap

The renovation roadmap provides detailed and individualised renovation advice to building owners. The key elements of a renovation roadmap are: the on-site visit and energy audit, performance indicators to measure progress, recommendations for the building owner and simplified summary information. Tools and equipment needed by energy auditors, such as EPC software, should also be considered. The software used to insert data needs to be adapted to the local conditions, including language, and integrated with existing software.

Construction procedures also differ between countries and regions, so the default assumptions should be adapted in the iBRoad concept. Another technical aspect raised by qualified experts is that renovation roadmaps ought to be based on real energy consumption, not theoretical consumption as in most EPCs. An approach including both real and theoretical consumption is recommended.

Performing a techno-economic assessment is also critical to assess the impact of the suggested renovation steps on energy demand, CO_2 emissions, share of renewables and relevant economic indicators[6]. The ways that the techno-economic assessment modules can be integrated into the iBRoad concept are described in "*The iBRoad tools structure: How to integrate techno-economic assessment, individual building renovation roadmap and logbook components in iBRoad*"[6].

Energy experts performing the audit should be adequately trained considering all country-specific and technical aspects and equipped with the necessary skills to perform the required calculations and activities. Energy auditors ought to also have access to databases with technical products (e.g. certified material) or even technical drawings (e.g. how façade insulation is executed, types of ventilation products, etc.). A list of qualified and certified professionals should be easily accessible to homeowners looking for energy auditors.

Information on technical aspects related to renovation measures and the relevant benefits ought to be accessible to homeowners in clear language, avoiding technical jargon. Considering that benefits such as improved comfort, wellbeing, health, etc., are the main drivers for homeowners to renovate, these benefits need to be incorporated in the roadmap. BPIE recently developed a methodology to quantify the multiple benefits of energy renovations[7].

Objectivity and quality need be ensured for information coming from both the homeowner and the auditor, while the process of inserting information into the roadmap must also be simplified with semi-automated procedures (e.g. a complex but sophisticated back-end with a user-friendly and simple front-end). Processes for connecting data entered in national-level software with the roadmap assistant[3] software used by auditors can be facilitated by means of web services and

[3] *The iBRoad roadmap assistant is the corresponding software which assists in the production of the roadmap documents. The roadmap assistant is used by the auditor only, not by the building owner, as it requires expert knowledge. Data is entered into the iBRoad-Plan only by the energy auditor* [21]

automatic feeds which can enormously reduce the additional effort and cost of entering information twice in different applications.

Logbook functionalities

The logbook is the main repository of all relevant building information (including energy bills, equipment maintenance recommendations, insurance and property obligations, and financing options available in the area for renovation projects, e.g. incentives, tax credits, green loans). The key elements of the logbook are data gathering, functionalities and ownership. On data gathering, linking the tool to authentic data sources managed by the government (e.g. certificates and inspections) can increase trustworthiness (e.g. according to VEA, the credibility of the Woningpas (see step 4, section III below) depends on the reliability of the data). The logbook functionalities are developed based on the core elements and information it should provide (e.g. in Flanders, the Woningpas allows the user to use different services according to specific preferences)[2]. The end-user and owner of the logbook is the property owner, who can grant access to building information to third parties (e.g. public authorities). However, there are cases (Bulgaria) where the ownership of the logbook is unclear, and people would not be willing to share data about their property with e.g. responsible authorities. Risks like this should be assessed, if possible.

Management (and handling) of the database and its links with existing EPC databases or other governmental databases (e.g. administration documents, etc.) are crucial aspects. There are countries where plenty of information is already available (e.g. Flanders with EPCs, housing administration, soil contamination, energy use, etc.) and there are great opportunities to make this accessible through a logbook. If digital data already exists, it may be possible to automatically feed it into the logbook, but a legal basis for this might be necessary.

The usability of the logbook increases if different actors can access certain data points; it could, for example, be coupled with a one-stop-shop service for building renovations, or data access could enable new business models based on aggregating demand. Attention should be paid to safeguarding data security and privacy when transferring data between different entities. Where digital data is not available, then homeowners could insert their own data. The complexity of retrieving relevant information from different sources needs to be considered: this may include EPC data from ministries, energy agencies and local planning authorities and energy consumption figures from utilities.

Technical information and data related to the building's construction that are accessible through the logbook must be of high quality. Further technical requirements that ought to be explored are the availability and accessibility of an EPC database as well as the possibility to import data from the EPC calculation software.

Information stored in the logbook and its functionalities can evolve over time and range from energy production and consumption to equipment maintenance, as well as insurance, property plans and obligations, energy bills, smart meter data and links to available financing options for renovation projects (e.g. green loans, incentives, tax credits)[8]. Therefore, all building information from the logbook has to be updated regularly, or in real time. Data storage also needs to be considered; Flemish experts involved with the Woningpas highlighted questions around where to store the data (public/private cloud server), who is responsible for the data, how long it has to be kept and whether

it should be validated. Further details and guidance on setting up an iBRoad logbook can be found in the report *The logbook data quest – Setting up indicators and other requirements for a renovation passport*[8].

iii. Legal and regulatory feasibility

Another category of barriers to the design, implementation and European uptake of iBRoad are legal and regulatory aspects. Norms and regulations should be assessed before design to ensure the concept can be applied and implemented in that specific country or region. Detailed due diligence needs to take place to ensure all regulatory and ethical requirements are met as there might be, for example, legal constraints to accessing data from existing databases. In any case, every country/region will have to find a balance between effectiveness and privacy. For example, the Energy Performance of Buildings Directive (EPBD; 2018/844, Article 2a) refers to building renovation passports as an optional scheme to be included in the long-term renovation strategies. In Flanders, representatives of federal and regional legal services, notaries and the federation of real-estate agencies were consulted to give advice on data sharing, protection and obligations of building owners.

