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DIGITAL BUILDING LOGBOOKS AND STAKEHOLDER MAPPING: A CROSS-SECTORAL APPROACH TO DATA COLLECTION AND SHARING

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Abstract

Digital building logbooks (DBLs) are designed to provide a platform to ease data sharing among stakeholders between and beyond the architecture, engineering, construction and operation (AECO) sectors. However, there is a gap in understanding among stakeholders regarding their roles and the overlaps and differences in the data they need. With the findings from qualitative research, the paper provides a new framework to DBL stakeholder mapping that facilitates the identification of stakeholders necessary for effective data exchange and efficient decision-making at different phases across the building lifecycle. This approach defines the roles of the stakeholders as data providers, data users or both, providing an initial impression to how building data can be sourced into and out of the DBL. The paper ultimately demonstrates the relevance of building data for all identified stakeholders, emphasizing the importance of a cross-sectoral involvement in DBLs.

Introduction

The European goal to increase the current renovation rate of 0.4-1.2% to 3% has been challenged by several barriers (Gómez-Gil et al., 2022). One such barrier often overlooked in literature is the lack of building data.

The limitations in the availability, reliability and storage thereof have been viewed as recurring impediments in the decarbonization of the built environment; namely when evaluating the real state of buildings, measuring decarbonization progress, advocating the urgency of retrofits, and during decision-making for planning renovation and maintenance (Monzón & López-Mesa, 2018; Blum, 2009; Talamo & Bonanomi, 2015).

The lack of building data sees great urgency, though it has rarely been addressed in literature (Gómez-Gil et al., 2022). While there is a continuous inflow of new building data, there still seems to be a lack of data particularly on the existing building stock. Gomez-Gil et al. (2022) describe the problem of data loss and unavailability as a "multidimensional problem which affects all scales: local, national, and European". Locally at municipal level, it is still a problem in European member states that the issuing of construction and renovation licenses is paper based, increasing risks of information loss and limiting possibilities of information processing and sharing. Where old but digital data is available, they are "available in spreadsheets or flat tables [and] linkages between them [are] not possible" (Formosa & Pace, 2022).

To provide an indication on the potential extent of the shortage in building data, the Housing Europe Observatory (2023) reported that dwellings built before the oil crisis in the 1970s accounted for 25-67% of the total stock in the 27 European countries studied. It can be deduced that if data and information on these dwellings are available at all, the likelihoods of them being dated, out of context, one-off, not in digital or easily changeable formats, (very) partially covered and/or has adopted a questionable research methodology are significantly high.

What should be stressed here is that the existing housing stock exceeds that of the new in most developed countries (Housing Europe Observatory, 2023). For instance, in the Netherlands, new constructions account for less than 1% of the existing housing stock each year (Centraal Bureau voor de Statistiek, 2023a, 2023b). This means that today's existing housing stock will account for at least 70% of the total building stock in 2050. Therefore, decarbonizing the available housing stock should be prioritized when concerning the 2050 climate goals.

To overcome building data loss and to increase the data accessibility and interoperability, Digital Building Logbooks (DBLs) were first introduced at the European level to address the fundamental issue of data loss and unavailability that is grounded on the asymmetric and obsolete way of data collection by all relevant stakeholders involved (Gómez-Gil et al., 2022). The DBL is designed to record and trace every change made to a building across its lifecycle, including but not limited to changes in ownership, tenure or use, maintenance and refurbishments. It is intended to be a dynamic tool that enables improved logging, management and accessibility of all data, information and documents on buildings. For that purpose, it holds "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" (European Commission et al., 2020, p. 12).

The proposal to use the DBLs to promote and design building renovation processes, on the other hand, is recent (Gómez-Gil et al., 2022). It was recognized in the Renovation Wave Strategy as an autonomous tool to contribute to "create better conditions for staged renovation[s]" (European Commission, 2020). From what started off as a digital repository, DBLs have since evolved to bear the capacity to convert building data into actionable information for all relevant stakeholders. Essentially, the DBL is founded on the grounds that all information and data stored in DBLs are easily shared between and beyond the stakeholders of the architecture, engineering, construction and operation (AECO) sectors.

