Study on the Development of a European Union Framework for Digital Building Logbooks

FINAL REPORT

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ABSTRACT

This study provides the basis for the development of an EU framework for Digital Building Logbooks. The definition of Digital Building Logbook has been created as part of this study, based on a thorough stakeholder consultation, interviews with experts and detailed analysis of 40 existing Building Logbook initiatives across Europe and beyond. In short, a Digital Building Logbook is a common repository for all relevant building data; it facilitates transparency, trust, informed decision making and information sharing within the construction sector, among building owners and occupants, financial institutions and public authorities. Following the identification of the main gaps that have to be addressed a set of actions has been proposed to address those gaps. Out of them three priority actions are proposed to be carried or supported by the European Commission in order to spread the use and efficient functioning of Digital Building Logbooks: (1) Development of a standardised approach for data collection, data management and interoperability and its legal framework; (2) Development of guidelines for linking existing databases; and (3) Launch of public funded R&I projects to further explore the Digital Building Logbook concept and its implementation. For each priority action, a comprehensive assessment is carried out, including a set-up and roll-out plan, a feasibility evaluation and synergies with existing EU and international initiatives.

ACKNOWLEDGEMENTS

EXECUTIVE SUMMARY

Introduction

The availability of consistent and reliable data can contribute to better design, construction and management of buildings, improved market information and transparency, creation of innovative services and business models, as well as more effective policymaking.

Studies suggest that the construction sector is underdeveloped in terms of overall digitalisation and data applications in comparison with other industry sectors. Building-related data (such as physical building characteristics data, environmental performance information and real estate transaction data) is often scarce, of unreliable quality and limited accessibility. The lack of a common data repository amount to additional costs and inefficiencies, stifle innovation, increase risk and undermine investor confidence.

The study on the "Development of a European Union Framework for Digital Building Logbooks" aims to support the widespread use of Digital Building Logbooks across Europe. It also encourages data transparency and increased data availability to a broad range of market players, including property owners, tenants, investors, financial institutions and public administrations. In addition, Digital Building Logbooks contribute to several EU initiatives and Strategies, such as "A Europe fit for the digital age", the "European Green Deal'' and its Renovation Wave, the new Circular Economy Action Plan, and the dedicated Strategy for a Sustainable Built Environment.

Definition of a digital building logbook

The following definition of Digital Building Logbook is proposed. It was elaborated based on a thorough review of existing literature, consultation with 32 experts through semi-structured interviews and 93 answers received through an online survey (see [1]). It was also discussed at three online events on 13 May, 1st July and 17 November 2020, gathering respectively 68, 66 and 94 participants.

> A digital building logbook is a common repository for all relevant building data. It facilitates transparency, trust, informed decision making and information sharing within the construction sector, among building owners and occupants, financial institutions and public authorities.
>
> A digital building logbook is a dynamic tool that allows a variety of data, information and documents to be recorded, accessed, enriched and organised under specific categories. It represents a record of major events and changes over a building's lifecycle, such as change of ownership, tenure or use, maintenance, refurbishment and other interventions. As such, it can include administrative documents, plans, description of the land, the building and its surrounding, technical systems, traceability and characteristics of construction materials, performance data such as operational energy use, indoor environmental quality, smart building potential and lifecycle emissions, as well as links to building ratings and certificates. As a result, it also enables circularity in the built environment.
>
> Some types of data stored in the logbook have a more static nature while others, such as data coming from smart meters and intelligent devices, are dynamic and need to be automatically and regularly updated. A digital building logbook is a safe instrument giving control to users of their data and the access of third parties, respecting the fundamental right to protection of personal data. Data may be stored within the logbook and/or hosted in a different location to which the logbook acts as a gateway.

Data governance

While the benefits of Digital Building Logbooks are undisputed, concerns over privacy, confidentiality, and control of data can be a limiting factor to the market uptake of Digital Building Logbooks. The Digital Building Logbook, and generally, open access to data, is riddled with challenges related to data protection, competitiveness, confidentiality, liabilities over the accuracy of the data as well as business models built on the premise of withholding data rather than sharing data. One of the most pertinent questions related to Digital Building Logbooks is the responsibility of holding, maintaining and updating all the – often sensitive and private – information.

Most stakeholders consulted agree that the building owner should be the principal owner of the information contained in the Digital Building Logbook. However, certain information should be made available to third parties with the data owner's consent. In this sense, the access to Digital Building Logbooks can be tiered according to different stakeholder categories and the purpose of data access. A data access layer can further clarify who has access to the data and who has the right to amend or delete records.

Regarding data storage, while there is no easy and "one size fits all" solution to the data storage question, three main approaches are being considered by current initiatives:

- Digital Building Logbook as a *database* which physically stores all the information related to the building.

- Digital Building Logbook as a digital *gateway* to which data and information can be linked via a unique building ID. The advantage of this approach is that information can be collated from various sources (both public and private) and the information is up to date whenever data is being updated at source.

- *Hybrid* versions which are a combination of the above two approaches.

Data privacy and security will also have a decisive impact on the success of the Digital Building Logbook. One of the key challenges finding the right arrangement for data privacy and security is given by the fact that both (1) EU data protection provisions are being modernised and constantly adapted, as well as (2) technology is developing fast providing new data-gathering opportunities but also challenges. Digital Building Logbooks will also need to be compliant with the General Data Protection Regulation (GDPR). Consequently, cyber risk and privacy must be at the forefront – with collaboration from the construction value chain, operators, IT companies, public authorities and active engagement of the public – to ensure the security of the data in the Digital Building Logbook. Setting a balanced agenda that would equally benefit citizens, markets and the public good will be an ongoing process.

State of play and review of national and sectorial initiatives

40 building logbook initiatives in different countries were analysed with the aim to highlight key success factors and barriers to the implementation of building logbooks: 31 are from EU countries, one is from Iceland (non-EU/COSME country), one from the USA and one from Switzerland (both non-EU/non-COSME countries) together with six H2020 research projects.

Building logbooks analysed

- Arc platform - USA
- BASTA Loggbok – Sweden
- Bedrebolig – Denmark
- Building Passport GBC – Finland
- CIBSE TM31 - UK
- Dossier d'intervention ultérieure – Belgium
- Electronic building ID – Greece
- Eigenheim Manager – Germany
- Fascicolo del Fabbricato - Italy
- Federal Register – Switzerland
- Gëbaudepass – Germany
- Hausakte – Germany
- Homebook – France
- Home Information Pack – UK
- Home report – Scotland
- Ilmastoviisaat Taloyhtiöt – Finland
- ImmoPass – Germany
- Klimatdeklaration – Sweden
- Le carnet numérique du logement - France
- Libro del Edificio - Spain
- Livro de obra - Portugal

- Madaster – The Netherlands
- Wikihabitat – France
- Min Villa – Sweden
- Mon carnet logement - France
- Opleverdossier – The Netherlands
- PAS-E – Spain
- Passeport Efficacité Énergétique - France
- Platform CB'23 – The Netherlands
- Produktkollen – Sweden
- Property Register – Iceland
- QDF Hausakte – Germany
- Real estate service manual – Finland
- Woningpas – Flanders

- **Relevant H2020 projects**
  - IBroad
  - ALDREN
  - BAMB
  - BIM4EEB
  - DigiPLACE
  - X-tendo

Each building logbook was analysed using an evaluation template (see [2]) which covers several aspects:

- Description of the initiative;
- Data fields and functionalities included;
- Public or private, paper or digital, mandatory or voluntary;
- Data management approach;
- Applicability over different types of buildings and usage by different stakeholders;
- Affinity and compatibility with other European initiatives.

The initiatives were clustered based on five maturity levels: under development, tested, in place, discontinued and relevant H2020 projects. This division allowed the review of the different groups to focus on specific aspects.

The building logbooks analysed mainly aim at ensuring access to information, support better decision-making, market transparency, and simplify the construction process. As part of the review the following key success factors were identified.

Bedrebolig	Produktkollen	Madaster	Woningpas
Building logbook development based on previous study, tests, and stakeholders experience			

Real estate service manual	Property Register	Federal Register
Regular updates		

Woningpas	Property Register	Federal Register
Clear legal framework		

Eigenheim Manager	Easy to use and user friendly
Min Villa	

Include process for data validation	Federal Register
	Woningpas

Clear scope of the building logbook			
CIBSE TM31	Woningpas	Federal Register	Property Register

Alignment with other initiatives/industry standards		
BASTA Loggbok	Opleverdossier	Arc platform

Detailed information on what should be provided by the different stakeholders in the value chain	
Real estate service manual	Produktkollen

Building logbooks success factors.

The analysis of the initiatives tested, in place and the discontinued building logbooks highlighted different barriers that prevent or slow down the uptake.

Cost implications
- Costs for implementation, update and validation

Static nature of the building logbooks
- Information often need to be manually updated and the building logbook does not include dynamic information on the day-to-day use

Privacy and data management
- Not clear data ownership and data handling procedures, including data validation

Access to information
- Information accessible only on site and/or to specific stakeholders

Administrative burden
- No clear understanding of the use and added value of the building logbook

Fragmented regional approach
- In particular in Italy and Spain where regions develop their own requirements for building logbooks

Barriers implementation building logbooks.

Gaps analysis

Based on the above-mentioned findings and on the stakeholder consultation, the gaps that still have to be addressed at EU, national, regional and sectorial levels were identified.

Financial aspects   **User expectations**   **Data aspects**   **Legal aspects**

Gap #1 Lack of a sound funding model	**Gap #6** Challenges linked with the interoperability of the repository
Gap #2 Digital building logbook's benefits not clear to all the stakeholders	**Gap #7** Issues with data governance
Gap #3 Inconsistency around the scope and purpose of the logbook	**Gap #8** Lack of defined legal framework
Gap #4 User-friendliness not optimised	**Gap #9** Uncertainty around the role of EU and MS level policy
Gap #5 Barriers to updating the digital building logbook	

Key gaps to be addressed.

15 actions to address these gaps were proposed, each being characterized according to predefined features and accompanied by a qualitative assessment regarding the feasibility, added value and resources needed, potential synergies with existing building logbooks related initiatives and acceptability by the professionals in the sector.

- Action A. Launch of publicly funded R&I projects to further explore the digital building logbook concept and its implementation

- Action B. Cost-benefit analysis and impact assessment

- Action C. Identification of different funding models

- Action D. Market potential study of specific functionalities

- Action E. Communication campaign and awareness-raising activities

- Action F. Make digital building logbooks mandatory for public buildings
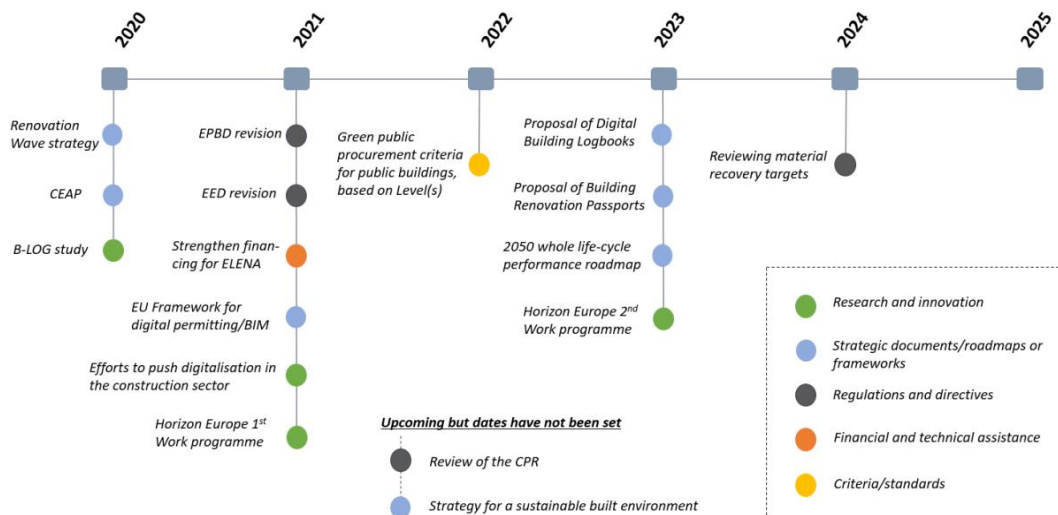
- Action G. Creation of a digital building logbook definition at EU level, including data fields and functionalities

- Action H. User experience study

- Action I. Development of a standard for data collection, data management and interoperability

- Action J. Development of guidelines for linking existing databases

- Action K. Training for construction and built environment professionals

- Action L. Juridical/legal study about data governance aspects (ownership, privacy)

- Action M. Development of a public tool enabling plug-ins from the private sector

- Action N. Exploration of potential legislative actions

- Action O. Mapping and guidance for the deployment of digital building logbooks

Recommended Commission actions

The final part of the study identifies, among the above list of 15 actions, three priority actions for the European Commission to consider and potentially carry out in support of the widespread use and efficient functioning of digital building logbooks across the EU. The assessment comprises a feasibility evaluation, a concrete action plan and an overview of potential synergies with existing EU and international initiatives. The identification of actions is based on stakeholder recommendations, their assumed impact, and their potential to alleviate the bottlenecks (or gaps) impeding the successful deployment of Digital Building Logbook schemes.

The Renovation Wave strategy encompasses several relevant provisions, including the proposal to introduce Digital Building Logbooks (2023), but also the revision of the Energy Performance of Buildings Directive (EPBD), the review of the Construction Product Regulation (CPR), a 2050 whole-life cycle roadmap (2023) and the review of material recovery targets. These policy developments create the ideal momentum for the European Commission to further develop and implement the concept of the digital building logbook.

Policy timeline based on the Renovation Wave Communication. Only provisions relevant for the digital building logbook are included.

Priority action 1: Development of a standardised approach for data collection, data management and interoperability including its legal framework

Most experts engaged in this study think that a wider uptake of the digital building logbook requires a systematic and more closely aligned capture of information, data gathering, processing, exchange and storage[1]. This entails all building-related data, of both static and dynamic nature, and can include administrative documents, plans, description of the land, the building and its surroundings, technical systems, traceability and characteristics of construction materials, performance data, and links to building ratings and certificates.

An EU-wide harmonised set of logbook data protocols would enable interoperability and the inclusion of external databases while bringing together fragmented and scattered data across several organisations (or even departments within the same organisation). The standardised digital building logbook would be a safe instrument, at once giving to users control of their own data and allowing access to third parties while respecting the fundamental right to protection of personal data. It would also help Member States to develop and adopt legislation and public initiatives, fostering not only the uptake of the digital building logbook but also the digitalisation of the whole value chain.

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[1] See stakeholder outcomes in [1].

Priority action 2: Development of guidelines for linking existing databases

The digital building logbooks, as described the Renovation Wave strategy and within this study, rely on connections which enable data exchange between several data repositories. A large number of building information databases exist across the EU, whereas the purpose of the digital building logbook is to bring these data sources together and become a common gateway to access data. Linking a large number of existing databases – such as public registries (e.g. information on administrative aspects, soil, cultural heritage), LCA-related (e.g. commercial life cycle inventory data like Ecoinvent, EF-compliant data, or national EPD databases such as the Belgian B-EPD database or the French INIES database), national EPC databases, energy or water consumption, tenure or use, plans etc. as well as databases related to the Smart Readiness Indicator, building renovation passports and the Level(s) framework – is thus vital for the success of digital building logbook development and its implementation. Incorporating trustworthy data sources will increase the chances of a successful implementation. Connecting all these data sources and users requires common 'languages' – interfaces and protocols – to enable interoperability, data consistency and information exchange.

Priority action 3: Launch of publicly funded R&I projects to further explore the digital building logbook concept and its implementation

This priority action explores the launch of publicly funded Research and Innovation (R&I) projects to further explore the digital building logbook concept and its implementation. R&I projects can be funded at different levels, including at European level and Member State level. Expert interviews suggest that the Horizon Europe programme provides the most appropriate opportunity for a publicly funded project on the digital building logbook. Additional opportunities at Member State level –including the European Regional Development Fund (ERDF), Interreg and LIFE – are also briefly covered.

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LIST OF ACRONYMS AND ABBREVIATIONS

API	Application Programming Interface
BIM	Building Information Modelling
BMS	Building Management System
BRCW	Basic Requirements for Construction Works
CEAP	Circular Economy Action Plan
CEN	European Committee for Standardisation
CENELEC	European Committee for Electrotechnical Standardisation
CMMS	Computerized Maintenance Management System
COBie	Construction Operations Building Information Exchange
CPR	Construction Product Regulation
DESI	Digital Economy and Society Index
DG	Directorate General
DSO	Distribution System Operator
EC	European Commission
EED	Energy Efficiency Directive
EF	Environmental Footprint
EIT KICs	European Institute of Innovation & Technology, Knowledge & Innovation Communities
ELENA	European Local Energy Assistance
EN	European Standard
EPB	Energy Performance of Buildings
EPBD	Energy Performance of Buildings Directive
EPD	Environmental Product Declarations
EPC	Energy Performance Certificate
ERDF	European Regional Development Fund (ERDF)
ESO	European Standards Organisation
ETSI	European Telecommunications Standards Institute
EU	European Union
GDPR	General Data Protection Regulation
GIS	Geographic Information System
IEC	International Electrotechnical Commission
IFC	Industry Foundation Classes
IMS	Information Management System
ISO	International Organization for Standardization
IT	Information Technologies
JRC	Joint Research Centre
LCA	Life Cycle Analysis
LCC	Life Cycle Costing
MS	Member State
OGC	Open Geospatial Consortium
OEF	Organisation Environmental Footprint
PCR	Product Category Rules
PEF	Product Environmental Footprint
PEFCRs	Product Environmental Footprint Category Rules
PTNB	Plan de Transition Numérique du Bâtiment
R&I	Research and Innovation
RICS	Royal Institution of Chartered Surveyors
SRI	Smart Readiness Indicator
SWOT	Strengths, Weaknesses, Opportunities and Threats
TC	Technical Committees
TRL	Technology Readiness Level
UX	User experience
W3C	World Wide Web Consortium

INTRODUCTION

Background and justification

A lot of valuable information is generated and gathered over the life cycle of buildings at different stages (e.g. design, construction, operation, renovation, repair, upgrading) and for various purposes (e.g. regulatory compliance, cost management, operation and management, insurance, finance). This wealth of information could be highly beneficial for property, asset and facility management if it were easily available and structured. However, this information is largely not organised and managed in a systematic way. Some information only benefits few market players; sometimes information has to be re-created several times and often almost none stays in the hands of property owners. Information is spread over many places and tools for safely storing, digitising and updating information are largely missing.

This situation leads to a lack of transparency and limited availability of information to assess building performance and asset value, and the risks related to investment and management decisions in sustainable construction. It also reduces the chances of contractors and building managers to learn from experience and good practice, because of possible different reporting formats. Limited data availability creates also difficulties for financing institutions, banks and investors to gain information on risk profiles, so as to adapt their risk management strategies accordingly and to develop financial instruments.

Digital building logbooks could boost the availability of structured information for a number of purposes to a broad range of market players, including property owners, tenants, investors, financial institutions and public administrations, as mentioned in the Clean Energy Package of November 2016.

A digital building logbook is a digital repository where a building's main properties (ownership, building design, materials used, structures, installations, systems, adaptations, investment, operational and maintenance costs, health and safety, performance indicators, certifications, etc.) can be compiled and updated when necessary throughout the life of the building, granting an easily accessible and comparable overview of a specific building. Further information like energy bills, water and waste management, maintenance recommendations/requirements as well as insurance and ownership obligations could be included.

The building logbook could facilitate access to structured information about how the building was originally designed, what changes were made and what is its actual performance service level and planned maintenance. It may draw upon information from other sources such as construction standards and calculation methods originally used, building information models, building's operation, maintenance, health and safety records/action plans, energy certificates/audits, environmental performance assessments, etc.

Ownership of the information contained in the digital building logbook stands with property owners. However, this information could be made fully or partly accessible to third persons (e.g. authorities, maintenance professionals, valuation professionals, insurers, etc.)

The present study aims to develop an EU framework to support and structure the widespread use of digital building logbooks in the EU Member States. The overall aim is to increase data availability and transparency on buildings' related properties to a broad range of market players, including property owners, tenants, investors, financial institutions and public administrations. The expected impacts of digital building logbooks include the increase of structured information altogether and the reduction of information asymmetries along the building supply chain and the building life cycle, which will improve cost management, facilitate decision-making and building operation and maintenance, renovation, assessing mortgage and insurance-related risks, and improved energy and environmental performance. It will reduce significantly the need to recreate information over the life cycle of the building.

The use of digital logbooks might entail certain risks such as:
- An increased administrative burden for owners and professionals;
- Uneven distribution of costs and benefits, since those who collect/provide the data are often not those who later benefit from it;
- High operation and maintenance costs of the supporting digital environment;
- Legal concerns (data protection rights, liability questions for false data);
- Uncertainty on how to assure high quality and reliability of data;
- Inconsistency and lack of comparative ability (benchmarking) between different formats of digital logbooks, generating confusion, discrepancies and mismanagement of data.

Therefore, the specific objectives of this study are to address the following questions regarding the development and functioning of digital building logbooks:
- Who are the involved stakeholders?
- Which market needs will building logbooks address in the first place?
- What are the key roles and responsibilities of market participants along the value chain to achieve increased confidence in data quality and transparency?
- What kind of digital framework is needed to facilitate this information exchange? How could it be integrated with Building Information Modelling (BIM)?
- What are the current and possible future business models, taking into account related costs (e.g. administrative and maintenance costs)?
- Who should/could have access to information and data of the digital building logbooks, under which conditions and for what kind of format?
- What would be the impacts of digital building logbooks in terms of information accessibility, information transparency on buildings' performance, quality assurance for buildings operation, maintenance and renovation/refurbishment, supporting property valuation and financial analysis? How to achieve the fair distribution of benefits created by a digital building logbook?
- What are the unintended or negative effects that the widespread use of digital building logbooks could cause?
- Considering existing national and private systems related to building logbooks, is there a need for a European approach for data collection and management? How will it strengthen existing systems or support the introduction of new systems elsewhere? What would be the benefits of supporting information exchange at national and European levels? Which concrete steps should the Commission undertake to support the logbook approach?
- How would such an initiative fit into the existing EU policy framework and connect to other current initiatives (Energy Performance Certificates, European Voluntary Certification Scheme (EVCS), Smart Readiness Indicator, building renovation

passports, Level(s), construction and demolition audit guidelines, green public procurement toolkit, etc.)?

In this respect, the study performs a mapping of current practice and review relevant public and private initiatives promoting the use of building logbooks in order to identify business models, key points for good practice with respect to usage, data management and digitalisation of building logbooks and the critical gaps that still needs to be addressed in these domains.

Based on this analysis, the study also assesses whether an EU-wide common approach:
- Should be voluntary or mandatory;
- Could facilitate the launch of building logbook initiatives, where such systems do not exist, without invalidating the already existing schemes in other Member States;
- Could address the critical gaps identified beforehand.

The study defines the scope and focus of the EU framework, and propose a concrete action plan to be implemented. An appropriate consultation strategy of stakeholders should ensure the success of the study and the uptake of the proposals.

Methodology and structure justification

Figure 1 presents the four main tasks carried out by the B-LOG consortium formed by R2M Solution, VITO and BPIE:
- Task 1: Definition of Digital Building Logbook,
- Task 2: State of play and review of national and sectoral initiatives promoting the use of building logbooks,
- Task 3: Gaps analysis,
- Task 4: Recommended EU Commission actions.

The various activities carried out within Task 5 (Stakeholders consultation) are represented by the blue bubbles which are connected to the other tasks.
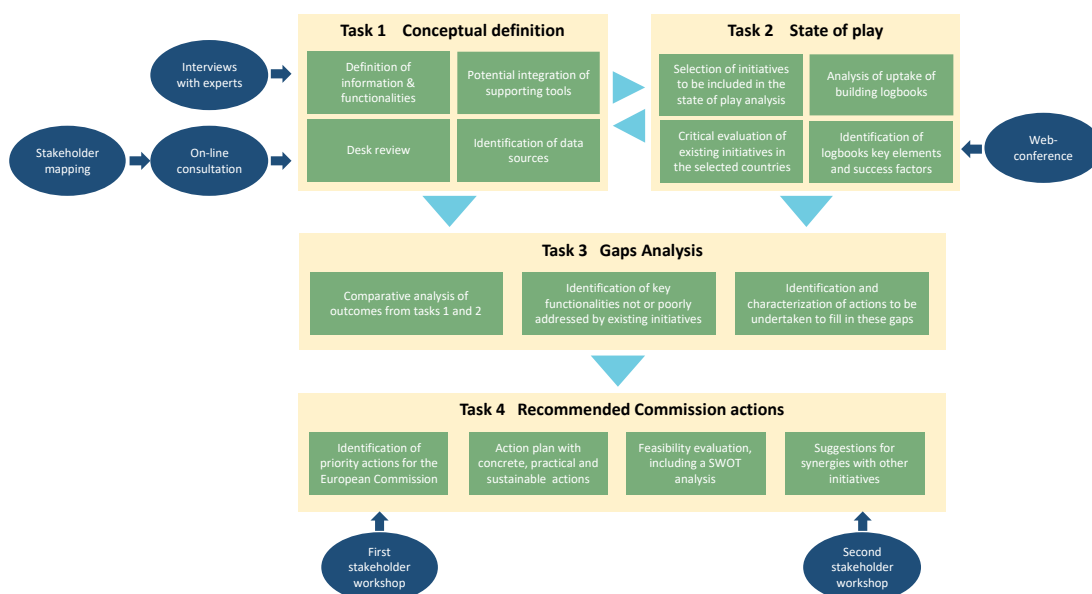
Figure 1: Overall approach and organisation of work for the study

Task 1: Conceptual definition of Digital Building Logbooks. Its objective is to define the role and scope of Digital Building Logbooks, including the type of information collected and stored, their sources, and the functionalities and tools applicable to potential users. Data management issues, confidentiality and data protection issues are addressed. A desk review is supplemented by an on-line consultation and by interviews with experts. The Digital Building Logbook definition encompasses three main features: non-dynamic information, dynamic information and potential link to external tools.

Task 2: State of play and review of national/sectorial initiatives promoting the use of building logbooks. Its objective is to analyse the state of play with the uptake of building logbooks and identification of key elements, success factors and perceived benefits. Different building logbooks were analysed and scored against a pre-defined evaluation matrix. The analysis has also reviewed the different approaches for data capture, data management, quality control and data sharing. The results of the analysis were reviewed by a stakeholder group for the identification of perceived benefits and barriers of each initiative.

Task 3: Gaps analysis. Its objective is to analyse, based on outcomes from Tasks 1 and 2, the gaps that still have to be addressed at EU, national, regional and sectorial levels, and to identify actions to be undertaken to ensure a widespread use and efficient functioning of Digital Building Logbooks. Then, 15 actions to address these gaps were proposed, each being characterized according to predefined features and accompanied by a qualitative assessment regarding the feasibility, added value and resources needed for each action, potential synergies with existing building logbooks related initiatives and acceptability by the professionals in the sector. This has paved the way for the launch of Task 4.

Task 4: Recommended Commission actions. Its objective is to identify and assess three to four priority actions for the European Commission to carry out or support, which would foster a widespread use and efficient functioning of digital building logbooks. The assessment has included a feasibility evaluation, a concrete action plan and a suggestion for synergies with existing EU and international initiatives.

Task 5: Stakeholders consultation. The objective of this transversal task is to ensure all relevant experts and stakeholders are consulted throughout the project and their input included in the project outcomes. The task started with the mapping of key project stakeholders. Then, these stakeholders were consulted through online consultation (a survey) and bilateral interviews, according to a schedule designed in accordance with other tasks where stakeholders' inputs are required. Finally, two stakeholder meetings were organised (in a digital manner due to the COVID-19 crisis).

Summary of stakeholder consultation

Figure 2 summarizes the comprehensive stakeholder consultation activities undertaken for this study.
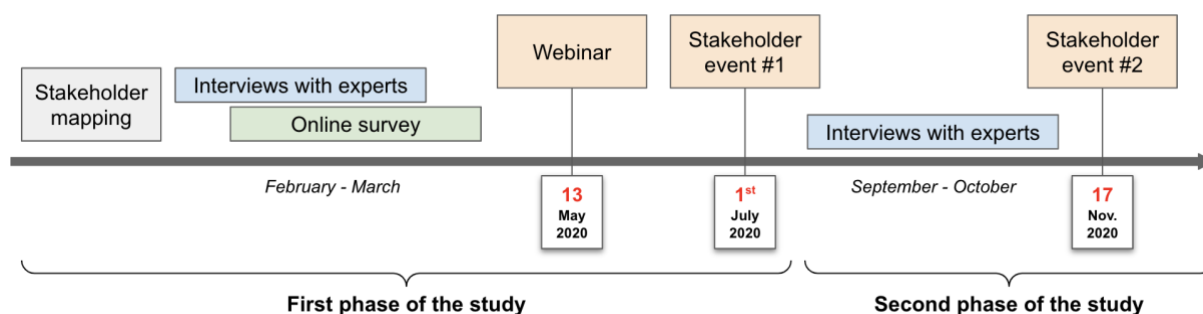
Figure 2: Stakeholder consultation activities

First, a stakeholder mapping has been elaborated to identify the key stakeholders to be engaged (Figure 3).
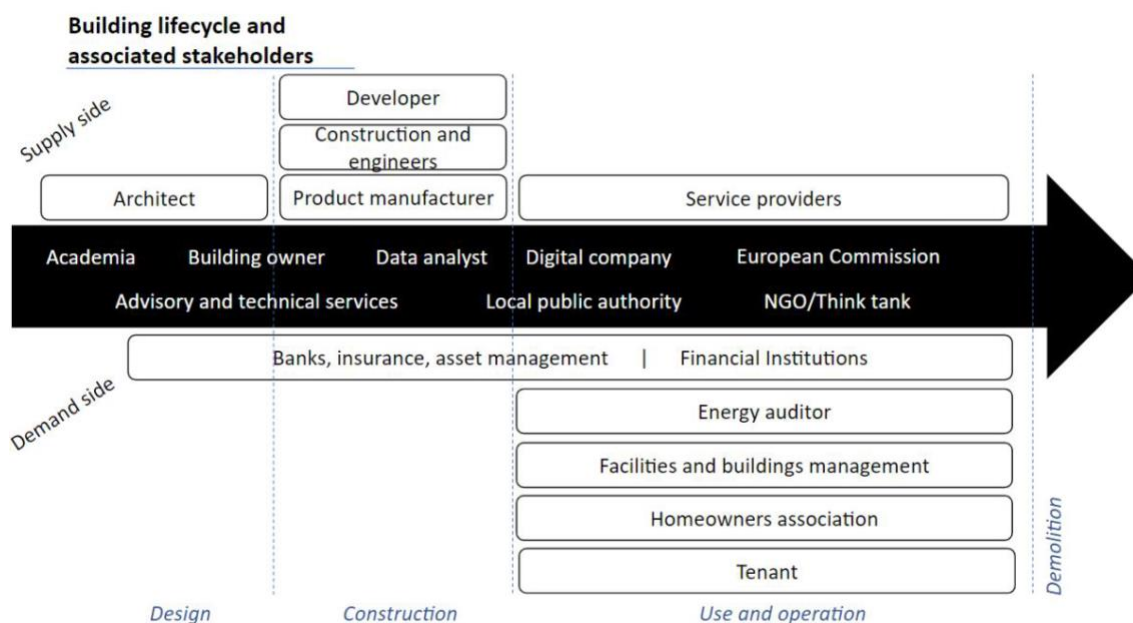
Figure 3: Stakeholder mapping in relation to the Digital Building Logbook

Based on the stakeholder mapping, a list of contacts was created including representatives of all stakeholder groups. During the initial phase of the study, two main forms of consultation were undertaken (see Table 1):
1. In-depth interviews with selected experts (in conjunction with Tasks 1 and 3),
2. Online survey with a broader group (in conjunction with tasks 1, 2 and 3).

Table 1: Metadata of the first-round consultations

	Online survey	
Number of respondents		93
Survey time		15-20 mins. (estimate)
Number of EU countries represented		19
Stakeholder groups represented		Demolition [1], building owner [2], finance [3] architects [4], digital [4], engineer [4], contractors and craftspeople [7], construction material and products [13], public authority [18], research [30]
	Interviews	
Number of respondents		32
Interview time		30-80 mins. (average around 50 mins.)
Number of EU countries represented		9
Stakeholder groups represented		Building owner representatives [3], construction industry and manufacturers [2], energy efficiency manufacturers [1], digital [4], building automation and control [2], finance [1], real estate developer [1] and research [3]. Eight respondents have experience of implementing a version of a Digital Building Logbook, as a private [5] or public [3] initiative.

The first-round consultation findings are presented in Report 1 – Definition of the Digital Building Logbook [1] and summarized in Chapter 1 of the present report.

A webinar gathering 68 participants was organised (13 May 2020) to share the survey results, discuss the recently established definition of what a digital building logbook is, and then have a discussion on identifying potential benefits and barriers of implementation. The webinar results are presented in Report 2 – Building Logbook State of Play [2].

The first phase of the study was concluded by the organisation of a stakeholder event gathering 66 attendees (1st July 2020). The purpose of the event was to:

- Receive input from stakeholders to support the identification and classification of priority actions for the European Commission, i.e. to strengthen the decision process of various potential policy measures
- Explore synergies with other EU initiatives:
  - How can the Digital Building Logbook contribute to EU policy goals such as:
    - a deeper and more digital single market (New Industrial Strategy for Europe);
    - a more resilient and climate-proof building sector (European Green Deal and the announced 'Renovation Wave' initiative);
    - supporting the construction industry towards climate neutrality and building a more circular economy (Circular Economy Action Plan and Strategy for a Sustainable Built Environment);
    - Construction Product Regulation (CPR) review, Sustainable Product Policy and Products Digital Passports?
  - What EU actions are necessary to support the uptake of the Digital Building Logbook?
  - What is the role of the value chain in the support of the development and implementation of Digital Building Logbooks?

Table 2: Agenda of the first stakeholder event

Total plenary introduction session	5 minutes	Welcome note + Housekeeping - Jesse Glicker (BPIE)	
	15 minutes	Introduction by the European Commission - Ms Natalia MARTINEZ PARAMO, Head of Unit for COSME in the Executive Agency for Small and Medium size Enterprises of the European Commission - Ms Fulvia RAFFAELLI, Head of Unit for Construction and Circular Economy in DG GROW of the European Commission	
	10 minutes	Presentation of the DBL definition - Zsolt Toth (BPIE)	
	10 minutes	Brief presentation of the existing initiatives review - Giulia Carbonari (R2M)	
	15 minutes	Presentation of gaps analysis - Sophie Dourlens-Quaranta (R2M Solution)	
	10 minutes	Q&A - Jesse Glicker (BPIE)	
	10 minutes	Introduction to the topics to be discussed in smaller groups - Maarten De Groote (VITO)	
Parallel sessions on 4 thematic areas	First break out session 45 minutes	Topical discussion with small group (A) Group 1: Neethi Rajagopalan (Vito) Group 2: Anne Paduart (VITO)	Topical discussion with small group (B) Group 1: Thomas Messervey (R2M) Group 2: Andrea Costa (R2M) Group 3: Alessandro Lodigiani (R2M)
	Break – 10 minutes		
	Second break out session 45 minutes	Topical discussion with small group (C) Group 1: Jon Volt (BPIE) Group 2: Maarten De Groote (VITO)	Topical discussion with small group (D) Group 1: Zsolt Toth (BPIE)
Total plenary conclusion session	5 minutes	Key message from each group - Jesse Glicker (BPIE)	
	10 minutes	Impressions from the European Commission	
	5 minutes	Next steps in B-LOG / Elaboration of recommendations for EC actions -Sophie Dourlens-Quaranta (R2M)	

For the second phase of the study focused on priority actions the European Commission could carry out or support to foster a widespread use and efficient functioning of digital building logbooks, selected experts were interviewed to contribute to the assessment of each priority action (see Chapters 5 to 7 of the present report).