Local adaptation

Relevant legal structures of the respective country ought to be identified, while regulations and bureaucratic processes that hinder local implementation of the iBRoad concept must be investigated, to determine how to adapt them. This could involve the need and procedures for obtaining building permits in different countries. In Bulgaria for example it is not yet feasible to integrate iBRoad in national policies as smaller buildings (iBRoad targets single-family houses) are not required to undergo an audit or possess EPCs. Legal structures must be further explored to see if they already consider a stepwise renovation, and if incentives support this. The French 2015 Energy Transition Law for example introduces bold new renovation targets, which aim to achieve “Bâtiment Basse Consommation” (BBC) level by 2050 for the entire building stock. The trigger point “renovation embarquée” has been deployed as well as one-stop-shop advisory services. However, current financial support does not appear to match the ambition and there is a risk this will result in shallow instead of deep step-by-step renovation[9]. The iBRoad concept has to be established and adapted to respond to legal requirements at local level (established by regions or municipalities), and its tools have to be compatible with national requirements to enhance their use.

National legislation should also be adapted or established to facilitate the uptake of the iBRoad concept. In Flanders for example, a decree on the logbook (gebouwenpasdecreet) had to be worked out to establish a legal framework for the Woningpas/gebouwenpas[10]. There must also be a plan for countries, such as Bulgaria, where it would already be feasible to integrate iBRoad in national policies. Collaboration and data sharing between different administrations should be further enhanced and legal barriers for this must be addressed.

Last but not least, both options of mandatory and voluntary implementation ought to be investigated and considered. According to expert insights, in some countries (such as Poland and Romania) a mandatory scheme would be most appropriate to ensure a successful uptake of the iBRoad concept, while in Germany and Austria, a voluntary scheme is more feasible at this point.

Data privacy and availability of resources

The already developed iBRoad concept includes a digital tool (a logbook), which contains a set of building-related data (legal, administrative, technical and operational aspects and possibly some personal data). This raises issues concerning confidentiality, integrity and availability. Data privacy and security are protected by EU legislation[4] and every digital document (e.g. building logbook) containing confidential information has to respect this regulation[8]. Legal requirements that go beyond the General Data Protection Regulation (GDPR) or that can influence data availability in the specific country should also be explored. The GDPR contains opening clauses allowing European Member States to put national data protection laws in place to complement the GDPR. For example, the National Data Protection Law in Croatia made use of specific opening clauses of the GDPR "which enables certain restrictions of data subject (individuals) rights (incl. right to access, to information, to object etc.) in relation to data processing for statistical purposes". In Estonia, the data subjects may be hampered when processing personal data by law enforcement agencies, while in Spain policymakers adopt specific provisions to restrict data subject rights[11]. At the same time, the logbook ought to be enriched with enough information to become useful. In Germany, for example, there is little public support for a centralised EPC database, because of concerns around data privacy issues. Ownership of the database and third-party access must be handled with care considering privacy issues.

Data security aspects such as confidentiality, integrity and availability should be considered when setting up a logbook database. Confidentiality must ensure that the information can only be seen by authorised people, integrity must ensure that the information cannot be changed or removed without authorisation, while availability ought to ensure that only authorised people can access information when needed. In case of data breaches, access to information (who-what-when) can be investigated through user records and access to personal data must be thoroughly audited and easily queried. Actions to consider around data protection within iBRoad are shown in Figure 2. Further details on this topic can be found in the section on data protection in the report '*The logbook data quest: setting up indicators and other requirements for a renovation passport*'[8].

[4] *GDPR Regulation 2016/679*

DATABASE

	1		2	3	4	5	6	7	8	9	10
Actions	by Design	by Default	Controller/DPO	Policy Privacy	Users profiles	Consent of PD	Purpose of PD	Accuracy of PD	Storage limitation	Security of PD	PD Breach
Data gathering	x	x									
Database			x	x	x	x	x	x	x	x	x

Figure 2: Personal data protection actions around iBRoad (Source: iBRoad, The logbook data quest)

iv. Human-related restrictions

The renovation roadmap and logbook will only be successful if people find them useful. People are likely to be hesitant to enter data in the logbook unless it is in their interest to do so. Feasibility and replicability thus depend not only on designing and implementing the basic elements of the instrument, but also on creating a vision that can entice people to use it.

Human-oriented training of experts

The iBRoad project has put effort into the comprehensive training of auditors, communication and adaptation of existing training schemes, as this is essential for the success of the iBRoad tools. Auditors often follow specific routines and while they are expected to have the technical knowledge, soft skills that enable clear communication with clients are often missing. As well as technical skills, energy auditors should have good communication skills, establish effective communication channels and build professional relationships with building owners. This should enable them to emphasise the wider benefits of energy renovation (e.g. improvement in comfort, wellbeing and health) and follow the basic iBRoad principles shown in Figure 3. Further information on this topic can be found in *'The concept of the Individual Building Renovation Roadmap: An in-depth case study of four frontrunner projects'* and in the '*Handbook for Energy Auditors'* [2] [12].

In addition, energy auditors must develop an engagement strategy, build trust and set clear expectations (e.g. effective communication, project management).