However, the built environment and construction sector are traditionally fragmented with the immense numbers of

stakeholders involved. These stakeholders often have conflicting interests; the difference in information needs, use of data and purposes is inevitable. Data that is relevant and of value to every stakeholder involved is often unavailable in one place and a systematic approach to organizing and managing it is largely missing. The challenge thus lies in the gap in the understanding among stakeholders of the overlaps in the data they need in common, as well as the significance of their roles in DBLs and the larger ecosystem.

This paper therefore aims to address the gap in stakeholder understanding in the context of building data in DBLs, emphasizing the importance of cross-sectoral collaboration in data collection and sharing. This paper results in a new framework mapping DBL stakeholders that clearly highlights the importance of engaging stakeholders from both within and beyond the AECO sectors to ensure that: (1) the DBL is used at its full capacity, (2) reliable data is available and can be accessed in DBLs and (3) stakeholders recognize the urgency for cross-sectoral collaboration in data collection and sharing.

Research Methods

The research involved a literature review and qualitative research, in addition to the synthesis of the results from the two methods through stakeholder mapping.

To understand the scope of all internal and external stakeholders involved, this paper first builds on the findings from several EU studies on DBLs. As a starting point, the early report on the development of a European Union framework for DBLs by European Commission et al. (2020) defined and identified the key stages of a building lifecycle wherein the role of DBLs is significant, as well as 17 stakeholder groups from across the entire construction and built environment value chain involved in the process.

This list of stakeholders was refined and categorized in the subsequent DG-GROW project led by Ecorys et al. [1], which aims to develop a European model for DBLs to promote tools and protocols that enable data sharing and usage throughout the construction ecosystem. In their final report, Ecorys et al. (2023) grouped the stakeholders into five main user categories and outlined their potential DBL use based on their needs.

This paper then expands on the initial desk findings through two-part qualitative research: a survey questionnaire and a series of focus group sessions. The online survey questionnaire (65 respondents) was conducted to explore the (desired) roles of the stakeholders in the various DBL systems.

The second part of the qualitative research is conducted in collaboration with Demo-Blog [2]. Short for *Development and Demonstration of Digital Building Logbooks*, Demo-BLog is a Horizon Europe funded project which sees to cultivate a decision support tool that enables existing initiatives to identify optimal sustainability transition pathways that are driven by clustered DBL data. It aims to further exhibit how DBL data can serve to advance the current evaluation strategies for climate and energy transition implemented at various levels in Europe.

Demo-BLog brings together five currently operational DBLs in Europe to develop and demonstrate four diverse functionalities addressing key societal challenges, ranging from ‘quick wins’ to complex industrial transaction objectives including circularity. Table 1 provides and overview of the five DBLs and its active regions.

Table 1: The five DBLs studied in Demo-BLog (Grant agreement ID: 101091749).

Name DBL	Owning bodies	Active regions
Chimni	Chimni	United Kingdom
CLÉA	Qualitel	France
CAPSA	Chillservices	Germany, Scotland, the Netherlands, and Italy
Woningpas	VEKA, OVAM, Wonen-Vlaanderen and Departement Omgeving	Flanders (Belgium)
Cirdax	Re-Use Materials	The Netherlands and Belgium

With Demo-BLog, a series of focus group sessions were conducted to further identify individual stakeholder contributions and significance. The sessions were conducted in four regions where the DBLs studied had the most influence in: United Kingdom, Flanders (Belgium), France and Germany. Table 2 provides an overview on how the DBL is positioned in the four study regions.

Table 2: Overview of the positioning of the DBL in the four study regions (Findings from Demo-BLog).

