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CONNECTING DOTS: HARNESSING DIVERSE PERSPECTIVES FOR THE INTEGRATION OF DIGITAL BUILDING PERMITS AND LOGBOOKS

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Abstract

The integration of Digital Building Permits (DBP) and Digital Building Logbooks (DBL) is increasingly recognised as essential for sustainable and data-driven construction and building lifecycle management. This study examines how European initiatives, including permitting platforms, logbook gateways, city Digital Twins and building stock observatories, contribute to DBP and DBL integration, often implicitly. Using a step-by-step thematic analysis of stakeholder and expert interviews, the research identifies shared data foundations, maturity gaps and governance challenges. The findings outline initial pathways for aligning fragmented initiatives and support the development of coherent and interoperable DBP and DBL ecosystems.

Introduction

The pace of digitalisation in the built environment sector has gained new momentum amid growing sustainability focus (Papadaki *et al.*, 2023). Requirements in terms of energy efficiency, the rational use of resources, and the implementation of more circular practices have led to new demands for data availability and accessibility, while also giving purpose and direction to the digitalisation of processes (European Parliament and European Union Council, 2022). Data-driven instruments, long assumed to be needed, are emerging, such as the Digital Product Passport for Construction (DPP_C) and the Digital Building Logbook (DBL) (Papadaki *et al.*, 2023). These instruments are intended to span many domains, aiming to meet the abovementioned requirements. Also, they are meant to work in combination with existing digital technologies such as Building Information Modelling (BIM) and Geographic Information Systems (GIS), to name a few (Calvetti, Mêda and Sousa, 2021). There is the intuition that several initiatives not specifically targeting DPP_C and DBL are already using or will need to use the same data. Not recognising the connections can introduce several constraints on the path towards efficiency, sustainability, and modernisation in the construction and built environment sectors. Therefore, this study seeks to identify whether there are connections to be made by considering diverse perspectives. Based on the observations, it aims to provide initial guidelines that support different paths to achieving a common goal, with a main focus on DBL.

The DPP_C focuses on product data. Within the context of the new Construction Products Regulation, it serves to disclose the declaration of performance and conformity, including the essential characteristics, and to enable harmonised marketing across the EU (European Parliament and the Council of the European Union, 2024b). Furthermore, the digital tools developed are designed to preserve the data and expand their use, as the products will be incorporated into construction projects and built objects (European Parliament and the Council of the European Union, 2024b). The DBL is building-centred (Mêda *et al.*, 2022). It is envisaged as a multi-level, multi-layer information container that collects, connects, and supports relevant construction-related data at land cadastre, built object, and building unit levels, to be made available for multiple purposes (Grow, 2023). Its initial motivation was the energy performance of buildings, establishing a common framework and data points for this specific output (Gómez-Gil, Espinosa-Fernández and López-Mesa, 2022). However, it was realised that, given the data requirements, a set of additional purposes could be achieved within the same effort (Gómez-Gil *et al.*, 2022). Notwithstanding, the energy-related purpose has been a major driver, and this is now part of the EU legal framework under the new Energy Performance of Buildings Directive (EPBD) (European Parliament and the Council of the European Union, 2024a). The observation of the relationships at the building level and construction process life cycle led to exploratory research on the alignment, benefits and synergies with another long-recognised research domain, critical for the efficiency of building construction; the building permitting process (Noardo *et al.*, 2022; Fauth and Seiß, 2023; Fauth *et al.*, 2025). Further, the EU's Renovation Wave strategy and the Affordable Housing plan heavily rely on data to increase knowledge of the European built stock, its uses, performance, and resource potential, among other key figures (European Commission, 2020, 2025). Digital instruments are needed to collect, manage and process that data. The DBL, the Digital Building Permit (DBP), other associated concepts and the Digital Twin (DTw) platforms are fundamental pieces to make it happen (CEN/TC 442, 2026)(Calvetti *et al.*, 2025).