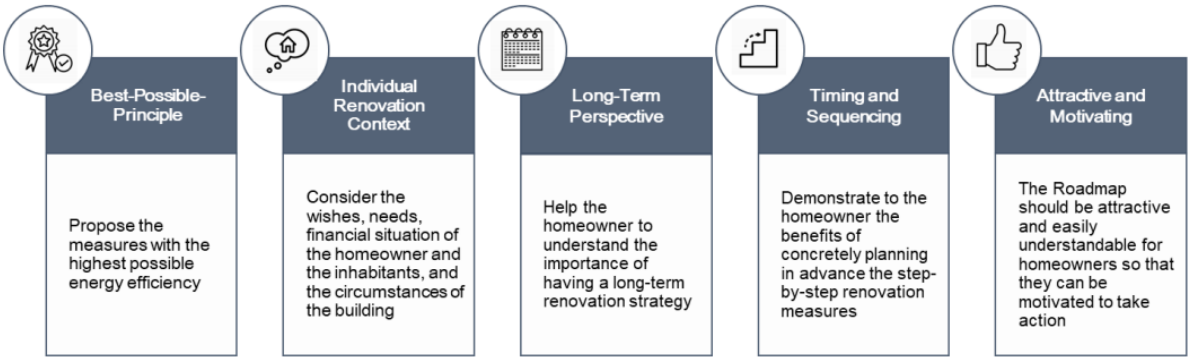

Figure 3: The iBRoad roadmap principles at a glance

User-friendliness of the tool

From its conceptualisation, iBRoad has emphasised user-friendliness and adjustability to country-specific conditions. Those responsible for implementing the tool should make a special effort to ensure it does not lose its focus on user-friendliness as well as considering behavioural aspects and insights. These could include raising people's awareness, engaging them to contribute to the social good, making complex information more accessible, and facilitating accurate assessment of risks, costs and benefits [13]. User-friendliness goes beyond ensuring that the tool is easy to use: it also covers insights from end-users' needs and expectations. From lessons learnt so far, the iBRoad concept should be attractive with a clear design, using non-technical and motivating language. Further details on this topic will be available in our upcoming evaluation and lessons learnt report.

Language restrictions

iBRoad has been established in non-technical language that the end-users (homeowners) can fully understand (simple and directed at non-specialists)[5] [2] [14]. Regions and countries interested in adopting the iBRoad concept should maintain its non-technical language. In addition, it is crucial for the tools to be available in the national language of the country replicating the iBRoad concept.

To maximise the engagement potential, iBRoad is promoted through agreed channels. Partners of the iBRoad project: (i) include iBRoad information on their organisation's website with an active link to the project's website; (ii) actively promote iBRoad news through their organisation or personal social media channels; and (iii) include iBRoad information, findings and reports in their newsletters [15].

[5] *These are points mentioned in the following reports: 'iBRoad Stakeholder Meetings: Key notes and findings of 1st physical events round' and 'The concept of the Individual Building Renovation Roadmap: An in-depth case study of four frontrunner projects'*

III. FEASIBILITY OF THE iBRoad CONCEPT IN THE EU

Under Article 19a of the EPBD, the European Commission is tasked with assessing how EPCs could be improved as well as exploring the concept of building renovation passports by 2020. This means that although building passports are not required at national level, the European Commission will conduct research to assess whether such schemes (including as an optional provision) could be feasible. This, depending on the assessed feasibility, could later result in a legal provision to require them nationally [16].

The European Commission has further launched an ongoing feasibility study to analyse the possibilities, need and timeline for the potential introduction of EU provisions in relation to an optional building renovation passport. There is also an upcoming European Commission study on the development of an EU framework for a digital logbook for buildings. The results of these studies, together with the results from the countries in which iBRoad is being tested, could inform the development of the building renovation passport at EU level.

A feasibility study is performed to determine whether an innovative initiative is legally, economically and technically viable [17]. Its aim is to examine and evaluate the possible future success or failure of prospective endeavours. The endeavour is defined as 'any future project examined for its prospective feasibility' [18]. Feasibility studies help us determine whether an intervention is required for further testing. They enable assessment of whether the project idea can be shaped to be relevant and sustainable. Based on the knowledge from feasibility studies, the eventual 'go/no go' decision is made [19] [18].

A feasibility study of the iBRoad concept implementation throughout the EU requires substantial effort in different areas, including concept design, stakeholder involvement, market analysis, software development, legal and financial preparations as well as expert training. Having identified the main barriers to design and implementation of the iBRoad concept as a first step, further below we present the required steps [20] to conduct a feasibility study:

i. Step 1: Concept initiation

The iBRoad concept can be initiated by different actors. Depending on local circumstances, the process can be launched by public (e.g. Flanders: Woningpass) or private actors (e.g. Denmark: BetterHome) or even a mixture of both [2]. Examining the way these actors are triggered and organised, the interest from the government, the existence of strong private partners and the urgency to move both is key. Surveys of several stakeholders reveal that available finance (financial incentives such as subsidies, etc. and financing instruments such as targeted loans offered by private banks, etc.) could trigger renovation and that at the same time there is a desire to know how to renovate/how to avoid mistakes. These can spark the decision to develop a tool like the building renovation passport [3].

Public authorities

The iBRoad tools can support countries' commitments to targets (e.g. climate resilience target, improving living standards, etc.). The ability to link the tools with other public but also private instruments (e.g. financial subsidies) is an advantage of launching the iBRoad concept with support

from public authorities (e.g. energy agencies, municipalities, etc.). However, launching the tool with support from public authorities also comes with potential disadvantages like the longer time needed for implementation, their expectations (e.g. do they want to have access to information?) and being linked to election and public budget cycles [2].

Private actors

The iBRoad concept can also be initiated and managed by private companies or individual actors (e.g. energy suppliers, insulation companies, heating industry, private agencies). The main benefits of the instruments initiated by private actors are the expertise in creating a competitive product as well as a better knowledge of its commercialisation in the market. One of the main challenges in this case is to build trust among the customers, a challenge that is larger in some countries than others [2].

Combination of public authorities and private actors

The concept can also be a mixture of both public and private actors. This model can combine the benefits of the other two options and take advantage of what the public authorities and the private actors do best (e.g. market analysis, quality control, coordination with other instruments). Non-governmental organisations, think-tanks and research organisations can also be part of the mixed model. To ensure the functioning of the mixed model, it's important to establish clear governance rules, including monitoring and evaluation mechanisms to maintain the balance of power between parties [2].