Study regions	Positioning of the DBL
United Kingdom	The use of a DBL is not mandatory. There are six commercial providers* that together, at the UK government’s instigation, form the Residential Logbook Association (RLBA) to bring the DBLs to a common standard and promote data interoperability.
Flanders (Belgium)	The use of a centralized, government owned DBL, *Woningpas*, is mandatory for all homes in Flanders. It is automatically available for all building owners, both natural persons as well as businesses.
France	The use of DBLs for homes has been mandatory for all new buildings since 1 January 2023. Since then, a DBL must be established at moments of construction or renovation, equipped with an analysis on the environmental impact.
Germany	The use of a DBL is not mandatory. In comparison to the other regions studied, the stakeholders indicated that the lack of building data is most severe in Germany.

**Note that there are other property logbook providers that exist outside of RLBA.*

The synthesis of the review results and the empirical analysis resulted in the subsequent mapping of the stakeholders according to the phase(s) of the building lifecycle in which they are (potentially) engaged to the DBL. The analysis showed that stakeholders can be largely categorized into two groups in the context of DBL data: data users and/or providers. This approach was essential when identifying the type of data exchange that is necessary at various points in the building lifecycle, as well as how the gaps in data sourcing can be resolved with the larger involvement of stakeholders.

Literature Studies

DBLs: EU's solution to data loss and unavailability

The European Commission et al. (2020) describe that "the capturing and maintenance of data and information is the backbone of the DBL". They claim that a systematic, well-organized and standardized scheme for data collection and storage has the capacity to alleviate the following barriers that is observable in the current scene:

"Firstly, due to the absence of a systematic approach to capturing, storing, analysing and organising it, valuable data and information are lost. Secondly, the storage of data is fragmented and scattered across several organisations (and even departments within the same organisation). Thirdly, data that is collected and stored by one individual actor is not necessarily accessible and available to other actors in the value chain." (European Commission et al., 2020, p. 15).

A DBL is thus designed to improve transparency and trust between the various stakeholders involved.

DBL stakeholders as defined by early EU studies

Early European studies on DBLs conducted identified 17 stakeholder groups that are (potential) benefiters and/or contributors of DBLs (European Commission et al., 2020). Table 3 provides an overview of the list.

Table 3: 17 stakeholder groups as identified by the European Commission et al. (2020).

Stakeholder groups
Landlords and owner-occupiers (incl. prospective buyers and sellers)
Tenants
Designers
Developers
Construction contractors
Investors
Banks and insurers
Material suppliers (incl. urban miners)
Facility and building managers
Demolition contractors
Public authorities and policymakers (ie. urban planners)
Real estate agents
Researchers
Utilities
Certifiers
Lawyers, solicitors and conveyancers
Valuers

Lifecycle approach and users of a DBL

Opportunities for data collection are present at every stage of the building lifecycle, and they each exhibit different needs of data usage (European Commission et al., 2020). Naturally, every stakeholder requires access to accurate data that can seamlessly address their needs at different points of the building lifecycle. For the AECO sectors — and any other relevant— to leverage the full potential of structured data, the processed information should be transferred and available integrally throughout the entire building lifecycle. Figure 1 presents the preliminary stakeholder mapping in relation to the DBL conducted by the European Commission et al. (2021).

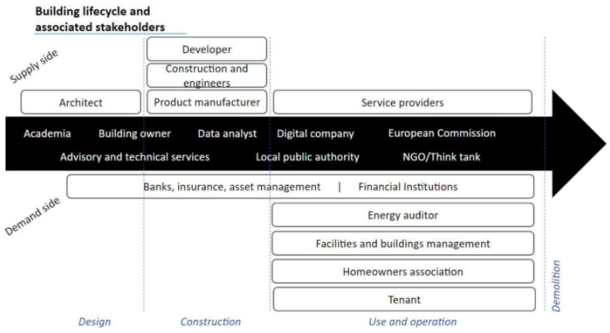

Figure 1: Stakeholder mapping in relation to the DBL (European Commission et al., 2021).