Finally, the study was concluded by a second stakeholder event (17 November 2020) gathering 96 attendees with the following main objectives:

- Overview of main project results:
    - Brief presentation of the definition of Digital Building Logbook
    - Learnings from leading international examples
    - Actions for the EC to foster the uptake of Digital Building Logbooks
    - Synergies with EU and international initiatives
- Presentation and discussion of project policy action points
- Validation/Open session for stakeholder feedback
- Q+A with participants

The first panel session was dedicated to the success criteria according to the frontrunners and addressed the following discussion points:

- What is the business case for setting up logbooks? What are the drivers? What are the costs and benefits? How and to whom do these accrue?

- Practical implementation: what are the success criteria and risks to be avoided?

- What is the role of national/local public authorities? What is the role of the private sector?

- How should the data be accessed, by whom and under what conditions? How to sort data management and governance issues?

- How do you make sure that the data is reliable and up to date? How to assure quality of data?

The second panel session was dedicated to initial reactions from experts and building value through data (digitalisation of the construction sector and data standards). It addressed the following discussion points:

- How can the logbook improve efficiencies and collaboration across the construction sector?

- How to break down data silos? What is needed to share data? Technical solutions, stakeholder relations and business models?

- What is the role of national/local public authorities? What is the role of the private sector?

- What are the most urgent actions and concrete measures in terms of assuring level playing field, data standards, interoperability and skills?

Table 3: Agenda of the second stakeholder event

Welcome and introduction	5 minutes	Welcome note + Housekeeping *Moderator: Oliver Rapf, BPIE – Executive Director*
	10 minutes	Introduction by the European Commission *- Natalia Martinez Paramo, Head of Unit for COSME in the Executive Agency for Small and Medium Size Enterprises* *- Fulvia Raffaelli, Head of Unit for Construction and Circular Economy in DG GROW*
Overview: digital building logbooks in theory and practice	10 minutes	Digital Building Logbook definition *Zsolt Toth, BPIE*
	10 minutes	Building Logbooks across Europe: success factors and barriers *Giulia Carbonari, R2M Solution*
	25 minutes	**Panel 1: Success criteria according to the frontrunners (project managers from existing logbook initiatives & the demand side)** *Moderator: Giulia Carbonari, R2M Solution* *Panellists:* ● Tine Vande Casteele – Project manager, Woningpas ● Pablo van den Bosch – Director, Madaster ● Jos Duchamps – Managing director, PROCOS group, director, IFMA global board ● Christine Lemaitre – CEO, DGNB
	15 minutes	Q&A to speakers (including the European Commission), open discussion and feedback from the audience *Moderator: Oliver Rapf, BPIE*
	10 min	BREAK
Looking ahead: recommendations and building value	20 minutes	Recommendations of the study to foster the uptake of Digital Building Logbooks in Europe *Maarten De Groote, VITO*
	25 minutes	**Panel 2: Initial reaction from experts & building value through data** *Moderator: Oliver Rapf, BPIE* *Experts:* ● Rui Fragoso – Head of buildings department, ADENE ● Paul Surin – Global Lead Building environment BIM, IBM; Construction Products Europe, Chair Digitalalisation Task Group ● Sussi Wetterlin – CEO, BASTAonline AB ● Thomas Vandenbergh – CEO, A-STAY (part of BESIX STAY) ● Marzia Bolpagni - Senior Advisor on Digital Innovation, Mace
	25 minutes	Q&A with the public on policy actions and expert reactions *Moderator: Oliver Rapf, BPIE*
Conclusion	5 minutes	Conclusion and next steps *Oliver Rapf, BPIE*

PART I. SUMMARY OF THE FIRST PHASE OF THE STUDY: CONCEPTUAL DEFINITION, STATE OF PLAY AND GAPS ANALYSIS

During the first phase of the study, the following activities were carried out:

- *[Task 5]* Comprehensive stakeholder consultation activities were undertaken since the beginning of the study. During the first phase of the study, 32 stakeholders have been interviewed one by one; an online survey was run, to which 93 stakeholders have responded; a webinar with 68 participants was organised; a stakeholder meeting with 66 participants was been organised.

- *[Task 1]* Based on desk research and the above-mentioned stakeholder consultations, a comprehensive conceptual definition of the Digital Building Logbook was developed. A specific report was dedicated on this: Report 1 – Definition of the Digital Building Logbook [1]

- *[Task 2]* In parallel with Task 1, 40 building logbook initiatives have been analysed, according to a predefined template in line with the questions raised in the online survey and in the interviews. This was the topic of a specific report: Report 2 – Building Logbook State of Play [2].

- *[Task 3]* Then, following the outcomes of Tasks 5, 1 and 2, the main gaps that still have to be addressed to ensure a widespread use and efficient functioning of Digital Building Logbooks have been identified, and actions to address those gaps have been proposed. This work had been anticipated by including relevant questions in the interviews and the survey.

- *[Task 4]* Finally, a methodology was prepared to identify the 3 to 4 priority actions that the European Commission could carry out or support. This identification has also been supported by the above-mentioned stakeholder meeting.

CHAPTER 1: CONCEPTUAL DEFINITION OF THE DIGITAL BUILDING LOGBOOKS

Objectives

Data concerns almost every aspect of the built environment: from how individuals and businesses use and interact with properties, to how a building's energy consumption and construction details are recorded and analysed to support informed decisions about construction and real estate processes. Data is used for benchmarking and progress tracking of performance improvements and energy use, business planning, internal and external reporting, risk assessment and financial underwriting. The availability of consistent and reliable data can contribute to better design, construction and management of buildings, improved market information and transparency, creation of innovative services and business models, as well as more effective policymaking.

Studies suggest that the construction sector[2] is underdeveloped in terms of overall digitalisation and data applications in comparison with other industry sectors.[3] Building-related data (such as physical building characteristics data, environmental performance information and real estate transaction data) continues to be scarce, of unreliable quality and limited accessibility.[4] The lack of a common data repository amount to additional costs and inefficiencies, stifle innovation, increase risk and undermine investor confidence.

The study on the "EU-wide Framework for a Digital Building Logbook" aims to support the widespread use of Digital Building Logbooks across Europe. It also encourages data transparency and increased data availability to a broad range of market players, including property owners, tenants, investors, financial institutions and public administrations. In addition, the DBL will contribute to the strategy "A Europe fit for the digital age" as well as in the "European Green Deal'' and its Renovation Wave, the new Circular Economy Action Plan, and the dedicated Strategy for a Sustainable Built Environment.

Several European countries have developed and implemented logbook-type initiatives over the last years, including, for example, the Woningpas in Flanders (BE), the private initiative BASTA in Sweden and the PTNB in France. All these initiatives share a common objective to increase data availability and transparency to a broad range of market players. The existing DBLs differ however in terms of focus (e.g. on energy efficiency or materials), data handling and digital solutions employed. A common European approach covering the entire lifecycle and comprising all relevant building information could increase learnings and enable synergies, interoperability, data consistency and information exchange.

Approach implemented

Task 1 has delivered the first deliverable of this one year-long project. It aims to present a definition of a Digital Building Logbook, building on a state-of-play analysis and stakeholder input from across Europe. The report outlines the potential role and scope of an EU-supported Digital Building Logbook, including the central features of the instrument, as well as data handling and governance issues. The report builds on a thorough review of existing

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[2] For the purpose of this report, *construction sector* includes the following sectors of the NACE Rev.2 Statistical classification of economic activities in the European Community: Construction (Section F), Real Estate Activities (Section L), Architectural and Engineering Activities (Section M, Division 71)

[3] McKinsey (2016) Digital Europe: Pushing the Frontier, Capturing the Benefits, European Commission (2019) Supporting digitalisation of the construction sector and SMEs & BPIE and i24c (2016) Driving Transformational Change in the Construction Value Chain

[4] Hartenberger et al. (2019) The Building Passport as an enabler for market transformation and circular economy within the built environment: SBE19 Conference Series paper and RICS (2017) Global Trends in Data Capture and Management in Real Estate and Construction

literature, consultation with 32 experts through semi-structured interviews, as well as quantitative input received through an online survey (93 respondents).

The **desk research** explored existing studies and projects carried out on the topic of Digital Building Logbooks. The literature was identified through a snowball method, where additional literature was discovered based on a few central studies[5], as well as stakeholder input (see bibliography for the full list of literature). The initial findings of the parallel research stream of this project, which explores existing schemes and initiatives, have also been considered. These include, but are not limited to, national and local initiatives promoting the use of a Digital Building Logbook (e.g. Woningpas in Flanders and PTNB in France), as well as private initiatives (e.g. Eigenheim Manager in Germany and Passeport Efficacité Énergétique in France). The desk research also covered academic articles (e.g. Lützkendorf et al, 2019 and Hovorka et al, 2012), industry publications and other relevant studies (e.g. RICS, 2017). Woningpas in Flanders and PTNB in France), as well as private initiatives (e.g. Eigenheim Manager in Germany and Passeport Efficacité Énergétique in France). The desk research also covered academic articles (e.g. Lützkendorf et al, 2019 and Hovorka et al, 2012), industry publications and other relevant studies (e.g. RICS, 2017).

The **online survey** gathered stakeholder views and input regarding the type of information to be included in the Digital Building Logbook, functionalities it could incorporate as well as data governance issues. Semi-structured **interviews** were held with 32 experts to collect more in-depth insights. The interviewees were selected based on their field of expertise to gather a wide range of perspectives (see questions in Annex A in Report 1 – Definition of the Digital Building Logbook [1] and metadata of the consultations in above Table 1).

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[5] Most notably: Ganter, M.; Lützkendorf, T (2019) Information management throughout the life cycle of buildings - Basics and new approaches such as blockchain, Daniotti, B; Gianinetto, M & Della Torre, S (2020) Digital Transformation of the Design, Construction and Management Processes of the Built Environment & Virta, M.; Hovorka, F.; Lippo, A. (2012) Building Passport as a Tool to Evaluate Sustainability of Building

The views of experts and stakeholders were gathered to get additional input regarding the type of information to be included in Digital Building Logbooks and to identify the key features of the instrument. The consultation also provided insights on barriers and enabling conditions for the development of Digital Building Logbooks. The main findings are presented below and additional results in Report 1 – Definition of the Digital Building Logbook [1].

How important do you consider the following functionalities in a Digital Building Logbook?

The majority of survey respondents think that all listed functionalities are, at least, somewhat important. The most popular functionality is the "automatic input of data from 3D/BIM model", where 64% say it is very important and just 8% think is not important. The benefits linked to the most popular functionalities are very clear and straight-forward, as they exist to some extent today. The benefits related to "valuation and due diligence" and "authorisation to third parties" might be more difficult to grasp for non-experts.
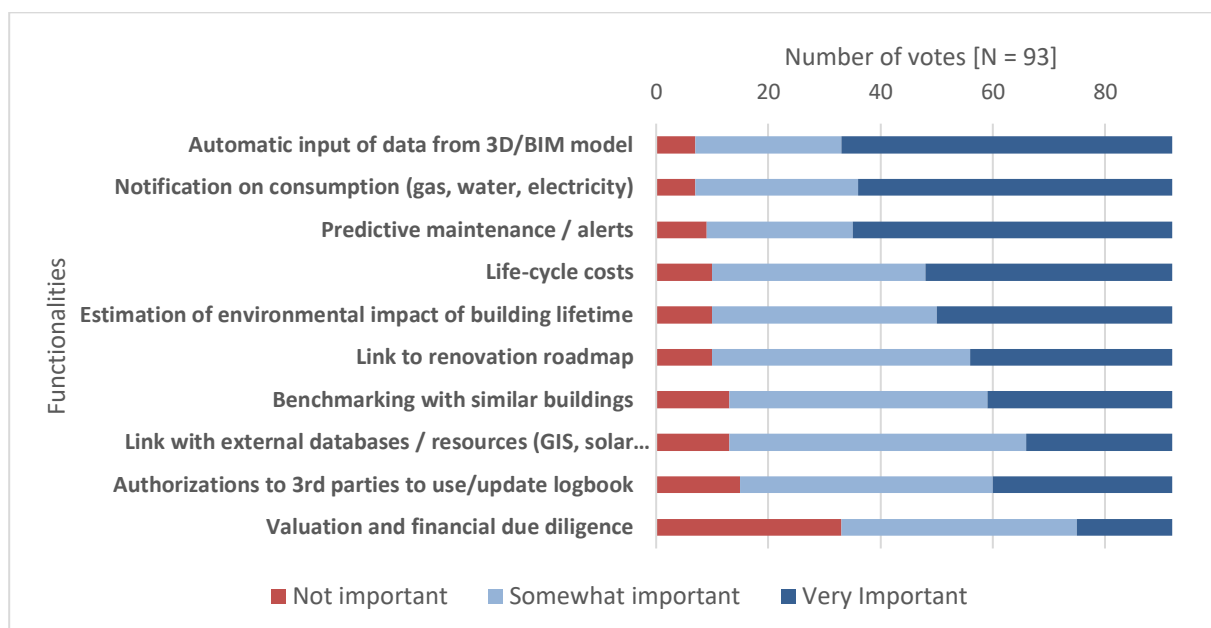
Figure 4: Survey - Digital Building Logbook's functionalities

What type of data do you think should be collected in the Digital Building Logbook?

The majority of survey respondents think that all listed data types are, at least, somewhat important. The most popular data type is the "building description and characteristics", where 87% say it is very important and just 5% think is not important or should not be included. As with the functionalities, the most popular data types are traditional data types, description of the building, the equipment and material. The benefits related to the least popular data types are less straight-forward and more difficult to grasp for non-experts.
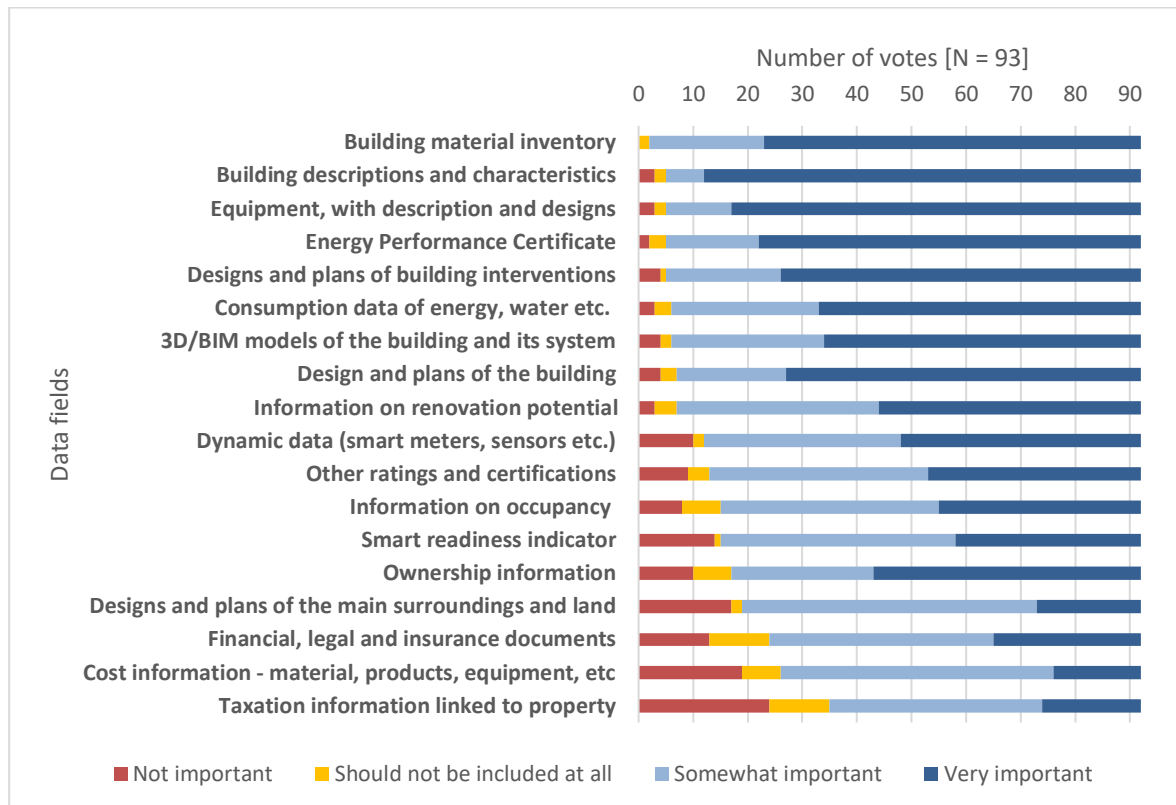
Figure 5: Survey - data fields

In your opinion, who should be responsible for data ownership and liability?

The respondents were asked who should be responsible for the data and its liability. The respondents suggested a wide range of actors and constellations, yet two of them were recurring rather frequently:

- 59% suggests to the building owner, either alone or together with a public authority.
- 34% refers to the public authorities, either alone or together with other actors. The main reason provided is to ensure data quality and reliability.

Who should have access to the Digital Building Logbook data?

The respondents were also asked to answer a question on data accessibility for the three main user types: building owners, public authorities and 3rd party actors (which can be actors in the construction value chain, utility companies etc.).75% think that building owners should have full access to the data stored in the Digital Building Logbook about their building. 52% think that 3rd party actors should have access to "individual project data". 54% think public authorities should have "limited access", while 36% think they should have "full access".

How are the consultation results referenced throughout this chapter?

The relevant survey results are presented in a footnote adjacent to a specific finding or statement. The interview findings are used throughout the text with a reference to the specific interviewee. Each interviewee was assigned a code based on their field of expertise (e.g. BU stands for building owner representative). The number next to the interviewee ID indicates the exact interviewee, which is kept anonymised in this report.

Interviewee type ID

BC – *Building automation & control expert* **DI** – *Digital expert* **LB** – *Logbook implementer*
BU – *Building owner representative* **PA** – *Public authority* **RED** – *Real estate developer*
CO – *Construction value chain* **R** – *Researcher* **F** – *Finance expert*

A Digital Building Logbook is a common repository for all relevant building data. It facilitates transparency, trust, informed decision making and information sharing within the construction sector, among building owners and occupants, financial institutions and public authorities.

A Digital Building Logbook is a dynamic tool that allows a variety of data, information and documents to be recorded, accessed, enriched and organised under specific categories. It represents a record of major events and changes over a building's lifecycle, such as change of ownership, tenure or use, maintenance, refurbishment and other interventions. As such, it can include administrative documents, plans, description of the land, the building and its surrounding, technical systems, traceability and characteristics of construction materials, performance data such as operational energy use, indoor environmental quality, smart building potential and lifecycle emissions, as well as links to building ratings and certificates. As a result, it also enables circularity in the built environment.

Some types of data stored in the logbook have a more static nature while others, such as data coming from smart meters and intelligent devices, are dynamic and need to be automatically and regularly updated. A Digital Building Logbook is a safe instrument giving control to users of their data and the access of third parties, respecting the fundamental right to protection of personal data. Data may be stored within the logbook and/or hosted in a different location to which the logbook acts as a gateway.

How the Digital Building Logbook can contribute to EU policy goals

The **EU Commission work programme 2020 communication** sets out a targeted agenda to implement six priorities and the key initiatives that support them. The work programme focuses in particular on the opportunities that can be generated by 'the twin ecological and digital transition'. The two most relevant priorities in this regard are the **European Green Deal** and **A Europe fit for the digital age**. The Digital Building Logbook can greatly enhance these goals by playing a role in relation to the following policy initiatives:

- **A deeper and more digital single market (New Industrial Strategy for Europe)** – improved data availability, common data protocols and collaboration within the value chain will contribute to the development of an EU data economy and common European data spaces. Clarification of data governance issues and data sharing models can protect IPR and strengthen the legal framework for a single market in digital services.

- **More resilient and climate-proof building sector (European Green Deal and the announced 'Renovation Wave' initiative)** – the Digital Building Logbook and connected digital features can accelerate and maximise the impact of building policies to deal with climate change and protect the environment. Availability of granular performance and maintenance data in addition to the Energy Performance Certificate (EPC) and Smart Readiness Indicator (SRI) could provide a more robust and reliable indication of energy performance and reduce performance gaps. The Digital Building Logbook is instrumental to gain a better overview of the building stock at all levels, to better assess the effectiveness of energy efficiency measures on a larger scale, tailor support measures, set benchmarks and strategies, monitor progress towards climate goals. Comprehensive information about buildings means that Digital Building Logbook users and value chain actors can make better decisions about how and when to renovate buildings.

- **Supporting the construction industry towards climate neutrality and building a more circular economy (Circular Economy Action Plan and Strategy for a Sustainable Built Environment)** – information about construction and building materials (type, quantity/amount, origin, carbon footprint, recycled content, as well as the end-of-life dismantling, reusing and recycling possibilities) facilitates source separation and increases recycling quantity/quality, prevents waste and closes loops. The Digital Building Logbook can vastly contribute to improve the general transparency and efficiency of construction and real estate markets as well as empowering building owners to play a more active role in the circular economy.

- **Data privacy and security (European Data Strategy)** - A "European way to digital transformation" which enhances open data, respects fundamental rights, and contributes to a sustainable, climate-neutral and resource-efficient economy.

- **Construction Product Regulation (CPR) review, Sustainable Product Policy and Digital Product Passports** – The forthcoming European Circular Dataspace aims to mobilise the potential of digitalisation of product information, introducing for example digital product passports which can closely interact with Digital Building Logbooks. Similarly, the revision of CPR may include recycled content requirements for certain construction products, whereas the Digital Building Logbook and traceability of construction products can support the increase of recycling content and value from the recycling of materials.

Data governance

Data governance refers to the process, organisation and standards implemented to ensure the effective and efficient storage and access to information. The Digital Building Logbook concept is a response to "the lack of a universal system that would facilitate access, storage, update and transfer of building-related data and information in a standardised format along the value chain."[6] But benefiting from the Digital Building Logbook requires settling a series of questions around data ownership, access, storage, privacy and security.

While the benefits of Digital Building Logbook are undisputed, concerns over privacy, confidentiality, and control of data can be a limiting factor to the market uptake of Digital Building Logbooks. The Digital Building Logbook, and generally, open access to data, is riddled with challenges related to data protection, competitiveness, confidentiality, liabilities over the accuracy of the data as well as business models built on the premise of withholding data rather than sharing data. One of the most contentious questions the Digital Building Logbook should clarify is the responsibility of holding, maintaining and updating all the – often sensitive and private – information.

Data ownership

Most stakeholders consulted agree that the building owner should be the principal owner of the information contained in the Digital Building Logbook.[7] However, certain information should be made available to third parties with the building/data owner's consent.[8] In this sense, the access to Digital Building Logbooks can be tiered according to different stakeholder categories and the purpose of data access. A data access layer can further clarify who has access to the data and who has the right to amend or delete records. For

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[6] RICS (2017) Global Trends in Data Capture and Management in Real Estate and Construction

[7] 12 out of 20 interviewees (the number that answered this question) argued that the building owner should be the owner of the data. The others argue that the ownership should be divided among several actors or "the same as today", or that it should be the role of the manufacturers/contractors to keep the information updated and accurate. 75% of the surveyed experts say the building owners should have "full access" to the stored data.

[8] 65% of the surveyed experts think third parties should have either "full access" (13%) or access to "individual project data" (52%).

example, public authorities could have given access to information[9] that is considered non-sensitive and non-intrusive.[10] Public authorities and the research community could be granted privileged access to aggregated and anonymised data for more effective policy making and a better overview of the building stock. Other stakeholder categories such as building professionals or financial institutions can gain access with the consent of the owner.

Storage

The lack of a centralised storage location, with data often scattered across many organisations and departments, was confirmed as one of the most significant challenges faced by all stakeholders.[11]

While there is no easy and "one size fits all" solution to the data storage question, three main approaches are being considered by current initiatives:

- Digital Building Logbook as a *database* which physically stores all the information related to the building.
- Digital Building Logbook as a digital *gateway* to which data and information can be linked via a unique building ID. The advantage of this approach is that information can be collated from various sources (both public and private) and the information is up to date whenever data is being updated at source.
- *Hybrid* versions which are a combination of the above two approaches.

Another key issue is the trustworthiness of the data source which is as important as the availability of data itself. Data originating from public authorities are generally considered more reliable which would suggest that public bodies ought to be responsible for setting up a central Digital Building Logbook . Commercial logbook initiatives seem however to be more in tune with market needs and offer functionalities catering for the flexibility and extensive requirements of commercial real estate actors. Aligning these different frameworks will be one of the main purposes of the common EU Digital Building Logbook to avoid market confusion and the situation whereby despite the growing number logbooks available, stakeholders continue to keep data in their private silos and large proportions of information still not being accessible to stakeholders.

Finally, liability, quality assurance and validation mechanisms will also need to be improved and enforced, to support the usability of the Digital Building Logbook [LB4, LB5, LB6, CO1].

Data privacy and security

Data security will have a decisive impact on the success of the Digital Building Logbook. Data privacy and security were also themes consistently picked up by interviews. The experts think it is essential that these requirements are fully addressed, and that the best actors to ensure this are the public authorities.

One of the key challenges finding the right arrangement for data privacy and security is given by the fact that both (1) EU data protection provisions are being modernised and constantly adapted, as well as (2) technology is developing fast providing new data-gathering opportunities but also challenges. Digital Building Logbooks will need to make sure they are compliant with the General Data Protection Regulation (GDPR). Consequently, cyber risk and privacy must be at the forefront – with collaboration from the construction value chain, operators, IT companies, public authorities and active engagement of the public

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[9] 36% of the surveyed experts think public authorities should have full access to the data, while 54% think their accessibility should be "limited". Several interviewees argue that public authorities can have access to overall building data as long building owners' data privacy is safeguarded.

[10] What is "non-intrusive" varies greatly across the EU and should therefore be defined by Member States.

[11] RICS (2017) Global Trends in Data Capture and Management in Real Estate and Construction

to ensure the security of the data in the Digital Building Logbook. One interviewee argued that "we need to put in place a code of conduct" for how to deal with these issues [DI4].

Building user privacy can be considered as the main concern due to all the data that sensors collect. The Digital Building Logbook should contribute to making buildings more user-friendly; that means only building users should access personal data especially in commercial or public buildings with multiple tenants. On the other hand, some of the functionalities built in the Digital Building Logbook can function effectively even with anonymised data and other legal restraints. Additional interdisciplinary research is needed to assess the potential and risks offered by innovative solutions (e.g. blockchain [CO1, DI1]) to preserve data privacy and security.

All these indicate that there may not be easy and one-size-fits-all solutions. Setting a balanced agenda that would equally benefit citizens, markets and the public good will be an ongoing process and will likely require the following elements:[12]

- *Public engagement*: wider public awareness campaigns about the benefits and risks of sharing data based on evidence and "success stories." Developing an ongoing dialogue with the construction sector, public and policymakers will inevitably be a long-term process as it implies building trust and understanding the benefits and risks of data sharing
- *Clarity and transparency*: clarity and transparency over the terms of use of data including regulation and enforcement to limit any fragmentation of the data protection framework
- *Training and education*: construction sector stakeholders, professionals and building owners need to be better equipped with digital and ethical skills to take full advantage of the Digital Building Logbook.

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[12]The European Commission (2019) Communication of data protection rules as a trust-enabler in the EU and beyond – taking stock recommends the further development an EU data protection culture and make full use of the tools provided for in the GDPR, as well as the continuation of awareness-raising activities and engagement with stakeholders.

CHAPTER 2: STATE OF PLAY AND REVIEW OF EXISTING INITIATIVES

Objectives

Over the lifespan of buildings, data is routinely collected by multiple stakeholders for various reasons as many decisions rely on data availability. However, the lack of a common approach and structure among stakeholders which would make this wealth of information widely available, organised and easily accessible, makes this data often unusable as it gets discarded, forgotten or it is not compatible with other stakeholders' systems[13]. The lack of an overarching structure shared across the built environment leads to information asymmetry, lack of transparency and higher risk for investment and decisions.

Tools for information management applied to buildings have the potential to enable better decision making throughout the building lifespan: management of technical and function aspects, safety, conservation of economic value, certification[14], improved energy and environmental performances, etc. Organised and shared data that can be re-used would not only reduce uncertainty but also time and cost needed for recollecting missing information.

In a more simplistic concept, building logbooks are a repository developed for the management of buildings information. Overtime, due to the complexity of buildings and the number of stakeholders involved, the idea of building logbooks has developed in different ways, resulting in the creation of an array of tools and requirements across Europe and worldwide for collecting and using buildings' data.

To be able to inform future decisions and set a direction that will support the widespread use of digital building logbooks across Europe, it is important to understand what is already available, in particular what works and what doesn't, in the existing (and past) building logbooks.

As part of Task 2, 40 building logbook initiatives in different countries have been analysed with the aim to highlight key success factors and barriers to the implementation of building logbooks.

Approach implemented

The identification of the initiatives started with a thorough literature review and desk research, which was then integrated with the feedback received by the stakeholders during interviews and online survey as part of Task 1. The final list includes 40 initiatives (see below): thirty-one are from EU countries, one is from Iceland (non-EU/COSME country), one from the USA and one from Switzerland (both non-EU/non-COSME countries) together with six H2020 research projects.

Each building logbook was analysed using an evaluation template (see Annex A in Report 2 – Building Logbook State of Play [2]) which covered several aspects:
- Description of the initiative;
- Data fields and functionalities included;
- Public or private, paper or digital, mandatory or voluntary;

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[13] RICS Et.al. "Global trends in data capture and management in real estate and construction", Nov. 2017 – see rics.org/insight

[14] Dejaco, M. et al. (2017) "Streamlined management of the built environment: the district and the building logbook as risk prevention tools". Re-shaping the construction industry, Maggioli Editore https://re.public.polimi.it/retrieve/handle/11311/1032396/227766/Building%20and%20urban%20logbook.pdf

- Data management approach;
- Applicability over different types of buildings and usage by different stakeholders;
- Affinity and compatibility with other European initiatives.

The results of the analysis were presented to stakeholders during a webinar held on 13 May 2020. During the webinar participants answered a series of polls that were used to gain their view on barriers and benefits of the building logbooks (see Chapter 4 in Report 2 – Building Logbook State of Play [2]).

Building logbooks analysed

- Arc platform - USA
- BASTA Loggbok – Sweden
- Bedrebolig – Denmark
- Building Passport GBC – Finland
- CIBSE TM31 - UK
- Dossier d'intervention ultérieure – Belg
- Electronic building ID code – Greece
- Eigenheim Manager – Germany
- Fascicolo del Fabbricato - Italy
- Federal Register – Switzerland
- Gëbaudepass – Germany
- Hausakte – Germany
- Homebook – France
- Home Information Pack – UK
- Home report – Scotland
- Ilmastoviisaat Taloyhtiöt – Finland
- ImmoPass – Germany
- Klimatdeklaration – Sweden
- Le carnet numérique du logement - Fra
- Libro del Edificio - Spain
- Livro de obra - Portugal

- Madaster – The Netherlands
- Wikihabitat – France
- Min Villa – Sweden
- Mon carnet logement - France
- Opleverdossier – The Netherlands
- PAS-E – Spain
- Passeport Efficacité Énergétique - France
- Platform CB'23 – The Netherlands
- Produktkollen – Sweden
- Property Register – Iceland
- QDF Hausakte – Germany
- Real estate service manual – Finland
- Woningpas – Flanders

- **Relevant H2020 projects**
  - IBroad
  - ALDREN
  - BAMB
  - BIM4EEB
  - DigiPLACE
  - X-tendo

Maturity Levels

During the analysis, the initiatives were clustered based on five maturity levels: under development, tested, in place, discontinued and relevant H2020 projects. This division allowed to focus the review of the different groups on specific aspects (Table 4). The results of the analysis are presented following this clustering approach.

The list and brief description of the initiatives in place can be found in Chapter 3 of Report 2 – Building Logbook State of Play [2].The analysis of the initiatives Under development, Tested and Relevant H2020 projects can be found in Annex B of the same report.

Table 4: Aspects for the analysis based on maturity levels

| Under Development | Initiatives planned to be implemented or not yet operational |

•What is the aim of the initiative?

| Tested | Initiatives piloted on a small number of buildings |

•What was the outcome of the test?
•Is there going to be a follow up implementation?

| In place | Initiatives currently operative |

•How is the building logbook used (data included, functionalities, type of buildings, stakeholders use, etc.)?
•How is data managed/reviewed/updated?
•What are the success factors and barriers?

| Discontinued | Initiatives no longer in place |

•Why was it discontinued?

| Relevant H2020 projects | Projects linked with the building's logbook concept |

What is the aim of the project?
How does it connect with the building's logbook?

Initiatives in place

Out of the 21 initiatives[15] currently operational, 14 are public and 7 are private, with most of the public initiatives (10) being mandatory and most private initiatives being voluntary (6).

The split between paper-based and digital initiatives is almost equal (10 and 11). However, most of the mandatory initiatives are paper based whilst the digital ones are mainly voluntary, showing a more "static" and classical approach of the public sector (Figure 6).

The analysis highlighted that there is currently very little affinity between existing building logbooks and other European initiatives, with the only exception of some building logbooks that include the EPC and can be used for developing renovation roadmaps.

Overall, there is no common approach regarding stakeholder usage and access by third parties: 15% of the initiatives are for public use only whilst 55% are made available to other actors of the supply chain or potential buyers. However often interested parties can only access the information on site because the paper-based building logbooks are kept there.

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[15] For Fascicolo del Fabbricato (Italy), out of the three regions that apply it we have considered the implementation in the region Lazio.

Costs are generally linked with collecting, and where applicable validating, the information, however, there is no clear business model for private initiatives that emerge and that can be replicated.

When we look at the market uptake for each initiative, the number of buildings where the building logbooks are used, there is obviously a clear distinction between the mandatory, which in theory should be always widespread, and the voluntary, which are more limited in numbers.

However, it is clear that even among the mandatory initiatives there are differences: countries like Spain and Italy have a fragmented approach, where the regions are responsible for the definition and implementation of building logbooks, which leads to very specific cases and smaller numbers of buildings where building logbooks are used. In Italy only three regions out of twenty (Campania, Lazio and Calabria) require the development of the Fascicolo del Fabbricato whilst in Spain all seventeen regions require to complete the Libro del Edificio however the level and

IP1 - Arc platform – USA
IP2 - BASTA Loggbok – Sweden
IP3 - Bedrebolig – Denmark
IP4 - CIBSE TM31 – UK
IP5 - Dossier d'intervention ultérieure – Belgium
IP6 - Eigenheim Manager – Germany
IP7 - Fascicolo del Fabbricato – Italy
IP8 - Federal Register – Switzerland
IP9 - Gëbaudepass – Germany
IP10 - Hausakte – Germany
IP11 - Home report – Scotland
IP12 - Libro del Edificio – Spain
IP13 - Livro de obra – Portugal
IP14 - Madaster – The Netherlands
IP15 - Min Villa – Sweden
IP16 - Opleverdossier – The Netherlands
IP17 - Produktkollen – Sweden
IP18 - Property Register – Iceland
IP19 - QDF Hausakte – Germany
IP20 - Real estate service manual – Finland
IP21 - Woningpas – Flanders (Belgium)

type of information included vary from region to region. In terms of applicability over different type of buildings (Figure 7), most of the initiatives in place focus on dwellings, while only two of the initiatives analysed (CIBSE TM31 and Fasciscolo del Fabbricato) are not usable for dwellings. 48% are applicable for office, industrial and public buildings, with a similar percentage when comparing to mandatory (45%) and voluntary (50%) building logbooks.

