



## UNLOCKING DIGITAL BUILDING LOGBOOK IMPLEMENTATION – EXPLORING POTENTIAL CONTRIBUTIONS FROM THE REAL ESTATE SECTOR

Pedro Mêda<sup>1</sup>, Judith Fauth<sup>2</sup>, and Helder Pereira<sup>3</sup>

<sup>1</sup>CONSTRUCT – Gequaltec, Porto University Faculty of Engineering, Porto, Portugal

<sup>2</sup>Technical University of Munich, Munich, Germany | University of Cambridge, Cambridge, UK

<sup>3</sup>Zome Real Estate, Porto, Portugal

### Abstract

There is growing interest in Digital Building Logbooks (DBL) and Digital Building Permits (DBP) as these instruments are being positioned as game changers in modern construction. These are data-driven concepts and there is still a research gap and lack of awareness on how to implement them, namely by using existing data sources. Portugal and existing buildings in need of renovation works are used as case, where real estate activities with innovative tools are explored and analysed to provide perspectives on how the outputs already align and can be strategically worked to achieve quick wins for DBL deployment and permitting issuance.

### Introduction

Grammar dictionaries define a “Logbook” as an official document that records information about a defined physical asset. The same addresses the “Passport” as an official document containing personal information and usually a picture, allowing the passport owner to travel to other countries and prove their identity (Dictionary, no date). The two concepts share common ground. They are meant to be official documents containing reliable information that can be recorded and tracked serving a specific purpose. In the case of the passport, enabling travelling between countries is a defined purpose. These common characteristics are paramount for concepts shaping the construction agenda and trends in Europe and worldwide.

The EU Digital Building Logbook (DBL) (Dourlens *et al.*, 2021) or the Digital Building Passport (GABC and UNEP, 2021), in a broader sense, is being positioned as one of the key digital instruments for the accomplishment of the twin (green and digital) transition strategy. The UN Sustainable Development Goals (SDGs) and the EU Green Deal are wide-range and long-term strategies expressing concerns about climate action, clean and affordable energy, biodiversity protection, sustainable economic growth and sustainable consumption and production (Mügge *et al.*, 2023). In its broad value chain, the construction industry can provide relevant contributions by increasing the reuse/recycling rates, improving energy efficiency, leading to savings on energy

consumption and scaling the use of renewable sources, just to name a few (van Stijn and Gruis, 2020).

The ability to perform such improvements relies on the capacity to have widespread knowledge of the characteristics of the existing built environment. This is decisive for buildings because they represent 40% of total energy consumption in the EU, 50% of the global material extraction and 36% of energy-related greenhouse gas emissions (Maduta *et al.*, 2023). Decreasing these indicators will only be possible if buildings-related data becomes more available, trustworthy, and capable. The EU DBL is the official digital document where all the relevant and reliable data is to be collected, recorded, managed, updated, and used for defined purposes during a building's life cycle.

Real estate is one of the construction industry value chain dimensions. It encompasses a set of activities such as property sales and brokerage, appraisal, and valuation. These heavily rely on using existing property-related data from various sources that must be summarised, confirmed, updated, and often amended prior to ownership change/real estate transaction (Mêda, Calvetti *et al.*, 2024). A kind of “trustworthy passport” is needed to enable “identity confirmation” and the “property travelling” between owners. To improve the quality of this process, mitigate risks and provide added value to clients, real estate has been developing new services supported by digital technologies.

The motivation for this research derives from the awareness that real estate collects and organises relevant building-related data as part of its activities. In addition, as underlined by (Buchholz and Lützkendorf, 2023, 2024), there is a gap in the research on how real estate can contribute to DBL implementation. One of this research aims is to explore and better understand how real estate services align with the DBL implementation strategy. In addition, following previous studies (Mêda, Fauth *et al.*, 2024), there is the objective of understanding how real estate activities can relate to a permitting process, namely Digital Building Permits (DBP), considering that many transactions involve existing, low-performing and/or in-need renovation buildings/properties.