Figure 2 illustrates the simplified building lifecycle, with the phases in which the various stakeholders interact with the building defined.

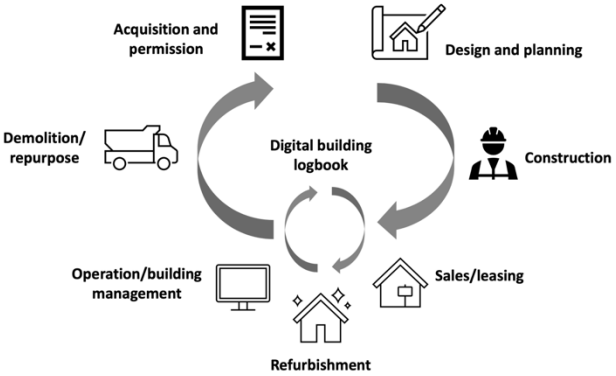

Figure 2: Simplified building lifecycle and the role of the DBL (European Commission et al., 2020).

In the context of DBLs and data, the various phases can be grouped to three larger phases (European Commission et al., 2020). Firstly, the design, planning and construction phases present the prime moment for the collection of data on the physical characteristics of the building, including information on the materials used and where they are located in the building. The collected information can then be used to prove compliance with building regulations and certification schemes (European Commission et al., 2020). Functionalities such as the

construction project management can be used to ease information sharing between the various stakeholders involved, and the primary stakeholders in these phases can be said to be designers, architects, developers, contractors and material suppliers.

In the sales and/or leasing, operation and property management phases, data collection largely revolves around the operation and performance of the building. Such data may touch on maintenance, ownership transfer and change of use. The processed information can then facilitate, for instance, the identification of maintenance and renovation needs, the monitoring of user behaviour and the tracking of administrative requirements (European Commission et al., 2020). The information is likewise important for financing, as well as transaction underwriting and execution. Key stakeholders include building owners, tenants, facility managers, utility companies, real estate service providers, energy auditors, contractors and the financial sector.

The repurpose or demolition phases make use of all the data collected on the building, its composition and materials to support decision making processes when strategizing the next best step for the building; be it to refurbish, repurpose or demolish, or to optimize or extract the most value from recycling the building materials (European Commission et al., 2020). Key stakeholders include building owners, demolition companies, product maintenance service companies and recycling companies.

Considering the complexity and fragmented nature of the AECO sectors, it is evident that the data architecture of DBLs should place extra emphasis on the diversity in the data source including both legacy systems and state-of-the-art, the interoperability of the tool, as well as potential third party data processing tools and sources.

Recent findings from Ecorys et al. (2023)

In the subsequent DG-GROW project, the stakeholders that were identified by the European Commission et al. (2020; see Table 3) were grouped into five main user categories as can be seen in Table 4 (Ecorys et al., 2023).

Table 4: Five user categories as identified and defined by DG-GROW (Ecorys et al., 2023).

User categories	Primary use of a DBL
Governmental agencies (GA)	To obtain insights for policymaking, the issuing of licenses and enforcement of regulation and disaster management
Construction sector (CS)	To obtain building-related information on the design and build.
Building owners (BO)	To collect information about their buildings for exploitation and maintenance purposes.
Financial institutions (FI)	To perform analysis based on formulas to gain insight into the assets market and its developments and gain an understanding for building transactions.
Utility companies (UC)	To obtain information on the connections of utilities to the building and the analysis of its uses, and provide information related to building use or performance.

The study later developed to creating user journeys of the five user categories that highlights the (potential) use of the DBLs of each category. The exemplified user journeys of the four user groups can be seen in Figure 3.