In order to allow a more efficient adoption of the iBRoad concept at national or regional level and also promote a better link with entities and institutions at national level, it is essential to identify and engage relevant stakeholders who can also contribute or benefit. Further details on stakeholder involvement can be found in: '*The logbook data quest: Setting up indicators and other requirements for a renovation passport*' and '*The iBroad concept in practice: Report on suggested elements, content and layout of the iBRoad tools*' (stakeholder sections) [8] [21].

In Bulgaria, to give an example, the iBRoad concept might be integrated in a national building stock repository system managed by the Ministry of Regional Development which is included in the draft of the national housing strategy, and data could be partially collected by the national census. If the logbook is privately managed, it must emphasise its market implementation so that included projects can achieve a better market positioning.

ii. Step 2: Preliminary analysis

Project scope

The iBRoad tools should first outline a plan, including what it aims to achieve, how it intends to achieve it, who is involved and how it should be developed (e.g. targeted number of deep renovations aiming to reduce CO_2 emissions, etc.).

The project's scope should be defined in detail, in line with and tailored to the national context.

Market analysis and research

A market analysis involves the investigation of aspects such as what kind of renovations are being performed in the country, the situation of the building stock and homeowners' willingness to invest in energy renovation. National programmes to fund renovation in residential buildings, completed or still running, and levels of energy poverty should be explored.

As part of the market research, the supply side should also be analysed: what renovation services are offered by the construction sector, how did the renovation sector respond to support programmes and what is the view of homeowners related to holistic versus step-by-step deep renovation approaches? In Bulgaria, for example, renovation is usually done step-by-step without any design project, often by inexperienced workers: there is no understanding of the added value of getting technical advice from an audit or roadmap.

The available 'systems' for renovation advice that already exist in the country and the experience of energy auditors in providing recommendations or just reporting on the current status of a building can also be investigated.

In the market analysis, deep renovation should be clearly differentiated from shallow renovation, and minimum performance levels for renovation measures should be considered (e.g. U-values, performance of components etc.).

The market must be further examined by identifying and understanding the potential end-users of iBRoad and their needs (e.g. homeowners, their potential financial capacities, etc.). It is essential to identify the market uptake of the iBRoad concept (e.g. energy auditors, contractors, renovation experts, etc.) and examine the different types of businesses that would be affected, while exploring the willingness of the construction value chain to invest in a project like iBRoad (as in Denmark and France – see Step 4 below). The tool must fit the business models of the value chain and market actors must be able to see the value of these new opportunities.

Executing a country-specific 'business' analysis on the countries' views in implementing the renovation roadmap and/or the logbook is also important. The approach adopted by iBRoad involved market analysis including users' needs, deep renovation targets and a modular development allowing for a paced implementation in different regions or countries. It is crucial for countries to know that they can deploy the tool their own way and that it can start small (without neglecting the final goal) and expand based on the country-specific needs.

Legal: enabling policy

For the iBRoad to be effective, it should be accompanied by enabling policies and measures that promote deep renovation and financing mechanisms adapted to deep staged renovation (instead of measure-based incentives, where owners are pushed to use incentives before the programme

disappears rather than doing what is needed in the right order). Experts suggested that the iBRoad tools should be embedded in long-term policies, including the long-term renovation strategies required under the EPBD.[6] Policies and strategies must be created and adapted to include sustainable energy issues at all governance levels.

Stakeholders from Bulgaria mentioned that the iBRoad tools 'have the potential to seriously impact policy-making in Europe to surge a decarbonised building stock. In countries where the state supports programmes and prioritises measures in multifamily buildings, it is one of the few support tools at the disposal of individual owners. Thus, it covers a major gap in raising awareness for the benefits of a deep energy retrofit for this sector, showing potential to transform the renovation roadmaps and the project logbook into a major impetus for access to professional expertise and tailored advice for the building owners' [14].

iii. Step 3: End-user needs and stakeholder engagement

It is important to understand the end-users and other stakeholder needs, preferences and expectations related to the new instrument. As mentioned above, the market analysis provides a first stage for a preliminary exploration of stakeholder needs; this stage covers a more in-depth analysis of their needs and expectations. Understanding the behaviour, the preferences and the decision-making process of clients including end-users and other stakeholders is crucial. This was an initial step performed to help us develop the iBRoad tools. Market research and analysis (survey, in-depth interviews, etc.) can be performed at various stages of the process: before developing the concept, during its design and for testing purposes both during the pilot phase or before releasing the product on the market [2].

End-user needs

Understanding the end-users' needs will enable a more effective design of the individual buildings renovation roadmap tailored to specific markets. Fully considering the needs of end-users (including building owners and building occupants) avoids the risk of 'locking-out' future renovation solutions due to lack of foresight.

In preparation for testing the iBRoad tools in Bulgaria, Poland and Portugal, 1,502 user-profiles were analysed[7], including information on knowledge of their needs, preferences and trust in the pilot countries. This survey was carried out to develop the iBRoad tools and can serve as an example of preliminary market research. A few key findings from a set of qualitative interviews and a survey conducted by Ipsos in the three countries are summarised below (Figure 4) [3]:

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[6] *Energy Performance of Buildings Directive (EPBD) 2018/844, Article 19a*

[7] *The iBRoad consortium contracted Ipsos, a global market research and consulting firm, to conduct the user survey.*

Figure 4: Key findings on the needs and preferences of end-users in Bulgaria, Poland and Portugal

A further takeaway from this survey is that most building owners (between 76% and 84%) in all three countries planned to finance the renovation with their own savings. As deep renovation is rather expensive, most owners will perform one measure after the other with some time interval. A building renovation roadmap could ensure that the best measures are taken in an optimal order.