This section presents the motivation and an overview of the research topic. It follows with a description of the

research design and methods. A review is performed, focusing on the outcomes from existing studies. Characterisation of real estate is provided, focusing on the case under analysis and the collected data points. Data analysis is developed to assess the alignment with the logbook and permit data requirements, discussing the main findings. The conclusion section completes the article, expressing the main outcomes, its limitations, and future research directions.

## Research Design and Methods

The research strategy methodological steps defined by (Nogeste, 2015) were used to set the research design. In terms of paradigm, realism is used as the objective is to emphasise the existence of a reality, the data collected by real estate in Portugal for the purpose of property transactions, regardless of the awareness or realisation of how it can contribute to the DBL and DBP. An inductive approach is practised by collecting the data used in transaction processes, namely when using an innovative tool developed by a Portuguese real estate player. The analysis was performed by the authors and was based on the collection of opinions from seven editions, in which groups of twenty real estate agents were trained on how to work with the innovative platform. These elements are used to identify patterns, support conceptualisation, and develop the theory on how this innovative tool and its deliverables can support DBL and DBP. As mentioned, and supporting the research methodology, a player operating in Portugal, Zome Real Estate, and the innovative tool/service that is being implemented, “Imóvel Verificado” constitutes the case. In addition, it is worth framing that the case assumes an existing multi-familiar building that needs substantial construction works (to be performed in compliance with the Renovation Wave strategy), and a change of ownership is to occur with the assistance of a real estate agent. “Imóvel Verificado” was used, and the analysis aims to assess to which extent the data collected for that purpose suits the requirements to build a DBL and instruct a DBP for a renovation. The realisation is unlocked from evidencing the relationships based on data, purposes, and contributions to DBL and DBP.

## Review DBL, DBP and real estate

### Existing studies on DBL and DBP

The objective of establishing a concept that could somehow centralise, but mainly, make more available information related to a built asset is not new (Owen, 2013). Facility management software has been doing that for the purpose of asset management, as well as common data environments for project documentation. More recently, EU-funded projects have focused on developing tools that could make more digitally available building/property data for the purpose of energy performance assessments and reuse/recycling of components (Signorini, *et al.*, 2021; Gómez-Gil *et al.*, 2022b). All these initiatives were targeted to solve

specific purposes, resulting in low interoperability capacity, information gaps and inability to consider other topics. To better understand the broader perspective, the Commission initiated, in 2019, the study on the "EU-wide Framework for a Digital Building Logbook" (Carbonari *et al.*, 2020). Together with the evaluation of existing information systems and manual processes across EU member-states, the formal definition of DBL was established. The findings supported the introduction of the concept in EU legislation, namely on the "Renovation Wave" strategy, published in 2020 (European Commission, 2020). From 2021, the proposal to revise the Energy Performance of Buildings Directive (EPBD) introduced the DBL as the main common repository for all relevant building data. The new EPBD, published as Directive (EU) 2024/1275, confirmed the contents and introduced prescriptions on how the DBL must interact with other concepts such as the renovation passport (Article 12), building systems (Article 16) and databases for the energy performance of buildings (Article 22) (European Parliament and the Council of the European Union, 2024).

Several researchers have devoted their efforts to exploring different potential dimensions of the DBL, such as the stakeholders mapping (Hwang, 2024), models and new digital technologies (Gómez-Gil *et al.*, 2022b, 2022a), data structures and existing information supporting its accomplishment (Malinovec Puček *et al.*, 2023; Gómez-Gil *et al.*, 2024; Mêda, Calvetti, *et al.*, 2024). This last aspect aligns with the research background, as it is meant to explore further the data discovery journey. It is worth mentioning that associated with DBL are three different dimensions of the built asset: The “CadastralParcel”, the “Building”, and the “BuildingUnit” (Grow, 2023).

In addition, recent studies explored and proved the relationship between logbooks and permits (Mêda, Fauth *et al.*, 2024), highlighting the need to perform a data discovery journey to typify permitting data requirements. Some research has been done to typify permit data at the EU level (Fauth *et al.*, 2024). However, higher granularity can be practiced when focusing a specific member state. To conclude, it is worth mentioning that most research has focused on the case of new buildings. Few studies have explored renovation situations where a strong relationship between the aspects under research is found to exist.