Figure 6: Mandatory/Voluntary initiatives

Figure 7: Applicability different types of buildings

The requirement for when the building logbook should be implemented in the mandatory initiatives differs: four are mandatory for new buildings and renovations, two for new buildings only and one when selling the property whilst the real estate service manual, the Woningpass, the Federal register and the property register are applicable for the entire building stock (Figure 8).
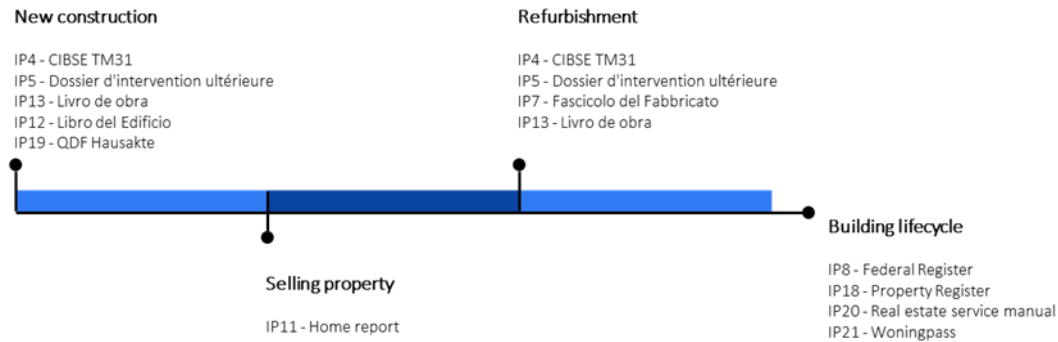
Figure 8: Implementation timeline of mandatory building logbooks

The 21 initiatives analysed have different levels of digitalisation (Figure 9): the ones located in the bottom left part are the less advanced because either fully paper based or developed through non-technical software (i.e. Excel) and accessible only in hard copies. On the opposite side, the initiatives in the right top part of the graph are not only developed through more advanced tools but are also accessible online.

Figure 9: Map level of digitalisation and access for building logbooks in place

Data fields and functionalities

The map of the data fields included in each building logbook[16] (Figure 10) shows that the data mostly present across the building logbooks are related to general administrative information together with building characteristics and information on building operation and use. It is interesting to notice that Madaster, Opleverdossier and Arc platform (all voluntary) include the largest number of data fields compared to the others.

Figure 10: Data fields building logbooks in place

The analysis of the functionalities confirms what shown for the data fields: among the initiatives currently in place, building logbooks are mainly used as collector of administrative and construction information together with operational maintenance and use. Only some of the more "advanced" functionalities (benchmarking with similar buildings, alerts on performance/condition, environmental impact, or compatibility with 3D/BIM models) listed at the bottom of Figure 11 are available in few voluntary initiatives.

Figure 11: Functionalities building logbooks in place

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[16] During the analysis, a partial inclusion of information has been considered as a green square

Data management

70% of the initiatives have a structured approach to data which are collected following a multi-categories' cataloguing, 10% present macro-categories only whilst 20% do not use any type of structure but just list documents that should be included. By dividing again the initiatives between mandatory and voluntary, it is clear that almost all mandatory initiatives have a structured approach, with specific data fields to be included in the building logbook, whilst voluntary tend to work mostly with macro-categories, which define at higher level what information should be included. The responsibility for populating the building logbooks is generally with the building owner or, in case of a new development or refurbishment, with the building constructor. The Property register, the Federal register and the Woningpas are three exceptions where information is updated and collected by the municipalities/public authorities with the Woningpas being automatically updated as it links with other existing databases and platforms.

Seven out of the eleven mandatory initiatives have no process for data validation with the following exceptions:
- The Ministry of Environment of Finland and Portuguese local municipalities are entitled to verify the information provided and inspect the properties;
- Iceland requires the verification of information and has a price list for the validation;
- In Switzerland, the Federal Statistical Office defined a set of rules and processes for quality control and checks to be carried out on the information collected to ensure correct updates of the data;
- In Italy, the information within the "Fascicolo del Fabbricato" is validated by a registered technician (engineer, architect, etc.).

Success factors

The building logbooks analysed mainly aim at ensuring access to information, support better decision-making, market transparency, and simplify the construction process. As part of the review the following key success factors were identified (Figure 12).
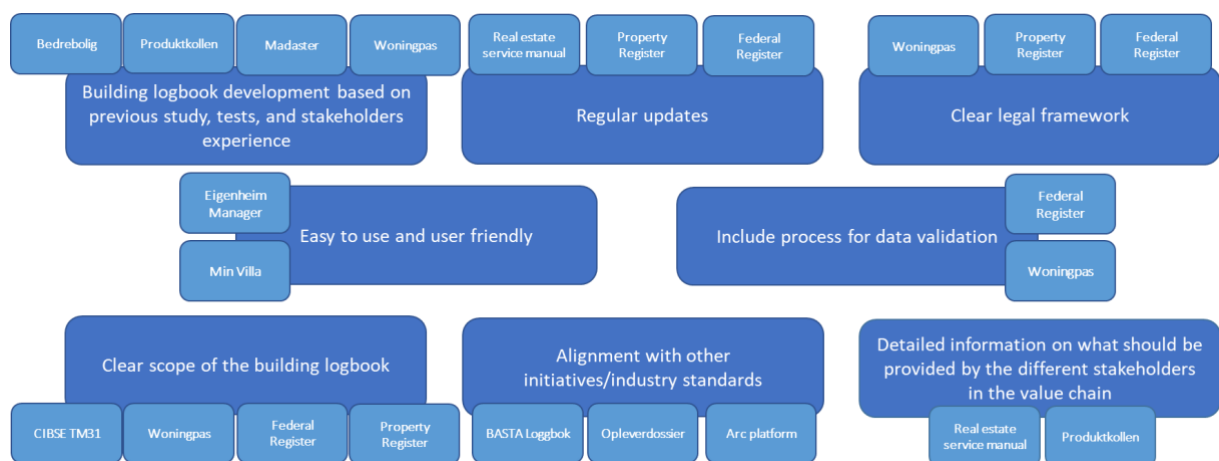
Figure 12: Building logbooks success factors

Discontinued initiatives

Home Information Pack (HIP) was introduced in 2007 for building transactions with the aim of making more information available at the beginning of the home buying/selling process and reduce the time between

| D1 - Home Information Pack – UK |
| D2 - ImmoPass – Germany |

offer and sale[17]. The information pack included mainly administrative documents (a property information questionnaire, EPC, sale statement, evidence of title) that were generally kept by the agent and shared with potential buyers. After several changes in scope and motions to revoke, the HIP requirement was suspended in May 2010 following General Election. During the 2010 political campaign HIP became part of different parties' manifestos, with pledges like "Abolish Labour's expensive and unnecessary Home Information Packs which increase the cost and hassle of selling homes" and "Scrap burdensome Home Information Packs, retaining the requirement for homes to have an energy performance certificate". [16]

The **ImmoPass** was a private initiative developed in 2000 by HypoVereinsbank and Dekra which created a building assessment process with over 130 evaluation criteria divided in thematic areas (building, open space, healthy living, environment, and energy, building services and construction). The aim of the evaluation was to provide a transparent assessment of the quality of the properties during planning and construction, support communication between all stakeholders[18] and rectify defects at early stage of the construction phase to reduce costs for corrections[19]. The cost of the review was €3.300 which included three audits at the site and pollution measures. Stakeholders involved in the initiative confirmed that ImmoPass no longer exists however they did not provide an explanation on why it was suspended.

Barriers to the implementation of building logbooks

The analysis of the initiatives tested, in place and the discontinued building logbooks highlighted different barriers that prevent or slow down the uptake (Figure 13).

Cost implications
- Costs for implementation, update and validation

Static nature of the building logbooks
- Information often need to be manually updated and the building logbook does not include dynamic information on the day-to-day use

Privacy and data management
- Not clear data ownership and data handling procedures, including data validation

Access to information
- Information accessible only on site and/or to specific stakeholders

Administrative burden
- No clear understanding of the use and added value of the building logbook

Fragmented regional approach
- In particular in Italy and Spain where regions develop their own requirements for building logbooks

Figure 13: Barriers implementation building logbooks

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[17] House of Commons (2010) "Home Information Packs: a short history"
https://commonslibrary.parliament.uk/research-briefings/rp10-69/

[18] DEKRA SE (2000) "Innovationspreis für den ImmoPass Neutrale Qualitätsaussage hilft dem Immobilienkäufer"
https://www.presseportal.de/pm/6647/192259

[19] UmweltDialog (2007) "ImmoPass: Kostenersparnis für Mensch und Umwelt"
https://www.umweltdialog.de/de/verbraucher/leben-und-wohnen/archiv/2007-02-14_HVB_ImmoPass.php

Conclusions

The analysis of the state of play of the building logbooks shows that the basic concept underpinning the initiatives, although with different facets, are similar, particularly for the mandatory ones. Building logbooks are used to collect administrative information, together with building characteristics and operational data.

The number of countries where building logbooks are tested or currently under development confirms a growing interest on the topic with public authorities and private companies that are developing tools to meet the requirements and needs of the build environment users and stakeholders. Although not a single building logbook included in the analysis encompasses the full array of data fields and functionalities, the most recent initiatives in place are integrating the "classical" information and functions with more advance features, which make the building logbook a dynamic tool that can better respond to different stakeholders' requests and needs (energy, LCA, BIM, certification, etc.).

The potential to push building logbooks even beyond their current scope emerged in the analysis of the H2020 projects: building logbooks can become enabling tools for initiatives such as the renovation roadmaps or for investment decision making and can also be enriched with details that can support circular economy.

Both the analysis and the feedback received from the stakeholders during the webinar showed that ease of use is the key element for a successful building logbook. Different countries (France, UK, specific regions in Italy) defined building logbooks as burdensome after the implementation/test, which results in the suspension of the initiatives. Only a clear understanding by the users of the usefulness of the building logbook together with an easy to implement approach would push the uptake and potentially create a business interest for private companies.

From the analysis, two different approaches aimed at simplifying the process of implementation are identified:
- the Woningpas, which links with existing databases and gets automatically updated, and
- the Federal Register together with the Property Register, where the public authorities are responsible for collecting and controlling the information.

It is interesting to note how Greece is trying to create, with the Electronic building ID Code, a full database of all properties in the country (similarly to Iceland and Switzerland), pushing however the effort of collecting the data on the building owners. This should be reviewed in the future, once the ID is operational, to see how it evolves. The (slow) approach of the construction industry towards technology is confirmed by the presence of many paper-based initiatives. The paradox of the industry is that working collaboratively by sharing information that are collected in a single point would solve some of the issues in construction (silos working, lack of collaboration, etc.); however, due to the nature of the industry itself it is not easily achievable. All the issues related with data, including quality assurance, lack of standardisation, privacy and accuracy can influence the utility and utilisation of the building logbook. Not validated / updated building logbooks lose their purpose and make the whole process an onerous and time-consuming exercise with very little benefits, which is one of the barriers to the uptake emerged from the analysis. It therefore appears that the natural evolution of building logbooks, to be able to overcome some of these barriers, is the digital environment, however it is important to clearly define the scope and functionalities to ensure success. Moving toward a digital building logbook does not imply to simply include files created electronically into the building logbooks but rather the development of an integrated instrument that not only provides accurate and up-to-date information but also enables analysis, based on the different users' needs, on how to manage, maintain and improve the building.

CHAPTER 3: GAPS ANALYSIS AND IDENTIFICATION OF ACTIONS ADDRESSING THE GAPS

Introduction to Task 3

Objectives

The objectives of Task 3 are:
- to analyse, based on outcomes from Tasks 1 and 2, the gaps that still have to be addressed at EU, national, regional and sectoral levels to ensure a widespread use and efficient functioning of building logbook for all building types;
- to identify actions to be undertaken by the European Commission, Member States or other stakeholders, to address those gaps;
- to characterise each of these actions according to predefined features, including a qualitative assessment regarding the feasibility, added value and resources needed for each action, potential synergies with the analysis of the building logbooks related initiatives, acceptability by the professionals in the sector, together with an estimation of the effort sharing between the European Commission, national, regional and local administrations, professional organisations in the construction and building sectors, other market players and the research community.

Approach implemented

The approach implemented is depicted on Figure 14. It combines an analytical methodology based on answers received to the online survey and interviews (Task 1) and on outcomes related to existing initiatives (Task 2) with an expert approach.
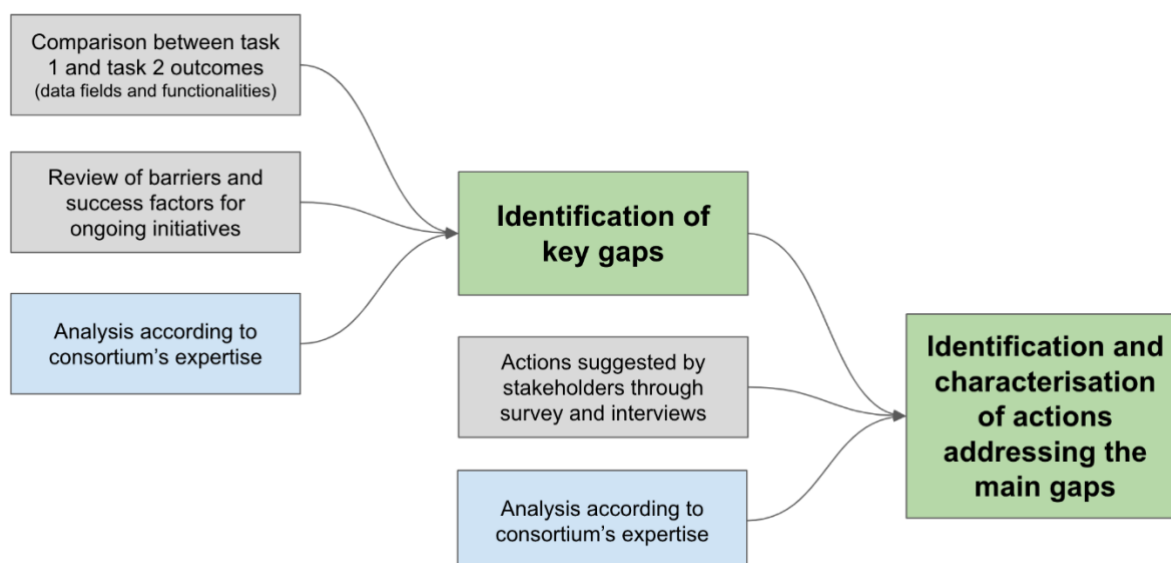
Figure 14: Approach for the gaps analysis

The key gaps to be addressed are firstly identified based on:
- A comparison of the data fields and functionalities to be included in Digital Building Logbooks according to Task 1's online survey and interviews, with the data fields and functionalities implemented by the existing initiatives reviewed in Task 2;
- A review of the barriers and success factors for ongoing and discontinued initiatives, as analysed by Task 2;
- Expert views based on previous works and research projects.

Then, actions that might be undertaken are identified and characterised based on:
- The key gaps previously identified;
- The actions suggested by stakeholders through the online survey and the interviews (Task 1);
- Expert views based on previous works and research projects.

Finally, actions are characterised according to an ad-hoc template presenting their main features.

Comparative analysis of outcomes from Tasks 1 and 2

Methodology

A two-fold approach is applied to compare the outcomes from the online survey conducted in Task 1, and the initiatives reviewed in Task 2:
- The data fields to be included in building logbooks,
- The functionalities to be offered by building logbooks.

For both, to investigate the degree of agreement among the surveyed experts and among the initiatives reviewed, the **Krippendorff's alpha** is used. This is a statistic that allows evaluating how the data collected in the study represents correctly the variables measured.[20] Furthermore, inter-sources Krippendorff's alphas are also calculated to compare the expectations from the surveyed experts in terms of data fields and functionalities to what is implemented within the initiatives reviewed. The analysis is then completed with the calculation of:
- The proportion of initiatives which have included the data field or functionality in question in their logbook, among all initiatives studied;
- The proportion of survey respondents who have considered the data field or functionality in question as "very important" or "somewhat important", among all respondents.

The difference between these two values represent the "gap" between stakeholders' expectations regarding logbooks' scope and functionalities, and what is implemented by existing initiatives.
This comparative analysis is supplemented by a review the key success factors and barriers faced by the initiatives reviewed, before identifying the main gaps that that have to be addressed to ensure a widespread use and efficient functioning of digital building logbooks.

Estimation of the level of agreement between stakeholders and level of alignment between existing initiatives

To investigate the level of alignment between the existing initiatives, Krippendorff's alpha is calculated for the aspects regarding "data fields" and "functionalities" (see Interrater reliability part in Table 5).

Table 5: Krippendorff's alpha calculations

	Interrater reliability		Inter-sources reliability (Initiatives vs. Survey)
	Data fields	Functionalities	
Initiatives	0.18	0.01	0.01
Survey	0.17	0.22	

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[20] Values range from 0 to 1, where 0 is perfect disagreement and 1 is perfect agreement. Source: https://www.statisticshowto.com/krippendorffs-alpha/. Krippendorff suggests: "[I]t is customary to require α ≥ 0.800. Where tentative conclusions are still acceptable, α ≥ 0.667 is the lowest conceivable limit (2004, p. 241)."

Overall, there is no alignment between the different initiatives reviewed (all Krippendorff's alphas < 0.2), meaning that existing building logbook initiatives have quite different contents across countries. The initiatives are better aligned for data fields than for functionalities, which tends to show that views are diverging less regarding the type of data to be included in the building logbook than regarding the functionalities that can be offered by the building logbook (see also Figure 10 and Figure 11 in previous chapter). It can be concluded that there is large diversity among existing logbook initiatives across countries, which calls for EU alignment.

Similarly, Krippendorff's alpha is calculated for the aspects regarding "data fields" and "functionalities" to investigate the degree of agreement between the survey respondents. Again, the agreement level is low (all Krippendorff's alphas <0.3). This shows that experts have a diverse range of opinions among all the potential opportunities that the building logbooks could bring. Yet, they tend to clearly agree on aspects such as the need of a "building description" including the typology of the "material and design" as well as the "equipment described within the logbook", the "ownership of the information contained" and the need for the scheme to represent a "digital safe of the content" (all these aspects were agreed by >70% of the respondents).

Finally, Krippendorff's alpha is calculated to compare the degree of consistency between the responses from the survey and initiatives reviewed (inter-sources reliability – see right part in Table 5). As expected, results show a very low chance of agreement both in the data fields and functionalities (Krippendorff's alpha close to 0), suggesting the existence of major gaps between the sources.

These gaps are further investigated with a focus made on the main ones (higher than 50%).

Data fields to be included in a Digital Building Logbook

Figure 15 shows, for each data field, the gap between the proportion of initiatives including this data field in their building logbooks (blue) and the importance of each data field as considered by the respondents to the online survey (green). The data fields for which the "gap" is higher than 50% are highlighted in red in the figure. They are the following (by decreasing order):

- *[81%]* Smart readiness indicator,
- *[71%]* Dynamic data (smart meters and sensors),
- *[70%]* 3D/BIM models of the building and its systems,
- *[68%]* Ratings and certifications other than energy performance certificate,
- *[56%]* Information on renovation potential.
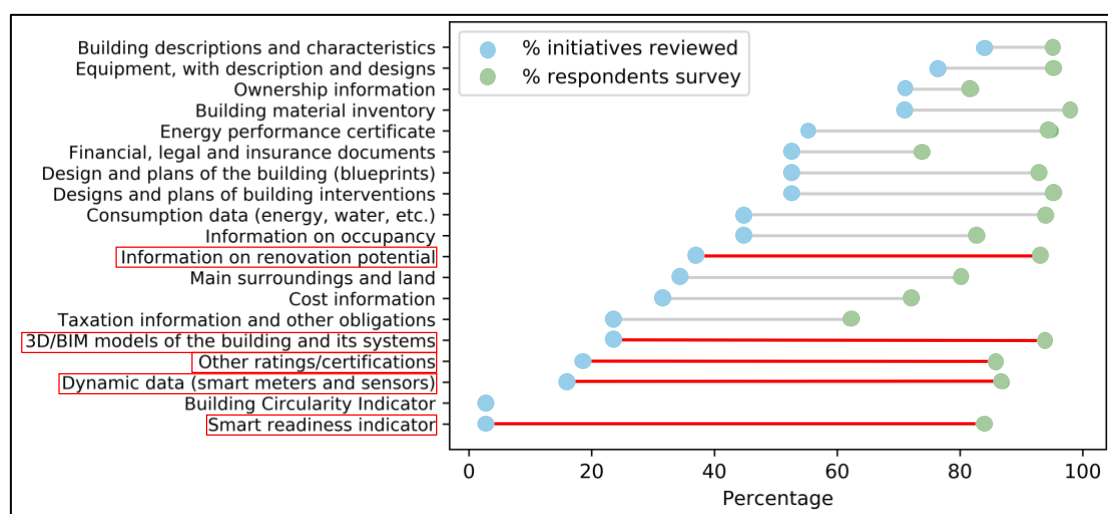
Figure 15: Gaps in data fields

Functionalities offered by a Digital Building Logbook

Similarly, Figure 16 shows in red, for each functionality, the gap between the proportion of initiatives offering this functionality in their building logbooks (blue) and the importance of each functionality as considered by the respondents to the online survey (green).

The functionalities for which the "gap" is higher than 50% are highlighted in red in the figure. They are the following (by decreasing order):

- *[81%]* Indication of smart readiness indicator of the building,
- *[80%]* Integration of BIM,
- *[71%]* Visualisation of future energy/cost saving potentials and life-cycle costing,
- *[68%]* Benchmarking, reporting and links to various certification and assessment schemes,
- *[60%]* Provision of a building renovation passport (renovation roadmap).
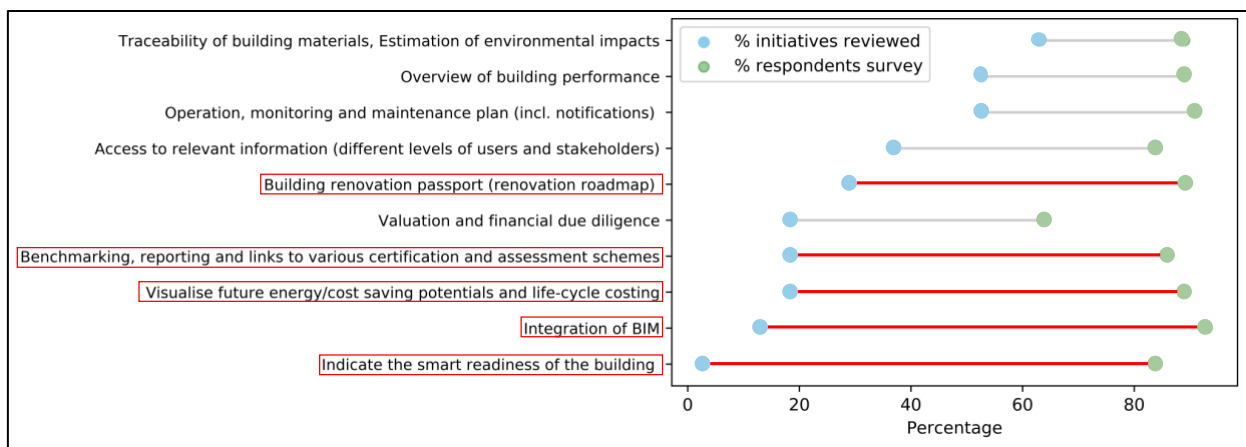
Figure 16: Gaps in functionalities

Review of barriers and success factors for the implementation of Digital Building Logbooks

The identification of barriers and success factors supports the identification of key gaps to be addressed.

Barriers and success factors were analysed for each initiative reviewed in Task 2 (see Figure 12 and Figure 13 in previous chapter). They were provided using free text boxes, from which some categories were derived. Besides, barriers and success factors have also been discussed during a webinar, with specific polls organised during the presentation of Task 2's outcomes (see Chapter 4 in Report 2 – Building Logbook State of Play [2]). Categories derived from Task 2 review were used for the multiple-choice questions submitted to attendees.

Results from Task 2 review and from the polls are presented in Table 6 and Table 7:

- Percentages in the first column correspond to the occurrence of the barrier or success factor in question in the initiatives reviewed;
- Percentages in the second column correspond to the number of votes for the barrier or success factor in question during the web-conference's polls. The voting was made spontaneously, therefore numbers in this column should be considered as indicative. Furthermore, participants could vote multiple barriers and success factors.
- Barriers and success factors are ranked by decreasing order according to the first column.

Table 6: Barriers to building logbooks' uptake

Barriers	From Task 2 review	From webinar
Lack of motivation to update the contents	18%	55%
Benefits not clearly identified	16%	47%
Too high cost	16%	31%
Administrative burden for homeowners	16%	43%
Unclear national legislation / Regional fragmentation	11%	41%
Issues with data privacy	8%	39%
Business model not defined	8%	33%
Issues with data accuracy	3%	33%
Some users not familiar with digital tools	0%	37%
Lack of synergies and consistency with other instruments	0%	47%

Table 7: Success factors to building logbooks' uptake

Success factors	From Task 2 review	From webinar
Ease of use	24%	83%
Alignment with other initiatives / industry standards (European, national, local)	21%	44%
Compulsory initiative	13%	35%
Data validation process	13%	35%
Free of charge	11%	33%
Usable by different stakeholder groups	11%	50%
Clear scope / purpose	8%	35%
Flexible framework	3%	19%
Applicable for different building types	0%	52%

Regarding the lack of motivation to update the contents, and the lack of understanding of the benefits provided by building logbooks, significant examples come from the test initiatives carried out in France in 2017 in the framework of PTNB "Plan Transition Numérique dans le Bâtiment" (Digital Transition Plan in the Building sector). The purpose of those projects was to promote the uptake of digital dwelling logbooks and use the lessons learned to elaborate an implementation decree to make digital dwelling logbooks mandatory. The conclusions from the experimentations did not convince the national authorities and the decree has never been adopted, one of the reasons being the absence of a clear public interest that would justify the effort.

The too high cost of the building logbook is reported by several initiatives in Denmark, the Netherlands, France, UK, Italy. Cost aspects were one of the main reasons to stop the UK-based initiative "Home Information Pack". When the building logbook's costs are borne by end-users, the cost barrier is sometimes combined with the building logbook being perceived as an administrative burden for the end-user. There is therefore room for new business models as a way to contribute to the building logbook financing and create value based on their use.

Simplicity and ease of use are reported as key success factors. The alignment with exiting initiatives and standards is also an important success factor, especially for applications during the construction phase.

The outcomes of the review of existing building logbooks together with the stakeholders' answers to the web-conference's polls on both barriers and success factors lead to the following highlights:

- **Costs vs. benefits**: Identification of and communication about benefits of building logbooks are key factors to convince stakeholders to implement and use the tool. The lack of motivation of end-users to update the contents of the Digital Building Logbook is another key barrier, certainly related to the lack of understanding about benefits. Finally, the cost of the building logbook, as well as the business model for its development, have to be acceptable to end-users and in line with the benefits provided.

- **Synergies and ease of use**: User-friendliness is key. Administrative burden should be minimised for end-users. Compatibility and consistency with other instruments are important facilitators for the uptake of the building logbooks. In particular, the building logbook has to be usable by different stakeholder groups and applicable for different building types.

- **Data handling**: Issues with data privacy and the need to protect end-consumers are reported. Data accuracy has to be ensured through a solid data validation process.

- **Legal framework**: The provision of a clear legal framework and minimisation of regional fragmentation are important aspects to facilitate market uptake. Ultimately, making the Digital Building Logbook compulsory is a radical option to force its uptake.

Stakeholders views about the possible actions to facilitate the deployment of Digital Building Logbooks

Methodology

The answers provided by interviewees regarding the role of the EU in the development of Digital Building Logbook are analysed, as well as the answers received to the online survey regarding the actions to be undertaken by the European Commission, the Member States, the Regional / Local Governments and the Construction Sector in order to facilitate the deployment of an EU digital building logbook.

This allows establishing a preliminary list of actions to be undertaken to facilitate the Digital Building Logbook development.

Analysis of interviewees' opinion and survey's answers

Within Task 1, 30 semi-structured interviews were conducted to collect in-depth insights from experts selected based on their field of expertise to gather a wide range of perspectives. The following questions were included in the interview questionnaire in order to feed Task 3 (see Annex A in Report 1 – Definition of the Digital Building Logbook [1]):

- What do you think the role of the EU should be in developing/promoting a Digital Building Logbook ? Should the EU even have a role?

- Which action(s) are most important to facilitate the deployment of Digital Building Logbooks (on different levels)?

Among the 24 interviewees who answered the first question, 19 (79%) clearly said the EU should have a role. Five interviewees provided a "Yes, but" answer. Those stakeholders are reluctant to harmonised and prescribed solutions, obligations, creation of an EU-wide Digital Building Logbook .

The possible roles of the EU, according to interviewees, are presented in Table 8 (first column).

Table 8: Actions suggested by stakeholders

Main actions suggested by stakeholders	According to interviewees		According to survey respondents		
	Possible role of the EU	Possible role of the EC	Possible role of Member States	Possible role of regional / local governments	Possible role of the construction sector
• Develop a standard (single template with core features)	60%	39%	5%		
• Set out legal basis / Make some minimum features mandatory	44%	19%	42%		
• Conduct communication campaign / Share best practices	36%	25%	11%	18%	10%
• Provide guidance and support to Member States	24%	15%			
• Integrate Digital Building Logbook with existing framework	16%	1%			
• Provide positive incentives	12%	8%	4%	8%	
• Identify benefits vs. costs	12%	3%	1%		
• Develop a public tool with possible plug-ins from private sector	4%	8%	3%		
• Start with public buildings	4%		4%	11%	
• Set up and maintain national database			8%		
• Provide support to users			3%	11%	
• Provide digital data					38%
• Provide training					10%
• Participate in definition					26%

Open answers from interviewees have been grouped into 9 categories of actions, as follows:

- *Develop a standard (single template with core features):* The definition of standards is expected as a flexible framework which can work in different national environments; it would address the structure of the logbook, the data sets, the functionalities, the boundaries of responsibilities between the different parties (manufacturers; contractors; building professionals intervening in the maintenance; homeowner; etc).

- *Set out legal basis / Make some minimum features mandatory:* Some stakeholders expect a clear legal basis to be defined, with some minimum features made mandatory, for instance with regards to safety.

- *Conduct communication campaign / Share best practices:* A broad communication campaign and sharing of best practices are suggested, in order to stimulate the adoption of logbooks and ensure mutual learning. Existing initiatives should be promoted, the exchange of knowledge facilitated and interoperability between solutions encouraged. A working group may be set up at EU level.

- *Provide guidance and support to Member States:* The EC is expected to develop some guidelines to support Member States, especially the less advanced ones, to make all countries use the same language.

- *Integrate the Digital Building Logbook with existing framework:* The Digital Building Logbook should not be a standalone instrument, but rather should be integrated with existing frameworks. For instance, the Digital Building Logbook should include the building performance score assessed by Level(s). The link with existing EPCs should be established.

- *Provide positive incentives:* Financing of experimental initiatives and launch of research and innovation projects are suggested.

- *Identify benefits vs. costs:* A cost-benefit analysis is needed, comprising the identification, quantification and characterisation of benefits for each type of actor

and at societal level (health, safety, energy transition); and the estimation of correspond costs and who should bear them.

- *Develop a public tool with possible plug-ins from private sector:* Building the IT infrastructure and hosting the server may be done at EU level. Public data may be made available through APIs.
- *Start with public buildings:* Public authorities are expected to require Digital Building Logbooks in public tenders for their own buildings in order to give the good example.

Within the online survey, to which 93 stakeholders contributed, the following questions were raised:

- What role should the European Commission play in promoting / designing / implementing an EU Digital Building Logbook? *(free text answer)*
- What action(s) should the following actors take in order to facilitate the deployment of an EU digital building logbook? *(check box, then free text answer)*
  - o Member States,
  - o Regional and local governments,
  - o Construction sector,
  - o Other.

Table 8 (second column) shows the roles that the EC could play according to survey respondents. Only two respondents did not answer this question.

These roles have been grouped into the same categories than the interview answers. Survey respondents have provided answers quite similar to interviewees, with the following relevant differences:

- The need for communication and sharing of best practices is more often mentioned;
- The set-up of a public tool corresponding to basic Digital Building Logbook features is more often mentioned.

In addition, 73 respondents have suggested a role for Member States (third column in Table 8). These roles have been grouped into the same categories, with two relevant additions:

- *Setup and maintain a national database:* Some stakeholders expect Member States to set up a cybersafe database at national level. Public authorities may be responsible for data ownership and be able to have an overview of the building stock condition. By having access to building data, public authorities could better allocate renovation grant.
- *Provide support to users:* Some support has to be provided to users for the data gathering. It can take the form of help desks, hot-line or educational materials (i.e. seminars, webinars, etc.).

38 respondents have also suggested a role for regional and local governments (fourth column in Table 8), which would mainly be supportive and early adopters for public buildings.

Furthermore, 58 respondents suggest a role for the construction sector (fifth column in Table 8), which is expected to:

- *Provide digital data:* The construction sector is expected to supply Digital Building Logbooks with structured, good-quality data (initial data and updates linked with renovations, declaration of products and construction systems, BIM data, etc.).
- *Provide training to construction professionals and an overall support to the instrument*: Construction professionals need training, for instance regarding the use of digital tools and standardized methods for LCA and LCC.
- *Participate in the Digital Building Logbook definition*: the construction sector should be associated to the Digital Building Logbook definition together with the European Commission and the Member States to facilitate its acceptance and implementation.

Finally, 18 respondents have suggested a role for other stakeholders. The most commonly cited stakeholders are:

- Research organisations, which could support the Digital Building Logbook definition and provide advanced methods and tools for data analytics;
- Training organizations: provide training courses for professionals responsible to prepare the needed material;
- Financial institutions and insurance sector, which could request the data of the Digital Building Logbook;
- Built environment stakeholders like real estate agents, building managers, etc., which could facilitate access to the necessary information.

Conclusion: identification of key gaps and actions to address those gaps

Nine key gaps to be addressed have been derived from the previous data and are categorised into four groups as illustrated by Figure 17:

- Users' expectations,
- Financial aspects,
- Legal aspects,
- Data aspects.

Financial aspects   **User expectations**   **Data aspects**   **Legal aspects**

Gap #1	Lack of a sound funding model
Gap #2	DBL benefits not clear to all the stakeholders
Gap #3	Inconsistency around the scope and purpose of DBL
Gap #4	Low user-friendliness
Gap #5	Barriers to updating the DBL

Gap #6	Challenges linked with the interoperability of the repository
Gap #7	Issues with data governance
Gap #8	Lack of defined legal framework
Gap #9	Uncertainty around the role of EU and MS level policy

Figure 17: Key gaps to be addressed

The final list of key gaps is presented within the next section.