The most important aspects respondents wanted to see in a renovation roadmap are the estimated costs of each renovation step (between 59% and 69%), the expected benefits in terms of reduced heating consumption/bills (between 48% and 60%) and technical information to help them avoid mistakes (between 47% and 56%). What respondents mainly wanted to see in a logbook were the building features (49%–59%), technical specifications (46%–58%) and basic information about the house (48%–55%). Respondents from Portugal are more interested in finding the energy performance certificate in the logbook (62% compared to 41% and 38%) [3]. It is crucial that every country willing to assess the feasibility of the instrument performs a similar or more comprehensive study.

End-users further claimed that public authorities could play a role in setting up and incentivising the use of a building renovation passport, for example by:

- setting up the structure for data gathering and use
- providing funding for energy audits
- raising awareness on the benefits of deep energy renovations
- providing funding for the development of a national tool [3].

Stakeholder input

To identify the replicability of the iBRoad concept in different countries, several stakeholder meetings were held in the iBRoad partner countries. Amongst others, participants were public authorities, building and consumer associations, financial services, etc. Some of the main findings per country, useful for the future replicability of the iBRoad concept, are summarised below[8] [14]:

- Bulgaria: single-family buildings are outside the scope of the legal requirements to perform energy audits, so market-based solutions need to be developed.
- Germany: there is an ongoing procedure for building renovation passports and data exchange should occur in both directions: from the online building tool to the passport and vice versa.
- Poland: the implementation of the iBRoad concept must be pursued as soon as possible to deal with the county's greatest problem – smog.
- Austria: renovation coaches must have interdisciplinary competencies like creativity, social skills, communication and others, and be able to propose solutions that the building owners may initially not like.
- Greece: there is a need to convince the market of the usability of the iBRoad concept and the added value that it will bring to the market.
- Belgium: good communication of the benefits is vital to foster a successful energy transition.
- Romania: it is necessary to raise the level of ambition and establish a clear, detailed and quality set of performance requirements, both in designing and executing the renovation work.
- Portugal: Portuguese consumers give high importance to buildings' energy efficiency, not only when deciding to purchase a property but also with their willingness to finance the renovation costs with their savings.

It is recommended that stakeholder dialogues are carried out throughout several phases of the design, implementation and evaluation as this can bring benefits including raising awareness of the new tool and gathering feedback for future improvements. In addition, involving external parties will increase their rate of engagement and acceptance. The implementation process can be further improved by using the communication network of stakeholders from iBroad.[9]

iv. Step 4: Comparison and integration with relevant existing tools

The tools, programmes and schemes (e.g. EPCs) already available on the market (private or public) ought to be explored to investigate whether iBRoad should further build on these, offer a parallel product or develop a new independent tool. For example, in some countries such as Portugal or Belgium, this could mean linking the iBRoad tools to their existing EPC scheme.

A set of criteria, such as data access and availability, innovation level, implementation type of the initiator, impact on the market and more, can be defined to assess the schemes and initiatives.

[8] *All relevant input from stakeholders can be found here: www.youtube.com/watch?v=l-EItLhcMNA*
[9] *https://ibroad-project.eu*

Further criteria could include technical aspects (such as calculation approaches), organising bodies, or look and feel. Based on this set of criteria, relevant schemes, including the building renovation roadmap and the logbook, can be further reviewed and developed.

Four existing initiatives on the concept of the individual building roadmap are briefly presented in this section to show how the different elements can be designed and implemented. Examining possible links with similar tools is important to increase recognition and impact.

Flanders, Belgium (Woningpas and EPC+)

The Flemish Energy Agency (VEA), in cooperation with a wide network of stakeholders, has designed and implemented the "Renovation Pact", designed to lead to a thorough improvement of the energy performance of the region's building stock. One of the main actions foreseen in the Renovation Pact is to develop the Woningpas (a logbook) and the EPC+ (a more user-friendly version of the EPC, including a clear overview of measures, ordered by priority, needed to reach the 2050 objective). The two instruments aim at providing building owners with useful, easy-to-understand information and long-term guidance. Through these instruments, the public authorities in Flanders also intend to contribute to the region's long-term objectives [2]. EPC+ in Flanders is an evolution of their existing, and rather successful, EPC scheme. A lot of Flemish people view the roadmap feature as providing added value. This couples with the logbook, which is a new tool, created as it was considered necessary to monitor the transformation of the building stock (and make things more digital and convenient).

France (Passeport Efficacité Énergétique)

The concept for the Passeport Efficacité Énergétique (P2E) was developed by the Shift Project together with a group of building specialists and professionals, and offers advice to owners, auditors and renovation professionals. The objective was to unlock the thermal renovation of residential buildings, identified as an imperative step towards decarbonising the economy. The P2E association that leads the initiative promotes a pragmatic approach, building upon the opportunity to trigger energy renovation every time maintenance work is done in a building. Comfort is defined as a key performance indicator [2] [22]. The P2E was developed outside any existing system and is an initiative of researchers and companies believing in the solution. The model can be used by cities and one-stop-shops, of which there are many ambitious examples in France.

Germany (Individueller Sanierungsfahrplan)

The concept of the Individueller Sanierungsfahrplan (iSFP) – 'individual renovation roadmap' – was initially developed and tested by ifeu and ECONSULT in the federal state of Baden-Württemberg (BW). The Sanierungsfahrplan BW is an energy audit instrument, publicly funded by the state bank (L-Bank) and carried out by certified energy auditors. The public funding will stop at the end of 2019 as the iSFP will then be supported at federal level. Besides residential buildings, the official decree defining the Sanierungsfahrplan also defines requirements for a renovation roadmap for non-residential buildings. It includes customised measures, technical documentation and support material for implementation for the building owner, and also provides training to the energy

auditors to help obtain technical and communication skills [2] [22]. The EPC scheme in Germany is a 'tick-the-box' exercise, the country having a very developed energy audit culture. The iSFP is thus an evolution of a normal energy audit. The authorities integrate the new roadmap with existing programmes and requirements and making it more relevant.