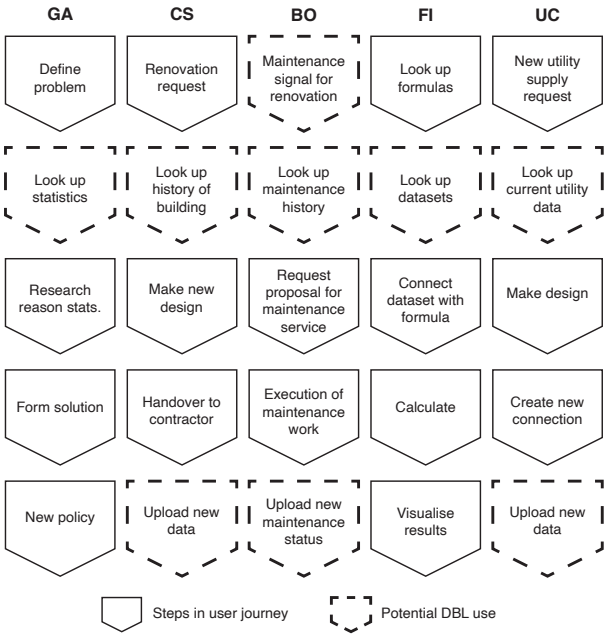

Figure 3: The exemplified user journeys of the four user categories and their potential use of the DBL (Ecorys et al., 2023).

A key finding that is significant in this study is that some stakeholders, in this case the CS, BO and UC user categories, are seen as both data users and providers. This multiplicity in the roles of the stakeholders at different phases of the building lifecycle in the DBL system provides a new light to the research on DBLs, that the two-way interaction between stakeholders and the tool, and the need for stakeholders to proactively engage with the DBL to ensure that the data stored therin is updated, accurate and remains valuable.

Survey Findings

We conducted a survey among those stakeholders identified from available literature —including but not limited to building professionals, building owners, data owners, government agencies— to identify the requirements, functionalities and benefits that are relevant to the stakeholders; for instance, data, equipment and technology, standards, and benefits such as decarbonisation, cost efficiency, resource allocation and access to trusted and traceable information. Table 5 provides a breakdown of the survey participants.

Table 5: Breakdown of survey participants in stakeholder groups.

Stakeholder group	%
Landlords and/or leaser	5
Owner-occupiers	18
Tenants (Lessees)	5
Architects and designers	5
Developers (Real-estate)	2
Banks and/or insurers	1
Building material suppliers	2
Facility and/or building managers	2
Valuers	1
Certifiers	3
Researcher	20
Public authorities	11
Policy makers	4
Other*:	21

**Other stakeholder groups as indicated by the respondents include DBL providers, service designers, data(base) companies and providers, as well as IT developers.*

Findings from the survey that is relevant to this paper can be largely categorized into two themes: data collection and data accessibility. On the former, the survey helped prove a valuable hypothesis; while stakeholders can benefit as users of the tool and the data therein, they can simultaneously play the role of data providers. Though the level of responsibilities across the data fields may differ, building owners, public authorities, building experts, financial institutions, and both public and private registers are perceived as equally valuable (potential) data providers for the efficient collection of building data.

For instance, homeowners, construction contractors, architects and facility managers are not only identified as crucial data providers for their role in updating every change made to the homes into the DBL, but are equally active data users when assessing and planning the necessary retrofit works. Government authorities can provide access to public databases that would supplement the data in the individual DBLs, while policymakers need the overview of the housing stock to efficiently distribute resources. Financial institutions, in contrast, would be active data users for efficient valuations of homes and encourage a wider roll out of DBLs in the market.

The survey also emphasized on the importance to note that the role of the stakeholder as data providers is not one-off. To ensure that the building data provided by the DBL is up to date, the regular revisions of building data is fundamental, imposing that the continuous engagement of the relevant stakeholder to the DBL throughout the entire building lifecycle is crucial.

When concerning the issue of data accessibility, the survey identified a list of third parties that could and/or should be granted access to (part of) the data a DBL holds. Several stakeholders raised here include buyers, architects, energy advisors, notaries, material and utility suppliers, estate agents, property lawyers, enterprises, financers, assurers, housing advisors and service providers. It can be deduced from this list that stakeholders across the entire construction and built environment value chain should orbit around the DBL, for the benefit of greater overall sectoral transparency, value chain integration, innovation and circularity.