The present study, grounded on the constructivist paradigm (Cobb, 2006), builds on recent works that have demonstrated the relationship between the DBL and the

DBP concepts and, subsequently, the added value of assessing and forecasting the potential synergies between them (Mêda, Fauth, Schranz, Sousa, *et al.*, 2024; Mêda, Fauth, Schranz, Urban, *et al.*, 2024). Moreover, this work aims to explore further how various initiatives currently underway can contribute to this integration (Fauth, J.; Mêda, P.; Gisbert Ferrer, P.; Flickenschild, M.; Babok, 2025). A step-by-step thematic analysis (Naeem *et al.*, 2023) is conducted based on interviews with qualified stakeholders with in-depth knowledge of the permitting and logbook domains. The selection is related to their involvement in the development and implementation of initiatives in affiliated domains. This enables qualitative assessments based on diagrams to define a conceptual model, supported by a maturity framework, for DBP and DBL integration. The aim is to discuss the need to set paths that can help industry stakeholders understand the landscape of concepts and how initiatives pointing to other goals can be adjusted or already partially cover the scope of what DBP and DBL want to achieve. In this sense, the research questions are as follows: Considering different existing initiatives, how do they perceive DBP and DBL integration? Considering their specific objectives, how can these initiatives contribute towards that integration? Which actions (maturity increments) can be done to foster that integration?

Following this Introduction, the present research starts with a background that systematises the problem and the contributions from previous research. The explanation of the methodology employed follows to present the results from the thematic analysis. A discussion on the main aspects to be considered as part of a maturity framework is provided, together with study limitations and future perspectives. The work finalises with a conclusions section in which the answers to the research questions are presented.

Background

The Transition pathway for Construction has paved the way for the industry to advance towards the green and digital transition goals (Papadaki *et al.*, 2023). Despite developments and evolutions in understanding, this document remains a cornerstone of the EU's strategy for a Sustainable Built Environment (SBE).

The accomplishment of an SBE relies on the ability to have available buildings/built stock data for a wide range of purposes, from theoretical models of energy efficiency to energy performance monitoring, space identification and their maintenance plans and requirements, bill of materials, quantities for reuse/recycling, change of ownership, dangerous substances in products, planning of investment needs, among others. The DBL, working as a DTw enabler at the building level (Staff, 2021), helps unlock the buildings' unawareness of these dimensions.

However, a DBL needs to be deployed early in the design phases and will need to interact with databases, processes, platforms, and tools to link, collect, organise, compile, and manage data points (Mêda *et al.*, 2022). While BIM is often identified as one of the main components of digitalisation strategies for construction, those often struggle to explore metadata or the Level of Information Need (LOIN) in the BIM model (ISO, 2018). Data-driven processes, such as building permitting, require a clear identification of the required data points (Bloch and Fauth, 2023). Significant research exists on the digitalisation of building permits, with some focusing on BIM (Ullah, Witt and Lill, 2022).

Interestingly, despite the research community's growing interest in DBL, this remains quite unknown (Fauth, J.; Mêda, P.; Gisbert Ferrer, P.; Flickenschild, M.; Babok, 2025), meaning that stakeholders recognise the need for a type of database or information container capable of capturing and retaining the necessary data, but don't assume it as a logbook. This realisation was only perceived during the study on the synergies between DBL and DBP (Fauth, J.; Mêda, P.; Gisbert Ferrer, P.; Flickenschild, M.; Babok, 2025). The study findings confirmed that integration between logbooks and permits is both feasible and emerging, creating opportunities to reduce duplication, automate compliance checks, and streamline processes. The benefits range from improved housing delivery to more accurate environmental performance and administrative efficiency. It is worth highlighting efficiency gains from faster procedures, as well as improved transparency and trust through centralised, validated data (Fauth, J.; Mêda, P.; Gisbert Ferrer, P.; Flickenschild, M.; Babok, 2025). However, not understanding how relationships and interactions work across different perspectives or purposes is more than just a challenge; it can lead to misunderstandings. These misunderstandings can result in shortcomings, inefficiencies, and, more critically, blockers and frustrations regarding the innovations being implemented.