The analysis also includes a proposal for 15 actions to address those gaps, as represented on Figure 18 – some actions addressing several gaps and some actions specifically focused on one single gap.
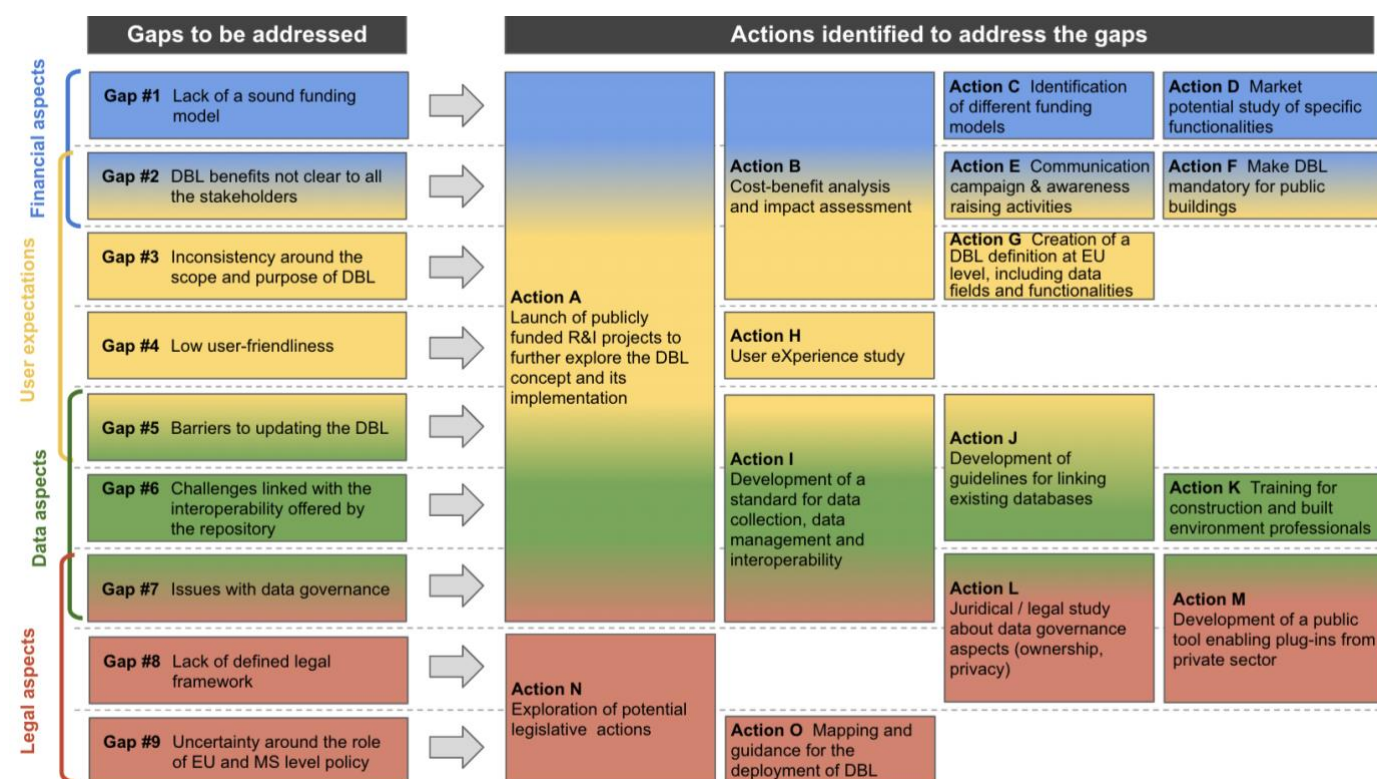
Figure 18: Key gaps and actions to address the gaps

Actions have then been characterised according to a structured template. Within this template, the following aspects are listed:

- **Action type**, which can be supportive action, study, development.
- A brief **description**, including possible synergies with other initiatives.
- The **gap(s) addressed** by the action.
- A pie chart indicating the **effort sharing** between the European Commission, national administrations, regional or local administrations, professional organisations in the construction and building sectors, other market players and the research sector. This chart should be considered as a qualitative assessment rather than a quantitative assessment. Some explanations are provided regarding the role of each type of actor.
- A radar graph indicating the **strengths and weaknesses** of the action along five axes: technical feasibility, added value to meet the needs, affordability, synergies with existing initiatives, acceptability by professionals of the value chain. Each of these dimensions is qualitatively assessed on a scale from 1 to 5, where 1 corresponds to a serious weakness and 5 to a strong advantage. Again, some explanations are provided to justify the assessment.
- Finally, the **other actions linked** to the action in question.

The characterisation of each of the 15 actions according to this template is presented in Annex 1.

Important remark: the actions listed and described here below are not mutually exclusive: some can be combined, and some make sense only if others have been undertaken.

Detailed description of key gaps to be addressed

Gap #1 Lack of a sound funding model.

Developing, implementing and maintaining Digital Building Logbooks comes at a cost. The development of the logbook's building blocks (features, data sets, functionalities) can be financed through both public and private means. Further work needs to be carried out to identify what parts of the Digital Building Logbook are best to be financed by the public sector (i.e. aspects related to common interests such as transparency, access to data) and what parts are best addressed via private initiatives (e.g. operationalising the Digital Building Logbook and developing functionalities).

If the Digital Building Logbook development relies (fully or partly) on the private sector, sound business models have to be designed, tested and implemented. In particular, if end-users have to pay for using the Digital Building Logbook, the price has to be acceptable. Different funding schemes may co-exist in the various territories of the EU.

> → **Actions to address this gap:**
> - **Action A.** Launch of publicly funded R&I projects to further explore the Digital Building Logbook concept and its implementation
> - **Action B.** Cost-benefit analysis and impact assessment
> - **Action C.** Identification of different funding models
> - **Action D.** Market potential study of specific functionalities

Gap #2 Digital Building Logbook's benefits not clear to all the stakeholders.

As previously mentioned, a number of benefits could be linked to the Digital Building Logbook, applicable to stakeholders across the entire construction and built environment value chains, such as greater overall sectoral transparency, value chain integration, innovation and circularity. Digital Building Logbooks could also offer stakeholder-specific benefits.[21] Focusing on the benefits – and the Digital Building Logbook's functionalities that help to realise the benefits – is key to build support among market players who would otherwise perceive the Digital Building Logbook as an additional administrative burden. In certain countries (e.g. France, Finland, Germany, UK), logbook initiatives have faced some obstacles caused by *inter alia* a lack of understanding of the benefits generated. That is why the Digital Building Logbook's benefits have to be clearly identified and communicated, both at societal level and at the level of different types of stakeholders (e.g. building owners, tenants, financial institutions and public authorities).

> → **Actions to address this gap:**
> - **Action A.** Launch of publicly funded R&I projects to further explore the Digital Building Logbook concept and its implementation
> - **Action B.** Cost-benefit analysis and impact assessment
> - **Action E.** Communication campaign & awareness raising activities
> - **Action F.** Make the Digital Building Logbook mandatory for public buildings

Gap #3 Inconsistency around the scope and purpose of Digital Building Logbook.

As observed in the review of existing initiatives, there are many different interpretations of what a Digital Building Logbook should be. The present study is a significant step in reaching a common understanding about the Digital Building Logbook scope and purpose. [22] This work

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[21] See Report 1 – Definition of the Digital Building Logbook [1] for stakeholder-specific benefits and for the link between functionalities and benefits.

[22] See Report 1 – Definition of the Digital Building Logbook [1] for core and optional data fields to be included in the Digital Building Logbook.

should be pursued so that a common definition, encompassing the scope and the purpose of the Digital Building Logbook, is endorsed at EU level by the construction and built environment value chains. It should include the conditions for accessing data by third parties and other data governance requirements.

In addition, the comprehensiveness of the Digital Building Logbook has to be clarified. The Digital Building Logbook should underpin a lifecycle approach and support informed decision-making taking into account resource optimisation and circularity principles.

→ **Actions to address this gap:**
- **Action A.** Launch of publicly funded R&I projects to further explore the Digital Building Logbook concept and its implementation
- **Action B.** Cost-benefit analysis and impact assessment
- **Action G.** Creation of a Digital Building Logbook definition at EU level, including data fields and functionalities

Gap #4 Low user-friendliness.

Regarding the Digital Building Logbook's "features" (e.g. digital interface, data syncing, etc.) and "functionalities" (services built around the Digital Building Logbook), user-friendliness is key to users (both home owners and professionals), as pointed out by several interviewees and mentioned as a key barrier or success factor in the review of existing initiatives. Therefore, user-friendliness of the tool is a must, otherwise the tool can be considered like another administrative burden by the users. Any Digital Building Logbook initiative should take into account User eXperience (UX) principles in order to stimulate the use of the Digital Building Logbook information for informed decision-making, to plan interventions to the building, to facilitate the update of the logbook by the users and to make the most of the other ongoing initiatives. Support to users should be provided according to such principles.

→ **Actions to address this gap:**
- **Action A.** Launch of publicly funded R&I projects to further explore the Digital Building Logbook concept and its implementation
- **Action H.** User eXperience study

Gap #5 Barriers to updating the Digital Building Logbook.

Some logbook initiatives have encountered a lack of motivation of users (for instance homeowners) to update the contents of the building logbook. It may be combined with lack of user-friendliness of the Digital Building Logbook interface (gap #4). It may also result from a lack of appreciation of benefits of Digital Building Logbook (gap #1). Specific actions are needed to ensure a systematised and standardised approach to data from data capture, gathering, storing, processing and updating. Automatic updates of the Digital Building Logbook would be welcome (for instance with smart meters data).

→ **Actions to address this gap:**
- **Action A.** Launch of publicly funded R&I projects to further explore the Digital Building Logbook concept and its implementation
- **Action I.** Development of a standard for data collection, data management and interoperability
- **Action J.** Development of guidelines for linking existing databases

Gap #6 Challenges linked with the interoperability offered by the repository.

The Digital Building Logbook has to be fed from various data sources, and it can also act as a data source for other protocols (for instance certifications). Common data standards,

matching and syncing processes are therefore needed, and have been rarely implemented by the existing initiatives reviewed.

The constant evolution of the construction sector in terms of digitalisation has to be taken into account and linked to the Digital Building Logbook. For instance, as soon as BIM becomes widely spread the Digital Building Logbook should embed BIM data. In addition, it would make sense that in the future the Digital Building Logbook reflects the Smart Readiness Indicator (SRI) of buildings. The Digital Building Logbook should also synchronize with the data coming from electricity smart meters[23]. Generally speaking, interoperability with industrial data, tools and protocols needs to be ensured.

Furthermore, data accuracy and quality have to be ensured through a solid data validation process.

→ **Actions to address this gap:**
- **Action A.** Launch of publicly funded R&I projects to further explore the Digital Building Logbook concept and its implementation
- **Action I.** Development of a standard for data collection, data management and interoperability
- **Action J.** Development of guidelines for linking existing databases
- **Action K.** Training for construction and built environment professionals

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Gap #7 Issues with data governance.

Issues with data privacy (related to third-party access to the Digital Building Logbook and trust with regards to sensitive information) and data ownership, together with the need to protect citizens' rights (homeowners, occupants of the building) have been reported in the interviews and the existing initiatives analysis. Digital Building Logbooks will need to make sure they are compliant with the General Data Protection Regulation (GDPR).

Consequently, cyber risk and privacy must be at the forefront – with collaboration from construction and real estate companies, operators, IT companies and public authorities to ensure the security of the data in the Digital Building Logbook .

→ **Actions to address this gap:**
- **Action A.** Launch of publicly funded R&I projects to further explore the Digital Building Logbook concept and its implementation
- **Action I.** Development of a standard for data collection, data management and interoperability
- **Action L.** Juridical / legal study about data governance aspects (ownership, privacy)
- **Action M.** Development of a public tool enabling plug-ins from private sector

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Gap #8 Lack of defined legal framework.

Ten of the initiatives reviewed are compulsory. Several surveyed experts also claim that Digital Building Logbooks should be made mandatory at EU or national level to force its large-scale deployment (see above Table 8).

However, stakeholders' views diverge regarding what should be mandatory and what should be voluntary. This is strongly linked with the identification of funding models, benefits and

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[23] By 2024, it is expected that almost 77% of European consumers will have a smart meter for electricity. Source: https://ec.europa.eu/energy/topics/markets-and-consumers/smart-grids-and-meters/overview_en

scope (gaps #1, #2 and #3). For instance, either the availability of a Digital Building Logbook, or both its availability and its use, might be made mandatory.

More generally, the impacts of making any provision mandatory should be carefully assessed, both for new and existing buildings. The principle of proportionality, according to which an administrative authority may only act to exactly the extent that is needed to achieve its objectives, should be applied when it comes to making any Digital Building Logbook-related provision mandatory.

→ **Actions to address this gap:**
- **Action L.** Juridical / legal study about data governance aspects (ownership, privacy)
- **Action M.** Development of a public tool enabling plug-ins from private sector
- **Action N.** Exploration of potential legislative actions

Gap #9 Uncertainty around the role of EU and MS level policy.

Stakeholders' views diverge regarding the need for harmonisation at EU level and the flexibility of national policy measures. For instance, the EU may define one single standard to be applied in every Member State or only define some principles and thresholds that Member States would apply with a certain flexibility. The principle of subsidiarity, according to which there should be no EU intervention when an issue can be dealt with effectively at Member States level, should be applied.

→ **Actions to address this gap:**
- **Action N.** Exploration of potential legislative actions
- **Action O.** Mapping and guidance for the deployment of Digital Building Logbook

CHAPTER 4: APPROACH FOR THE SELECTION OF THE PRIORITY ACTIONS

Introduction

Based on the gap analysis and the assessment of the actions that would foster a widespread use and efficient functioning of digital building logbooks in Task 3 (previous chapter), three priority actions have been selected as the main recommendations for the European Commission to consider.

This selection was made in consultation with the EC, following a three-step approach (as shown in Figure 19), taking into consideration criteria identified during the preliminary phases of the project and stakeholders' input:
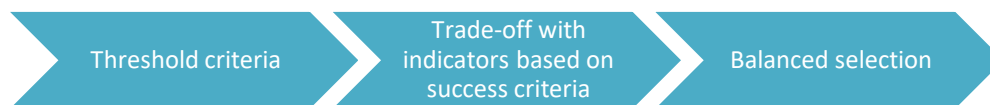
Figure 19: Three-step approach for the selection of priority actions

Step 1 - Threshold criteria

The identification of actions is based on the stakeholder recommendations, their assumed impact and potential to alleviate the bottlenecks (or gaps) impeding a successful deployment of the digital building logbook schemes. The criteria have already been considered in the previous gaps analysis and are, therefore, not included in these threshold criteria.

Only actions that meet the minimum threshold criteria were retained for the trade-off analysis. Actions not meeting the following criteria are therefore excluded from the next steps:

- **European Commission's leverage capacity:** the action should, to a large extent, be developed, carried out and/or supported by the European Commission. This criterion, therefore, excludes actions that require a strong role – such as leading– by Member States, or private actors.
- **Synergy potential:** potential synergies with other EU or international initiatives, given that the implementation potential and chances of success of the priority actions depend on these synergies.
- **Feasibility:** the action should be technically and financially feasible for the European Commission to carry out.

Step 2 - Trade-off with indicators based on success criteria

To prioritise the suggested long list of 15 actions as described in previous chapter and detailed in Annex 1, the consortium carried out a trade-off analysis for each action using several weighted criteria. These criteria were selected taking into account:

- Stakeholder interviews and survey results, as included in *Report 1 – Definition of the Digital Building Logbook* [1]
- Digital building logbook success factors, as discussed in *Report 2 – Building Logbook State of Play* [2].

This resulted in the selection and weighting of the following criteria to evaluate the priority actions (in order of weighted importance).

Table 9: Criteria to evaluate the priority actions

	Success criteria	Weighting
1	The action enables the development of a clear legal framework (both EU and national level), amongst others on data security, building data requirements, mandatory vs voluntary framework, etc.	19%
2	The action demonstrates benefits for users (building owners and occupants), the construction sector and industry in general, financial institutions and public authorities.	17%
3	The action will lead to the development of new business opportunities and novel business models.	13%
4	The action facilitates the social acceptance and future use of the Digital Building Logbook (i.e. easy to use and high-user friendliness).	12%
5	The action can strengthen synergies with existing EU and international initiatives.	12%
6	The action is equally applicable to all member states and stimulates a European harmonisation.	10%
7	The action will simplify, facilitate and enable a regular update – potentially automated – of the required Digital Building Logbook data and information.	7%
8	The action can build further on existing Digital Building Logbook research, tests and stakeholders experience.	6%
9	The action strengthens consistency and reliability to the scope of the Digital Building Logbook scheme, and endorses at EU-level the definition developed under this study.	5%

The weight for each criterion is expressed in a percentage (with a total of 100% for the 9 criteria), which allows a good differentiation between the weights.

Experts from the consortium have evaluated whether the actions meet the above criteria. Since the original long list of actions had already been created based on direct stakeholder input, and the criteria and their weighting were also considered the stakeholder interviews, the stakeholders were not asked to evaluate (and thus prioritise) the actions directly. Feedback from interactive discussions taking place during stakeholder meetings organised was also taken into account.

Each action was evaluated by the consortium experts for all the criteria on a 5-point Likert scale: strongly disagree (1), disagree (2), neither agree nor disagree (3), agree (4) and strongly agree (5). This rating was multiplied with the weighting of the specific criterion, allowing for classification of the actions on the long list.

Step 3 - Balanced selection

A ranking according to the approach described above guarantees a prioritisation corresponding to the highest potential success, however, it does not guarantee that the three to four first actions will be balanced. For example, they may only cover legal and financial aspects, excluding user expectations and data aspects. With this in mind, the consortium executed a cross-check of the top four actions to guarantee a balanced selection. This cross-check considered the following aspects:

- **Gaps:** are the four main groups of the gap categorisation (users' expectations, financial aspects, legal aspects, data aspects) covered? Note that actions can be categorised in more than one group.
- **The building blocks of the Digital Building Logbook:** are the main building blocks of the Digital Building Logbook definition covered under the selected actions? Those building blocks are i) Data & information, ii) Features, Functionalities & benefits and iii) Data governance.
- **Type of action:** is there sufficient variation in the types of action? In Task 3, it is indicated whether the action is supportive, a study, development or legal by nature.

In case the top-ranked actions were not balanced according to the above cross-check, the alternative would have been to analyse and select priority actions which were more balanced – but this proved not to be necessary.

PART II. SECOND PHASE OF THE STUDY: RECOMMENDATIONS OF PRIORITY ACTIONS TO THE COMMISSION

In the previous phase of the study, the main gaps to foster a widespread use and efficient functioning of digital building logbook and the actions to address these gaps, have been identified by the involved experts.

The three-step approach described in the previous chapter enabled a well-informed choice of the following three actions, worked out in detail in this part:

- *[Priority Action 1]* Development of a standardised approach for data collection, data management and interoperability and its legal framework.
- *[Priority Action 2]* Development of guidelines for linking existing databases.
- *[Priority Action 3]* Launch of public funded R&I projects to further explore the Digital Building Logbook concept and its implementation.

Following the three-step approach, the priority actions identified are therefore concrete, sustainable and create impact to both the end users and construction sector and public authorities. The board of experts decided to exclude the action "Market potential study of specific functionalities" (Action D - in red) from the list of priority European Commission actions given that this action will need to be carried out by market actors rather than the European Commission. The final classification of the selected actions is shown in Table 10.

Table 10: Classification of actions as a function of the score obtained.

	Trade-off 15 proposed Commission actions for the roll out of the DBL											
	Weighting	19%	17%	13%	12%	12%	10%	7%	6%	5%		
		Criteria	Criteria	Criteria	Criteria	Criteria	Criteria	Criteria	Criteria	Criteria	Score	Score
-	**Actions**	1	2	3	4	5	6	7	8	9	(1-5)	%
Action I.	Development of a standard for data collection, data management and interoperability + Legal aspects	4.3	2.0	3.7	2.7	4.3	5.0	4.7	5.0	5.0	3.8	76%
Action J.	Development of guidelines for linking existing databases	3.7	2.4	3.3	3.0	5.0	4.7	5.0	4.7	4.0	3.7	75%
Action D.	Market potential study of specific functionalities	2.7	5.0	4.3	3.7	3.7	3.0	2.0	5.0	3.0	3.7	73%
Action A.	Launch of publicly funded R&I projects to further explore the DBL concept and its implementation	3.7	4.3	4.0	3.7	2.7	2.9	3.0	4.7	3.3	3.6	72%
Action N.	Exploration of potential legislative actions	5.0	2.3	3.3	2.3	4.3	4.3	2.3	4.0	3.7	3.5	71%
Action O.	Mapping and guidance for the deployment of DBL	3.1	3.0	2.4	3.6	4.1	4.4	4.0	5.0	3.8	3.5	70%
Action G.	Consolidation and endorsement of the DBL definition	3.7	2.7	2.7	3.3	3.0	4.7	2.7	5.0	5.0	3.4	68%
Action L.	Juridical / legal study about data governance aspects (ownership, privacy)	5.0	1.3	2.3	3.3	4.0	4.7	3.3	3.3	4.0	3.4	68%
Action H.	User eXperience study	2.66667	3.3	2.7	5.0	1.7	2.3	4.0	4.7	3.0	3.1	63%
Action M.	Development of a public tool enabling plug-ins from private sector	2.7	2.3	4.7	2.7	3.3	3.0	3.3	4.0	3.3	3.1	63%
Action E.	Communication campaign & awareness raising activities	1.7	4.0	2.7	4.7	2.3	3.3	2.3	4.0	2.7	3.0	61%
Action B.	Cost-benefit analysis and impact assessment	2.0	4.7	3.0	2.3	2.3	3.7	1.7	4.3	3.0	3.0	60%
Action F.	Make DBL mandatory for public buildings	3.7	3.3	2.7	2.0	2.3	2.3	1.7	3.0	3.0	2.8	56%
Action K.	Training for construction professionals	1.3	3.7	2.3	4.0	2.3	2.3	4.0	3.7	2.3	2.8	55%
Action C.	Identification of different funding models	1.3	3.3	3.7	3.0	2.3	2.0	2.0	4.0	1.7	2.6	52%

A comprehensive assessment of each selected priority action was carried out, including:

- a set-up and roll-out plan;
- a feasibility evaluation; and
- synergies with existing EU and international initiatives.

The assessment builds further on step 1 of the threshold criteria and is based on in-house expertise, desktop research and interviews with external experts.

Set-up and roll-out plan for each priority action

Drawing on the results of the previous research within this project, the consortium proposed a detailed set-up and roll-out plan for each priority action. A high-level process-flow for the implementation of each action is accompanied by a description of the main actors (participants and beneficiaries), the management and financial perspective, and an indicative timeline.

Feasibility evaluation

A feasibility evaluation was carried out for each identified action including a SWOT analysis,[24] estimation of resources and benefits. The SWOT framework addresses the economic viability along with the technical and legal feasibility, as well as human-related aspects. While the strengths and weaknesses focus on the action itself (i.e. internal focus), the opportunities and threats explore the external framework in which the action should operate. The results of the SWOT analysis combined with estimates of necessary resources/ benefits enabled the consortium to analyse how the suggested priority actions can be best embedded in the European and wider international context:

- What are the EU priorities and targets?
- How do the actions contribute to the UN Sustainable Development Goals?[25]
- Will the actions be supported or opposed by Member States and stakeholders?
- How will the digital building logbook develop in the short, medium and long term?
- How will it contribute to the competitiveness of and innovation within the EU construction sector?

The summary of the feasibility evaluations is the basis for specific and concrete recommendations tailored to the European Commission's expectations.

Synergies with existing EU and international initiatives

The implementation potential and chances of success of the priority actions will increase through building synergies within a larger framework of EU and international initiatives. For the relevant initiatives, the consortium provided a suggestion for synergy and indicated its relative importance.

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[24] A SWOT (strengths, weaknesses, opportunities and threats) analysis is a framework used to evaluate the potential of an initiative, organisation or policy action.

[25] The 2030 Agenda for Sustainable Development – adopted by all United Nations Member States in 2015 – contains 17 Sustainable Development Goals. https://sdgs.un.org/goals

CHAPTER 5: PRIORITY ACTION 1 - DEVELOPMENT OF A STANDARDISED APPROACH FOR DATA COLLECTION, DATA MANAGEMENT AND INTEROPERABILITY INCLUDING ITS LEGAL FRAMEWORK

Context of the action

Most experts engaged in this study think that a wider uptake of the digital building logbook requires a systematic and better aligned capture of information, data gathering, processing, exchange and storage.[26] This entails all building-related data, of both static and dynamic nature, and can include administrative documents, plans, description of the land, the building and its surroundings, technical systems, traceability and characteristics of construction materials, performance data, and links to building ratings and certificates.

An EU-wide harmonised set of logbook data protocols would enable interoperability and inclusion of external databases, while offering an approach to bring together fragmented and scattered data across several organisations (or even departments within the same organisation). The standardised digital building logbook would be a safe instrument, at once giving users control of their data and allowing access to third parties while respecting the fundamental right to protection of personal data. It would also help Member States to develop and adopt legislation and public initiatives, fostering not only the uptake of the digital building logbook but also the digitalisation of the whole value chain.

Two fundamental questions need to be answered to facilitate an aligned and structured data approach:

1) **To what level is it necessary to formalise and align these technical specifications across Europe?**
2) **How can the approach be anchored in European legislation?**

For the first question, there are two main approaches available: i) an official mandate for a European standard, and ii) a technical study with wider and more open stakeholder involvement.

Is a series of European standards mandated by the European Commission, including examples such as the ISO 52000 series on the energy performance of buildings,[27] necessary to ensure data interoperability and safety? Is it a better alternative to start with a technical study, commissioned by the European Commission, as was the case with Level(s) – the European framework for sustainable buildings?[28]

Both options are common practice and have their individual advantages. To make an informed decision about the most suitable pathway, the specific circumstances will need to be considered – for example existing or forthcoming legislation, time constraints, industry interest etc. In the following section several options are identified and compared in a high-level implementation process flow, accompanied by a description of the main actors, management and financial aspects, and an indicative timeline.

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[26] See stakeholder outcomes in Report 1 – Definition of the Digital Building Logbook [1].

[27] Set of Energy Performance of Buildings standards, developed under a mandate from the European Commission to support the EPBD, published in summer 2017. This set of standards enables the assessment of the overall energy performance of a building. https://www.iso.org/standard/65601.html

[28] Level(s) is a common European approach to assess and report on the sustainability of buildings. Using existing standards, the voluntary Level(s) framework provides a common language for building sustainability, which other initiatives can also use. https://ec.europa.eu/environment/eussd/buildings.htm

As for the legislative adoption of the standards, opportunities within the EU decision-making process will be identified. As the digital building logbook concept has not yet been introduced into European legislation, the study will consider both legislative and non-legislative acts, but also EU policy papers. The latter do not have legislative weight, but they are often used to elevate specific topics in the European spotlight and prepare the ground for 'hard' policy measures. As such, it is relevant to point out the inclusion of the digital building logbook in the New Circular Economy Action Plan[29] adopted by the European Commission in March 2020 and in the Renovation Wave strategy published on 14 October 2020.[30]

The legal aspects are covered in the potential process flow of the following sections.

Set-up and roll-out plan

Aspects to cover under a digital building logbook EU standardisation process

Standards usually provide technical specifications for a level of performance, assessment methods for products, specific (calculation) method, or sometimes a combination of different aspects. For the digital building logbook, the latter is the case.

According to the experts, the main purpose of an EU harmonisation or standardisation process for a digital building logbook should be to establish **a semantic data model of the core digital building logbook elements**. The model should comprise a **standardised dictionary** (or vocabulary) of all building-related terms that may be used in a digital building logbook initiative, and define how they should be understood and used.

This would include a precise definition of the essential elements that a digital building logbook needs to enable interoperability with existing databases, integration of functionalities and data exchange between different users, while at the same time ensuring legal compliance. For example, it could include a data template containing core EU-level data fields, as well as country-specific requirements, guidelines for the organisation of logbook data, and protocols for data capturing.

The semantic model may be used by private actors and public authorities for the development and implementation of digital building logbooks.

The standard (or technical specifications) should comply with at least the following criteria:
- Technology-neutral
- Compatible with relevant international and European standards related to (the digitalisation of) the construction sector such as Building Information Modelling (BIM), Energy Performance of Buildings (EPB), Sustainability of construction works etc.
- The application of this standard should comply with the requirements for EU regulation 2016/679 on the protection of natural persons with regard to the processing of personal data and on the free movement of such data (GDPR)
- Allows for the establishment of practical, user-friendly and flexible data
- Takes into account the special needs of different stakeholders, with special attention for building owners and users.

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[29] In the New Circular Economy Action Plan the Commission announces that a new comprehensive Strategy for a Sustainable Built Environment will be launched which will promote circularity principles throughout the lifecycle of buildings by – amongst others – developing digital logbooks for buildings – https://ec.europa.eu/environment/circular-economy/pdf/new_circular_economy_action_plan.pdf

[30] The renovation wave initiative will build on measures agreed under the Clean energy for all Europeans package and aims to double annual energy renovation rates in the next ten years. – https://ec.europa.eu/energy/topics/energy-efficiency/energy-efficient-buildings/renovation-wave_en

The sharing of information among a large and diverse pool of stakeholders unavoidably raises questions on intellectual property rights regarding the work of, for example, the energy expert or other building professionals and service providers. Consensus should be reached on allowing the building owner to freely use and distribute the logbook data without formal approval procedures but with adjusted and 'contained' liability. Database and licensing rights could also be looked at in a similar way to maintain the full use of logbooks.

The standards should therefore provide clarification in terms of:
- Hierarchy of the information
- Intellectual property ownership
- Obligations and liabilities of data suppliers
- Purpose of information exchanges
- Roles and responsibilities for information management.

Stakeholders

In certain key policy areas, the European Commission can mandate the development of standards, mainly to provide a basis for the safety testing of products but also in other areas such as supporting an emerging area of technology. The latter could be suitable for the standardisation process of the digital building logbook.

European standardisation is a consensus-building process that involves many players. As the development of standards is mainly initiated by market needs, industry plays an important role. European standards (EN) are then developed through one of the three European standards organisations, i.e. CEN, CENELEC and ETSI. For the development of digital building logbook standards, CEN would be the most appropriate. The European Committee for Standardisation (CEN) brings together the national standardisation bodies of 33 European countries. It provides a platform for the development of European standards in domains such as construction, chemicals and more.[31]

The technical committees (TC) are the key bodies of standardisation. A technical committee is a group responsible for the development and drafting of standards which are then ratified by European standards organisations. All stakeholders interested in the draft standard are entitled to participate, but only representatives of national standardisation bodies have the right to vote on the committee. Technical committees are composed of experts in a specific field representing national committees, industry, professional associations, government, trades unions and other stakeholders.[3]

Process flow

The potential pathways to achieve a digital building logbook EU harmonisation process are directly related to the required level of standardisation of the technical specifications (whether through a formal process or otherwise), and the extent to which these could/should be anchored in European legislation.

Formal standards versus alternative options

The difference between formal and informal standards is in the representation of those involved in the development and approval processes. For formal standards (at least in terms of the formal approval processes) the processes operate through national representation, rather than through organisational or individual representation as is the case for informal standards.[4]

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[31] More information on key players in European standardisation: https://ec.europa.eu/growth/single-market/european-standards/key-players_en

As an alternative to the formal European standards (EN), similar research and development on technical specifications can be executed through a technical study, with the aim of developing a uniform or harmonised European approach, potentially leading to technical recommendations and even standardisation.

While the development of informal standards or alternative technical studies might potentially offer advantages of flexibility, focus and speed of delivery, the formal standards process, as enshrined in the ISO/IEC Directives (which almost universally define the basic structures and processes for formal standards development), offers unrivalled rigour and transparency. [4]

EU regulatory framework

When aiming to create compulsory digital building logbook technical specifications to be adopted and implemented by Member States, European standardisation as such will not be sufficient since there is no regulatory base in the European legal structure. Standards in themselves thus do not have a legal weight to mandate their implementation.

While standards are voluntary codes and have no binding force by themselves, if they are part of a regulation or directive they essentially become a legal act. In other words, if a regulation or directive makes reference to a standard or ties certain requirements to a standard, compliance with the standard becomes a legal requirement.

A very important consideration is thus whether a mandatory EU-wide system is required, or if there is a system available that can be used across the EU on a voluntary basis.

The procedure followed for a European legislative proposal depends on the type and subject of the proposal. The vast majority of EU laws are jointly adopted by the EU Parliament and Council, while in specific cases a single EU institution can adopt alone.

The European Council and the European Parliament can authorise the European Commission to adopt two types of non-legislative acts:[32]

- Implementing acts, which introduce measures to ensure laws are implemented in the same way throughout the EU countries
- Delegated acts, which amend or supplement existing laws, notably in order to add new non-essential rules.

Potential pathways for EU-aligned and/or standardisation of digital building logbook technical specifications

Different pathways are possible to achieve a harmonised and/or standardised data approach for the implementation of the digital building logbook across Europe. These pathways exist of consecutive actions, which could in some cases partly run in parallel, leading to shorter timeframes.