Focus Group Sessions

Findings from both literature and the survey were thereafter employed in the composition of the focus group sessions with key stakeholders from four DBL-active regions: United Kingdom, Flanders (Belgium), France and Germany. Participants for the sessions were gathered through consultations with the DBL providers. 19 key stakeholders were identified as crucial contacts in the implementation and development of the DBLs across the four regions. Table 6 identifies the location and domains of the focus group participants.

Table 6: Breakdown of focus group participants.

Location	Participant	Stakeholder domain(s)
United Kingdom	1	Quality scheme
	2	Quality scheme
	3	DBL provider and DBL trade body
	4	Energy accreditation scheme I
	5	Energy accreditation scheme II and energy professional
	6	Independent climate organization
Flanders (Belgium)	1	Government climate agency I
	2	Government climate agency II
	3	Homeowner association
France	1	DBL provider
	2	DBL provider
	3	Certification scheme
	4	Consumer association
Germany	1	DBL provider
	2	Building professional (academia)
	3	Independent consultant and surveyor
	4	Climate professional
	5	Independent organization
	6	Energy innovation community

The aim of the focus groups was to study the optimal DBL performance in the respective regions. Part of the session was reserved to further distinguish individual contributions and significance of the stakeholders relevant to the operational DBLs and construction systems of the four regions. This was conducted in the form of a collective stakeholder mapping exercise, where participants of various domains in the study region collaborated in creating the matrix together.

From the focus group sessions, it was deduced that the differences in the language, operations and organizations of the construction sector, as well as the legal framework of a specific geographical region influence the defining and mapping of DBL stakeholders to a large extent. The variance in the regional positioning of the DBL and the

developments of the tool in relation to the implementation and technological levels, public awareness and locally available tools —such as public databases and energy accreditation schemes— naturally increased the complexity in identifying and defining relevant DBL stakeholders in the different practical environments. Ultimately, the survey questionnaire and the focus group sessions collectively identified 38 stakeholders that are used in the subsequent mapping exercise, as can be seen in Table 7.

Table 7: 38 stakeholder groups identified from the qualitative studies.

Stakeholder groups	
Owner-occupiers	Real estate agents
Architects and designers	Investors
Construction contractors	IT providers
Certifiers	Local authorities
Public authorities	Public waste agency
Policy makers	Guarantee bodies
Facility and/or building managers	Distribution network operators (DNOs)
Landlords and/or leasers	Renovation advice providers
Researchers	Service designers (UX)
Banks and/or insurers	Retrofit service providers
Utility providers	Social housing providers
Building material suppliers	Surveyors
Developers (real-estate)	Building safety regulator
Tenants (Lessees)	Competent person schemes
Valuers	Energy data providers
Demolition contractors	Funding party
Energy experts	Maintenance contractor
Energy suppliers	International organizations
Data companies (inventories and registering)	Lawyers, solicitors and/or conveyancers

DBL stakeholder mapping exercise

With the information gathered from desk research and preliminary analysis, a mapping template was created to then compare the results with how the stakeholder roles are perceived in practice. Figure 4 (see next page) provides an overview of the combined findings of the four focus group sessions that was later validated by Demo-BLog experts.

The approach to DBL stakeholder mapping proposed in this paper builds on the approach undertaken by European Commission et al. (2021; see Figure 1). Similarly, the mapping of the DBL stakeholders in this exercise is likewise two-part: (1) distinguishing the role of a stakeholder as a data user and/or provider along the horizontal axis of the matrix and (2) identifying the phase(s) in the building lifecycle in which the stakeholder is engaged along the vertical axis.