Research on permits is more extensive, with multiple relevant contributions. Recently, several European projects have been finished. These have helped people understand the differences between EU countries and the plans to make building permits more digital (European Commission, 2023). In this context, and with relevance to the present study, four maturity levels have been established regarding DBPs. They are as follows: 1) paper-based, 2) digital paper, 3) digital BIM-based process, 4) digital BIM-based process with GIS (European Commission, 2023).

Methodology

As mentioned, the present research builds on previous work, including desk research (Moore, 2018) and literature reviews, to provide an overview of existing scientific studies and strategic documents at the EU level focusing on DBL, DBP, and their combination. As part of those studies, a series of semi-structured interviews was performed to capture impressions from a sample of relevant stakeholders directly involved in digitalisation initiatives, with additional insights from experts (Fauth, J.; Mêda, P.; Gisbert Ferrer, P.; Flickenschild, M.; Babok, 2025). These interviews lasted about 1 hour and were conducted in October/November 2025 (Table 1). A semi-structured interview guideline was intended to cover several topics related to permitting and logbook

integration, with a focus on housing projects. The interviewees gave their permission for transcription. To ensure confidentiality, sensitive data were anonymised.

Table 1: Example of a table where the caption should be on top of the table

	Stakeholder type	Exper-tise	Country Region	Experi-ence
1	Municipality Dep. Head	DBP	Estonia	10 years
2	Project manager	DBL	Flanders	10 years
3	Project manager	DBP/GIS	The Netherlands	10 years
4	Municipality Dep. Head	DBP	Austria	15 years
5	Project manager	EPBD	Europe	15 years

Given the specific contexts and objectives, different conventions were used to express similar topics. Therefore, a step-by-step thematic analysis process, as proposed by Naeem (Moore, 2018), was followed. This process comprises the following steps: 1) Transcription, familiarisation with the data and selection of quotations, 2) Selection of keywords, 3) Coding, 4) Theme development, 5) Conceptualisation through interpretation of keywords, codes and themes. Despite familiarity with the data, transcription and selection of quotations from the recordings were performed manually for each interview from start to finish. This was because the important information was scattered across different places rather than presented as answers to specific questions. The next step involved selecting relevant keywords to explain and define the objectives and key features of the initiatives. However, because the interviewees had different nationalities, it was necessary to take two distinct analytical steps to ensure everyone understood the topic the same way. 1) Relationship between different concepts in each initiative; 2) Classification of keywords in the following categories: “scope”, “data type”, “process/deliverable”, “concept”, “requirement/rule” and “technology”. Implementing these steps involved coding and theme development. An inductive coding approach was practised as the concepts emerged directly from the interview data. To ensure coding consistency, an audit trail was established. From the initial narrative descriptions of each initiative, keywords were refined to yield the final themes, along with diagrams summarising the descriptions. Specific colours and shapes are used to highlight the labelling in the diagrams. These elements are detailed in the following section.

Results

This section addresses the individual results based on the thematic analysis steps. Descriptive overviews of the initiatives and the simplified diagrams are presented. Due to space constraints, the description was preferred over the diagrams. However, a more complete graphical perspective is provided for the first case presented to exemplify the work performed. Additionally, authors use dashed lines on the diagrams to show ongoing and future developments. As mentioned before, from existing studies and the initiatives to be presented, the integration between the DBP and the DBL has not been the focus or the driving objective. The section ends with an analysis of all the cases, identifying the overlaps and setting a common framework.

Digital construction platform (Estonia)

Regarding the e-construction platform initiative in Estonia, here defined as digital construction platform (for generalisation purposes), the developments were focused on achieving a multi-module solution that could 1) Contribute to the establishment of a Digital Twin at the country scale; and 2) Set a governance framework for construction processes life cycle digitalisation. To put these aspects in place, BIM and GIS were considered, along with existing legacy documentation and data points, such as the national building registry, the cadastral database, and land spatial planning. Other relevant data types were considered, such as the ownership, tax data, utilities networks and consumption data (energy and water). Some of these legacy data types originate from building permitting processes; therefore, BIM-based permitting was implemented to streamline compliance checks and assessments for issuing permits and to make relevant data available for other phases of the construction life cycle. Although the DBL is not a clear and individualised concept in the system, many of the data types, data points and potential features are considered, making its materialisation as a “*de facto*” feasible concept (Figure 1).