Based on a literature review and expert feedback, the following potential pathways are identified:

» *Option A: Initial legal basis, followed by standardisation procedure, concluded by legal adoption at Member State level*
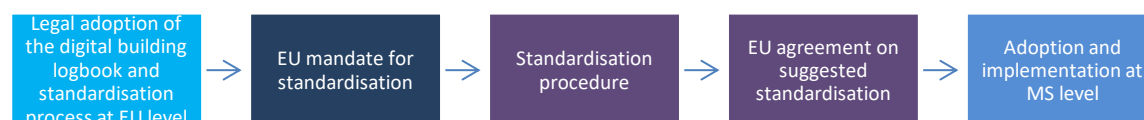
» *Option B: Initial legal basis, followed by a technical study, concluded by legal adoption at Member State level*

```
┌─────────────────┐     ┌─────────────────┐     ┌─────────────────┐     ┌─────────────────┐
│ Legal adoption  │     │ EU technical    │     │                 │     │   Voluntary     │
│ of the digital  │     │ study on        │     │ Involvement of  │     │ implementation  │
│ building logbook│ ──► │ digital building│ ──► │ industry and    │ ──► │ of digital      │
│ and technical   │     │ logbook data    │     │ frontrunner MS  │     │ building logbook│
│ harmonisation   │     │ approach        │     │                 │     │ in frontrunner  │
│ process at EU   │     │                 │     │                 │     │ MS              │
│ level           │     │                 │     │                 │     │                 │
└─────────────────┘     └─────────────────┘     └─────────────────┘     └─────────────────┘
┌─────────────────┐
│ Adoption and    │
│ implementation  │
│ at MS level     │
└─────────────────┘
```

» *Option C: Initial EU mandate for standardisation, standard development, concluded by legal adoption*

```
┌──────────────┐   ┌──────────────┐   ┌──────────────┐   ┌──────────────┐   ┌──────────────┐
│ EU mandate   │   │ Standardisa- │   │ EU agreement │   │ Legal        │   │ Adoption and │
│ for          │──►│ tion         │──►│ on suggested │──►│ adoption of  │──►│ implementa-  │
│ standardisa- │   │ procedure    │   │ standardisa- │   │ the digital  │   │ tion at      │
│ tion         │   │              │   │ tion         │   │ building     │   │ MS level     │
│              │   │              │   │              │   │ logbook      │   │              │
│              │   │              │   │              │   │ standard at  │   │              │
│              │   │              │   │              │   │ EU level     │   │              │
└──────────────┘   └──────────────┘   └──────────────┘   └──────────────┘   └──────────────┘
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» *Option D: Initial technical study, frontrunner involvement and voluntary implementation, concluded by legal adoption*
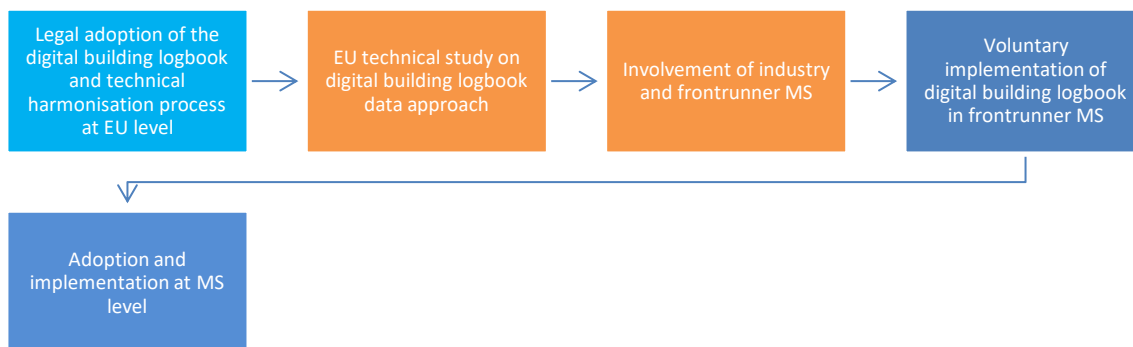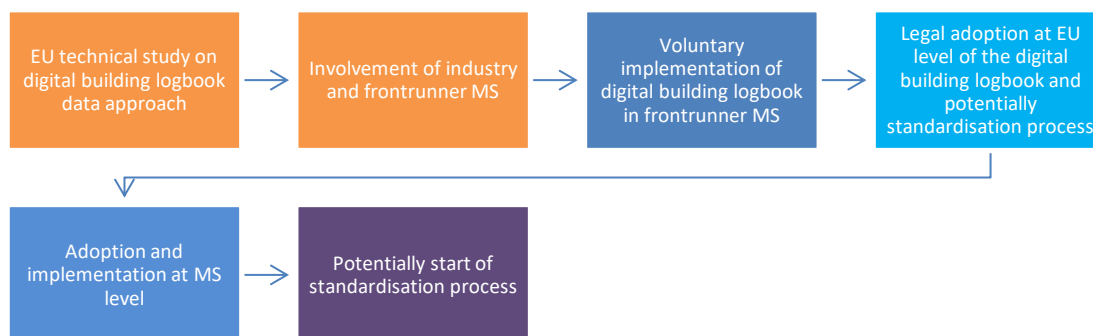
```
┌─────────────────┐   ┌─────────────────┐   ┌─────────────────┐   ┌─────────────────┐
│ EU technical    │   │ Involvement of  │   │ Voluntary       │   │ Legal adoption  │
│ study on        │   │ industry and    │   │ implementation  │   │ at EU level of  │
│ digital building│──►│ frontrunner MS  │──►│ of digital      │──►│ the digital     │
│ logbook data    │   │                 │   │ building logbook│   │ building logbook│
│ approach        │   │                 │   │ in frontrunner  │   │ and potentially │
│                 │   │                 │   │ MS              │   │ standardisation │
│                 │   │                 │   │                 │   │ process         │
└─────────────────┘   └─────────────────┘   └─────────────────┘   └─────────────────┘
┌─────────────────┐   ┌─────────────────┐
│ Adoption and    │   │ Potentially     │
│ implementation  │──►│ start of        │
│ at MS level     │   │ standardisation │
│                 │   │ process         │
└─────────────────┘   └─────────────────┘
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» *Option E: Initial technical study, frontrunner involvement and voluntary implementation, concluded by legal adoption*

```
┌─────────────────┐   ┌─────────────────┐   ┌─────────────────┐   ┌─────────────────┐
│ EU technical    │   │ Involvement of  │   │ EU recommenda-  │   │ Voluntary       │
│ study on        │   │ industry and    │   │ tion (no        │   │ implementation  │
│ digital building│──►│ frontrunner MS  │──►│ mandatory       │──►│ of digital      │
│ logbook data    │   │                 │   │ requirement)    │   │ building logbook│
│ approach        │   │                 │   │                 │   │ in frontrunner  │
│                 │   │                 │   │                 │   │ MS              │
└─────────────────┘   └─────────────────┘   └─────────────────┘   └─────────────────┘
```

The above identified actions, leading to harmonised and/or standardised data approach for the implementation of the digital building logbook across Europe, have each their duration.[33]

Duration European regulation

The development of new European regulation usually has a timeframe of three to four years.[34]

Other non-binding EU policy measures such as guidelines, recommendations or communications also take time to implement, usually a year or more.

Duration mandate European Commission

- Drafting of the mandate
- Mandate
- Acceptance of the mandate by the ESO
- Start of expected standardisation work

If a regulatory base exists, the mandating phase has a duration of about one year, usually more.

Duration European standard development

- Proposal to develop an EN
- Acceptance of the proposal
- Drafting
- Enquiry – public comment at national level and weighted vote
- Adoption by weighted formal vote
- Publication of the EN
- Review of the EN

From first proposal to final publication, developing a standard usually takes about three years. [5]

Duration technical study

A technical study will have to be preceded by the elaboration of tender specifications, most likely executed by the relevant unit of the European Commission supported by an expert group. This preparatory phase, and the launch of the tender process has a duration of about one year.

A technical study generally has a timeframe of one to two years, with a potential extension of a follow-up study of roughly one to two years.[35]

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[33] Timeframe for the different actions is based on expert interviews and desktop research.

[34] As for example the Construction Products Regulation had a first agreement in 2016 and is currently being assessed. The Directive amending the Energy Performance of Buildings Directive (2018/844/EU) started with a public consultation in 2015 and lasted until 2018.

[35] E.g. both the first and the second SRI technical support studies had a duration of about 18 months.

Considering these indicative durations, the timeframe for the different pathways can be aligned in a planning starting from 2021. As some actions could partly run in parallel, the below planning indicates also the option for shorter timeframes:
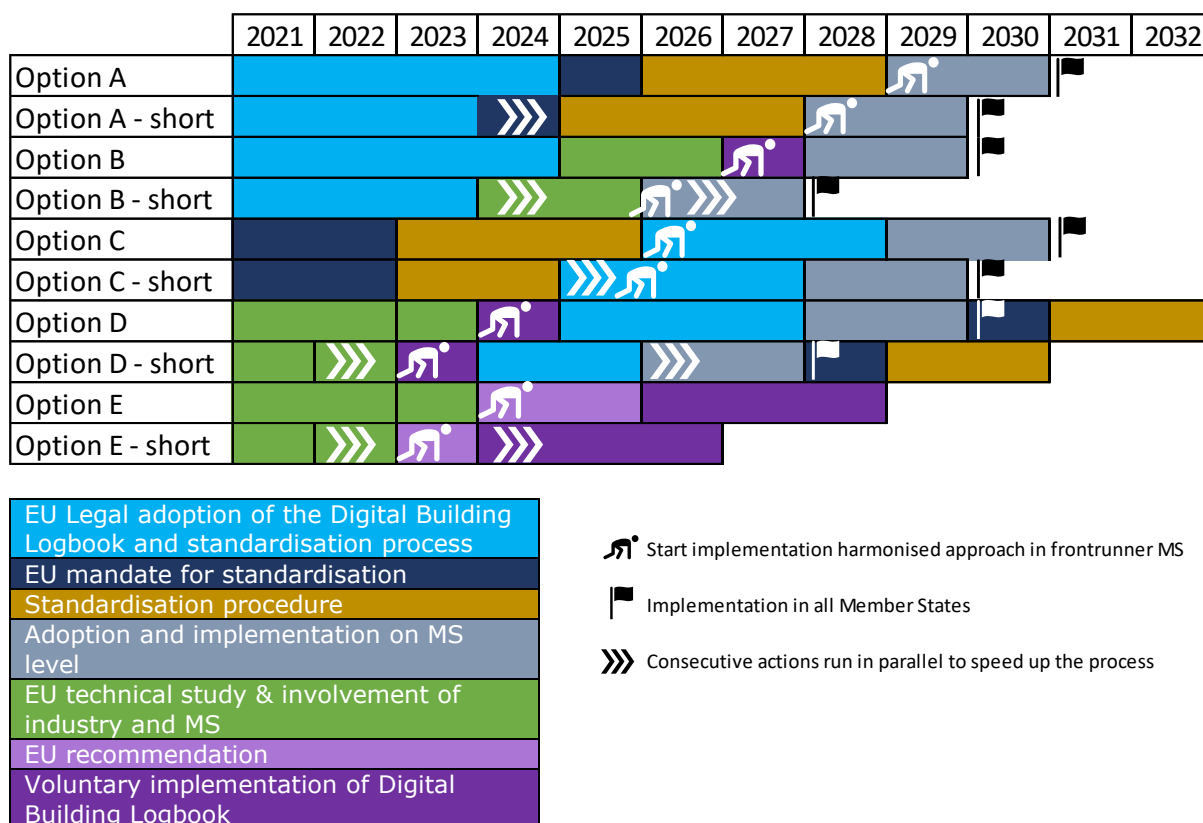
Figure 20: Overview timeframe for the optional pathways for EU aligned and/or standardisation of digital building logbook technical specifications (both standard and short options)

Based on the above timeframe, it can be concluded that both legal adoption and formal standardisation are time-consuming procedures and may hamper the uptake of the digital building logbook in the mid to long term.

A technical study, with the significant involvement of industry and frontrunner Member States, would enable a harmonised uptake of the digital building logbook in various Member States, but would have a less rigorous framework. Additionally, **a technical study may be more suitable than a formal standardisation for engaging industry experts and market players, as the latter process limits participation to members of European technical standards bodies only.**

Financial perspective

European Commission mandates may provide financial support for the development of European standards: these can only be accessed through a European technical committee, and the budget has to be agreed by the European Commission before contracts can be finalised.

The total cost of a standardisation approach is not publicly known, and neither is the average contribution of the European Commission, but experts point out that the cost of most standardisation processes is largely covered by industry.

Feasibility evaluation

Legal feasibility

There is as yet no legislation to prompt direct action on the digital building logbook standardisation process – in contrast to, for example, the Smart Readiness Indicator or the Building Renovation Passport.

Additionally, the digital building logbook is still a relatively new and innovative concept, and although it is widely recognised as a potential game changer in the construction value chain, the European industry is not (yet) fully prepared to rally behind the concept. Since formal standardisation is mainly initiated in response to explicit market needs, the lack of industry-wide support for the logbook may hinder the launch of a standardisation process.

When enshrining the digital building logbook in an EU legal framework, the main targeted parties are the Member States themselves. However, the promotion and recognition of the concept, and (voluntary) technical guidance, are vital. Building awareness and collective support for the logbook across the entire industry is paramount for its success. The benefits will need to be clearly articulated and potential concerns/liabilities clarified with each party. The current consensus within the involved experts is that the logbook would be a voluntary market-based tool: this needs to be kept in mind for the legislative action. Enshrining the digital building logbook in EU law is thus less essential than implementing measures to enable it, i.e. measures focusing on the legal and technical aspects of data exchange and improved data availability. The lessons learned from government-led logbook initiatives – which failed to a certain extent due to the lack of support from market players who perceived the logbook as an additional burden – are a further reminder that legislation alone will not achieve the set objectives.

There is currently no obvious EU legislation into which the digital building logbook could effortlessly fit. Neither the Construction Products Regulation (CPR)[36] led by DG GROW (as is the digital building logbook), nor the Energy Performance of Buildings Directive (EPBD)[37] led by DG ENER, seem initially a natural match. The CPR has a very different nature and concerns product level information. The EPBD is building-related but has a narrower focus mostly on energy, while the digital building logbook is cross-disciplinary. Between the two policies, the EPBD could be more appropriate due to the recent reference to the digital building logbook in the Renovation Wave Strategy in the context of building renovations (see below), however the broader application and the life cycle perspective of the logbook will need to be retained. In this sense, it is suggested that DG GROW should coordinate and closely collaborate with several DGs, including ENV, ENER and CNECT to make sure that the inclusion of the Digital Building Logbook in any legislation accurately reflects the scope of the logbook.

The inclusion of the digital building logbook in the Renovation Wave[38] provides an important push to continue its development and the exploration of the best policy avenues to support its uptake. With the growing importance of building data and the need to align European Commission initiatives and strategies, a digital building logbook will be key "to integrate all building-related data"[39] and facilitate collaboration among DGs and Member States. The forthcoming Strategy for a Sustainable Built Environment should accelerate its regulatory uptake. Given the dynamics of the field, an agile approach is recommended which would

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[36] The CPR lays down harmonised rules for the marketing of construction products in the EU – https://ec.europa.eu/growth/sectors/construction/product-regulation_en

[37] The EPBD covers a broad range of policies and supportive measures to boost energy performance of buildings and improve the existing building stock – https://ec.europa.eu/energy/topics/energy-efficiency/energy-efficient-buildings/energy-performance-buildings-directive_en

[38] Frans Timmermans, Vice President of the European Commission, has indicated the Renovation Wave as the priority policy instrument for economic recovery and to fight climate change.

[39] A Renovation Wave for Europe – greening our buildings, creating jobs, improving lives, https://ec.europa.eu/energy/sites/ener/files/eu_renovation_wave_strategy.pdf p.8

initiate the development of technical specifications, but also would sustain momentum and stakeholder engagement. The technical specifications should thereby focus on a semantic data model of the core elements of a digital building logbook. This will involve strong collaboration between a 'coalition of the willing', bringing together an alliance of private actors (e.g. IBM, BESIX, BAM, ENGIE Fabricom, Siemens, ABB, CGI, Vinçotte, Immoweb, Befimmo), Member States implementing the logbook (Belgium, Portugal, France, Sweden etc.), and research organisations.

A technical document endorsed by the European Commission would serve as the main reference, and be useful for the market. A good example of a technical document of this kind is the '*Handbook for the introduction of Building Information Modelling by the European Public Sector*'[40]. An official EU recommendation, and potentially a wider legislative framework, could then be decided on later.
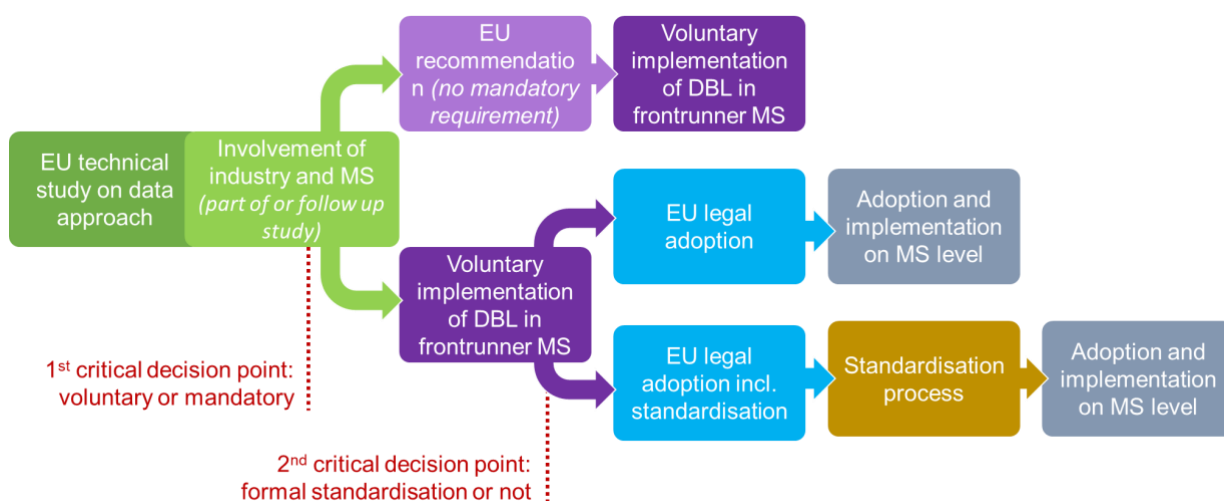
Figure 21: Process flow of the agile approach to obtain a European harmonised and/or standardised data approach for the implementation of the digital building logbook, allowing for different critical decision points.

Such reference document would support the 'coalition of the willing' in implementing digital building logbook initiatives throughout Europe, which in turn would increase the likelihood of the development of EU legislation.

Another relevant example of an agile approach of this kind is Level(s)[41], which provides a common European approach to the sustainability assessment and reporting of buildings. Using existing standards, the voluntary Level(s) framework provides a common language which other initiatives in the construction and built environment can also use. The links between Level(s) and logbooks are unambiguous and both initiatives can support each other to a great extent. If the logbook data model was aligned with Level(s), the logbook could (1) provide access to data to support calculations of the indicators within Level(s); and (2) store and visualise reliable and comparable data on sustainable building performance across Europe. [42].

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[40] Developed by the EU BIM Task Group, commissioned by the European Commission. http://www.eubim.eu/handbook/ [25]

[41] More info on Level(s), the European framework for sustainable buildings: https://ec.europa.eu/environment/eussd/buildings.htm

[42] Chapter 8 contains a more comprehensive elaboration on the synergy between Level(s) and the Digital Building Logbook

Technical feasibility

When developing standards for the digital building logbook the focus should be on market integration, which means that overcomplication should be avoided. For example, the ISO 52000 series on energy performance of buildings are perceived by many stakeholders as too complex.

An interesting aspect of the ISO 52000 series is the template for a national annex that enables Member States to tailor the methodology to their national situations. While this increases their willingness to accept the standard, the approach also introduces the risk of a divergence in technical specifications which would miss the original objective of a harmonised approach.

There is a lot of technical expertise available, in research institutes as well as in technical (standardisation) committees, EU R&I projects (e.g. iBroad, ALDREN, BAMB, BIM4EEB, X-tendo, DigiPLACE etc.), some Member States etc.

Compared to the SRI or Level(s), the digital building logbook has a technical disadvantage in that it is not easy to test. **Guidelines on the interoperability of logbooks, the development of a platform linking with other databases, and the development of features and functionalities, will require significant investment and commitment.** This is where i) a technical study on a coherent approach for linking existing databases with the digital building logbook (see chapter 6) and ii) the support of EU R&I funding (see chapter 7) are most needed.

Economic viability

If the industry is not on board there is no chance for standardisation, since the standard will not be adopted by the EC but by CEN. With this in mind, the logbook's user advantages and business opportunities need to be clear.

Human-related aspects

The suggested agile approach would allow for the market to develop at its own pace, but within an overall harmonised system. It would allow to generate interest for the digital building logbook concept and demonstrate the benefits for its different user groups. The main users include building owners, tenants, facility managers, utility companies, real estate service providers, energy auditors, contractors and financiers. [1]

Synergies with existing standards and EU initiatives in the built environment

There are several standards, both formal and informal, as well as EU initiatives in the built environment which are relevant for the development of (a set of) digital building logbook standards. In this section, only specific initiatives relevant for the standardisation approach are presented. Potential overall synergies with EU initiatives are described in chapter 8 of this study.

e-Invoicing

A specific mention should go to the European standard on electronic invoicing (EN 16931-1:2017). E-Invoicing is a digital solution that enables public sector contractors and companies to receive and process electronic invoices in line with the European standard. While the topic is not directly related to the built environment or the construction value chain, the nature of the standard is very much alike.

> **Scope of the electronic invoicing standard EN 16931-1:2017**
> *This European standard establishes a semantic data model of the core elements of an electronic invoice. The semantic model includes only the essential information elements that an electronic invoice needs to ensure legal (including fiscal) compliance and to enable interoperability for cross-border, cross-sector and domestic trade. The semantic model may be used by organisations in the private and the public sector for public procurement invoicing. It may also be used for invoicing between private sector enterprises. It has not been specifically designed for invoicing consumers. This European standard complies at least with the following criteria: – it is technologically neutral; – it is compatible with relevant international standards on electronic invoicing; – the application of this standard should comply with the requirements for the protection of personal data of Directive 95/46/EC, having due regard to the principles of privacy and data protection by design, data minimisation, purpose limitation, necessity and proportionality; – it is consistent with the relevant provisions of Directive 2006/112/EC; – it allows for the establishment of practical, user-friendly, flexible and cost-efficient electronic invoicing systems; – it takes into account the special needs of small and medium-sized enterprises as well as of sub-central contracting authorities and contracting entities; – it is suitable for use in commercial transactions between enterprises.* [6]

The similarities with the suggested aspects to be covered by the (set of) digital building logbook standard(s) is striking (see above description).

Revision of the Construction Products Regulation (CPR)

The CPR is currently being revised,[43] and stakeholders are invited to provide recommendations on how the current CPR framework can be revised. Digitalisation can play a crucial role. Recommendations might be formulated for construction materials towards product passports (covering the entire value chain) to improve data sharing at building level. The revision of the CPR will be relevant for potential digital building logbook standard(s) as well, focussing on the materials used and their performance at the building level, especially modules providing building material inventories covering information across the entire value chain (in-use performance, maintaining performance, end-of life scenarios etc.). Combining the data of product passports with digital building logbooks will for instance support extending the service-life of buildings and give better insights in end-of-life possibilities, thus enabling buildings to be reused and refurbished in an optimal way.

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[43] Review of the CPR – https://ec.europa.eu/growth/sectors/construction/product-regulation/review_en

Sustainability of construction works

The CEN/TC 350 'Sustainability of construction works' has proven to be successful for the material manufacturers. Over the past 10 years, a lot of Environmental Product Declarations (EPD) have been published. The second amendment of EN 15804:2012+A2:2019 resulted in an alignment with the Product Environmental Footprint (PEF) as requested by the European Commission and was published in 2019. This standard is vital to the construction material sector in order to converge methods and methodologies in line with the specificities of the construction sector. The EN 15804:2012+A2:2019 and the current revision of EN 15978:2011 on the assessment of environmental performance of buildings will be used as a frame within Level(s), to which DG Environment has run an alignment process for the PEF. The EPDs published according to the standard are intended for use as an input into assessments at building level and are therefore relevant for potential digital building logbook standard(s) as well, especially modules providing building material inventories.

Additional relevant initiatives

A digital building logbook standard or harmonised technical specifications could also build further on and refer to initiatives such as ISO 19650 'Organisation and digitisation of information about buildings and civil engineering works',[44] International Construction Measurement Standards, GDPR regulation, Green Building XML, IFC data models etc., as well as private products starting to emerge in the market (e.g. systems of interfacing between BIM, CMMS and BMS).

An EU-wide standardised application programming interface (API) could communicate with digital building logbook databases, which would create a new common EU market, enabling software vendors to integrate connections with digital building logbook databases in a uniform approach for all Member States. Use case examples are BIM / GIS software automatically retrieving relevant geometric information[45] from the digital building logbook in a secure way, or DSOs having information on electric vehicle charging points in buildings in a specific city district (cf. revised EPBD Art. 8 provision on recharging points).

Various standardisation organisations are working on topics related to the digitalisation of the construction sector. Formal international standardisation for building information modelling (BIM) is organised by ISO (e.g. ISO TC59 / SC13 'Organization and digitization of information on buildings and civil engineering, including BIM' and TC184: 'automation systems and integration') and at European level by CEN (e.g. TC442). In addition to formal standardisation, there are also informal standardisation initiatives in this field such as the buildingSMART International initiative that developed the Industry Foundation Classes (IFC) as a neutral and open specification for the BIM data model which they maintain, or the Open Geospatial Consortium (OGC) for GIS standards. GIS standards are open standards for the global geospatial community including the built environment. Another example of an informal initiative is the World Wide Web Consortium (W3C) which focuses on underlying web technology. [7]

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[44] Organisation and digitisation of information about buildings and civil engineering works, including BIM – https://www.iso.org/standard/68078.html

[45] Physical features of the buildings such as volume, floor area, height, etc.

CHAPTER 6: PRIORITY ACTION 2 - DEVELOPMENT OF GUIDELINES FOR LINKING EXISTING DATABASES

Context of the action

The digital building logbook, as described in the Renovation Wave strategy and within this study, relies on a connection that enables data exchange between several data repositories. A large number of building information databases exist across the EU: the purpose of the digital building logbook is to bring these data sources together and become a common gateway to access all this data. Linking a large number of existing databases – such as public registries (e.g. information on administrative aspects, soil, cultural heritage), LCA-related (e.g. commercial life cycle inventory data like Ecoinvent, or EF-compliant data, national EPD databases like for instance the Belgian B-EPD database[46] or the French INIES database[47]), national EPC databases, energy or water consumption, tenure or use, plans etc, as well as databases related to the smart readiness indicator, building renovation passports and the Level(s) framework – is thus vital for the success of digital building logbook development and its implementation. Incorporating trustworthy data sources will increase the chances for a successful implementation. Connecting all these data sources and users requires common 'languages' – interfaces and protocols – to enable interoperability, data consistency and information exchange.

To facilitate the development and implementation of digital building logbooks and maximise their interoperability with existing databases, a coherent approach across Europe for linking existing databases with the digital building logbook is recommended.

There are two main reasons for the need for a technical study developing guidelines on how this can be achieved:

1) The legal framework regulating the processing of personal data is already in place,[48] but the specifications for the content and technical structure still need to be developed.
2) With the rapid digitalisation of the sector, there is currently strong 'momentum' to drive the launch of the initiative.

Note that it is the primary focus of this task to provide guiding principles about how access should be structured, rather than to describe the way in which the data coming in from the different databases should be linked.
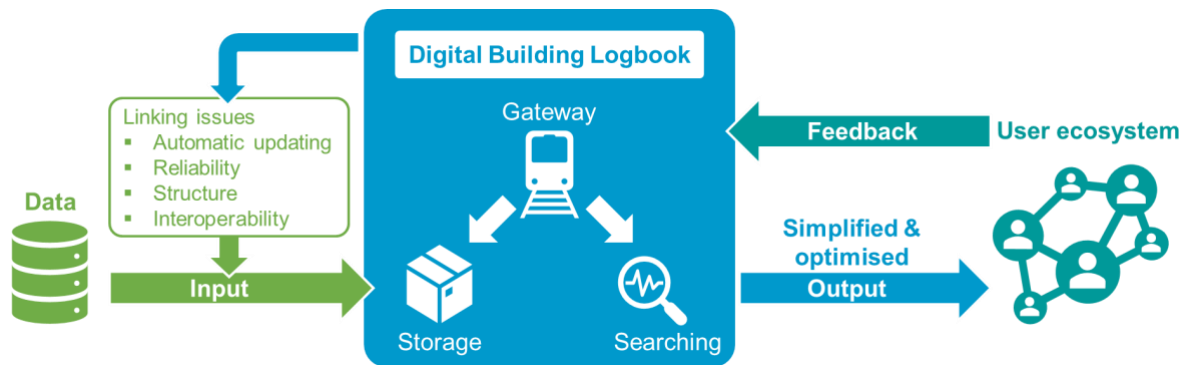
The digital building logbook acts as a gateway to facilitate the exchange of building-related information. The linkage of the databases can be achieved by storing directly relevant data or by creating a bridge to access it, as visualised in Figure 22.

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[46] The EPD is a database that allows manufacturers to communicate publicly the environmental impact of their products – https://www.health.belgium.be/en/database-environmental-product-declarations-epd

[47] INIES database collects environmental and health information of products, equipment and services for evaluating the performance of construction works – https://www.inies.fr/home/

[48] The General Data Protection Regulation (GDPR), the Data Protection Law Enforcement Directive and other rules concerning the protection of personal data – https://ec.europa.eu/info/law/law-topic/data-protection_en

Figure 22: Theorised diagram of the digital building logbook gateway function

Set-up and roll-out plan

To facilitate this process, it is recommended that a technical study should be carried out to develop guidelines. The launch of publicly funded R&I projects to further explore the digital building logbook concept and its implementation are elaborated under chapter 7. As the timeline in that exploration shows, the first results of such an approach can be expected at the earliest by 2023. Given the urgency of the situation, a technical study on these guidelines should be put out for tender as soon as possible.

Among other subjects, this study should cover an overview of existing databases, the trustworthiness of available data sources, and analysis of how the various databases can become more reliable and better aligned with the digital building logbook, as well as how to enable interoperability, data consistency and information exchange. This can for example be done thorough APIs, which are one of the main vehicles of modern digital architectures, enabling many opportunities for new business models.

The guidelines should also include a forecast of how new databases with linking potential for the digital building logbook will evolve. Digital experts have pointed out that the future will open up new opportunities to collect data (e.g. sensors, real-time energy use), which will come with new possibilities and responsibilities in terms of data privacy and security.
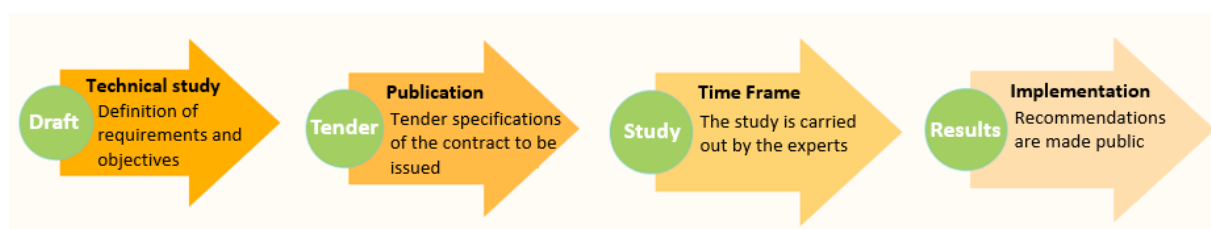
Figure 23: Flow chart of the technical study process

Understanding the context of linking existing databases

The purpose of this section is to provide an extensive reasoning for the tendering of guideline development for linking existing databases. Such a technical study will have to be defined and commissioned by the European Commission. The contractor will be in charge of carrying out the study following the specifications issued in the tender, and to present the main results in an applicable format.

A database is a computer entity which stores, organises, protects and supplies data. There are diverse types of databases to meet different needs. Linking multiple databases might require the existence of identifiers or 'primary keys' (e.g. building id) in each of the databases so the information of interest from multiple sources can be selected in one query. In addition, an intuitive user-friendly structure for the gateway interface is recommended.

The transition to a digital society is a paradigm shift that includes all actors and sectors. Rapid digitalisation is changing market rules and mechanisms. The services within the construction and building sector are becoming more and more interconnected: this is a transition that includes all actors within the construction value chain, from small SMEs to global manufacturers. Digital tools are also game-changing for new regulatory mechanisms aiming at legislating the future development of building technologies and data records. With data-value increasing steadily, new needs and challenges are appearing at the market level; and having access to relevant data is becoming a priority for the different actors [8]. Under this perspective, we are witnessing an increasing interest (private and public) for the creation of databases such as data lakes, data warehouses or data observatories. The digital building logbook initiative responds to this increasing need for common data repositories. The digital linkage of databases within the digital building logbook is expected to bring several benefits, including:

- **Database accessibility**: the opportunities to access the data are currently not the same for all actors, as large firms with greater economic resources and more focused data activities might have some advantages. Promoting data-sharing and facilitating access to it can help generate new business opportunities, improve the efficiency of existing services and accelerate compliance with the environmental agenda.
- **Database interoperability**: the existence of open common linked data sources can contribute positively to the integration and exchange of data, eventually improving its relevance and fostering innovation.
- **Database reliability**: as information and data grow exponentially, the identification and validation of good quality data are becoming more complicated. Common databases whose trustworthiness is ensured by official certification mechanisms contribute to improving the impact of its use.

The benefits for these shared data repositories are even more significant in the European construction domain, which provides 18 million direct jobs and where professionals skills are very diversified [9]. Installers, building engineers and real estate agents can be interested in the same type of information, but the way they analyse it probably will be different. The successful deployment of the digital building logbook repository requires the specification of the scope that determines the way the data is poured, linked and occasionally stored within the digital building logbook. The digital technologies required for the build-up of successful linkage mechanisms are in full swing, and citizens' increasing interest in getting good and convenient information guarantees a promising future for the digital building logbook.

As reviewed in Report 2 – Building Logbook State of Play [2] there are currently digital building logbooks running within some Member States. However, when it comes to their function as a gateway, they diverge significantly in the type of data included, the access to it and their functionalities. From this perspective, the goal of the current action is to assess and define the requirements for ensuring a successful linkage of databases within European digital building logbook initiatives.
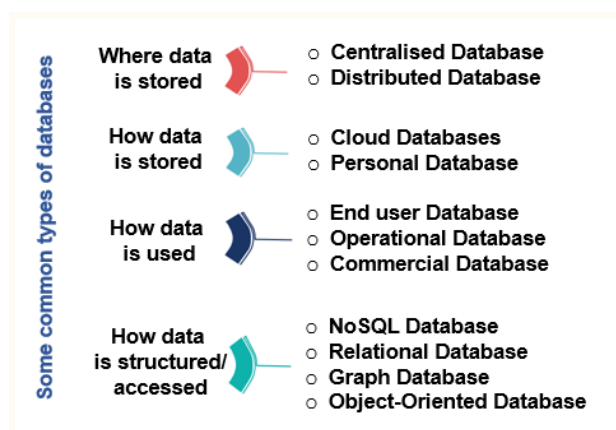
Figure 24: The linkage challenge

Stakeholders

The creation of European standards (discussed in previous sections of this document) could also be a valuable way of promoting linkages that facilitate synergies among countries.

From a governance perspective, DG GROW seems to be the most suitable for making strategic decisions and deciding on the content and expectations. As for this study, the tender process could be supported by an executive agency such as EASME.

It would be an option for the Joint Research Centre (JRC) to provide the internal research capacity that could be reinforced by external research contractors with expertise in digital technology, the construction sector or logbook implementation: some of these experts have already been contacted in the course of this study.

Process flow and main tasks

The development of guidelines for the linkage of databases and the description of the main targets in the EU procurement directive is the main reason to accelerate the deployment of the initiative. These guidelines could be issued at EU level but implemented at Member State level on a voluntary basis. The variety of existing **data infrastructures** and **linkage options** mean it would be sensible to identify and list the benefits and risks of the different linking schemes. It is important to consider that one linking scheme could be **only** suitable under some specific circumstances (e.g. typology of data, storage structure or Member State legislation).

To implement the action successfully, the technical study should include the following tasks:

Figure 25: Overview of the proposed tasks in the technical study

In Figure 25 the tasks specific to the study on the linkage guidelines are represented in the coloured squares. Dashed squares display tasks that can be added as part of a regular technical study (not developed in the text).

Task 1: Technical requirements to allow the linkage of databases

This task refers to the conception and operationalisation of the digital architecture that **regulates** and **optimises** the linkage between the diverse databases. Existing information structures such as the Construction Operation Building Information (COBIe)[49] should be considered as a way to facilitate the linkage between diverse databases. Internal linkage processes within the gateway should also respond to manipulation challenges such as data verification, hierarchisation of the main linkable keys, deduplication to decrease computational time, or compression to facilitate the exchange. The technical study should also specify aspects such as the digital building logbook functionalities offered at this level or the mechanisms to regulate the accessibility of the database.

According to one expert, the presence of intermediate processing layers or translation layers is essential to allow interoperability between the different databases.