### The real estate activity in Portugal

Real estate in Portugal plays a central role in the economy, contributing significantly to the Gross Domestic Product (GDP) and generating employment (Leal and Carreiras, 2025). With recovery following the 2008 financial crisis and the growing interest of foreign investors, the property market has seen a positive trend, characterised by dynamics of new construction projects and diversified market demand (Leal and Carreiras, 2025). Real estate covers a wide range of activities, such as property buying and selling, property development, real estate brokerage, property valuation, property management, renting, property investment, technology, and training.

Portugal has established itself as an attractive destination for living, tourism, and investment, factors that boosted the real estate business. The market is, however, facing significant challenges, such as a shortage of affordable housing, increased urban pressure and regulatory requirements, all requiring innovative and added-value solutions. Zome Real Estate is one of the players in Portugal, standing out for using innovative technology, providing specialised training for its agents, and using a customer-centric approach. The intense focus on innovation has been redefining industry standards by implementing practices that increase clarity and efficiency. Given the abovementioned competitive and complex property market, trust and transparency are seen as essential to guarantee safe and satisfactory transactions. To bridge the gap between a transaction where few validations or observations are performed and a transaction supported by a technical report and diagnosis led by a civil engineer, Zome Real Estate has developed a structured approach and an innovative tool for its Agents. “Imóvel Verificado” aims to assist property verifications according to the best knowledge and practices. The objective is to bring added value to all parties involved, namely, sellers and potential buyers, enabling a better

frameworks of processes and relationships in the case of new buildings, demonstrating how this could work (Mêda *et al.*, 2022; Gonçalves, Lam and Ritzén, 2024). For the case of existing buildings, materialising a DBL must rely on legacy data. Several studies have identified the challenges and issues associated with legacy data collection (Buchholz and Lützkendorf, 2023). Building a DBL in these conditions has several constraints and the exercise will always lead to a not ideal situation. A major intervention, such as a renovation, is an opportunity to perform a more detailed diagnosis of the existing built asset and, more importantly, allows a strategic prioritisation of what needs to be collected. The conditions to deploy a DBL are more favourable, and an aspiration set by the EU strategies. A renovation usually involves several stakeholders, such as a design team and contractors. However, this type of intervention often comes associated with ownership change, usually involving real estate agents. As mentioned, in these cases local authorities need to be engaged, namely for permitting processes. Figure 1 aims to evidence the elements and their relationships in a high-level framework, providing perspectives on the challenges and the potential links.