In summary, this initiative demonstrates a high level of maturity in digitalisation and, more importantly, in the relationship between processes, requirements, data types, and legacy databases to materialise a Digital Twin at the country level. A strong concern was expressed regarding the necessity for the country to invest in achieving a common national information ground (for buildings and other construction types and layers), despite the potential interest in supporting owner-specific needs. The building dimensions are paramount in the strategy, and although the DBL was not recognised as a component of the system architecture, its role, positioning, and potential uses are recognised. Moreover, substantial DBL data and associated features are already embedded in the system.

Logbook-centered initiative (Flanders)

This initiative assumes as its main objective providing a single data gateway for building owners (residential and non-residential) to have access to relevant buildings' legacy data. Many features of the DBL are covered by this gateway, which centralises existing data from Governmental and municipal databases, including those for spatial planning and environment, heritage, building registry, energy and water supply and consumption, building quality, materials, and waste. It should be noted that this is official national data. However, building owners are at liberty to contribute additional information and data points to the gateway, including alterations and

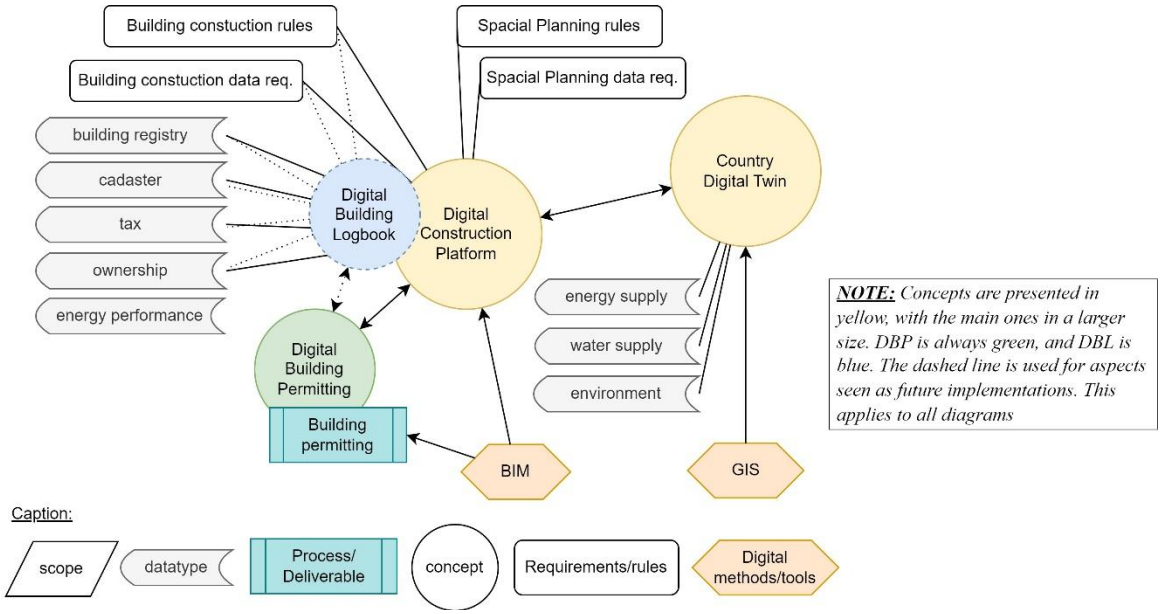

Figure 1: Schematic diagram of digital construction platform

maintenance actions. Following an initial development, setting a relationship with the building permitting processes was identified as a strategic step. In this respect, metadata and documentation for the initial permit and subsequent permits can be tracked. It is recognised that this DBL's primary concern is capturing legacy data and making it available. Improved features are required to capture additional data types and more dynamic data. In this respect, the forecasted steps align with the goal of developing a city platform where these features will be developed and integrated with the DBL (Figure 2).