Denmark (BetterHome)

BetterHome is an innovative business model initiated by four major building-component manufacturers in Denmark (Danfoss, Grundfos, Rockwool and Velux). While it is not a building renovation roadmap per se, the model shares many of its characteristics (user-centric, focus on deep renovations, adapting the role of installers, focus on multiple benefits and innovative technologies). BetterHome is an industry-driven one-stop-shop model, which has proven successful in boosting demand for holistic energy renovations in Denmark. The BetterHome model is currently developing a mobile application for the building owner. This can be used for a two-way communication, where the building owner can obtain support and BetterHome can nudge them to use their energy more wisely. In addition, the application will automatically notify the building owner when it is time to consider investing in a new measure (e.g. change heating system) [2]. BetterHome is a private scheme that utilises the open building registry in Denmark to provide a better product.

Interaction with tools existing or under development

Further information on similar tools, existing or under development, and their interaction with iBRoad across the EU was collected during the stakeholder meetings.

- In particular, the Portuguese raised concerns on the differences between the calculation processes and approaches (recommendation measures) on the energy certification of buildings.
- In Romania, the possible correlation of the useful tool ENERFUND[10] with the iBRoad tools was discussed.
- The use of the roadmap could be encouraged through links with existing subsidies in Belgium (Flanders).
- Greeks highlighted the importance of creating synergies between different existing national tools (e.g. EPCs) and the tools of the iBRoad and making these available to the market.
- In Austria, each province uses different software to calculate the EPCs, and some of them are working on the integration between EPC calculation software and other energy consultancy tools. Software producers hold the necessary tools to support modernisation. These tools can be useful in the replication of the iBRoad concept.
- There are already various logbook approaches in Germany, so it is recommended to establish a common data standard, similar to 'Open Immo' standard (www.openimmo.de) .
- In Bulgaria, integration could be pursued between the information system of the Sustainable Energy Efficiency Agency and the system currently developed by Sofia. The

[10] *http://enerfund.eu*

creation/development of one-stop-shops for in-depth energy renovation projects – providing general guidance on renovation leading to more comprehensive paid services, including links to companies – could complement the iBRoad project and be part of an integrated approach [14].

- Portuguese experts suggested that there is a good opportunity to link EPC central registries and the iBRoad logbook. Entities managing EPC registries could integrate the iBRoad logbook and therefore create an additional business model/link.

v. Step 5: Financial aspects

The required resources and potential financial risks to implement the proposed idea need to be identified. There are three main categories that involve financial aspects and require investments:

- Costs for the development of the tool (e.g. software programs and tools)
- Costs for the execution of the iBRoad concept, i.e. the operational phase (e.g. auditors' training costs)
- Costs related to the renovation works and the need for subsidies (the iBRoad tools would have no value if homeowners are not able to finance the renovation works).

Some key reflections from the market and inputs collected from relevant stakeholders throughout the iBRoad project on financial aspects are summarised below [14]:

- iBRoad instruments should be promoted to banks that develop and implement energy loan programmes.
- Some financing must be made available for deep renovation; it should be clear who will provide it and under which conditions.
- In many cases, people mentioned that they would be willing to do renovations if subsidies were available but they are not willing to pay for energy consultancy inspections.
- The preparation of documents related to the iBRoad tools must be partially or fully financed by external assets.

Sustainable funding from public or private sources, or a combination of both, is needed to design, test and implement iBRoad, adopt the tools at national level (business model for iBRoad) and finance the renovation works. The business model should consider how iBRoad will be paid for and how it can be integrated into other financing instruments like energy efficiency loans (e.g. is it part of the loan, paid by the owner before requesting the loan, or part of a public fund or another programme that enables access to a loan, etc.?).

For the case of Bulgaria, feedback on finance from national experts identified two types of users: those relying on their own funds (the majority) and those looking for credit from a bank. The first group is tougher to reach, so marketing/communication campaigns promoting the added value of consultancy are needed. The second is more feasible, as the price of the roadmap/audit can be included in the cost of the credit and banks would prefer to invest in projects of good quality that clearly show the expected results of renovation. The iBRoad can provide this information and banks can use it to assess the loan request. In both cases, access to public financing would boost energy renovation. Experts suggested that banks or financial institutions can be the best selling point for the iBRoad in Bulgaria. They have the opportunity and the skills to work with end-users on a standard

banking product, and are likely to have better soft skills than auditors for communicating with clients. A hotline for technical advice is crucial in this case. Bulgarian stakeholders further highlighted that without targeted subsidies it is very unlikely that the iBRoad concept will receive a warm welcome by the market. Public financing is crucial before it gets the volume and speed needed to really impact the market.

Public financing

In Flanders, the cost for setting up the instrument is carried by the Flemish government. Thanks to an inter-ministerial co-funding involving four Flemish administrations, the funds for the Woningpas are guaranteed until the release of the Woningpas Medium (in 2019), which is a richer and more dynamic version of the logbook. As part of the Flemish government's vision to become fully digital 'Vlaanderen Radicaal Digitaal', Flanders elaborated a finance contract for the design and IT development of the Woningpas for a five-year period (2017-2022). The administration is also developing a governance model so that other partners can join the collaboration for data collection (development and maintenance), including a financing model [2].

Private financing

In France, the costs for the design and testing of the P2E were covered by private actors: the Shift Project initially introduced the concept and a group of private companies agreed to provide seed funding for the creation of an association (Expérience P2E) in charge of developing the design and testing the concept. Several funding options have been discussed to further develop the passport and integrate it in different regions, but it is still unknown how funding will be guaranteed in the future [2].