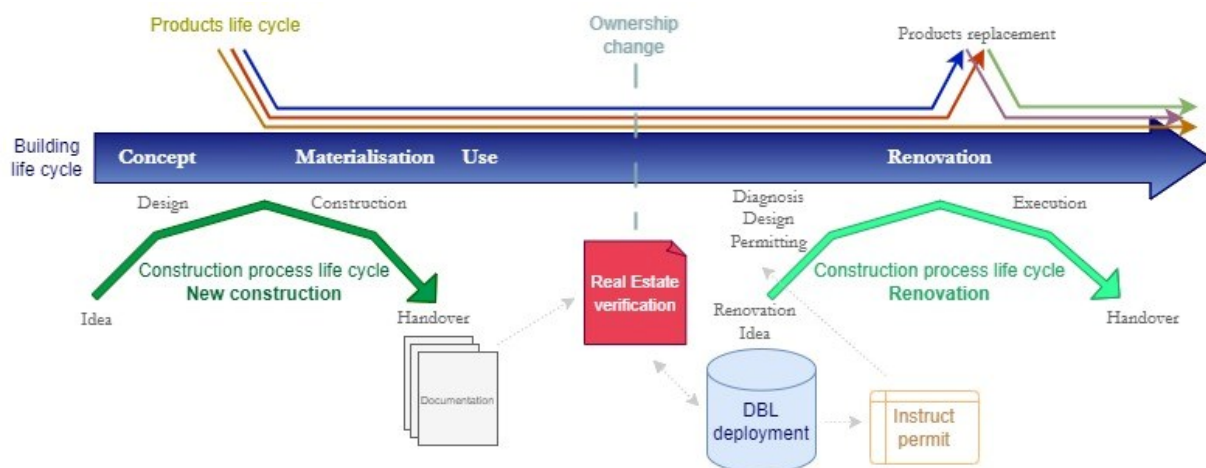


Figure 1: Information elements involved in the research and aligned with the DBL supported life cycles

understanding of the property characteristics, conditions, solutions, and whether the price is well adjusted. All the collected information is organised in a digital platform to deliver a comprehensive report for clients and experts. In terms of purposes, and among many possibilities, the report can clarify several relevant property characteristics and/or serve as a background for a more detailed technical diagnosis to be performed by a civil engineer or architect.

## Development

### DBL and DBP relationship with life cycles

To fulfil its definition (Dourlens *et al.*, 2021), the DBL needs to assume and work with different life cycles: the building, the construction process and the construction products' life cycles. Previous studies have proposed

### “Imóvel Verificado” data collection

The "Imóvel Verificado" platform was developed based on practical experience from real estate and national references used to diagnose buildings (LNEC - Laboratório Nacional de Engenharia Civil, 2007). It is worth highlighting that deliverables are built from verifying the existing documentation and from visual observation/test of the property and its spaces/systems/parts. As it can be easily understood, a dwelling differs from a multi-familiar residential building, and both differ from a non-residential building. The platform supports different possibilities providing guidance and a sequence of steps adjusted to the specific type. As mentioned, all contents explored in this research correspond to a property in an existing multi-familiar residential building. Figure 2 summarises the fifteen steps

that need to be considered for this case. A detailed explanation will be made following the sequence. However, only step one must first be set in.

The first step, “Building / Building Unit / Property general characteristics”, is devoted to the property presentation and where data points such as address, district, city, location, ZIP Code, geographic coordinates, and property images are to be captured. There is no mandatory standard for the coordinates, but there is a suggestion to use Google Maps. In this part, the real estate agent identification and the report date need to be settled.

The second step consists of the “Document repository”. A predefined list of documents must be observed, and when the document exists, a mark must be made on the checkbox. This will open a form to add the document and express its compliance or not. Depending on the type of document, data points such as document identification and issuing date need to be fulfilled. Although others can be added, the predefined list of documents includes the Matrix Certificate (CPU), the Property Registry (RP), the Use permit/license (UL), the Energy Performance Certificate (EPC) and the Technical Housing Datasheet (FTH). These documents are required by national legislation, local authorities or the EU framework (Mêda, Calveti, *et al.*, 2024). The property drawings, namely the plans, minutes from the condominium meetings and noting the existence of mortgages or forfeitures, are also part of this step. The document repository is paramount for collecting legacy documentation, observing its compliance, and making informed decisions about what might need to be solved before the transaction. In addition, it is a semi-digital compilation of all the mandatory legal documentation about the property.

1	Building / Building unit / Property general characteristics
2	Document repository
3	Characteristics of the surroundings
4	Services, infrastructures and accesses
5	Validations
6	Additional characteristics of the building / unit / property
7	Documental information regarding areas
8	Building / property / condominium
9	Exterior of the building / property
10	Main entrance
11	Building / property garage
12	Property spaces (description of the solutions 1 by 1)
13	(eventual) Ongoing construction works in the building
14	Special building / property systems
15	Report validation / issuance

Figure 2: The fifteen steps to produce the “Imóvel Verificado” report for the case under research

Steps three and four are related to the conditions of the property surroundings, namely in terms of existing

services and their distance (three) and the services, utility networks, and accessibilities to the property, such as the type of pavement on the street (four). Marking the checkboxes with the distances and the yes/no, as well as collecting photos that can be used as evidence, are aspects to be addressed in these two parts.