In this case, the initiative began without searching for an integration between DBL and DBP. During development and implementation, it was recognised that this would not only make sense but could also add value to the initiative's governance.

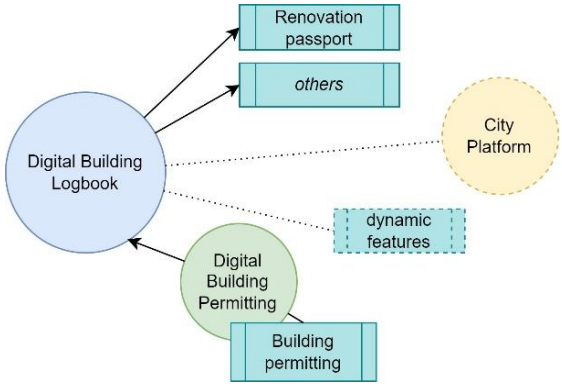

Figure 2: Simplified diagram for the initiative focused on the DBL.

City Digital Twin (The Netherlands)

The aim of this initiative is to build a platform that can materialise a digital twin at the city level. At the core of the goals is improving city operations in terms of efficiency, costs, and resource consumption. To accomplish them, several data sources were brought together from city maps, georeferencing systems, transport network information, and buildings' blueprints. The next step aimed to create a 3D city model. In this respect, and with regard to buildings, this requirement aligns with existing building permitting requirements, which already demand a BIM methodology and establish a set of information delivery specifications focused on openBIM. Linked data is used to aggregate data from the building level to the city level (Figure 3).

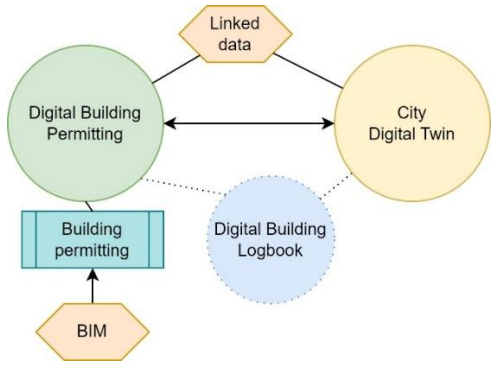

Figure 3: Simplified diagram for the initiative focused on the city's digital twin.

In this process, it made sense to integrate BIM-based permitting processes into the city's digital twin platform to enable observation of construction evolution related to DBP procedures and to streamline compliance checks for subjects such as spatial planning and available utilities. It is recognised that, for now, most available building data reflects the "as-design" condition, and only specific data points reflect the "as-built". However, this is part of the developments under consideration.

In summary, although the DBL was not recognised as a component for the city's digital twin systems architecture, its role, positioning, and potential uses were perceived. It was clear that logbook data and some features are already embedded in the system, although not structured with the vision of providing a structured Digital Building Logbook.

Single gateway for municipal permitting (Austria)

In this case, the initiative originated from the idea of centralising all permitting procedures on a single platform. Considering the wide range of permits that citizens can request from an authority, from kindergarten for children to car parking spots, urban waste containers, or construction operations, just to name a few, the objective was to provide a common access point. In this respect, building permits were identified as one of the relevant types to consider. The developments centred on dematerialising the process by establishing digital mechanisms and disclosing common rules for submissions by type. This new system links with the authority that receives all required documentation in PDF format to start the compliance checks. It is recognised that, at this moment, the system is working as intended, but there is the notion that improved digitalisation can be incorporated into building permitting procedures, namely through the use of BIM, augmented reality, and artificial intelligence (Figure 4). In this respect, considering the growing requirements for permitting in terms of data; as CO_2 consumption, materials used and recycling potential, among others; having all building-related data in one place — the logbook — would improve the initiative's goals.