The main questions that need to be answered for the successful implementation of the task include the following:

- **Functionalities**
    - Which types of functionalities concerning the linkage of databases should the digital building logbook include? E.g. inform users about updates (flagging), a record of information consulted and by whom, options for users to question data points, etc.?

- **Technical structure**
    - Which kind of software architecture should be used to establish the linkage? What append-query tools (used to merge databases) are needed to allow a precise selection of data from different sources?
    - How should security issues (malware protection etc.) be addressed?
    - Who should be the legal owner of the digital building logbook, given that the owner of the logbook and data could be different entities? EU, Member States, private actors?
    - How/when should the digital building logbook linkages be updated?

- **Storage**
    - Is there any information that all linked digital building logbooks should include? E.g. legal identification, primary keys etc.
    - Which information should never be stored in the digital building logbook?

- **Accessibility**
    - Definition of the different referencing-linkage mechanisms:
        - Between two or more databases
        - Between the users accessing the database
        - Who and how users should access the data in relation to the local context?
    - Which databases should be publicly accessible?

Task 2: Data properties

As task 1 described the functions and technical parameters that the digital building logbook should have to structure the communication of databases and data requests, task 2 should

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[49] COBie is an international interoperable format for sharing information in a structured way. It favours interoperability by unifying outputs and formats. It was developed by the buildingSMART alliance® and it is often used to organise the publication of non-geometric data for building information models.

be to determine the nature of the information that the digital building logbook should include. While the data logic behind the digital building logbook initiative commits to the principles for scientific data management – findable, accessible, interoperable and re-usable (**FAIR**) – the logbook's roll-out entails addressing some specific issues such as:

- **Data quality**
  - Should the digital building logbook establish quality criteria (validation process) to accept any data?
  - How should the MS/EU standards be considered before the linkage?

- **Data safety**
  - Data privacy should always be respected – it contributes to increasing the confidence of the data providers, but it might harm data quality
  - How should data safety be ensured? Are the latest EU standards (GDPR) enough to guarantee a safe linkage?
  - Regulation of authentication procedures when accessing the data.

This also means that the drafting of a data management plan (DMP) at European or Member State level should be considered.

On top of this, the experts contacted also mentioned the need to conduct a survey to identify the most relevant databases already available and whose integration should be prioritised in the future digital building logbook. Again, this exercise should be performed at both European and Member State level as some organisations might prefer national databases over EU ones or vice versa: Table 11 illustrates this fact. A brief overview of relevant databases which could be suitable for inclusion in future digital building logbook initiatives is provided in Annex 2.

Table 11: Example of a working table structuring a review of relevant databases for future digital building logbook initiatives

| Database name	Information origin	Description	Summary of attributes	Score
Energy Performance Certificate for Buildings (EPC)	European or National 🇪🇺 🇮🇹 🇫🇷 ... / Public initiative	Rating scheme that evaluates and summarises the energy performance of the building. It includes recommendations ...	*[radar chart: Safety, Reliability, Updatability, Integrity, Public, Accessibility, Manipulability]*	High relevancy ● 81% Low relevancy
TOTEM (Tool to Optimize the Total Environmental impact of Materials)	Only National 🇧🇪 / Semi-public initiative	Webtool that allows the Belgian construction sector to evaluate and become aware of...	...	...
The Environmental Footprint (EF)	Only European 🇪🇺 / Public initiative	Database designed to support the use of product environmental footprint (PEF) category rules (PEFCR) and organisational...	...	...

Task 3: Creation of new market opportunities

With the digitalisation of the EU and global economy, having data is no longer just a competitive advantage but has rather become a need. Data accessibility can simplify the decision-making process, facilitating the build-up of collaborative approaches, optimising coordination between professionals, enhancing customisation of services and reducing production costs. The digital building logbook initiative in general and the linking of databases in particular represent a good opportunity for stakeholders to develop new activities. An expert pointed out that appropriate linkage of databases will allow stakeholders to perform analysis automatically in the backend (through the use of algorithms and software tools such as BIM or Digital Twins). This will bring to the market new databases answering to concrete problematics, hence promoting new business opportunities.

For instance, private actors could compete to propose data visualisation dashboards, to provide updating services or to offer data-oriented services among many others. This opportunity should be included in the technical offer as it will eventually lead to the creation of new employment and will increase the impact of the digital building logbook. Some issues that should be addressed include:

- **Instructions for optimal data linkage and minimum requirements**
  - Technical data structure: Sources (gateway digital building logbook) → Data management system → Big data analytics tools

- **Establishment of required standards for the creation of common data environments**
  - E.g. ISO 19650-1:2018 for Building Information Modelling (BIM) etc.

- **Recommendations for SMEs**
  - Technological capabilities to allow the business potential of big data to be harnessed
  - Competitive advantages in relation to the new data infrastructures (digital maturity)
  - Ensuring and maintaining high levels of innovation and market knowledge.

Indicative timeline

To have an effective impact on digital building logbook deployment and the European digital agenda, the technical study on linking guidelines should start soon. The study could be linked with the technical study described under Chapter 5. The strong relation between the two topics allows for a close alignment between the studies. It is suggested that the technical study of the agile approach (Figure 21) as described in Priority Action 1 should touch upon the issue of interoperability and supports the preparation of this technical study.
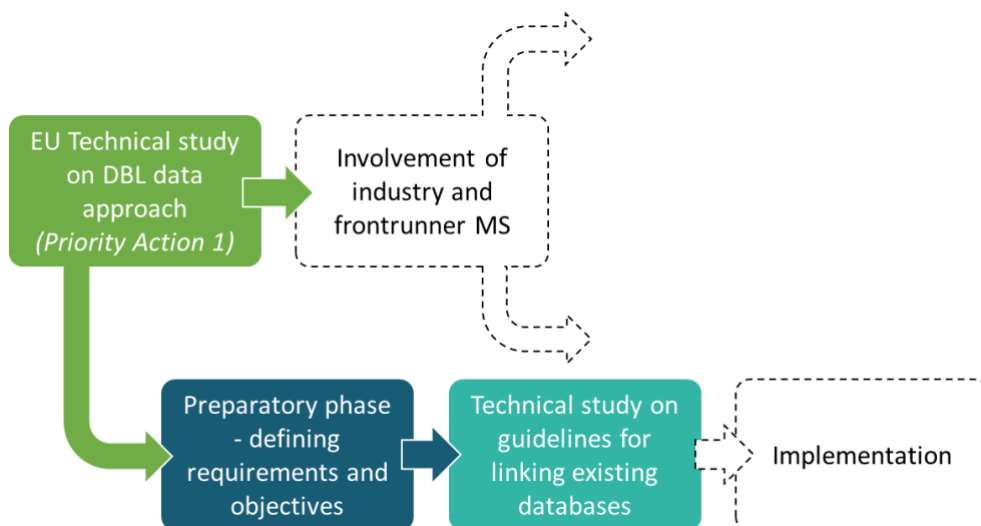
Figure 26: process flow of how technical study - as described in Priority Action 1 - feeds into the preparation of the technical guidelines for linking existing databases.

Feasibility evaluation

There are different types of databases, each with their own specificities depending on their structure, internal and external processes and functionalities. Enabling a centralised gateway capable of providing an appropriate information exchange among national and international data repositories represents one of the main challenges and success criteria of the digital building logbook. The section below analyses the most important opportunities and barriers to overcome to succeed in this task.

Analysis of opportunities and barriers to overcome: technical feasibility

Given the technical nature of this action, Table 12 describes and classifies the key aspects and their relative importance[50].

Table 12: Opportunities and barriers to the technical feasibility of the action

Opportunity	**Description**	**Relative importance**
Existence of usable standardised information structures	International standards in use, such as the Construction Operations Building Information Exchange (COBie), represent a good starting point for harmonisation. Future linkage of databases could be supported by decisional structures already implemented in these schemes.	Major
Technological 'momentum'	With the current massive generation of data, the digitalisation of information is becoming the main objective for public and private organisations; a need that was accelerated by the COVID pandemic. As a consequence, technological requirements to allow appropriate linkage operations are already accessible and market interest is growing.	Major
Flexible access	Access to the databases can be regulated publicly, privately or rely on an API to enable modular accessibility to specific features of the combined databases.	Moderate

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[50] These criteria are the result of the feedback provided by the stakeholders and experts consulted throughout this study. They include three different levels of importance: Minor, Moderate and Major.

Optimised access to key information	Optimising information exchange is also an essential issue that needs to be considered within the linkage process. Probabilistic models integrated within the linkage process could be used to facilitate access to the most frequently consulted information. The use of data caches can for instance help to store temporary copies of the data. Similarly, database pointers can allow a faster recovery of the data of interest. Deduplicating the data at its origin prior to its selection or compressing it when possible are some useful approaches that can help decrease the need for computational power, hence easing data exchange.	Major
Certification technology	Blockchain technology could be used to regulate and validate the information exchange between the different databases. Blockchain is decentralised and distributed, promotes transparency, enhances security and might increase the consistency of the data linked. While it also presents some downsides such as costly implementation, it has a promising future as a regulator of transactions and some experts even suggest that blockchain will end up replacing regular relational databases.	Minor

Barriers to overcome	**Description**	**Relative importance**
Lack of centralised storage	As data will be scattered across organisations, it is important to determine how it will be stored within the digital building logbook. Associated safety issues such as disaster recovery, partial storage solutions and data verification should be included for any potential information storage solution.	Moderate
Standards to facilitate the linkage: a data matching	Several of the experts consulted pointed out the need to apply intermediate translation layers to set up standards that facilitate interoperability between databases. While this issue represents one of the most important barriers to overcome to ensure the success of the digital building logbook linkage, the availability of technology at this level also brings an opportunity (see above). These standards range from basic operational levels, such as linkable database keys, to more end-user functionalities including common languages, protocols and interfaces.	Major
Dynamic data syncing	The digital building logbook gathers different types of data from multiple sources. These can include legacy systems, but also (smart) equipment connected to a building. Enabling real-time communication between these dynamic databases will bring promising opportunities to create market value.	Moderate
Trust-worthiness of databases	Some existing digital building logbooks guarantee the reliability of their databases through the control of public authorities' legislation (e.g. Flemish Woningpas). Nevertheless, the release of future databases will require quality minimums that certify the quality of their information.	Major
Historical data issues	Database structures are very diverse and have evolved significantly in recent decades, ranging from the first hierarchical structures of the 1960s to the multi-model structures of the last few years. As the purpose of the digital building logbook is also to connect to old databases, it is important that suitable processes are put in place to enable the linkage of these different records.	Minor
Security network	Unwanted dangerous information can get added or eliminated to the final data request while linking databases. Security measures can address voluntary (malware) or involuntary (primary key) errors when calling the data. Access control list (ACL) filters can help controlling incoming information as they act as a firewall for controlling ingress and egress traffic between two or more data environments.	Major
Information recovery system	Although this process takes place externally at the level of the databases, the linking mechanism could also track the reliability of the connected databases to ensure that the data will be available at all times. This is especially important for sequential operations in which the lack of a specific input can impact the final output.	Minor

Economic viability

The cost of the study is expected to be reasonable given that a number of comparable data structures are already up and running, and sufficient expertise has already been built up. The engagement of industry stakeholders and public authorities is an essential requirement to ensure the acceptability of and buy-in to the suggested approach. The evaluation of economic viability includes the following aspects:

- **Cost breakdown structure**: It is recommended that the economic analysis should include the cost of linking some of the most representative databases. This evaluation should contain the technical costs associated with the data management software, the personnel involved for its implementation and the expenses associated with its maintenance.

- **Financial constraints**: This description should include budget limitations related to the implementation of the digital building logbook linkage across the different Member States. Some Member States could require extra funding to reach the level of others (e.g. additional investment in digital infrastructure etc.). The Digital Economy and Society Index (DESI) illustrates the existing differences in digital performance between EU countries. These differences need to be better evaluated to establish the specific needs of the various countries.

- **Strategies to minimise additional costs**: The action may involve providing financial support to third parties. The role that the different private and public actors (e.g. national, regional funding) can have should be explained in this section. For instance, some Member States could have additional local funding or could be benefiting from existing infrastructure.

Balancing financial support and constraints should be assessed at the Member State level and be balanced at the European level.

Legal feasibility

Ensuring a common legal framework is essential to allow the linkage of databases within and between European Member States. The linking of databases should comply with the legislation and standards already in place. As suggested by the experts consulted, the information linked should always be treated as personal. With this in mind, the European General Data Protection Regulation (GDPR – 2016/679) could act as a filter to separate the information that can never be linked from the information that requires explicit user consent.

Favourable digitalisation schemes at national or regional levels could make all the difference to a successful linkage of databases within a digital building logbook. Data-sharing legislation on alignment should ideally precede any financial investment from public authorities to promote deployment of the digital building logbook.

Human-related aspects

The contractor carrying out the study should involve national (or regional) public authorities and stakeholders to provide specific insights. The terms of reference of the study should specify the need for experts in database solutions with experience in the European market.

CHAPTER 7: PRIORITY ACTION 3 - LAUNCH OF PUBLICLY FUNDED R&I PROJECTS TO FURTHER EXPLORE THE DIGITAL BUILDING LOGBOOK CONCEPT AND ITS IMPLEMENTATION

Context of the action

This priority action explores the launch of publicly funded research and innovation (R&I) projects to further explore the digital building logbook concept and its implementation. R&I projects can be funded at different levels, including the European level and Member State level. Based on interviews with experts Horizon Europe appears to be the most appropriate opportunity for a publicly funded project on the digital building logbook, so the Horizon Europe R&I programme will be the prior focus of this assessment. In addition, Member States can utilise programmes such as the European Regional Development Fund (ERDF), Interreg and LIFE to fund logbook-related studies and developments. An alternative option to encourage R&I on the digital building logbook would be the tendering of technical studies – but as this is not within the scope of this action, it will not be elaborated further here.

Set-up and roll-out plan

A high-level process-flow with a description of the main actors, the management and financial perspective, and an indicative timeline is described for the different actions at EU level which could facilitate publicly funded R&I projects.

### Overview of relevant EU R&I funding mechanisms

Horizon Europe

Horizon Europe is the EU's seven-year research and innovation programme, running from 2021 to 2027. The programme's general objective is to deliver scientific, technological, economic and societal impact from the EU's investments in R&I, to strengthen the scientific and technological bases of the EU and foster competitiveness in all Member States. With a proposed budget of around €100 billion over seven years, Horizon Europe is the largest EU R&I framework programme ever. It has the potential to generate significant economic, social and scientific returns [10]. The results of the European Commission's strategic planning process are set out in a multi-annual Strategic Plan to prepare the content in the work programmes and calls for proposals for the first four years of Horizon Europe.

The *Global Challenges and European Industrial Competitiveness* pillar of Horizon Europe [11, 12] (see Pillar 2 in Figure 27) should be of particular interest, according to the experts interviewed. This pillar supports research into societal challenges, reinforces technological and industrial capacities, and sets EU-wide missions with ambitious goals. Public R&I funding opportunities related to the digital building logbook could potentially be part of the *Climate-neutral and smart cities* mission area and could fit within the *Climate, Energy and Mobility* or the *Digital, Industry and Space* clusters.

Specific R&I topics contributing to further knowledge and exploration of the digital building logbook could be part of the Horizon Europe Work Programme facilitated through specific calls for proposals. With this aim in mind, this study on recommendations for the European Commission could be useful as an input in defining the content of such R&I call topics.

Figure 27: Horizon Europe preliminary structure
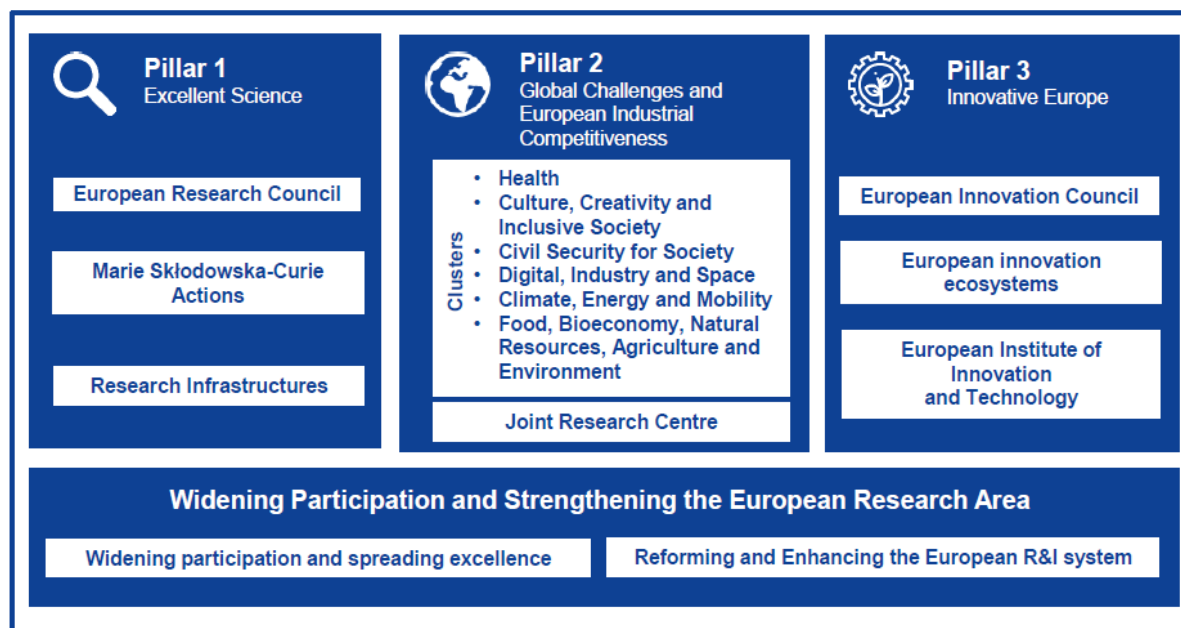
The European Regional Development Fund

The experts considered the European Regional Development Fund (ERDF) as an opportunity to endorse R&I on the digital building logbook for implementation in different regions across Europe. This fund aims to strengthen economic and social cohesion in the EU by correcting imbalances between its regions. The current ERDF programme covers the period between 2014 and 2020, with an overall budget of almost €200 billion to focus on the key priority areas of (1) innovation and research, (2) the digital agenda, (3) support for SMEs, and (4) the low-carbon economy [13].

In 2018 the European Commission published a proposal for the ERDF programme running from 2021 until 2027. The focus of ERDF funding will be on smart growth (through innovation, digitisation, economic transformation and support to SMEs) and a greener, carbon-free economy [14].

The regional aspect of the ERDF allows particular attention to be paid to specific territorial contexts relevant for the digital building logbook, such as characteristics of the building stock, the level of digitalisation in the construction sector, drivers and barriers for stakeholders for voluntary uptake of the digital building logbook schemes etc.

One of the experts pointed out the role of smart specialisation strategies related to the competitive advantages of the different regions. Smart specialisation refers to "*the national or regional innovation strategies which set priorities in order to build competitive advantage by developing and matching research and innovation own strengths to business needs in order to address emerging opportunities and market developments in a coherent manner while avoiding duplication and fragmentation of efforts*" (Regulation (EU) No 1301/2013 of the European Parliament and of the Council). *"A smart specialisation strategy may take the form of, or be included in, a national or regional research and innovation (R&I) strategic policy framework"*.[51]

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[51] Regulation (EU) No 1301/2013 of the European Parliament and of the Council of 17 December 2013 on the European Regional Development Fund and on specific provisions concerning the Investment for growth and jobs goal and repealing Regulation (EC) No 1080/2006

The digitalisation of the construction sector is recognised as an essential objective, especially within the smart specialisation strategies of Europe's regions. A lot of progress was made in recent years – think BIM, digital twins, prefabricated façade systems, robotics etc. – although there is potential for plenty more, as the digitalisation of our society comes with an ever-increasing amount of data, opening up new opportunities including new services and innovations. If the digital building logbook makes the data accessible, entirely new business opportunities for design, construction, operation, leasing, financing and real estate transactions can be rolled out.

Within this framework of opportunities, the digital building logbook can play a pivotal role facilitated through smart specialisation strategies at the regional level.

The interviewees pointed out that the European Commission specifically recommends incorporating 'Renovation Wave' priorities in the ERDF programme. As such, there is possibly an opportunity to include the digital building logbook – however, this strongly depends on the willingness of Member States, and it cannot be steered by the European Commission.

Interreg programme

The Interreg programme supports cooperation across borders through project funding, and was also mentioned as an opportunity by the experts. Interreg aims to tackle common cross-border challenges and find shared solutions in fields such as environment, research, sustainable energy and more. Interreg, with a budget of €10.1 billion over the period 2014-2020, is funded through the ERDF and invests in several cooperation programmes responsible for managing project funding [15]. For cooperation on the digital building logbook topic, it could be an opportunity to explore similarities across borders, e.g. in regions with similar building typologies or construction traditions, stimulating knowledge-sharing for use in digital building logbook schemes.

European Institute of Innovation & Technology Knowledge and Innovation Communities

Experts also suggested the European Institute of Innovation & Technology (EIT) Knowledge and Innovation Communities (KICs) as a possible opportunity for implementing actions related to the digital building logbook. EIT KICs are institutionalised European partnerships, where the EU participates in R&I funding programmes undertaken by Member States. [15] This type of partnership will only be implemented where other parts of the Horizon Europe programme would not achieve the desired objectives or expected impacts. EIT KICs are already established under the Horizon Europe framework. Key partners in creating the 'knowledge triangle' are higher education institutions, research organisations and companies, as well as other stakeholders. [16]

Potential relevant KICs for the digital building logbook are EIT Digital, EIT InnoEnergy and EIT Health. No KIC has solely been focusing on building and construction so far. In their activities, the KICs cover the innovation chain by knowledge sharing, training and education programmes, innovation projects and through support to SMEs. The aspect of training could be an interesting opportunity for the implementation and management of digital building logbook schemes, especially in countries where the digital building logbook concept is already established. The need for training for construction professionals, especially regarding digital technologies, was identified in previous studies. [7]

The possible roll-out of the digital building logbook has to be integrated into capacity-building programmes for both blue-collars and white-collars in the construction sector. This could, for example, include the use of digital tools and standardised methods for life-cycle analysis (LCA) and life-cycle costing (LCC). Ensuring data accuracy and quality for the digital building logbook also relies on a trained and skilled workforce. The functionalities that can be offered by the digital building logbook and the corresponding benefits also have to be understood by construction and building professionals.

LIFE

The LIFE programme was also mentioned by the experts. There is a proposal to expand this long-standing programme for environmental and climate action to include a sub-programme on the clean energy transition, which would be a continuation of market uptake actions supported under Horizon 2020 Energy Efficiency (2014-2020). There may be the opportunity to launch a call for proposals on topics related to the digital building logbook with a focus on creating a market and enabling regulatory conditions for wider implementation. Potentially, the widened scope of the LIFE programme could facilitate a cross-cutting approach for the logbook across energy, climate and environment issues.

Stakeholders

The Horizon Europe programme is co-created by several different Directorates General of the European Commission. The Council and the European Parliament negotiate and subsequently adopt the programme. Horizon Europe is being developed in an intensive co-design process. The European Parliament, EU Member States and associated countries, as well as expert groups and interested citizens, contribute collectively to the strategic planning process. [17] The latest consultation was launched in September 2020. Also, at a more detailed level of the work programmes, consultation rounds with different stakeholders are organised. At the time of the interviews, discussion rounds with the Member States regarding the content and topics of the work programmes were ongoing.

Horizon Europe will support European partnerships, consisting of public authorities, the private sector, foundations and other stakeholders, to deliver on global challenges and industrial modernisation through concerted R&I efforts. [16] This group of various stakeholders performs the co-creation and co-implementation work within the Horizon Europe work programme. Under the Horizon Europe programme, the digital building logbook could be addressed in the new European partnership Built4People. This partnership will provide a cross-cluster structure to create R&I pathways based on a holistic view of the built environment for sustainability and better living. The aim is to focus on sustainable development more holistically than its predecessor (the Energy-efficient Buildings Public-Private Partnership) under Horizon 2020, which was above all focused on the operational energy aspect.

The ERDF opportunity is managed and implemented at the national level through seven-year programmes, as part of a partnership agreement between the Member State and DG REGIO. The partnership agreement is prepared by each Member State with the involvement of stakeholders representing regional and local public authorities, as well as a wide range of social, economic, environmental and other interests. [18] The European Commission sets the framework and proposes the goals and top priorities of the ERDF. [19]

Through their partnership and bottom-up approach, smart specialisation strategies bring together local authorities, academia, business spheres and civil society from across Europe. [20]

Indicative timeline

Horizon Europe is expected to launch on 1 January 2021. The first Horizon Europe Strategic Plan for the period 2021-2024 is planned to be ready towards the end of 2020, subject to agreement between the European Parliament and Council on the EU's long-term budget over seven years and its related horizontal provisions.[17] The first work programme will run from 2021 to 2022. Discussion rounds with Member States regarding the content and topics of the work programme were ongoing at the time of the interviews. The publication of the final work programme is expected in December 2020.
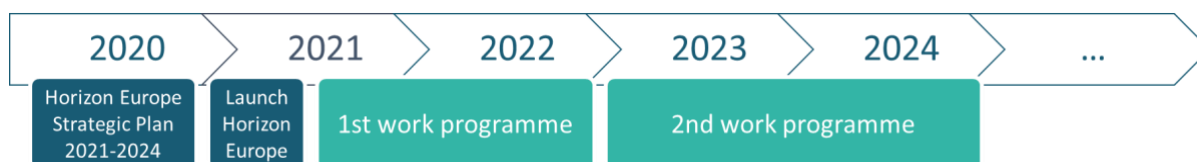
Figure 28: indicative timeline for the launch of Horizon Europe and the two work programmes

The outcomes of this study can be used as an input for the calls for proposals, which could include a more detailed description of a potential digital building logbook topic than the text of the work programme. However, if such a topic is not included in the first work programme, it will not appear in the Horizon Europe calls until 2023.

The need for demonstrators and pilot cases, for testing and validating the digital building logbook in various EU countries, was highlighted as an essential priority by several experts.

Financial perspective

Horizon Europe is designed with an investment mindset, rather than as a 'funding' instrument, and is built to help the EU make the transition to a sustainable and prosperous future. [10] Several experts suggested that a digital building logbook topic could be a good match for the Horizon Europe programme. They noted, however, that all topics in the draft work programme are subject to the final approval of the overall budget. The budget of the *various* clusters has not been fixed yet, and there is still considerable uncertainty about the various destinations and the number of calls to be launched.

Within the Commission's proposed budget of €100 billion over the period 2021-2027, the largest share (€52.7 billion) was reserved for the *Global Challenges & European Industrial Competitiveness* pillar, of which the digital building logbook could be part. The Horizon Europe funding options are comparable to the Horizon 2020 funding. In a legislative proposal setting up the Horizon Europe programme for the period 2021-2027,[52] Article 30 on the funding rates states that a maximum rate shall be fixed in the work programme. Except for innovation actions and programme co-fund actions, the programme may reimburse up to 100% of the total eligible costs of an action.

The ERDF budget for the current period (2014-2020) is over €185 billion. The allocation of ERDF funding varies depending on which key priority areas are addressed (e.g. low-carbon economy, innovation and research) and on the category of region (defined in terms of the GDP expressed as a percentage of an EU average).[18] As most of the resources of the current fund have been located and the programme is drawing to a close, the next seven-year programme should be looked at to find opportunities for digital building logbook R&I. ERDF investments will strongly focus on a smarter and greener EU, as 65% to 85% of ERDF and Cohesion Fund resources will be allocated to these priorities, depending on Member States' relative wealth [14].

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[52] COM (2018) 435 – Proposal for a Regulation establishing Horizon Europe – the Framework Programme for Research and Innovation, laying down its rules for participation and dissemination

Based on experts' feedback and the gap analysis, the following topics are suggested for further research. The topics are ranked in order of importance, with data governance and the linking of databases as the main priority.

Data governance

Data governance refers to the process, organisation and standards implemented to ensure the effective and efficient storage of and access to the information. Being a common data repository, the digital building logbook relies on the easy access, storage, update and transfer of building-related data and information, and thus on clear data governance rules and data management processes. Data governance includes:

- **Legal aspects,** which comprise data protection and privacy, IP rights and other liabilities. The General Data Protection Regulation (GDPR) agreed in 2016 is the EU's main regulation on data privacy. Following on from GDPR, the EU released the regulation on the free flow of non-personal data (FFD), as well as the Cybersecurity Act and the Open Data Directive. Given the wide scope and relative novelty of both regulations and digital technologies, confusion persists on how they apply to the digital building logbook at local/national levels: this is a point that wasn repeatedly emphasised by interviewees. A study, targeted at the digital building logbook implementers, could clarify the legal framework for digital building logbook implementation and could provide guidance and explanatory notes on privacy, security and intellectual property aspects relevant for the digital building logbook.
- **Technical matters,** which comprise provisions on interoperability, data standards, compatibility etc. The logbook gathers different types of data from multiple sources. These can include utility companies, the construction industry, (smart) equipment connected in a building, third-party service providers, public authorities etc. Connecting all these different data sources and users requires common data formats and data compatibility. A study, targeted at the digital building logbook implementers, data providers and users, could clarify the technical framework which could enable interoperability, data consistency and information exchange.[53]

Linking databases

The digital building logbook data will not only be stored within the logbook but could also be hosted in a different location to which the logbook acts as a gateway. A common understanding among the interviewed experts (as described in Report 1 – Definition of the Digital Building Logbook) is that it is even sufficient to incorporate existing data sources.

Linking the many existing building information-related databases – such as public registries (e.g. information on administrative aspects, soil, cultural heritage), LCA-related (e.g. GaBi or Ecoinvent), national EPC databases, energy or water consumption etc. – is thus vital for the success of digital building logbook development and its implementation. The Renovation Wave strategy, published by the European Commission in October 2020, foresees that the digital building logbook will incorporate data from databases linked to the smart readiness indicator, building renovation passport, and the Level(s) framework. The digital building logbook could also incorporate data from construction product declarations and BIM/digital twins. The inclusion of trustworthy data sources (e.g. originating from public authorities) increases the perceived value of the logbook and also the chances for a successful implementation. This subject is extensively covered under priority action 2.

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[53] Interoperability aspects are further discussed below in chapter 7: *Priority action 3: Guidelines for linking existing database*

Life cycle thinking and circularity

Life cycle and circularity refer to closing the material loops in buildings and the construction industry. In a whole life cycle approach the circularity of various aspects of the building is ensured, such as designing reusable and/or reversible buildings, tracking, tracing and optimising material sustainability, design for disassembly and end-of-life circularity. A holistic approach to the built environment considering all the life cycle stages including the end of life will ensure additional value creation for the end-of-life products and components in a building and avoid unsustainable trade-offs. Additionally, this approach can be useful in identifying targets and indicators to evaluate and promote circularity. Since each building context is different, the digital logbook can ensure that multiple reference benchmarks are available for a variety of scenarios. Additionally, the digital building logbook can aggregate a variety of circular building assessment tools which can allow for a complete circularity assessment of the building using a life cycle thinking approach. Challenges exist in the form of varying methods, data aggregation and the quantity datasets available for analysis used by the wide variety of tools available. Some calls under the current Horizon 2020 framework, such as CE-SC5-31-2020,[54] are already addressing the transition towards the systematic aggregation of information needed for a more circular economy. The digital logbook will then be a step towards compiling the information management system proposed in R&I projects from this call.

The digital building logbook has the potential to include building product information over all life cycle stages, incorporating data from materials passports. Under the EU Horizon 2020 project BAMB,[55] the digital materials passports developed are sets of data describing characteristics of materials in products that give them value for recovery and reuse. As such, they can be applied within for example BIM or digital twins to provide input data for assessments on reversible and circular design such as the Circular Building Assessment Tool. [21] A potential following step for the BAMB project would be to develop and implement a circular information management system (IMS) for buildings, their products and raw materials with reliable data. This would enable circularity assessment tools with key functionalities such as circularity benchmarks and life cycle performance. By allowing users to connect to the digital building logbook, the IMS architecture would support its further developments.

User experience

The main requirement of the digital building logbook is to gather all building-related data and to provide this through a smart and user-friendly interface, potentially available and accessible to different users including building owners and occupants, the construction and real estate value chain, financial institutions and public authorities. To achieve this, the digital building logbook should be equipped with some key features and several functionalities, as described in its definition [1].

The interviews carried out with logbook implementers made it clear that stakeholders ought to be consulted and engaged from the outset. This was stressed as key to making sure the instrument is adapted to user needs.

Regarding the digital building logbook features (e.g. digital interface, data syncing etc.) and functionalities (services built around the digital building logbook), user-friendliness is key to end-users: this was pointed out by several interviewees in the previous tasks and was mentioned as a key barrier or success factor in the review of existing initiatives. Common views are that "information should be easy to access" with the help of a "smart interface", "it ought to be automatically updated", and the structure should be "modular and layered".

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[54] CE-SC5-31-2020 – Develop, implement and assess a circular economy oriented product information management system for complex products from cradle to cradle – https://ec.europa.eu/info/funding-tenders/opportunities/portal/screen/opportunities/topic-details/ce-sc5-31-2020

[55] More information on the Circular Building Assessment Tool on http://bambcba.eu/

In short, the digital building logbook should be sufficiently flexible to make the right information available to the right actor at the right time. Any digital building logbook initiative should take into account user experience principles to stimulate the update of the logbook and its use by construction professionals and building owners.

For example, during the development of the Flemish 'Woningpas', extensive user experience testing was carried out, including online surveys of different user types, interviews and front-end testing at building fairs, focus group discussions and co-creation sessions.

Only a clear understanding by the users of the usefulness of the building logbook together with an easy-to-implement approach will push its uptake and potentially create a business interest for private companies.

Figure 29: User experience testing for the Flemish Woningpas (BE) – © Flemish Energy Agency

Development of a public tool enabling plug-ins from the private sector

The digital building logbook gathers different types of data from multiple sources, possibly including a variety of applications ranging from those installed and running on the premises of the building to cloud-based platforms exchanging massive amounts of data in real-time between different stakeholders. The data from these different sources must be able to 'communicate' in order for the digital building logbook to reach its full potential. Connecting all these data sources and users requires interfaces and protocols to enable interoperability, data consistency and information exchange. Future studies are likely to address this challenge by creating a single digital building logbook tool. Developed by public authorities, such a tool would be made available to stakeholders of the construction and building value chains along with building owners. The data architecture of the tool would have to link with existing databases, be compatible with multiple data sources and ensure data privacy and security.

Feasibility evaluation

The EU has ample existing initiatives on R&I funding, opening up opportunities for the launch of publicly funded projects to further explore the digital building logbook concept and its implementation. In this subsection, the feasibility of implementing this action is discussed.

Legal feasibility

Given the current momentum behind the digital building logbook – which includes the uptake of several digital building logbook-like initiatives, and the need to accelerate the digitalisation of the construction sector – its rapid inclusion in the first work programme seems crucial to secure the necessary R&I. Waiting for the second work programme (2023-2024) would be too late, considering the proposal, evaluation and execution phase of the R&I projects.

A two-step approach is recommended, where in the first work programme – in the context of the Renovation Wave – the focus is more on the R&I aspects of the digital building logbook, for example, preliminary experimentations and demonstrations of various pilots. For the second work programme (2023-2024), the focus could shift more towards applying best practices and lessons learned to other regions and countries.