Step five is “Validations”, and it is meant to observe a list of predefined compliance aspects. As previously, the list can be augmented with additional relevant validations. The predefined compliance checks are associated with the property house number, if the address matches what is presented in Google Maps, and if the agent collected images capturing all meaningful building/property identifications, numbers, and evidence of design team/contractor names when presented on the building.

Step six is devoted to further detailing property characteristics, namely the type of uses (residential, commercial, mixed, others), the building type (dwelling, apartment, other), property typology (example: T3), identification of special attributes or characteristics (example: last floor, seafront, large balcony), use permit data, such as issue date, property age, date of evaluation (related to CPU), energy performance certificate class and general condition state. Other aspects, such as occupancy, habitability, and risks related to the structure, are to be observed and marked yes/no on specific checkboxes.

The seventh step is key as it aims to foster transparency. The objective is to gather all the areas provided in the different documents so that all stakeholders can understand in a nutshell what is legally requested concerning that property. Real estate works with monetisation referenced to areas. However, different countries can practice different areas depending on the purposes, such as EPC and taxation.

Step eight organises more characteristics of the property, and condominium by requesting the building name, number of blocks, number of floors above and below ground, number of lifts, and the total number of properties. The existence of leisure areas, garages, and a company to manage the condominium are aspects to be observed and checked with yes or no.

Steps nine to twelve are similar in how they are presented and need to be fulfilled, although addressing different parts/spaces. Each step has a list of construction elements that need to be verified by taking photos and presenting a description. As presented in Figure 2, point nine is for the exterior of the building, where elements such as the façade, gates, accesses, and doorbell/video intercom are to be verified. Step ten focuses on the building's main entrance, where the verification of the walls, ceilings, floor, lighting system, and lifts, among others, is to be performed. Step eleven has a similar verification list but focuses on elements that exist in garages. Step twelve is turned to the observation and verification of the construction elements' condition in all property/building unit spaces. It is worth highlighting that performing the verifications in these steps has some flexibility, considering the wide range and variety of configurations and solutions that can be found in properties.

In step thirteen, the objective is to cover all possible construction works under development. In a positive case, the verification aims to provide a clear perspective on the situation.

Step fourteen is, in terms of presentation and verifications to be made, very similar to what was mentioned in steps nine to twelve. However, the scope is different and shifted to special systems equipping the entire building or the property. Due to their characteristics or centrality, some systems do not make sense to be repeated in different property spaces (when performing step twelve verification). As these can also represent an added value to the property, they are identified and described in this particular step.

The final step, fifteen, is meant for the validation and submission of the report. The consultant can perform an overview of all previous steps and produce a draft or a definitive deliverable.

In the next section, Figure 3 presents an overview of all the information, data points, and elements described in each step. As specified, the fifteen steps composing “Imóvel Verificado” collect and assess several data inputs, and, on top of it, the verification actions produce a

detailed inventory and perspectives on the technical solutions and their condition, bringing added value and transparency to transaction processes.

### Data Analysis and Discussion

In the previous section, a detailed description of “Imóvel Verificado” was performed, explaining the steps and the information elements to be collected for the purpose of real estate, namely property transactions, including promotion and execution. However, from the descriptions, it can be understood that several data points that constitute a requirement are already present in existing paper or PDF documents, deriving from digital formats or images. In any case, exploring the data sources and their support is a subject of other research. In this study, the goal is to understand to which extent the data collected for real estate suits the requirements for materialising a DBL on an existing building and supporting the issue of a DBP. Considering previous studies (Gómez-Gil *et al.*, 2022, 2024; Mêda, Calveti, *et al.*, 2024; Mêda, Fauth, *et al.*, 2024) and the framework presented in Figure 1, the analysis of the data collected by “Imóvel Verificado” is compared with DBL and DBP



Figure 3: Information/data points required for real estate to produce “Imóvel Verificado” report

requirements. The results derive from the authors' assessment and from the real estate agents' opinions when discussing the topic in training actions.