BetterHome, in Denmark, was also financed by private actors with a commercial incentive to increase the rate of (deep) renovation and grow the demand for their products. No public support has been granted to this project. The financial model of BetterHome is very simple: there are no payments between BetterHome and the installers or the building owners. BetterHome receives its whole budget from Danfoss, Grundfos and the ROCKWOOL Group, who, in return, retrieve indirect sales revenues [2].

vi. Step 6: Impact assessment

The objective of implementing the iBRoad concept across the EU is to have significant positive social, economic and environmental impacts. These can affect a broad group of stakeholders, such as homeowners, financial institutions, governments, energy distributors, energy experts, auditors, etc. The ways that these stakeholders are affected and how the impacts will be monitored and evaluated should be assessed prior to replication. Impacts on energy savings and construction works must also be evaluated. According to feedback collected from experts in Bulgaria, given the integration with funding mechanisms, the implementation of the iBRoad concept has the potential to alleviate energy poverty and improve indoor and outdoor air quality, bringing social, economic and environmental benefits.

Social

Benefits of energy renovation go far beyond the reduction of carbon emissions, and include improved health, comfort, wellbeing and productivity through enhanced indoor environmental quality (indoor air quality, thermal comfort, lighting, acoustics). A recent BPIE study made a first step in defining, measuring, quantifying and monetising the benefits of energy renovation investments in non-residential buildings (schools, offices and hospitals). This was done by investigating the specific impacts of indoor air quality, thermal comfort, acoustics and lighting on health or productivity [7] [23].

Economic

The development of customised renovation packages will increase the number of individual deep renovations, local employment and the quality of the works. This will also increase the real estate value and property prices [24]. As the iBRoad project targets residential buildings with a focus on single-family homes, a way of estimating this impact is to take into account the proportion of the population living in single-family homes in the corresponding country and estimate the impact compared to the entire building stock (Figure 5).

In addition, lessons learnt from existing cases such as the acceptance of end-users, the average saving per renovation process, collaboration with the construction sector, links to financing or number of increased deep renovations should be considered.

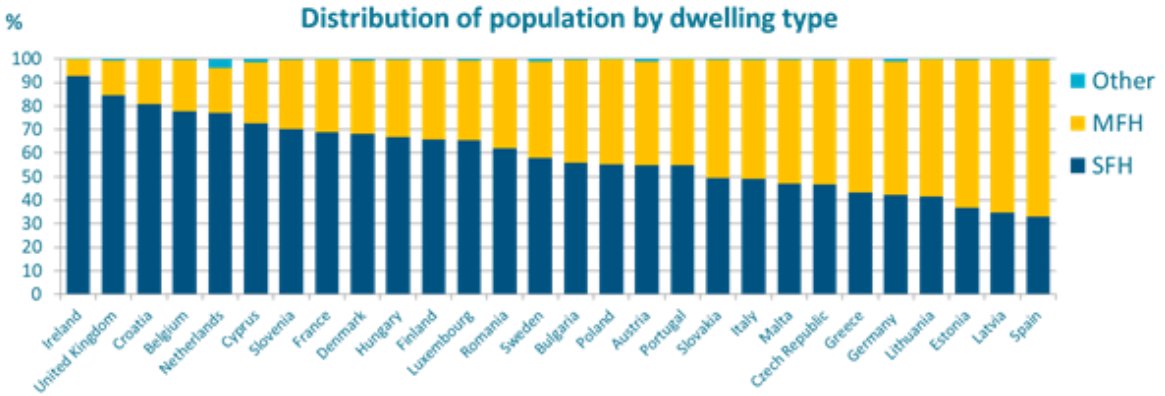

Figure 5 Distribution of population by dwelling type, single-family homes (SFH) or multi-family homes (MFH) (source: EU Building Stock Observatory)

Environmental

Renovation measures improve the energy performance of buildings and this has a significant positive impact on energy demand, greenhouse-gas emissions and air pollution (e.g. impact could possibly be calculated through findings from air pollutant measurements). The implementation of the iBRoad concept will generally raise awareness on energy renovations and environmental issues, enhancing the implementation of EU policies on the building stock renovation.

Capacity building

The implementation of the iBRoad concept will further positively impact capacity building and skills. The number of people with increased capacities, capabilities and competencies on energy issues should be estimated. In addition, quantitative indicators can be calculated from audits, logbooks, the training activities of auditors and the number of auditors.

IV. GUIDELINES FOR REPLICATING THE iBRoad CONCEPT

After identifying the main barriers to design and implementation of the iBRoad concept, the required steps to conduct a feasibility study should be explored. A feasibility study must then be performed to explore whether the initiative is viable. Once this is done, and a positive decision is made, the next step is to implement the initiative by considering all aspects covered in the feasibility study. Replicability refers to a process that allows a project or activity to be duplicated at another location or time. Replicability is the potential of an innovation, a project or a pilot test to be replicated, expanded, scaled up or adapted. Exploring the replicability of the iBRoad concept will help us identify if we can achieve its EU-wide implementation [25] [26].