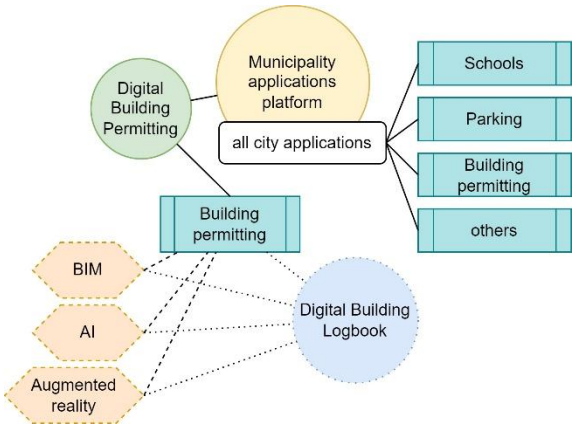

Figure 4: Simplified diagram for a single gateway for municipal permitting.

The building permitting processes require substantial documentation, and new requirements are being introduced that will increase the amount and complexity of that documentation and the compliance-checking procedures. It is acknowledged that digital technologies will be pertinent in addressing and rendering the new requirements tangible. The concept of a "data lake" storing all pertinent building information with the objective of streamlining the permitting process is both desirable and advantageous for a range of other requirements that extend beyond the scope of permitting. In this respect, it is important to be aware of how a DBL can quickly meet requirements for materials and recycling.

Building stock observatory (Europe)

Despite the different scope and dimensions, addressing this initiative is relevant given its alignment with the research's scope and the additional layer it adds to national-level initiatives. The EU building stock observatory is associated with the Energy Performance of Buildings Directive (EPBD) and aims to cover a broad range of energy-related topics, including energy consumption, building elements and installed technical building systems, energy performance certificates, nearly zero-energy buildings, and renovation rates. In this respect, renovation passports and the energy performance of buildings databases defined in Article 22 of the EPBD constitute key data sources (European Parliament and the Council of the European Union, 2024a). The EU building stock observatory combines data from member states on the energy performance of buildings, building types, building registries, and the number of permits by type. This information originates from multiple databases maintained by statistical bodies and authorities responsible for issuing energy performance certificates (EPCs). While these mechanisms are recognised as being important for the observatory's initiation, it is acknowledged that reducing data duplication, enhancing systematisation, and ensuring more reliable and accurate data are pivotal considerations. In this respect, the logbook is envisaged serving as the repository for the building's data, interacting with and collecting data from processes throughout the building's life cycle, such as permitting, renovations, maintenance, and other events (Figure 5).

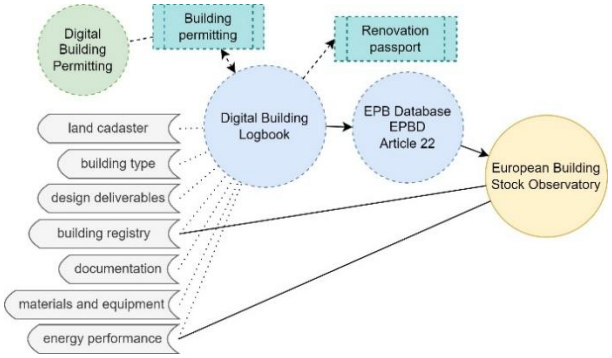

Figure 5: Simplified diagram focused on the Building Stock Observatory.

Despite the fact that this initiative is firmly rooted in the energy performance of buildings, it was acknowledged that its success will be contingent on the successful organisation of all relevant building data. Energy-related data constitutes only a fraction of this, with additional data sources including the technical solutions employed, equipment, spatial dimensions and orientation, among others. In this particular context, it is noteworthy that the DBL is mentioned in the EPBD in relation to the renovation passport. Considering that a substantial part of the observatory data comes from statistical offices, it is relevant to note that its origin lies in permitting processes. Therefore, although not explicitly mentioned, the outcomes of permitting play a critical role in enabling the observatory as it works today, suggesting that more digital processes in permitting would be beneficial.