Technical feasibility

Several research centres and other actors have started working on the technical aspects of digital building logbooks, thus creating a sound basis of knowledge. In terms of technology readiness level (TRL), Innovation Actions (typically with TRL 5-7 or 8) offer an opportunity to demonstrate the use of the digital building logbook, compared to R&I projects where the emphasis is on lower TRLs (typically 1 to 4). Supporting EU funding will help to demonstrate the digital building logbook concept at different levels (EU, national, regional), to identify business models and showcase a range of benefits (at societal or stakeholder level). Crucially, this should help relevant stakeholders to understand and accept the rationale behind the digital building logbook.

R&I actions on the digital building logbook should be required to mutually cooperate and to provide joint recommendations to policymakers. It is important to note that the added value of R&I actions depends on how the projects are implemented and how well the results are disseminated and exploited. Such R&I projects typically last three to four years, so it would take some time before the results became available.

The intermediate results of this B-LOG study, including a comprehensive digital building logbook definition, provide the backbone for the context description of the calls to be included in the work programmes. Besides the digital building logbook definition, consortia are also expected to use the main findings from the outcomes of this study.

Economic viability

Using the existing EU plans and budget for R&I to support actions with a thematic focus on the digital building logbook has the advantage of not needing additional resources. For example, some of the resources for Horizon Europe Clusters, Interreg and the LIFE programme can be allocated to support digital building logbook R&I. This is in contrast to, for example, technical studies on the digital building logbook, for which resources need to be approved by the commissioning body.

Human-related aspects

Some Member States tend to have more private sector-driven digital building logbook activities (i.e. by the construction industry), while others tend to use public tools (e.g. the Flemish Energy Agency in Flanders, Belgium).

Although stakeholders' views diverge regarding the need for harmonisation at EU level and the flexibility of national policy measures, a common view is that the European Commission is expected to guide Member States on how to implement a digital building logbook, to effectively support other actions.

For example, this guidance and support could start with the creation of a platform aiming to share digital building logbook knowledge, experiences and best practices, identifying early adopters, and mapping initiatives in Europe and possibly outside Europe as well. Such guidance would also support better harmonisation across the EU and ensure that national initiatives are comparable and replicable.

CHAPTER 8: SYNERGIES WITH EXISTING EU & INTERNATIONAL INITIATIVES

The implementation potential and chances for success of the priority actions will increase through building synergies within a larger framework of EU and international initiatives. The most relevant initiatives are the following:

- Building renovation passport
- Circular Economy Action Plan
- Digital Europe Programme
- Energy Performance Certificates
- Environmental Product Declarations
- Level(s)
- Product Environmental Footprint
- Renovation Wave
- Smart Readiness Indicator.

These initiatives and their potential synergies with the digital building logbook are described below.

Building renovation passport

The technical feasibility study[56] carried out by BPIE and INIVE for DG ENER in 2019 assessed the "possible introduction of an optional building renovation passport in the context of the Energy Performance of Buildings Directive". [22] A reference to "an optional scheme for building renovation passports" had been introduced in Article 2a of the EPBD by Directive 2018/844/EU, concerning national long-term renovation strategies to support the transformation of the national building stocks into highly energy-efficient and decarbonised building stocks by 2050. The building renovation passport is defined in the feasibility study as follows: "A building renovation passport provides a long-term, tailored renovation roadmap for a specific building, following a calculation based on available data and/or an on-site audit by an energy expert. The instrument identifies and outlines a deep renovation scenario(s), including steps to implement energy-saving measures that could improve the building's energy performance to a significantly higher level over a defined period. The instrument can be complementary to energy performance certificates and/or combined with digital logbooks." The Renovation Wave strategy also referred to the potential to link the digital building logbook to building renovation passports.

The feasibility study gathered information on available schemes, analysed their characteristics and implementation models, and assessed their maturity and effectiveness. Based on this, it concluded that the building renovation passport can be effective in increasing the renovation rate and depth, and the quality of the measures as well as which types of measures are being implemented. The study also outlined several policy packages for how the instrument could be supported or introduced by the EU.

The building renovation passport study exemplifies how the instrument and the digital building logbook can strengthen each other, which has also been elaborated in the B-LOG study. In light of the current developments of the two concepts, some highly relevant interactions of both frameworks are especially considered:

- The interface of the logbook could integrate the renovation pathway developed under the building renovation passport as one of its functionalities. While not featured in

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[56] Article 19a of the EPBD Directive 2018/844/EU required the European Commission to conduct a feasibility study to identify the need, possibilities and timeline for introducing EU provisions related to the inspection of stand-alone ventilation systems and an optional building renovation passport – https://www.epbd19a.eu/

the existing building renovation passport, this pathway could include whole-life carbon aspects.

- Some of the data required for the development of the renovation pathway – either gathered by an auditor or fully automated – might be directly available in the digital logbook, e.g. information on surface areas and technical details of heating and cooling equipment. This has the potential to reduce efforts, costs and nuisance related to on-site audits.
- The building renovation passport can be used to incentivise the end-user/building owner to engage with the digital building logbook and its functionalities.

Circular Economy Action Plan

As part of the European Green Deal, in 2020 the European Commission adopted a new Circular Economy Action Plan to support sustainable growth and "accelerate the transition towards a regenerative growth model that gives back to the planet more than it takes".[57] Construction and buildings are one of the key product value chains targeted by the Action Plan due to the impact of the sector on the EU's waste generation and total GHG emissions. The digital building logbook is one of the means that will promote circularity principles throughout the lifecycle of the buildings, supporting the improvement of durability and adaptability of the built assets, and will be included in the Strategy for a Sustainable Built Environment that the Commission will develop.

Digital Europe Programme

The digitalisation of the economy is one of the priorities set by the EU. The Strategy for a Digital Single Market, developed by the European Commission in 2015, aims to maximise the growth potential of the digital economy in Europe.[58] However, a lot still needs to be done to ensure EU industry will fully seize the digitalisation opportunities, in particular in the building and construction sector which is dominated by small and medium enterprises (SMEs) and, together with agriculture, ranks as one of the less digitised sectors.[59,60]

As part of the next long-term EU budget, the European Commission has proposed Digital Europe, a programme focused on building the strategic digital capacities of the EU and on facilitating the wide deployment of digital technologies. The programme will boost investments in supercomputing, artificial intelligence, cybersecurity, advanced digital skills; and will ensure a wide use of digital technologies across the economy and society, including through digital innovation hubs. Its goal is to improve Europe's competitiveness in the global digital economy and achieve technological sovereignty. Digital Europe will complement other EU programmes, such as the proposed Horizon Europe programme for R&I, as well as the Connecting Europe Facility for digital infrastructure.[61]

Digital Europe will support the uptake of advanced digital and related technologies by the industry, notably SMEs, thereby facilitating the uptake of digital building logbooks in the building and construction sectors.

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[57] https://ec.europa.eu/environment/circular-economy/pdf/new_circular_economy_action_plan.pdf

[58] European Commission: A Digital Single Market Strategy for Europe, COM 2015 (192)
https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52015DC0192&from=FR

[59] European Commission: Supporting digitalisation of the construction sector and SMEs Including Building Information Modelling
 https://ec.europa.eu/docsroom/documents/38281

[60] McKinsey (2016) Digital Europe: Pushing the Frontier, Capturing the Benefits, European Commission (2019)

[61] https://ec.europa.eu/digital-single-market/en/europe-investing-digital-digital-europe-programme

Energy Performance Certificates

The Energy Performance Certificates (EPCs) are important instruments that should contribute to the enhancement of the energy performance of buildings. EPCs play a central role in the context of Article 20 (2) EPBD, which asks Member States to provide information on the EPCs and the inspection reports on their purpose and objectives, on the cost-effective ways and, where appropriate, on the available financial instruments to improve the energy performance of the building to the owners or tenants of the buildings.[62] While it is not compulsory under the EPBD to set up a central or regional EPC register, almost all Member States have moved further than the obligations and set up a system to collect EPC data voluntarily. [24] These EPC registers are the primary source of information regarding certified buildings. The share of building registers in the EPC database varies across Europe.

The following interactions between the EPC and digital building logbook frameworks are currently envisioned:

- The digital building logbook can be a repository for storing EPCs and related data such as inspection reports and available financial instruments.
- Some of the data required for the EPC assessment might be directly available in the digital logbook, e.g. information on insulation materials used and technical details of heating and cooling equipment. This has the potential to reduce effort, cost and nuisance related to on-site inspections for the EPC assessment.
- The next generation of EPC can be developed taking into account the widespread use of digital building logbooks, and base its calculation methodology on part of the information included in the logbook.

From this perspective there are clear synergies with H2020 projects, such as X-tendo and iBRoad. The H2020 project X-tendo, standing for 'eXTENDing the energy performance assessment and certification schemes via a mOdular approach', will support public authorities and implementing agencies in the transition towards improved compliance, reliability, usability and convergence of next-generation energy performance assessment and certification. The outputs of this project are expected to have a significant impact on the development of the digital building logbook scheme, as relevant databases rely strongly on EPC data. As X-tendo's main objective is to facilitate the convergence of quality and reliability of EPCs across EU countries, the work done at this level will probably pave the way for the development and expansion in the use of digital building logbooks. iBRoad, by contrast, is a consumer-tailored project aiming at exploring, designing, developing and demonstrating the concept of individual building renovation roadmaps. With an innovative approach based on personalised information, the project seeks to empower energy auditors and end-users to undertake deep renovation measures.

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[62] https://ec.europa.eu/energy/eu-buildings-factsheets-topics-tree/energy-performance-certificates_en

Environmental Product Declarations

CEN/TC 350 'Sustainability of construction works' is responsible for the development of horizontal standardised methods for the sustainability assessment of new and existing construction works and standards for the Environmental Product Declarations (EPD) of construction products. On 30 October 2019, CEN/TC 350 published the new standard EN 15804:2012+A2:2019 'Sustainability of construction works – Environmental product declarations – Core rules for the product category of construction products'. This standard provides core product category rules for Type III environmental declarations for any construction product and construction service.

- EPD is a standardised way to quantify and communicate the environmental impacts of a product. The objective of an EPD in the construction sector is to provide the basis for assessing buildings and other construction works.
- The standard defines the environmental indicators that have to be declared and describes which stages of the product's life cycle are considered in the EPD and which processes are to be included. Additionally, it provides rules for the Life Cycle Inventory and the Life Cycle Impact Assessment, as well as for reporting environmental and health information that is not covered by LCA for a construction product, process or service.

EPDs for building products help to encourage the demand for, and supply of, building products that cause less stress on the environment. This happens through the communication of verifiable and accurate information on their environmental aspects, which stimulates the potential for market-driven, continuous environmental improvement. This standard is voluntary which means that there is no automatic legal obligation to apply it. However, future laws and regulations may refer to this standard and even make compliance with it compulsory, and some national laws also refer to this standard (e.g. France[63] and Belgium[64]).

The following interactions between the EPD and digital building logbook frameworks are currently envisioned:

- The digital building logbook can be a repository for storing the EPDs.
- Some of the data required for the EPD assessment might be directly available in the digital logbook, e.g. technical information on materials used.
- The quality of the data on environmental aspects of the building products is guaranteed, as EPDs are externally verified and reported in a uniform and internationally recognised format.
- The information provided in EPDs is directly used in quantified building assessment schemes. Increasingly demanded by architects and planners, it can be directly used in sustainable building design tools, e.g. to carry out a building life cycle assessment (LCA). For instance, in Belgium the federal EPD database is linked to TOTEM, the Belgian tool for assessing the environmental performance of buildings based on a life cycle assessment of materials (and recognised as one of the tools that can be used within the BREEAM certification). This allows the performance of calculations at the building level.
- The EPDs could, in time, be linked to performance declarations like those requested by the Construction Products Regulation65. One of the new key issues of the CPR is

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[63] The French Grenelle law demands that all high-volume consumer products sold in France must have an EPD

[64] The Belgian Royal Decree published on 14 July 2012 sets minimum requirements for the use of environmental claims for construction products and to register environmental product declarations in a federal EPD database. It is expected that these policies will be put in place in other European countries as well. http://www.ejustice.just.fgov.be/cgi_loi/change_lg.pl?language=nl&la=N&cn=2014052234&table_name=wet

[65] The Construction Products Regulation (CPR) lays down harmonised rules for the marketing of construction products in the EU. The Regulation provides a common technical language to assess the performance of

the requirement on sustainability, especially the sustainable use of natural resources, which are the basic requirements for construction works 7 (BRCW 7) and the reduction of life-cycle impacts of greenhouse gases (BRCW 3). Both requirements define relevant product-specific information involving the life cycle approach. Therefore, it is necessary to use the European standards, under development by the CEN technical committee (CEN/TC 350), to regulate in these areas of sustainability.

- The digital building logbook can be the repository for the EPDs and used in a synergistic way with all the other information included, enhancing the sustainability of the built environment.

Level(s)

In addition to Product Environmental Footprint (PEF) and Organisation Environmental Footprint (OEF), the European Commission adopted the Communication on Resource Efficiency Opportunities in the Green Building Sector (COM (2014) 445), which aims to move mainstream dialogue beyond operational energy to wider "sustainability" or "green" considerations. The main objective of this initiative is to promote more efficient use of the resources consumed by new and renovated commercial, residential and public buildings and to reduce their overall environmental impacts throughout their full life cycle. To support this development, reliable, comparable and affordable data, methods and tools are needed – and these are currently still lacking. Developed as a common EU framework, Level(s) provides a set of core indicators and common metrics for measuring and reporting the environmental performance of buildings along their life cycle.[23] Beyond the main focus on environmental performance, it also enables other important building performance aspects to be assessed using indicators for health and comfort, life cycle cost and potential future risks to performance. The scope of the Level(s) framework is office and residential buildings, both new and existing buildings at the point of a major renovation. The information available in the logbook could lead to an automated calculation of the cradle-to-grave LCA compliant with Level(s), and a user-directed interface could indicate several performances of the building as classified in Level(s). EPDs can serve as an input for the overarching LCA of the building. The digital building logbook can be a repository for storing both (1) input data required for the calculation of indicators and (2) the results of the overarching LCA during the design and in-use phase of the building.

Product Environmental Footprint

During the Environmental Footprint (EF) pilot phase[66] work has been carried out to improve data quality and comparability. The Product Environmental Footprint (PEF) method was developed by the Institute for Environment and Sustainability (IES) of the Joint Research Centre (JRC). It is a supporting method to the EC's objective to "establish a common methodological approach to enable the Member States and the private sector to assess, display and benchmark the environmental performance of products, services and companies based on a comprehensive assessment of environmental impacts over the life-cycle ('environmental footprint')". The PEF method was adopted by the Commission on 9 April 2013 and has been evaluated since 2014 in several PEF and OEF pilot projects. Regarding data quality, all data needed to develop a PEF for construction material or a building needs to meet the same quality requirements. The PEFCRs (Product Environmental Footprint Category Rules) include a very rigorous definition of the data quality requirements and the required documentation and transparency of the data. It would benefit the further uptake of the PEF initiative if the information on the environmental performance of the building materials and energy systems in the logbook could be developed in a PEF-compliant way.

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construction products. It ensures that reliable information is available to professionals, public authorities and consumers, so they can compare the performance of products from different manufacturers in different countries. https://ec.europa.eu/growth/sectors/construction/product-regulation_en

[66] The 2013-2016 Environmental Footprint (EF) pilot phase:
https://ec.europa.eu/environment/eussd/smgp/ef_pilots.htm

In 2019 the pilot phase ended, and the EF project moved into the transition phase. During this transition phase, the possible adoption of policies implementing the PEF method will be explored. Additionally, new PEFCRs and OEFSRs are being developed, existing PEFCRs/OEFSRs are being reviewed, and the EF method will be further refined and improved based on the experiences from the several pilots.

The PEF method and the EN 15804:2012+A1:2013 are being aligned as requested by the EC. The results were published in a new amendment, EN 15804:2012+A2:2019. Currently, the declarations according to this aligned standard are not yet mandatory. However, future laws and regulations may refer to this standard and even make compliance with it compulsory. Discussions are ongoing in this framework (see Circular Economy Action Plan) and in the framework of the revision of the CPR. The relevant interactions between the PEF and the digital building logbook are similar to those for the EPD.

Renovation Wave

The flagship EU Renovation Wave strategy launched on 14 October 2020 is comprehensive and far-reaching. Its premise is that to contribute to a higher 2030 climate target and decarbonise the building sector, a wide range of policies, measures and tools must be put in place at all levels to overcome existing barriers and mobilise all actors, including citizens, local authorities, investors and the construction value chain.[67]

The strategy recognises that effective building policies and measures can only be designed and implemented with consistent and reliable data, for example on energy consumption or environmental performance. The Renovation Wave proposes the introduction of a digital building logbook as a common repository for all relevant data over the entire lifecycle of the building, and to strengthen data collection through an updated EPC framework, with stringent rules on database availability and accessibility. The European Commission will also explore if and how the European Building Stock Observatory can become more reliable and robust.

Smart Readiness Indicator

The Smart Readiness Indicator under the Energy Performance of Buildings Directive provides a trustworthy indicator of the smart capabilities of the building and its equipment. In line with the provisions of the EPBD, three aspects of smartness are evaluated: the potential of the building services to adapt in response to the needs of the occupant, the readiness to facilitate efficient operation and maintenance, and the flexibility to shift loads and communicate with the energy grid. The methodological development of this indicator and the exploration of favourable implementation pathways have been investigated in a second technical support study for DG Energy by a consortium led by VITO. The timing of both studies has enabled direct exchanges and has mutually strengthened the development of both the digital building logbook and the SRI. In the light of the methodology of the SRI, some highly relevant interactions of both frameworks are currently envisioned:

- The digital building logbook can be a repository for storing the SRI assessment results and related data such as reports and/or labels.

- Some of the data required for the SRI assessment might be directly available in the digital building logbook, e.g. information on surface areas and technical details of heating and cooling equipment. This has the potential to reduce efforts, costs and nuisance related to on-site inspections for the SRI assessment.

- Smart building systems are a nascent field which face rapid technological evolutions. As a consequence, the SRI methodology will be subject to regular revisions, e.g.

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[67] The Renovation Wave initiative will build on measures agreed under the 'Clean energy for all Europeans' package and aims to double annual energy renovation rates in the next ten years: https://ec.europa.eu/energy/topics/energy-efficiency/energy-efficient-buildings/renovation-wave_en

regarding the catalogue of services which can be evaluated and the applicable thresholds. When an update of the SRI is issued for a building, the digital building logbook can act as a validated repository of the previously used SRI input data. It can even be envisioned that new SRI assessments are automatically conducted when a new calculation methodology becomes available. This would greatly decrease the burden and increase the potential of the SRI to inform and motivate the building owner.

- Data security is a crucial aspect in smart building technologies where data breaches can impose significant risks related to the privacy, safety and health and wellbeing of occupants. A digital building logbook could be a platform for keeping track of security aspects related to smart building services; e.g. providing a repository of validated 'data security labels'. In a more advanced version, the logbook might act as a framework that can provide alerts to occupants or facility managers in case of reported security breaches, and even suggest security patches.

- A crucial aspect of a truly smart building is a seamless integration of various systems and services. A multitude of both open and proprietary communication protocols is currently available on the market. Some gateways can ensure communication across multiple protocols, but not all systems can be made compatible. The digital building logbook can provide an overview of current systems in the building and their respective communication protocols. This will greatly ease the potential for future upgrades and expansions while limiting risks resulting from lock-in effects.

- In response to various stakeholder requests, the second technical support study for the SRI investigated the potential for also integrating data from continuous on-board monitoring in the assessment methodology. The digital building logbook can be a validated source for providing such data in a GDPR-compliant way.

The Renovation Wave strategy also refers to the potential to link the digital building logbook to SRI data.

CONCLUSIONS

Accelerated digitalisation of the construction sector

The digitalisation of our society comes with an ever-increasing amount of data, which allows for new opportunities including new services and innovations. Particularly for the construction sector, a lot of progress has been made in recent years – think BIM, digital twins, prefabricated façade systems, robotics etc. – although a lot of potentials are still there to seize.

In the digitalisation agenda of the construction sector, the digital building logbook plays a pivotal role. Digital building logbooks will serve as repositories for data on individual buildings, and will facilitate information-sharing within the construction sector and between building owners and tenants, financial institutions and public authorities. Access to and processing of reliable data will foster the roll-out of entirely new business opportunities for design, construction, operation, leasing, financing and real estate transactions.

Role for the European Commission

The European Commission can foster the widespread use and efficient operation of the digital building logbook by pursuing the following priority actions:

- Development of a standardised approach for data collection, data management and interoperability including its legal framework
- Development of guidelines for linking existing databases
- Launch of publicly funded R&I projects to further explore the digital building logbook concept and its implementation.

These priority actions are concrete, feasible and with potential high impact on the end-users, the construction sector and public authorities.

The implementation of EU initiatives such as a legal framework or official standardisation is very time-consuming, and this must be taken into consideration when reflecting on the necessary level at which to formalise and align technical specifications across Europe.

The promotion and recognition of the digital building logbook and (voluntary) technical guidance are vital. Building awareness and collective support for the logbook across the entire industry is paramount for the success of any initiative. The benefits will need to be clearly articulated and potential concerns/liabilities clarified with each party. The consensus is that the logbook would be a voluntary market-based tool. This needs to be kept in mind for the legislative action.

The enshrining of the digital building logbook in an EU law is thus less essential than implementing measures that enable the digital building logbook, i.e. measures focusing on legal and technical aspects related to data exchange and improved data availability.

The inclusion of the digital building logbook in the Renovation Wave provides an important push to continue the development of logbooks and the exploration of policy avenues which support their uptake (see Figure 30).

With the growing importance of cloud and edge computing and the need to align EU Commission initiatives and strategies, a digital building logbook will be key "to integrate all building-related data" and facilitate collaboration among DGs and Member States. The forthcoming Strategy for a Sustainable Built Environment can serve as the momentum to accelerate the regulatory uptake.
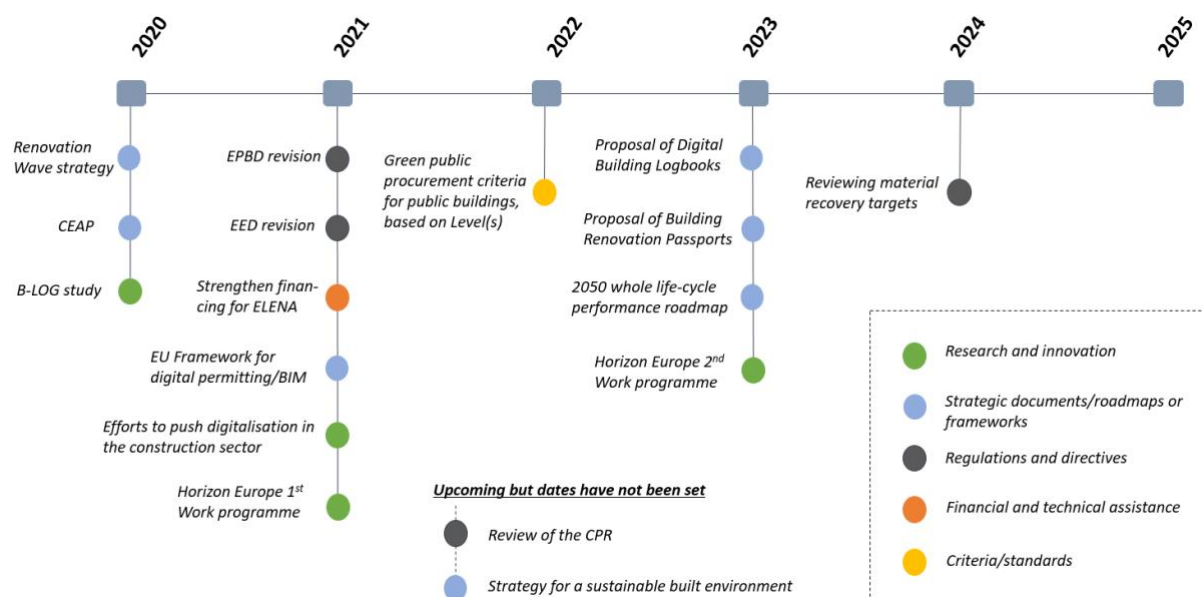
Figure 30: Policy timeline based on Renovation Wave. Only provisions relevant for the digital building logbook are included.

The digital building logbook is particularly complex since it is not obvious how to test it. Guidelines on the interoperability of logbooks, the development of a platform linking with databases, and the development of features and functionalities demand significant investment and commitment. Here is where the support of EU R&I funding is most needed. Funding programmes and technical studies could support those countries and organisations interested in implementing the idea, but these should always be underpinned by a harmonised approach.

Agile approach is most recommended

The number of countries where building logbooks are tested or are currently under development confirms a growing interest in the topic. Given the dynamics of the field, an agile approach is the most recommended to sustain momentum and stakeholder engagement, while the development of technical specifications should also be initiated, focusing on a semantic data model of the core elements of a digital building logbook. This needs to happen through strong collaboration by a 'coalition of the willing' which brings together an alliance of private actors, Member States implementing the logbook and research organisations. This approach would allow for the market to develop at its own pace, but within an overall harmonised system. It would allow the digital building logbook concept to gain interest and demonstrate the benefits for users.

The implementation potential and chances for success of the priority actions will increase through building synergies within a larger framework of EU and international initiatives. Given their cross-sector nature and relevance for the entire value chain over the full life cycle, the potential synergies are enormous.

Window of opportunity to take action

There is a strong and urgent need for demonstrators and pilot cases, for testing and validating the digital building logbook in various EU countries. The opportunity to include the outcomes of the B-LOG study in the Horizon Europe calls for proposals should be seized in its first work programme (2021-2022).

Additionally, to have an effective impact on digital building logbook deployment and the European digital agenda, it is recommended to launch the technical studies described in the previous sections as soon as possible.

The engagement of industry stakeholders is an essential requirement. To have the industry on board, the user advantages and business opportunities of the digital building logbook need to be clear. There is a clear window of opportunity for construction industry players to collaborate and provide input.

Now is the time to act. Collaborative processes are required to roll out the digital building logbook and accelerate digitalisation in the construction sector.

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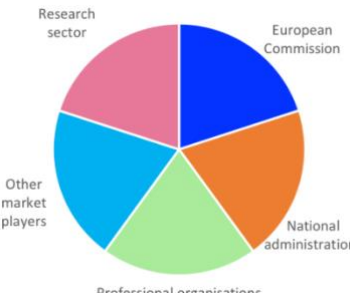
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ANNEX 1. DETAILED DESCRIPTION AND CHARACTERISATION OF EACH ACTION THAT ADDRESSES THE GAPS
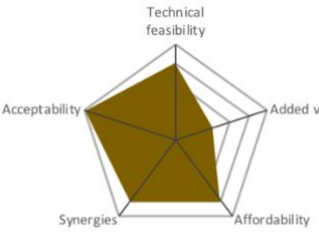
Action A. Launch of publicly funded R&I projects to further explore the Digital Building Logbook concept and its implementation

Action A.	Launch of publicly funded R&I projects to further explore the Digital Building Logbook concept and its implementation
Action type	Supportive action
Description	Research and Innovation projects could be funded at European level, and possibly at Member State level, in order to further explore the Digital Building Logbook concept and its implementation. Such projects would encompass for instance the following aspects: economic and business models, Digital Building Logbook's features and functionalities, User eXperience, interoperability, data governance, connection with other initiatives, etc. Such projects would also aim to demonstrate the benefits of Digital Building Logbooks in terms of resource efficiency, decarbonisation, safety and health. If funded at EU level, such projects should be required to mutually cooperate and to provide joint recommendations to policy makers (as for instance the BRIDGE initiative does for H2020 projects in the field of smart grids and energy storage[68]). Connection with the DigiPLACE project[69] should also be required. DigiPLACE is a framework which allows the development of future digital platforms as common ecosystems of digital services that will support innovation, commerce, etc. The project is aiming at creating a digital platform that will integrate technologies, applications and services of the digital construction industry. Building logbooks could be potentially part of the work for EU wide data spaces. [70] Finally, it would also be beneficial to list all the R&I projects funded at Member State level which contribute to exploring the Digital Building Logbook concept.
Gaps addressed	Gap #1 Funding model · Gap #2 Benefits · Gap #3 Scope and purpose · Gap #4 User-friendliness · Gap #5 Updates · Gap #6 Interoperability · Gap #7 Data governance · Gap #8 Legal framework · Gap #9 Role of EU and MS
Effort sharing	The European Commission and/or the national administrations would select and fund R&I projects through open calls. Stakeholders from the research sector, professional organisations in the construction and building sectors as well as other market players (software developers, UX experts, financial and insurance companies...) could participate in such projects.

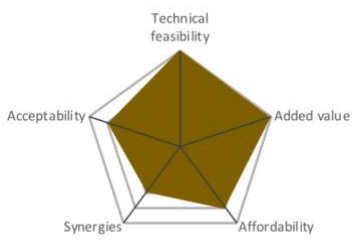[68] See https://www.h2020-bridge.eu/.

[69] See https://www.digiplaceproject.eu/.

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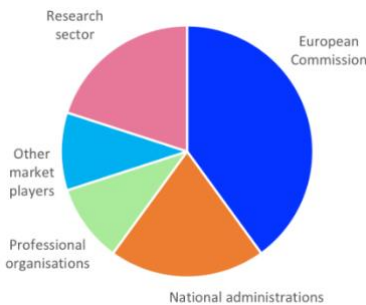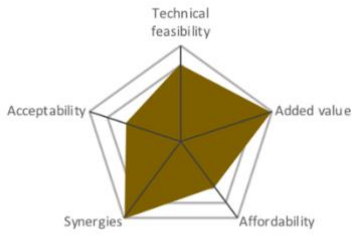
Strengths and weaknesses		Main strength of this action is that it would help demonstrating the Digital Building Logbook concept within different environments, identifying business models and illustrating benefits (at societal level or stakeholder-specific), thus facilitating the acceptability of Digital Building Logbook by the concerned stakeholders. Synergies with other initiatives could also be explored thanks to such actions. Cost of such projects is kept under control. Added value depends on how the projects are performing and how results are disseminated and exploited. In addition, those results would be made available after a few years since such R&I projects should last some 3-4 years.
Links with other actions	Action B. Cost-benefit analysis Action D. Market potential study of specific functionalities Action E. Communication campaign & awareness raising activities Action F. Make the Digital Building Logbook mandatory for public buildings Action H. User eXperience study Action J. Development of a standard for data collection, data management and interoperability	

Action B. Cost-benefit analysis and impact assessment
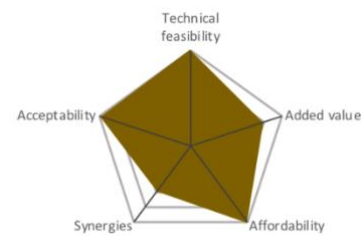
Action B.	Cost-benefit analysis and impact assessment
Action type	Study
Description	Before the European Commission proposes a new initiative, which is expected to have a significant economic, social or environmental impact, it assesses the need for EU action and the potential economic, social and environmental impact of alternative policy options in an impact assessment. Such impact assessment would be needed for any legislative or non-legislative action that the European Commission intends to carry out. Within such impact assessment, the correct application of the principles of subsidiarity (no EU intervention when an issue can be dealt with effectively by EU countries) and proportionality (EU action does not exceed what is necessary to achieve the objectives) should be assessed. Impact assessment at EU level can also be supplemented by cost-benefit analyses at Member States level, as it has been done, for instance, for the roll-out of smart meters in the electricity sector. The costs and the benefits of the Digital Building Logbook deployment indeed need to be assessed and compared.
Gaps addressed	**Gap #1** Funding model Gap #4 User-friendliness Gap #7 Data governance **Gap #2** Benefits Gap #5 Updates Gap #8 Legal framework **Gap #3** Scope and purpose Gap #6 Interoperability Gap #9 Role of EU and MS
Effort sharing	The European Commission would carry out the impact assessment that would rely on consultants or researchers as contractors. Stakeholders of the construction value chain and of the research sector would contribute to the impact assessment (stakeholder consultation). National cost-benefit analyses (CBAs) would be carried out by national administrations, based on CBA guidelines developed and promoted by the EC in line with the impact assessment.
Strengths and weaknesses	Carrying out such impact assessment and cost-benefit analyses is technically feasible, even though some inherent difficulties would be faced regarding the hypotheses and boundary conditions to be considered. Added value is high. The results of such studies would be instrumental for running a communication campaign (action E) and for exploring potential legislative actions (action N). Affordability is medium as the cost for a study like this could be significant, but under control. Synergies with other initiatives would be assessed within the impact assessment. Acceptability is expected to be medium, given that the hypotheses underlying the impact assessment and cost-benefit analyses can always be disputed.
Links with other actions	Action A. Launch of publicly funded R&I projects to further explore the Digital Building Logbook concept and its implementation Action C. Identification of different funding models Action E. Communication campaign & awareness raising activities Action F. Make the Digital Building Logbook mandatory for public buildings Action G. Creation of a Digital Building Logbook definition at EU level, including data fields and functionalities Action I. Development of a standard for data collection, data management and interoperability Action L. Juridical / legal study about data governance aspects (ownership, privacy) Action M. Development of a public tool enabling plug-ins from private sector Action N. Exploration of potential legislative actions

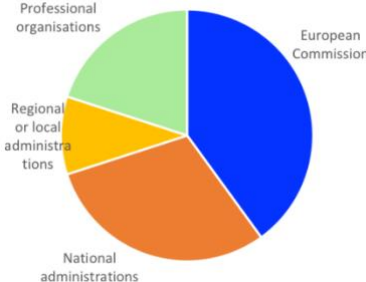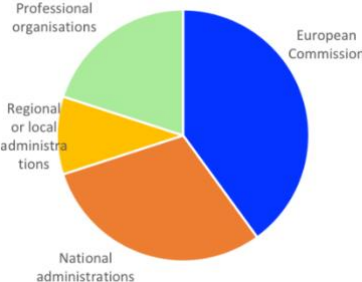## Action C. Identification of different funding models

Action C.	Identification of different funding models
Action type	Study
Description	Developing, implementing and maintaining Digital Building Logbooks comes at a cost. The development of the logbook's building blocks (features, data set, functionalities) can be financed through both public and private means. Further work needs to be carried out to identify what parts of the Digital Building Logbook are best financed by the public sector (i.e. aspects related to common interests such as transparency and access to data) and what parts are best addressed via private initiatives (e.g. operationalising the Digital Building Logbook and developing functionalities). If the Digital Building Logbook development relies (fully or partly) on the private sector, sound business models have to be designed, tested and implemented. In particular, if homeowners or construction professionals have to pay for using the Digital Building Logbook, the price has to be acceptable. This aspect is strongly linked with action D (Market potential study of specific functionalities). Different funding schemes may co-exist in the various territories of the EU.
Gaps addressed	Gap #1 Funding model · Gap #2 Benefits · Gap #3 Scope and purpose · Gap #4 User-friendliness · Gap #5 Updates · Gap #6 Interoperability · Gap #7 Data governance · Gap #8 Legal framework · Gap #9 Role of EU and MS
Effort sharing	The identification of different funding models can be done by various stakeholders (both public and private). Therefore, on the pie chart we have represented equal shares for all types of stakeholders.
Strengths and weaknesses	Technical feasibility is high. Connected initiatives (like for instance Energy Performance Certificates) and initiatives from other economic sectors can provide interesting insights. Added value is high: such study can help understanding the respective roles of each stakeholder. Affordability is quite high. Synergies are medium - they actually depend on the exact scope of the studies. Acceptability should be quite high, even though hypotheses of such studies can always be disputed.
Links with other actions	Action A. Launch of publicly funded R&I projects to further explore the Digital Building Logbook concept and its implementation Action B. Cost-benefit analysis and impact assessment Action D. Market potential study of specific functionalities Action G. Creation of a Digital Building Logbook definition at EU level, including data fields and functionalities