Deliberate efforts are required to scale up the tool into a widely accepted instrument, to benefit more people while at the same time anchoring renovation policies and programmes in a long-term perspective [25]. When replicating and implementing the iBroad concept in a country, it is crucial to consider and adapt to the country's specific characteristics and national and regional conditions such as national standards for demand calculation, data availability, cost of data, EPCs, climatic data, language, local policies, etc. All barriers to design and implementation and steps of the feasibility study mentioned in the previous chapters should be taken into account in the replicability phase.

i. Drivers

Replicating the iBRoad across Europe will be driven by a combination of public or private leadership, competition and collaboration. Leadership is essential to introduce a new instrument to the market, and to make it successful, it must be nurtured and pushed forward. For example, in Germany and Flanders the initiatives are driven by (regional) governments, while in Denmark (BetterHome) and France (the Passeport Efficacité Énergétique) the initiators are private actors. Competition amongst political groups or private actors could encourage them to develop an improved solution, like the iBRoad tools, to an existing problem such as building renovation. Lastly, collaboration across different administrations and stakeholders is crucial for the exchange of views and ideas. When people are involved in the process they have a higher tendency to support its outcome. It is also important to involve different players from different areas (economic, social, environmental) and across departments (e.g. buildings, urban planning, finance) from the beginning [27].

ii. Design and implementation stage

Strategic planning is required for replicating the iBRoad concept. At this stage, the iBRoad concept should be adapted to the local and regional regulatory requirements of the respective country. If legislation to support its implementation is either poor or does not exist, effort must be given to its development. Regulation ought to allow the deployment of the concept to be replicated, meaning that there may be cases when national regulations need modifications on minimum requirements for deep renovation, or in order to allow deep step-by-step renovation.

A core requirement for the replication of the iBRoad concept in different countries is that the proposed concept can positively interact with or build further on existing related tools but can also easily be adapted to a country's specific situation. The viability of all technical aspects involved within the renovation roadmap and the logbook should also be determined. Lack of acceptance and

recognition by homeowners of the iBRoad tools can be a significant barrier to implementation, so early involvement and understanding of homeowners in the design stage will increase their acceptability and the chances of successful implementation.

A project can be replicated if it is viable for the intended country or region (e.g. Austria has nine regions with different instruments and legislations, so replication should be adapted to regional conditions). This implies that all economic factors will evolve as desired and planned. Sustainable funding from public and/or private actors must allow for the design and implementation of the iBRoad concept. Funding should cover the overall costs of the programme implementation and, amongst others, the training of experts and all required software tools.

Once legal, technical and economic factors are taken care of, strategic planning ought to be developed to recruit more households to be renovated. Communication or recruitment campaigns led by private or public actors or even energy auditors could have a positive influence on increasing the uptake of the iBRoad concept, while stakeholders could be its ambassadors.

Implementation is a crucial stage of the replicability process. During this stage, the goals and objectives of the iBRoad concept are transformed into action. The implementation phase of the iBRoad as it is currently being tested in pilot countries is flexible enough to adjust to relevant feedback. This should also be ensured in further implementation. According to the Belgian experts, joint research and the involvement of stakeholders can improve the implementation of the iBRoad concept. The implementation of the iBRoad concept must be continuously monitored, and instruments to effectively monitor the process need to be available throughout. The process will provide ongoing and systematic information that will strengthen the implementation of the project. The monitoring process gives the opportunity to compare the implementation efforts to the original goals and targets and also helps determine whether sufficient progress is being made towards the expected results.

iii. Evaluation stage

Regular evaluation, adaptation and improvement throughout all stages of the design and development, implementation and operation are critical to ensure a successful replicability of the iBRoad concept. This should include proper compliance and control to ensure quality. To allow for a proper evaluation after the implementation, a methodology is needed to measure whether the expected targets are reached by comparing them with existing baselines. Evaluation and adaptation of several processes during the implementation of the iBRoad concept will allow for the development of a more efficient, user-friendly and widely accepted concept. It can further help maximise the impact of building renovation, ensure its usability and added value over time and produce insights that can be used for future project planning processes.

An evaluation strategy should initially be developed in which key evaluation questions and performance indicators must be set. Some questions that need to be accounted for in the evaluation are:

- Does iBRoad interact with existing relevant tools as initially planned (e.g. existing EPC scheme, audit software, etc.)?
- Are the intended beneficiaries of the concept (homeowners) being reached?

- How well does it contribute to the solution of the long-term renovation plan (number of deep renovations performed, number of auditors trained) [27]?

In Germany, the iSF initiative was evaluated based on surveys amongst homeowners, auditors and software companies [2]. The next stage of the evaluation strategy could include the data collection, analysis and interpretation, dealing with both building-related data and auditors' competencies. This could also cover evaluation of experiences and feedback from homeowners and other stakeholders (are they satisfied with its progress?). The last step of the evaluation is a report to communicate the evaluation results. This step can provide valuable information to other countries and regions willing to learn from the experience of those who implemented similar concepts. Without proper evaluation, it is difficult to discern how and why an idea, project or concept is successful or is failing, hampering its potential for further replication [27].

V. NEXT STEPS

This report provides an overview on the requirements that should be considered by those aiming to implement the iBRoad concept in their country. This is an ongoing work and details on specific elements of implementation will be found in upcoming reports. The next step will involve an analysis of the overall costs of the programme implementation and guidelines on how to cover these costs. At this stage, the overall costs of the programme implementation will be analysed; the costs of different models and ways to share the costs of the programme between the different actors such as buildings owners, tenants or public administration will also be identified. The above will contribute to the development of guidelines on how to keep the costs of the programme low and how to find a compromise between the required level of detail and the corresponding costs of the logbook.

The next stage will investigate options to increase the diffusion and impact of the iBRoad concept. Aspects to be examined cover support schemes for energy audits based on iBRoad, energy efficiency/renewable energy measures as well as tax and bonus-malus incentives. This step will further analyse regulatory approaches such as how to integrate the iBRoad concept in building codes, or incentives to carry out the iBRoad concept as part of renewable heating obligations. The potential integration of the iBRoad roadmap and logbooks into the EU legislation will also be investigated, while data protection issues and broader ethics aspects will be explored.

The potential extension of the iBRoad concept to different building types, such as multi-family buildings, will also be examined at a next step. There, a methodological approach will be refined to qualitatively broaden the application of the iBRoad concept. Amongst others, issues that will be considered at this step involve the different energy requirement specifications as well as the different ways of approaching building owners of either privately owned or rented properties, single or multi-family houses.

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