Setting a common ground

Despite the varying scopes of the initiatives, a strong overlap and a sequencing of objectives can be established, as these work with building data and processes associated with building construction (building permitting) and operation (energy efficiency). Of greater significance is the observation that DBP and DBL are prevalent despite the variations.

The thematic analysis indicates that the integration of DBP and DBL is widely recognised as both desirable and feasible. However, it was not explicitly included in the initiative's initial objectives. Furthermore, in the post-interview period, integration is regarded as being of the utmost importance. This, despite the general absence of DBL realisation at the time when the development strategies for the initiatives were formulated. In most cases, this is justified because the DBL studies were still being developed or because the widespread understanding of its role was still very low.

It is also worth noting that existing data sources are already related, linked, or associated with DBP or DBL-like functionalities. Building registry data, ownership, tax, design deliverables, energy performance, or legal documentation for building use constitute good examples. However, in terms of support, these can still be paper-based, PDF-based (images or metadata), GIS- or BIM-based (metadata), or a combination of these. On another level, city or country existing data sources, such as land cadaster or spatial planning, as well as characteristics of facilities such as water and energy supply, environmental constraints, among many others, also provide similar support. This represents a critical aspect that enables not just logbooks and permits, but also all the objectives mentioned for each initiative. In this respect, the gaps regarding a common national information ground, the uneven maturity across municipalities/countries, the confusion about definitions (stakeholders may want a "data container" but not call it a logbook), the varying data quality ("as-design" vs "as-built"), the governance and ownership questions, the compatibility with legacy systems, and scalability of metadata/LOIN definitions should be assumed as main barriers and concerns. Figure 6 aims to combine, in a single diagram, all the concepts, data types, digital methods/tools, and processes/deliverables that were approached individually.

Discussion

Digital Building Permits and Digital Building Logbooks are common and are perceived as critical to the success of initiatives like the ones explored. Increasing the maturity of each concept and working on its integration will expand the capabilities of city and country platforms, boosting the data availability, relationship and accuracy for the European Building Stock Observatory and, more importantly, improving the knowledge on buildings and their units for a wide range of stakeholders and purposes, from ownership management, real estate, city governance, and networks capacity, among many others.

Previous studies (Fauth *et al.*, 2024, 2025) demonstrate that building permits vary substantially from a process perspective. However, the object is the same, meaning that there is a common ground for the data needed to run these processes. Digital Building Permits already have maturity levels associated. It is evident that the initiatives under consideration vary in their DBP maturity, as indicated by the available information. With regard to the DBL, the establishment of maturity levels remains to be accomplished, a prerequisite for the formulation of a maturity framework centred on their integration.

In this respect, the present research points out some relevant aspects that will need to be considered in that definition, such as:

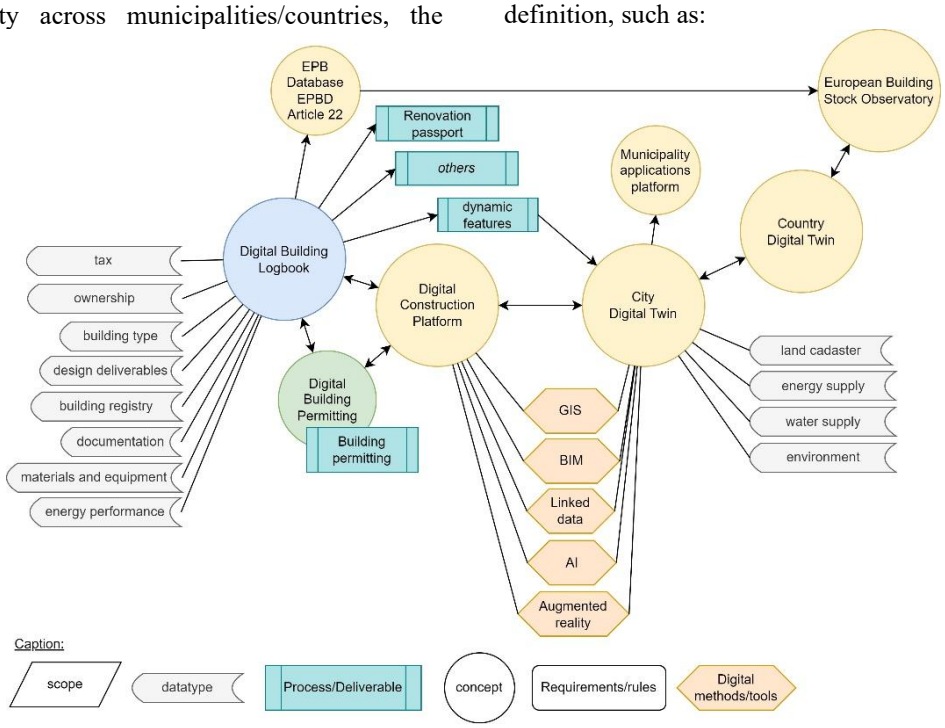

Figure 6: Complete diagram merging the initiatives.

- Identification of the life-cycle phases and associated data points covered, example “as-designed”, “as-built”, “as-use”, “all”, “only few”
- Data inputs, in relation to existing databases, such as land cadaster, permits, tax, ownership, others
- Data formats, in which form is the data associated to the DBL (similar to the DBP maturity levels)
- Use of GIS and BIM as supporting ground for the data (yes, no, to what extent)
- Level of integration, made visible to what extent the data overlaps are harmonised
- Data points status, dynamic vs static data
- Range of features covered or already implemented on the DBL (energy efficiency, ownership assessment, permitting, renovation passport, material passports, among others)

It is imperative to emphasise that the initial point of adoption, as evidenced by the diverse initiatives, has a substantial influence on subsequent integration, given their divergent approaches to the aforementioned aspects. In this regard, there is a perceived need to expand the studies and make a stronger push to define a comprehensive common framework for DBL.

Finally, it was observed that the motivations for the initiatives vary substantially. From country- and municipality-level strategic visions to meet legal requirements, there are several enablers for similar initiatives to take place. Notwithstanding, the clarification regarding DBP and DBL adoption and their integration is perceived as a critical enabler or barrier. Given the wide variety of legal diplomas involved, the EU, its member states, and municipalities' legal frameworks will need to provide stakeholders with clear guidance on how to approach these concepts.

The present research has limitations that are associated with the number of interviews and initiatives approached. In addition, the focus was more on the initiatives' organic aspects, seeking similarities rather than on the data points covered, which will be a topic for future research.

Working on all the abovementioned aspects, focusing on the existing data and how it can support the integration, and expanding knowledge of other initiatives are part of future research actions.

Conclusions

While previous studies were more theoretical, this study investigated existing real-life initiatives, bringing a new level of realisation on regarding the integration of Digital Building Logbooks and Digital Building Permits.

Considering the initial research questions, the following conclusions can be drawn:

- Integration between DBP and DBL is perceived as necessary and beneficial, but typically emergent rather than planned. Initiatives often embed DBL-like data without naming it, and they view DBP/DBL integration as a logical step to reduce duplication, enable compliance automation, and support policy goals.
- The perception varies depending on the scale/level: country platforms think in terms of governance and canonical data; city platforms focus on process simplification; observatories focus on data quality and standard datasets.
- It was observed that each initiative brings complementary assets:
  - Digital construction platforms bring governance, canonical identifiers, cross-domain linking, and scalability;
  - DBL gateways: owner-facing data aggregation, provenance/version control, owner workflows;
  - City Digital Twins: spatial integration, visualisation, operational data linking, as-built updates;
  - Permitting platforms: front-end submission workflows, compliance checking, documentation-based or BIM-based, metadata validation;
- Building stock observatories: regulatory requirements, standardised datasets, reporting needs that motivate upstream digitalisation.

As mentioned in the introduction, in addition to DBP and DBL, the Digital Product Passport for Construction integration within this framework is paramount and warrants further research.

Recognising the synergy between DBP and DBL is imperative, as only by overcoming the fragmentation of concepts can we avoid barriers to innovation and unlock the true potential of a modern, transparent built environment.

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