Figure 3 provides an overview of all the information collected/data points introduced in "Imóvel Verificado", highlighting with different colours the elements identified as relevant for DBL and DBP (light blue), relevant for the DBL (dark blue), among other situations (see the colour schema caption).

Regarding step one, the data collected is very similar to the one mentioned in this article's Introduction section when addressing the "travelling passport", and most of it is key for the DBL and DBP. It is worth mentioning that a standard identification of fields should be followed for the data points related to the address, such as the one set in INSPIRE Directive (European Commission, 2014). A similar situation could occur with the geographic coordinates. The report date and the real estate agent name can be relevant for the DBL if there is a requirement to track all the events (according to (Grow, 2023)), including change ownership and the stakeholders involved in the transaction. In brief, all elements were found to be relevant for the DBL, and most of them are relevant to the DBP. Most of the information elements are to be framed on the "DBL CadastralParcel" (Grow, 2023).

Step two is the document repository, and much of the introduced data points is an input of already existing information that is not in a digital format or not digitally available. All these elements are relevant for a DBL, and most of them are needed for or would derive from a permitting process (the Use permit, as an example). It is worth highlighting that the documentation presented is mandatory according to municipalities, national laws, and even European Directives and Regulations. The compliance assessment performed by real estate is very relevant towards ensuring "information reliability", an essential characteristic underlying the DBL implementation and enabling DBP, as previously mentioned. It is worth highlighting that in this step, the information presented is to be framed on the "DBL Building", where most DBP data stands, and "DBL BuildingUnit" (Grow, 2023).

Regarding step three, the discussions led to the understanding that the information is relevant today for the purpose of real estate to assess property added value. In the future, considering a scenario where all built assets have a DBL with a georeferenced pinpoint and disclose some of its data, this information could be automatically obtained. Considering the priorities for DBL, this information was not considered relevant. A similar situation occurs with the permitting process, where the same reasoning is applied.

Step four constitutes a double-check to observe the existing networks and utilities serving the building. In theory, this information should be structured and provided by municipalities where the built object stands. However, not all have this information structured for their entire territory, nor do utility providers, such as

telecommunications, to name one. It is worth mentioning that INSPIRE Directive has defined rules to support this type of network. For the DBL, it would be relevant to have more information than the one mentioning if a network or service exists. For example, regarding the water supply network, it is relevant to know the diameter of the pipes and the water pressure available to do hydraulic systems calculations. Despite their relevance, the collected elements are short for the DBL purpose. A similar situation is observed regarding permitting. This information should be part of the process, deriving from requests to municipalities. Considering a situation where a DBL is to be built to then request a DBP for the renovation, although relevant to know, the collected elements are insufficient to instruct the DBP.

As mentioned in step two, step five also aims to validate specific aspects and collect images to evidence others. This evidence is relevant and, more importantly, frame in the needed actions to ensure DBL information reliability. Regarding DBP, assuming that the information is previously confirmed in the DBL, these elements would not be relevant.

Again, and similarly to steps one and two, the elements to be set in step six are mostly relevant for the DBL and DBP, deriving from existing documentation produced during previous permitting, design and construction phases. It is worth highlighting that the data points frame on the "DBL Building" and "DBL BuildingUnit". The data points more directly related to the property verification, such as "general condition", "occupancy", or "risks", although not evident in the mentioned studies, could be relevant, namely for existing buildings where a DBL should start to be structured prior to a renovation process (Figure 1). It is worth mentioning that the DBL ontology proposed in the more recent EU studies (Grow, 2023) has a dataset named "dbl:conditionOfConstruction" that could correspond to the abovementioned "general condition".

Step seven was set to bring and foster transparency to the transaction by presenting the different areas and their values. Unquestionably, this data is key for the DBL and for the DBP. As mentioned in step five, there is another added value related to the trustworthiness of the data, as it is observed that areas are not always well calculated, and their definitions can sometimes be fuzzy. Given the importance of this information for a wide range of stakeholders and processes, clarification and simplification efforts should occur.