On the former, a data user is defined to be benefiters of the building data stored in the DBL. These stakeholders need specific data to address specific needs. For instance, an owner-occupier may want to observe data on the energy consumption of the home to identify energy-saving practices. A data provider on the other hand represents the supply side of the spectrum. Taking the same example, the utility providers may either provide monthly statements on the energy consumption of the home or install meters that provide real-time information on the energy use. The significance of stakeholders of both categories is also measured in the matrix to distinguish the levels of value and contribution per stakeholder.

The phases in the building lifecycle were first defined through desk research on the preceding European studies as was discussed in earlier sections of this paper, refined later with the inputs from the focus group studies on the operational aspects of the DBLs in the regions studied.

Every stakeholder analyzed in this mapping exercise is tagged to the relevant region to provide context on the difference in stakeholder roles and significance in the locations studied. As indicated in the legend, the stakeholders raised in the discussion in Flanders (Belgium), are tagged in orange, France in blue, Germany in green and the United Kingdom in pink.

Several ambiguities were raised in the validation stage of the stakeholder mapping. Conclusions largely orbit around a common observation: there is too little overlap between the DBL active regions than was hypothesized. A number of causes were identified here:

1. Inconsistencies in the representation of the stakeholder groups during the focus group sessions;
2. The inclusion of personal aspirations rather than reflect how the DBLs are used at volume; and
3. Gaps in terminology due to differences in processes and language.

However, the exercise itself proved that a critical reflection into the AECO sectors as well as the legal and operational systems in specific regional contexts is fundamental when defining the stakeholders of the DBL.

For instance, the roles of the competent person schemes, guarantee bodies and existing renovation advice and/or service providers in the renovation phase of the building are unique in the United Kingdom, while these roles are most likely present in different entities in other regions. In Flanders on the other hand, energy experts and the public waste agency exhibited great interest in the available DBL data in both the pre-use and the end-use phases of the building to identify how the (newly) available resources can be redistributed.

Being able to identify how the roles are dispersed across unique legal systems and the various steps involved has shown to help create discourses around the DBL and the possibilities of data sharing among stakeholders of different domains. Such discourses are crucial to close the gap in understanding among these stakeholders to not only increase efficiency in the collection of building data, but also the awareness on the significance of their roles in DBLs and the larger ecosystem to ensure that the collaboration between the sectors is present. The common