Action D. Market potential study of specific functionalities

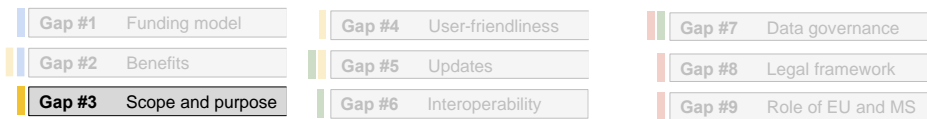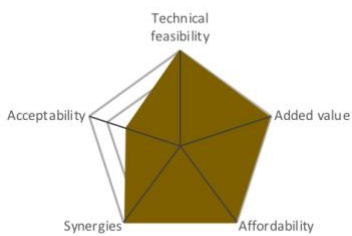| Action D.	Market potential study of specific functionalities
Action type	Study
Description	Functionalities refer to the services built around the Digital Building Logbook and its features. Functionalities have corresponding benefits or sets of benefits for the users. To offer maximum value and successful market uptake, Digital Building Logbook's functionalities must be prioritised effectively ensuring that it is responsive to the real needs of the construction and real estate industry. The first step in setting up a Digital Building Logbook is to develop a robust structure getting the main features and just a few functionalities right (e.g. digital safe for key documents) while keeping open the possibility of adding further functionalities in a modular fashion. Prioritising the addition of further functionalities should be decided according to their respective market potential and the benefits they generate. This is closely interlinked with the identification of funding models (action C).
Gaps addressed	Gap #1 Funding model, Gap #2 Benefits, Gap #3 Scope and purpose, Gap #4 User-friendliness, Gap #5 Updates, Gap #6 Interoperability, Gap #7 Data governance, Gap #8 Legal framework, Gap #9 Role of EU and MS
Effort sharing	The main stakeholders involved in this action are within the private sector: not only organisations from the construction and built environment value chains, but also the digital sector. However, the public sector at European, national or regional/local level may also be involved for specific functionalities generating strong societal benefits.
Strengths and weaknesses	Technical feasibility and affordability are high since classical market study tools can be used for this action. Added value is quite high as market studies are essential actions to carry out before launching any new functionality. Synergies with other initiatives are medium - the purpose of the market study is to focus on the potential of each single functionality; however, the potential would be higher if the functionality in question is consistent with other initiatives. Acceptability is high: by construction a market study includes an acceptability assessment.
Links with other actions	Action A. Launch of publicly funded R&I projects to further explore the Digital Building Logbook concept and its implementation Action B. Cost-benefit analysis and impact assessment Action C. Identification of different funding models Action H. User eXperience study

Action E. Communication campaign & awareness raising activities

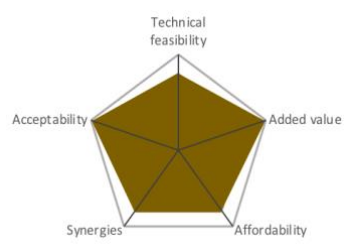| Action E.	Communication campaign & awareness raising activities
Action type	Supportive action
Description	As previously mentioned, a number of benefits could be linked to the Digital Building Logbook, applicable to stakeholders across the entire construction and built environment value chains, as well as some stakeholder-specific benefits. Focusing on the benefits – and the building logbook functionalities that help to realise the benefits – is key to build support among market players who would otherwise perceive the building logbook as an additional administrative burden. In certain countries, building logbooks initiatives have faced some obstacles caused by inter alia a lack of understanding of the benefits generated. The Digital Building Logbook's benefits have to be clearly and broadly communicated across the entire construction value chain, as well as to building owners, tenants, financial institutions and public authorities. That is why a broad communication campaign and awareness raising activities are necessary. They would also allow positioning the Digital Building Logbook among other related initiatives. However, such campaign should be undertaken once other actions have been conducted (Actions B, G and N at least).
Gaps addressed	
Effort sharing	A communication campaign and awareness raising activities would make sense at EU level, but they should be supported and replicated at Member State and possibly regional level. Professional organizations should be associated with such campaign, possibly in connection with Action K (training for construction and built environment professionals).
Strengths and weaknesses	There is no major weakness to such action, except that costs might be significant. As previously explained, such action would make sense only if other actions have previously been undertaken, to make the purpose of the communication very clear.
Links with other actions	Action B. Cost-benefit analysis and impact assessment Action G. Creation of a Digital Building Logbook definition at EU level, including data fields and functionalities Action J. Development of guidelines for linking existing databases Action K. Training for construction and built environment professionals Action O. Mapping and guidance for the deployment of Digital Building Logbook

Action F. Make the Digital Building Logbook mandatory for public buildings

Action F.	Make the Digital Building Logbook mandatory for public buildings
Action type	Legislative action
Description	Public authorities could be required to use Digital Building Logbooks for their own buildings and lead by example. This would contribute demonstrating the benefits of equally through communication campaigns and awareness raising activities (Action E). A similar approach is implemented by the Energy Performance of Buildings Directive (EPBD) for Energy Performance Certificates (EPCs): Member States have to ensure that, for public buildings where the floor area is higher than 250 m^2 and which are frequently visited by the public, an EPC is issued and is displayed in a prominent place clearly visible to the public.
Gaps addressed	Gap #1 Funding model; **Gap #2 Benefits**; Gap #3 Scope and purpose; Gap #4 User-friendliness; Gap #5 Updates; Gap #6 Interoperability; Gap #7 Data governance; Gap #8 Legal framework; Gap #9 Role of EU and MS
Effort sharing	European Commission; National administrations; Regional or local administrations	Such provision would be included in European legislation (for instance, in the next recast of the EPBD). The corresponding effort would be borne by the European Commission and by Member States. Then, such requirement would have to be transposed into national laws by Member States. Finally, its implementation would rely on all public authorities, in particular on local and regional administrations for all their buildings (office buildings, schools, etc.).
Strengths and weaknesses	Technical feasibility; Acceptability; Added value; Synergies; Affordability	If undertaken independently from other actions, this action might have serious weaknesses in particular in terms of acceptability and synergies with other initiatives. The main strength of this action is its affordability - the costs would actually been spread among multiple public authorities. Its added value would be moderated if all public authorities were implementing and using Digital Building Logbooks in a non-harmonised way.
Links with other actions	Action B. Cost-benefit analysis and impact assessment Action D. Market potential study of specific functionalities Action E. Communication campaign & awareness raising activities

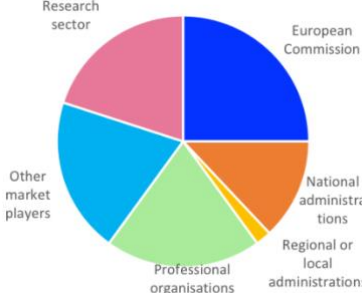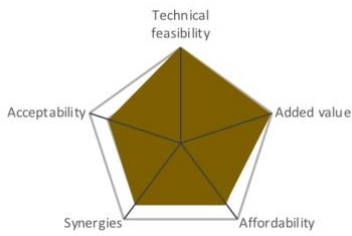*Action G. Consolidation and endorsement of the Digital Building Logbook definition*

Action G.	Consolidation and endorsement of the Digital Building Logbook definition
Action type	Study
Description	The present study is a significant step in reaching a common understanding about the Digital Building Logbook's scope and purpose. This work should be pursued so that a common definition is endorsed at EU level by the construction and built environment value chains. It should include the conditions for accessing data by third parties and other data governance requirements. In addition, the comprehensiveness of the Digital Building Logbook has to be clarified. The Digital Building Logbook should underpin a life-cycle approach and support informed decision-making taking into account resource optimisation and circularity principles.
Gaps addressed	Gap #1 Funding model · Gap #4 User-friendliness · Gap #7 Data governance · Gap #2 Benefits · Gap #5 Updates · Gap #8 Legal framework · **Gap #3 Scope and purpose** · Gap #6 Interoperability · Gap #9 Role of EU and MS
Effort sharing	Consolidation and endorsement of the present study would be borne by the European Commission and would also rely on other stakeholders that could contribute to support it (Member States, regional and local governments, professional organisations and the research sector).
Strengths and weaknesses	This action brings high added value given the various interpretations and diverse implementations of Digital Building Logbook across the EU. Such action would also allow making synergies and consistency with other initiatives clearer. Technical feasibility as well as affordability are not challenging for this action. However, come stakeholders may not accept some of the aspects of the study and acceptability issues might be faced.
Links with other actions	Action A. Launch of publicly funded R&I projects to further explore the Digital Building Logbook concept and its implementation Action B. Cost-benefit analysis and impact assessment Action I. Development of a standard for data collection, data management and interoperability Action M. Development of a public tool enabling plug-ins from private sector Action O. Mapping and guidance for the deployment of Digital Building Logbook

Action H. User eXperience study

Action H.	User eXperience study
Action type	Study
Description	Regarding the Digital Building Logbook's "features" (e.g. digital interface, data syncing, etc.) and "functionalities" (services built around the Digital Building Logbook), user-friendliness is key, as pointed out by several interviewees and mentioned as a key barrier or success factor in the review of existing initiatives. Common views are that "information should be easy to access" with the help of a "smart interface", "it ought to be automatically updated", and the structure should be "modular and layered". In short, the Digital Building Logbook should be flexible to make the right information available to the right actor at the right time. Any Digital Building Logbook initiative should take into account User eXperience (UX) principles in order to stimulate the update of the building logbook and its use by construction professionals and building owners.
Gaps addressed	
Effort sharing	We assume that stakeholders involved in this action would in general be within the private and the research sectors. However, the public sector at European, national or regional/local level would also be involved to specify UX principles.
Strengths and weaknesses	Technical feasibility and affordability are quite high. UX studies can involve structured approaches like Design Thinking. Added value is high, since user friendliness has been identified as a key aspect during the course of the present study. Synergies with other initiatives are quite high, as an UX study should take the user point of view, which may encompass several initiatives. Acceptability is high: by construction a UX study focuses on acceptability by users.
Links with other actions	Action A. Launch of publicly funded R&I projects to further explore the Digital Building Logbook concept and its implementation Action D. Market potential study of specific functionalities Action K. Training for construction and built environment professionals Action M. Development of a public tool enabling plug-ins from private sector

Action I. Development of a standard for data collection, data management and interoperability
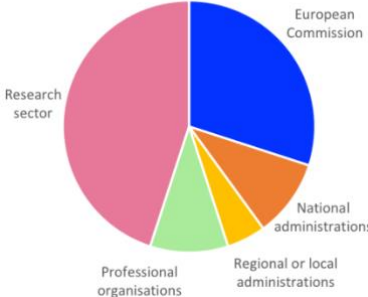
Action I.	Development of a standard for data collection, data management and interoperability
Action type	Development
Description	The experts pointed out a need for a systematised and standardised capture of information and data gathering and storing, as well as its processing (analysing and organizing). This entails all relevant building-related data, both with a static and dynamic nature, and can include administrative documents, plans, description of the land, the building and its surrounding, technical systems, traceability and characteristics of construction materials, performance data, as well as links to building ratings and certificates. A new set of Digital Building Logbook standards and standardised data protocols could provide a methodology for data collection, data management and interoperability, solving a number of issues. Firstly, a systematic approach to capturing, storing, analysing and organising would enable valuable data and information to be available throughout the whole life cycle of the building. Secondly, it would offer an approach to have access to data and information fragmented and scattered across several organisations (and even departments within the same organization). Thirdly, there would be an approach for the Digital Building Logbook to be a safe instrument enabling control to users of their data and the access of third parties, respecting the fundamental right to protection of personal data. Digital Building Logbook standard(s) would provide EU Member States a toolbox to help the implementation of the – potentially to be developed – Digital Building Logbook guidelines and/or legislation and aim also at higher transparency regarding the concept of the Digital Building Logbook. As with the ISO 52000 series on energy performance of buildings, a template for a national annex that enables Member States to tailor the methodology to the national situation could be possible. The Digital Building Logbook standard(s) could be developed by either a European Standardisation Organisation (e.g. CEN) preferably under mandate of the European Commission, national standardisation organisations or by the European Commission itself with extensive stakeholder contribution. A similar approach would be an interesting option for the Digital Building Logbook since standards and good practice already exist at both government and market levels. On the other hand, CEN would probably be the most obvious platform to develop Digital Building Logbook related standards, especially if these are to be cross-referenced or introduced in forthcoming EU or national legislation. When developing Digital Building Logbook related standards, the focus should be on the market integration, and therefore overcomplication should be avoided. For example, the ISO 52000 series are perceived by many stakeholders as too complex. The CEN/TC 350 'Sustainability of construction works' has been proven successful for the material manufacturers. The affiliated establishment of EN 15804:2012+A2:2019 on environmental product declarations and the current revision of EN 15978 Assessment of environmental performance of buildings, will be used as a frame within LEVEL(s), to which DG Environment has run an alignment process for the Product Environmental Footprint (PEF), and therefore relevant for potential Digital Building Logbook standard(s) as well. A Digital Building Logbook standard could also build further on and refer to GDPR regulation, Green Building XML, IFC data model, etc. as well as private products (e.g. systems of interfacing between BIM, CMMS and BMS) starting to emerge in the market. An EU-wide standardized API could communicate with Digital Building Logbook databases. The latter would create a new common EU market, enabling software vendors to integrate connections with Digital Building Logbook databases in a uniform approach for all MS. Use case examples are BIM / GIS software automatically retrieving relevant geometric information from the Digital Building Logbook in a secure way, or DSOs having information on EV recharge points in buildings in a specific city district (cf. revised EPBD Art. 8 provision on recharging points).

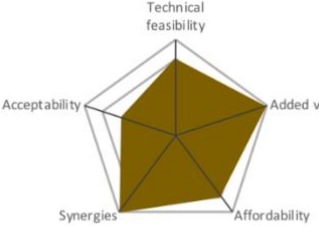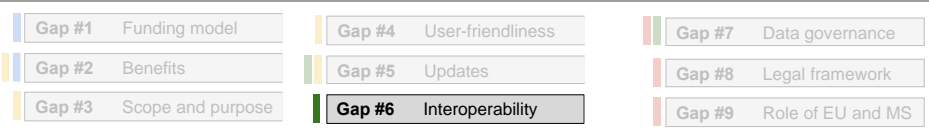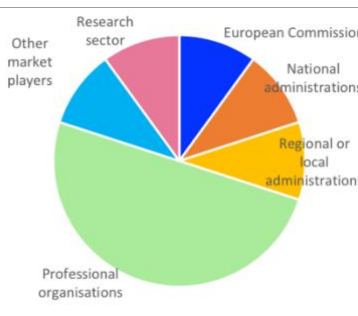|	
	An important aspect to be explored further is the public accessibility to Digital Building Logbook standards. Furthermore, the outcomes from EU projects like DigiPLACE, which is aiming at creating a digital platform that will integrate technologies, applications and services of the digital construction industry, should be taken into account. [71]
Gaps addressed	
Effort sharing	Different standardisation models should be assigned by technical committees to different building-related data initiatives at EU level. Actors from the research sector, professional organisations in the construction and building sectors as well as other market players (such as software developers) could participate in such action.
Strengths and weaknesses	This action would help facilitating the technical feasibility of the Digital Building Logbook. Synergies with existing initiatives could be explored such as the GDPR regulation, Green Building XML, IFC data model, etc. The cost is kept under control. The added value would be the prevention of losing valuable data and information, and having fragmented and scattered data across and within organizations. It would make data available to other stakeholders in the value chain.
Links with other actions	Action J. Development of guidelines for linking existing databases Action L. Juridical / legal study about data governance aspects (ownership, privacy) Action M. Development of a public tool enabling plug-ins from private sector

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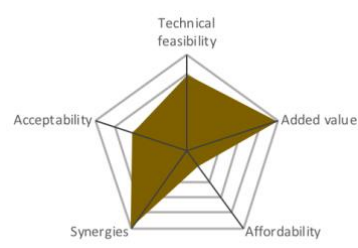
[71] See project website at https://www.digiplaceproject.eu/.

Action J. Development of guidelines for linking existing databases

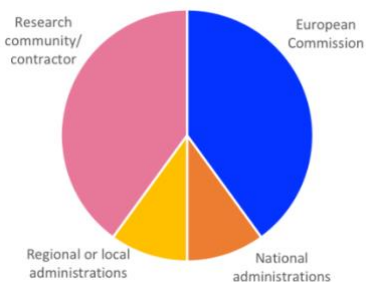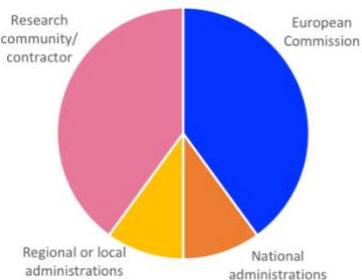| Action J.	Development of guidelines for linking existing databases
Action type	Study
Description	The Digital Building Logbook data will not only be stored within the logbook but could also be hosted in a different location to which the logbook acts as a gateway. A common understanding under the interviewed experts is that it is even sufficient to incorporate existing data sources. Linking the large number of existing building information related databases – such as public registries (e.g. information on administrative aspects, soil, cultural heritage), LCA related (e.g. GaBi or Ecoinvent), national EPC databases, energy or water consumption, etc. – is thus vital for the success of Digital Building Logbook development and its implementation. Especially trustworthy data sources (e.g. originating from public authorities) increase the chances for a successful implementation. Connecting all these data sources and users requires common 'languages' – interfaces and protocols – to enable interoperability, data consistency (as for example through common European data spaces for the manufacturing sector to ensure enhanced access to privately held data, via industrial data platforms) and information exchange. Several experts have highlighted the problem of "data matching" as one of the main obstacles. There is also a high potential for advanced technologies, such as blockchain, to support the alleviation of these issues. To facilitate the development and implementation of Digital Building Logbooks and maximise the potential incorporation of and interoperability with existing databases, a coherent approach on Member State levels for linking existing databases (and automatic updating) with the Digital Building Logbook is recommended. The success of the Digital Building Logbook depends not only on the quantity, but also on the quality, and therefore data quality marking schemes could be considered. A technical study has to be carried out to develop guidelines, which should include amongst others an overview of existing databases, the trustworthiness of the data sources as well as how to enable interoperability, data consistency and information exchange. This for example via Application Programming Interfaces (API), which is one of the main vehicles of modern digital architectures, enabling many opportunities for new business models. The guidelines could also include an outlook on expected evolutions related to new databases with linking potential for the Digital Building Logbook. The digital experts pointed out in the survey that the future will open up new technologies (e.g. sensors, real-time energy use) enabling additional data platforms, often private operated. The Digital Building Logbook could link as well to those new data platforms.
Gaps addressed	Gap #1 Funding model Gap #4 User-friendliness Gap #7 Data governance Gap #2 Benefits **Gap #5 Updates** Gap #8 Legal framework Gap #3 Scope and purpose **Gap #6 Interoperability** Gap #9 Role of EU and MS
Effort sharing	The European Commission defines the tender specification, commissions and supervises the study. The research contractor carries out the study and involves national (or regional) public authorities and stakeholders to provide specific insights. The EC could also decide for the member states to endorse the guidelines.

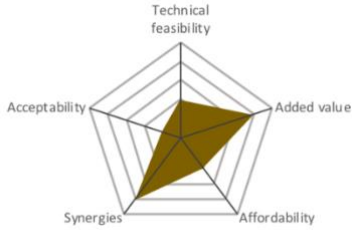| **Strengths and weaknesses**		This action delivers a high added value to the implementation and development of the Digital Building Logbook scheme by strengthening the scope. The digital technologies required are in an exponential expansion and will surely bring new prospects within the upcoming years with an increasing citizens interest in getting good and convenient information. To a certain degree the study requires technical data related expertise and some insights in innovative and expected evolutions. The goal is it to define the diverse linkage options with its benefits and risks. The costs of the study are expected to be reasonable and the presence of comparable data structures already running should help to find adequate professionals to perform it. Including European stakeholders and public authorities is essential to ensure the acceptability of the approach.
Links with other actions	Action I.	Development of a standard for data collection, data management and interoperability
	Action M.	Development of a public tool enabling plug-ins from private sector

Action K. Training for construction and built environment professionals

Action K.	Training for construction professionals
Action type	Development
Description	The need for training for construction and built environment professionals, especially regarding digital technologies, has been identified in previous studies (European Commission, 'Supporting digitalisation of the construction sector and SMEs including Building Information Modelling', 2019). The possible roll-out of Digital Building Logbook has to be taken into account in capacity building programmes for both blue-collars and white-collars in the construction sector, so that they are able to input data into the Digital Building Logbook as well as to use Digital Building Logbook data in other processes. This should include the use of digital tools and standardized methods for LCA and LCC. Ensuring data accuracy and quality for the Digital Building Logbook also relies on a trained and skilled workforce. The functionalities that can be offered by the Digital Building Logbook and the corresponding benefits also have to be understood by construction and building professionals (link with Action E - Communication campaign & awareness raising activities). For instance, professionals in charge of technical maintenance of buildings as well as auditors and certifiers for technical or energy performance of buildings should be trained to use the Digital Building Logbook in order to maximise the Digital Building Logbook benefits.
Gaps addressed	Gap #1 Funding model Gap #4 User-friendliness Gap #7 Data governance Gap #2 Benefits Gap #5 Updates Gap #8 Legal framework Gap #3 Scope and purpose **Gap #6 Interoperability** Gap #9 Role of EU and MS
Effort sharing	Professional organisations are expected to develop capacity building programmes, with the support of training bodies and the research sector. Public authorities at European, national and regional/local level should also guide and support such programmes.
Strengths and weaknesses	Technical feasibility of this action is quite high; however, affordability is low since thousands of workers across the EU would be concerned by such training programmes. Added value is high, as already demonstrated by other studies. Synergies with other initiatives are high (Build Up Skills initiative, Skills Blueprint for the Construction Industry / New Skills Agenda for Europe).
Links with other actions	Action A. Launch of publicly funded R&I projects to further explore the Digital Building Logbook concept and its implementation Action B. Cost-benefit analysis and impact assessment Action E. Communication campaign & awareness raising activities Action I. Development of a standard for data collection, data management and interoperability

Action L. Juridical / legal study about data governance aspects (ownership, privacy)
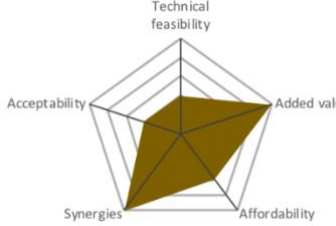
Action L.	Juridical / legal study about data governance aspects (ownership, privacy)
Action type	Study
Description	Data governance refers to the process, organisation and standards implemented to ensure the effective and efficient storage and access to the information. Being a common data repository, the Digital Building Logbook relies on the easy access, storage, update and transfer of building-related data and information, and thus, on clear data governance rules and data management processes. The General Data Protection Regulation (GDPR) agreed in 2016 is the EU's main regulation on data privacy. Following on GDPR, EU released the regulation on free flow of non-personal data (FFD), as well as and the Cybersecurity Act and Open Data Directive. Given the wide scope and relative novelty of both regulations and digital technologies, confusion persists of how these apply to the Digital Building Logbook at local/national levels, something that has been repeatedly emphasised by interviews. A study, targeted at the Digital Building Logbook implementers, could clarify the legal framework for Digital Building Logbook implementation and could provide guidance and explanatory notes on privacy and security aspects relevant for Digital Building Logbook. The study should explore other sectors in which the management of big data, including ownership and privacy issues, is also considered (for instance, health, transport and smart city sectors).
Gaps addressed	Gap #1 Funding model · Gap #4 User-friendliness · **Gap #7 Data governance**; Gap #2 Benefits · Gap #5 Updates · **Gap #8 Legal framework**; Gap #3 Scope and purpose · Gap #6 Interoperability · Gap #9 Role of EU and MS
Effort sharing	The European Commission defines the tender specification and commissions the study. The research community/contractor carries out the study under supervision of the EU. National and local administration bodies (main Digital Building Logbook implementers) provide additional insights.
Strengths and weaknesses	The action doesn't require extensive technical innovation or research, it is rather a comparative legal study. The acceptability is high as it doesn't touch upon with specific interest of stakeholder groups. It could be argued that clarifying legal aspects around data governance and data management are in the public interest and all involved parties in the Digital Building Logbook would benefit. The study would support the uptake of new Digital Building Logbooks (on EU, national or local level) but also provide clarity to the existing initiatives. The affordability would be high as the cost for a study like this would be relatively low. The added value is medium.
Links with other actions	Action B. Cost-benefit analysis and impact assessment Action I. Development of a standard for data collection, data management and interoperability Action M. Development of a public tool enabling plug-ins from private sector Action N. Exploration of potential legislative actions Action O. Mapping and guidance for the deployment of Digital Building Logbooks

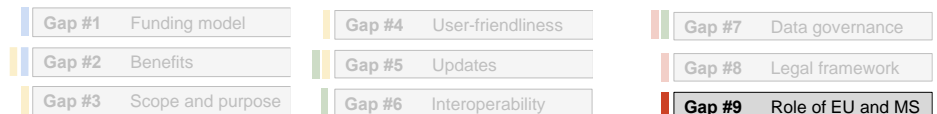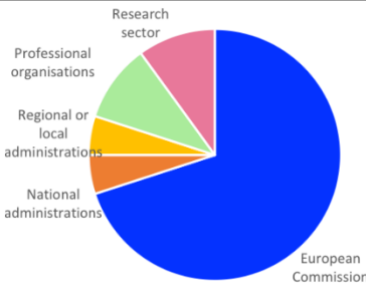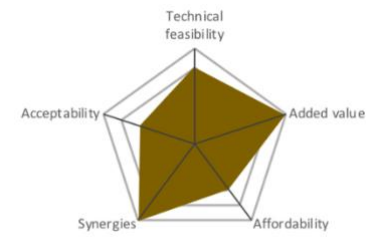*Action M. Development of a public tool enabling plug-ins from private sector*

Action M.	Development of a public tool enabling plug-ins from private sector
Action type	Development
Description	The Digital Building Logbook gathers different types of data from multiple sources, possibly including a variety of applications ranging from those installed and running on the premises of the building to cloud-based platforms exchanging massive amounts of data in real-time between different stakeholders. The data from these different sources must be able to "communicate" for the Digital Building Logbook to reach its potential. Connecting all these data sources and users requires interfaces and protocols to enable interoperability, data consistency and information exchange. This action consists in addressing this challenge by creating a single Digital Building Logbook tool. Developed and hosted by public authorities, such tool would be made available to stakeholders of the construction and building value chains and to building owners. The data architecture of the tool would have to link with existing databases, be compatible with multiple data sources and ensure data privacy and security. An option is to make the use of the tool free and compulsory for all information related to legal obligations: EPC, people's security (electricity, fire, etc.), environmental permits, etc. It would also be accessible to notaries for real estate transactions. The tool could also support the development of a broad range of functionalities offered by business actors, who could plug in various tools supporting the use of the Digital Building Logbook during the construction phase of the building (for instance linked to BIM) or its operation phase (facilitation of building maintenance, certification, etc.)
Gaps addressed	Gap #1 Funding model Gap #4 User-friendliness **Gap #7 Data governance** Gap #2 Benefits Gap #5 Updates **Gap #8 Legal framework** Gap #3 Scope and purpose Gap #6 Interoperability Gap #9 Role of EU and MS
Effort sharing	The tool could be developed at EU level, like for instance the EU Survey tool which is translated into most EU languages and is available to all EU citizens. Alternatively, such tool could be developed at Member State level according to common requirements, as it is done for the Energy Performance Certificates (EPCs). Professional organisations in the construction and building sectors would be associated to the tool's development. Other market players e.g. software editors would be contracted.
Strengths and weaknesses	This action may not be acceptable to all stakeholders in case only this tool can be used (public monopoly). Technical feasibility may be challenging, in particular if it is developed at EU level, since this single tool should adapt to various situations and countries. Centralisation and development of one single tool are certainly advantageous in terms of upfront costs, however in the long-run cost-efficiency may decrease. By contrast, synergies with other initiatives and added value can be very good.
Links with other actions	Action I. Development of a standard for data collection, data management and interoperability Action J. Development of guidelines for linking existing databases Juridical / legal study about data governance aspects (ownership, Action L. privacy) Action N. Exploration of potential legislative actions

Action N. Exploration of potential legislative actions

Action N.	Exploration of potential legislative actions
Action type	Legislative action
Description	The EU Commission should explore potential legislative actions to implement the Digital Building Logbook in Europe. The most reasonable approach, which was highlighted in the stakeholder consultation, would be for the EU to define and legislate the core elements of the Digital Building Logbook (incl. defining a central data governance structure) and allow the Member States to decide on the outer elements (incl. involvement of third parties and which functionalities to include). The "legislative action" should be linked to one or several ongoing strategies (as mapped out in Task 1), including: ● **New Industrial Strategy for Europe** – Improved data availability, common data protocols and collaboration within the value chain will contribute to the development of an EU data economy and common European data spaces. Clarification of data governance issues and data sharing models can protect IPR and strengthen the legal framework for a single market in digital services. ● **European Green Deal and the announced 'Renovation Wave' initiative** – The Digital Building Logbook and connected digital features can accelerate and maximise the impact of building policies to deal with climate change and protect the environment. Availability of granular performance and maintenance data in addition to the Energy Performance Certificate (EPC) and Smart Readiness Indicator (SRI) could provide a more robust and reliable indication of energy performance and reduce performance gaps. ● **Circular Economy Action Plan and Strategy for a Sustainable Built Environment** – Information about the construction and building materials (type, quantity/amount, origin, carbon footprint, recycled content, as well as the end of life dismantling, reusing and recycling possibilities) facilitates source separation and increases recycling quantity/quality, prevents waste and closes loops. ● **European Data Strategy** – A "European way to digital transformation" which enhances open data, respects fundamental rights, and contributes to a sustainable, climate-neutral and resource-efficient economy. ● **Construction Product Regulation (CPR) review, Sustainable Product Policy and Digital Product Passports** – The forthcoming European Circular Dataspace aims to mobilise the potential of digitalisation of product information, introducing for example digital product passports which can closely interact with Digital Building Logbooks. Similarly, the revision of CPR may include recycled content requirements for certain construction products, whereas the Digital Building Logbook and traceability of construction products can support the increase of recycling content and value from the recycling of materials.
Gaps addressed	Gap #1 Funding model Gap #4 User-friendliness Gap #7 Data governance Gap #2 Benefits Gap #5 Updates **Gap #8 Legal framework** Gap #3 Scope and purpose Gap #6 Interoperability **Gap #9 Role of EU and MS**
Effort sharing	The action is prepared and developed by the European Commission, and the legislative actions must be agreed together with the Member States.

Strengths and weaknesses		Technical feasibility is considered low: The legislative action supporting the Digital Building Logbook will need to be supported by investments in technical R&D, to make the system efficient and future-proof. The know-how exists among public and private partners. A good mix of parties must be involved in technical and legal developments. Affordability is medium, as the implementation will require substantial investments by the EU and the Member States. Synergies are high as the legislative action could, and should, support the existing building logbooks. The implementation by the Member States ought to build on existing infrastructure and knowledge and market practices. Acceptability is low, as legislative actions will likely require comprehensive stakeholder involvement and consultation process. Added value is high if implemented appropriately.
Links with other actions	Action B. Cost-benefit analysis and impact assessment Action F. Make the Digital Building Logbook mandatory for public buildings Action L. Juridical / legal study about data governance aspects (ownership, privacy) Action M. Development of a public tool enabling plug-ins from private sector Action O. Mapping and guidance for the deployment of Digital Building Logbooks	

Action O. Mapping and guidance for the deployment of Digital Building Logbooks

Action O.	Mapping and guidance for the deployment of Digital Building Logbooks
Action type	Supportive action
Description	Stakeholders' views diverge regarding the need for harmonisation at EU level and the flexibility of national policy measures. However, a common view is that the European Commission is expected to provide guidance to the Member States regarding how to implement Digital Building Logbooks, in order to effectively support other actions (actions F, I, J, K, M, N). This guidance and support could start with the creation of a platform aiming at sharing knowledge, experience feedback and best practices of Digital Building Logbook, identifying early-adopters, mapping Digital Building Logbook initiatives in Europe and possibly outside Europe. Such guidance would also support better harmonisation across the EU and ensure that national initiatives are comparable and replicable.
Gaps addressed	Gap #1 Funding model Gap #4 User-friendliness Gap #7 Data governance Gap #2 Benefits Gap #5 Updates Gap #8 Legal framework Gap #3 Scope and purpose Gap #6 Interoperability **Gap #9 Role of EU and MS**
Effort sharing	The European Commission would lead this initiative. National, regional and local administrations, professional organisations and the research sector would contribute by sharing their experiences.
Strengths and weaknesses	Added value of this action and synergies with other initiatives are high. Affordability is medium, since the creation, maintenance and constant update of the platform would represent a significant cost. Acceptability is medium as well: stakeholders would certainly appreciate receiving such guidance and benefitting from best practices sharing, but they would also have to share their own knowledge about what is working and what is not working, which might face some obstacles.
Links with other actions	Action A. Launch of publicly funded R&I projects to further explore the Digital Building Logbook concept and its implementation Action F. Make the Digital Building Logbook mandatory for public buildings Action I. Development of a standard for data collection, data management and interoperability Action J. Development of guidelines for linking existing databases Action K. Training for construction and built environment professionals Action M. Development of a public tool enabling plug-ins from private sector Action N. Exploration of potential legislative actions

ANNEX 2. RELEVANT DATABASES IN THE EUROPEAN CONTEXT

There are numerous databases available in the European built environment context, mainly coming out of public data observatories and national and international statistical agencies (INE, ADEME, EUROSTAT…). Nevertheless, there are also some private organisations providing relevant databases.

Database name	Country of origin	Relevance
Energy performance certificate (EPC) for residential buildings	European initiative; regulated at Member State level	Main and relatively universalised scheme to enhance the energy performance of European buildings
TOTEM (Tool to Optimise the Total Environmental impact of Materials)	Belgium	Web-tool that allows the construction sector to evaluate and become aware of the environmental impact of buildings and building elements
The Environmental Footprint (EF)	European initiative	Common methodological approach for quantifying the environmental performance of any product or service
ADEME – DPE bâtiment publics	France	Describes the energy performance of public buildings
Data Supply and Efficiency (SDFE)	Denmark	Agency that collects, manages and makes available geographic and administrative public-sector data to Danish decision-makers, businesses and citizens. Examples of databases interesting for the digital building logbook context include cadastral information and parcels or topographic data.
Observatorio Construcción de Edificios (INE)	Spain	Information at the district level regarding type of construction
ERA5	International	Dataset which provides hourly estimates of a large number of climate variables relevant for energy modelling
Fluvius – Energy Open Data	Belgium	Public platform managed privately that provides access to district energy data in Flanders (Belgium)
Emporis	International	Catalogue compiling some of largest buildings in the world ranked by height. Numbers of floors, building type, construction year and building status are also included
Demande de valeur foncière (DVF)	France	This database provides precise information about real estate sales since 2015

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