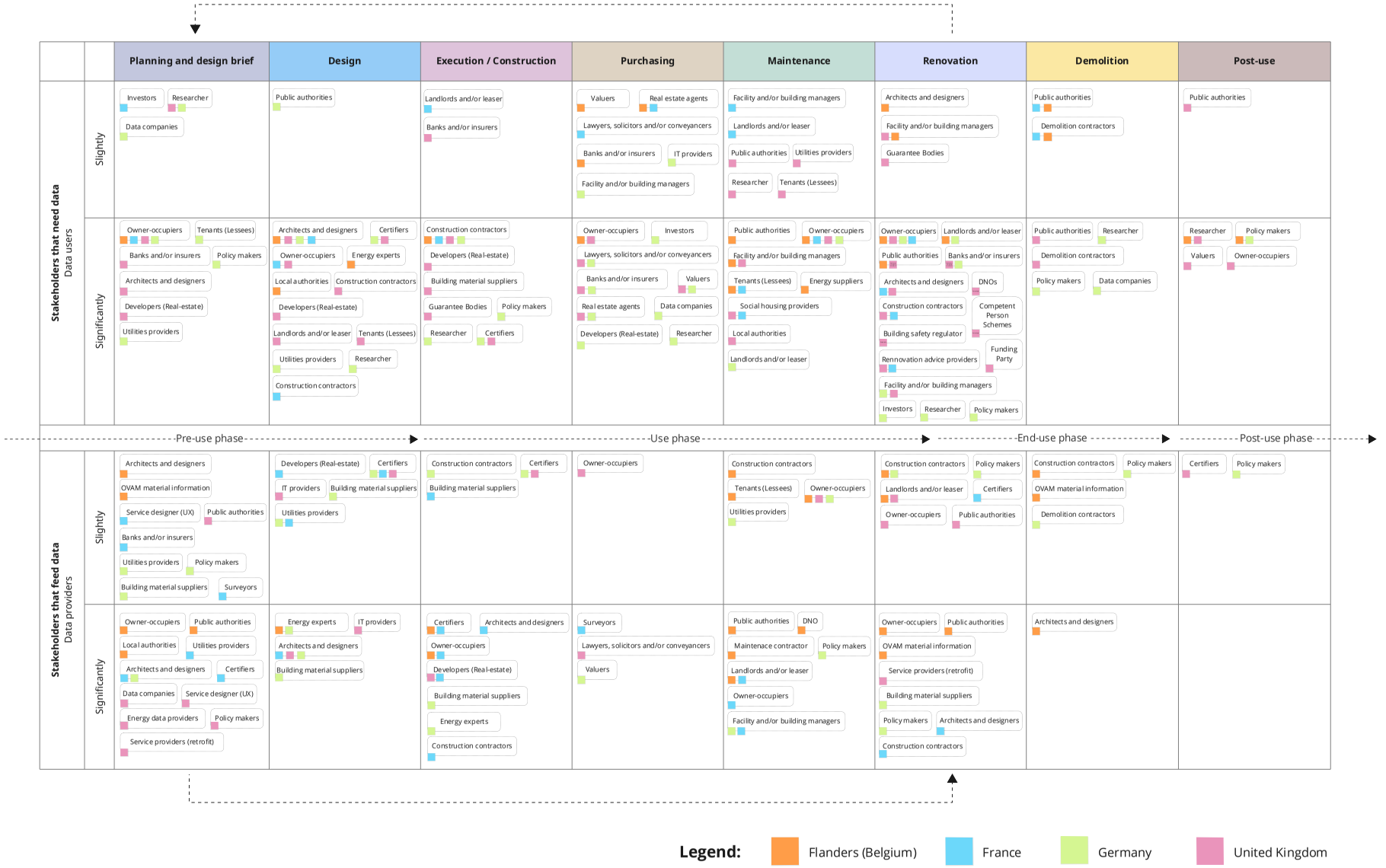

Figure 4: Combined findings of the stakeholder mapping with key stakeholders in the four regions studied, validated with DBL experts (Original work created for Demo-BLog, 2023)

consensus established will then positively open opportunities to further develop a centralized data collection method, a holistic quality scheme for the data collected, as well as the interoperability of the DBL that provides a secured platform for data sharing.

Conclusions

This paper discusses the challenge of stakeholder understanding in the context of digital building logbooks and calls for a wider discourse around the DBL for the cross-sectoral involvement in data collection and sharing. This is a crucial and challenging topic because the DBL and the EU policies around it are still under development. Previous studies indicated that a lifecycle approach to identifying DBL stakeholders is key, but the regional context must likewise be adequately anticipated to yield improved stakeholder engagement.

The findings of this paper indicate that the existing European approaches to DBL stakeholder mapping require a more critical approach. This paper therefore proposes a more comprehensive methodology which involves co-creation between stakeholders of various domains across the construction market value chain and a mapping matrix to visually represent the DBL stakeholder ecosystem that is unique to specific contexts. A key takeaway from this exercise is to place emphasis on the fact that the engagement of the stakeholder to the DBL is two-way, and stakeholders should be viewed as both data users and providers. This additional step helps provide an indication to the overlaps in the inflow and outflow of DBL data among stakeholders, therefore demonstrating the relevance of building data for all identified stakeholders.

Acknowledgments

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Notes

[1] For more information on the DG-GROW project, see https://www.ecorys.com/case-studies/technical-study-for-the-development-and-implementation-of-digital-building-logbooks-in-the-eu/.

[2] See https://demo-blog.eu/ for more information on the Demo-BLog project.

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