Similarly to the previous, step eight collects meaningful elements for the DBL, namely for the "DBL Building", as it presents several building characteristics. Most of the data points are also relevant for permitting processes. It is worth mentioning that a significant part derives from existing documents, and most of the others could be obtained directly or indirectly from them. All data points presented here are relevant for the DBL because information on the condominium management company is required at the building level, not to mention all the financial activity and relevant tasks performed. Regarding

DBP, condominium data is the only considered as not relevant.

Steps nine to twelve and step fourteen will be analysed together because the type of data collected is very similar, although focusing on different spaces belonging to the building or to the property. The aim of these steps is to identify the technical solutions in different construction elements (walls, ceilings, floors) and, in addition, for systems to observe if they are working or not (HVAC, lighting, water). Comparing the solutions with the documentation and assessing their condition are essential aspects of a real estate transaction, and despite being relevant data, it is a high-level one. This is to say that although important for the DBL and most of it for the DBP, it is not detailed nor technical enough. This means that additional work needs to be performed to set the background data for this to then placed after and on top of it. However, it is important to stress that these elements can streamline a lot the technical work.

As previously mentioned, the DBL should record all relevant events in a building (Grow, 2023). Therefore, all elements related to interventions (maintenance, repair, renovation) should be collected and organised. Most interventions require a permit, meaning that the document or the data points associated with any relevant information should exist and become part of the DBL. The data to be captured in step thirteen is relatively simple. However, even though few, depending on the situation, it can be valuable for a DBL. In an ideal situation, this step, namely the part addressing “Additional notes,” would be structured with permitting process data points. As evidenced in Figure 3, these elements would need to be further organised.

## Conclusions

This work explored how real estate activities, namely “Imóvel Verificado”, can contribute to the materialisation of the DBL. In addition, a complementary analysis was performed assessing to what extent the same data would streamline issuing a renovation permit. All observations were made in accordance with the existing studies on those concepts. It can be stated that “Imóvel Verificado” organises, validates and digitalises information that is relevant for DBL and DBP materialisation. More importantly, the process observes and performs compliance checks of the legacy data, enabling actions to perform amendments, making mismatches more visible and ensuring the trustworthiness of the data. Although meant for the specific purpose of property promotion and transactions, building a DBL from this information can ensure a quick win for widespread implementation and streamline the instruction of permitting processes.

This study was limited to observing and analysing the “Imóvel Verificado” information. Few or no considerations were made on the potential improvements to the platform to potentially strengthen alignments. Also, it was not possible to perform a detailed analysis of the contents of the documentation or forecast frameworks on

how these processes could be aligned. The analysis of the relevant data for DBL and DBP was performed during the training actions and later discussed between the authors. An additional limitation in terms of applicability is that “Imóvel Verificado” is a specific innovation from Zome Real Estate and it is not yet mandatory for all promotions and transactions.

Future research will focus on the above issues by exploring the changes resulting from the EU's ambitions to create a data space for construction. The increased availability of data will enable several changes in the report, which will be beneficial for many purposes.

Unquestionably, having an official document containing reliable information that can be recorded during a set of defined purposes for the built environment and its constituent parts makes all sense. The DBL, despite the novelty of its vision, will be materialised from a sum and collection of existing processes and data points, namely when the case is an existing building. As demonstrated, real estate activities, such as “Imóvel Verificado”, can help logbook implementation and, when applicable, instruct a permitting process. By prospecting the requirements to achieve the goals and clearly understanding what exists now and what steps need to be taken, a smoother path can be drawn, bringing together additional aspects that, in the end, can contribute to achieving quick wins and a broader realisation of the defined targets.

## Acknowledgements

The authors would like to thank to Zome Real Estate.

Pedro Mêda was financially supported by: Base Funding - UIDB/04708/2020 with DOI 10.54499/UIDB/04708/2020 (<https://doi.org/10.54499/UIDB/04708/2020>) of the CONSTRUCT - Instituto de I&D em Estruturas e Construções - funded by national funds through the FCT/MCTES (PIDDAC) The work of Judith Fauth has received funding from the European Union's Horizon 2020 research and innovation programme under the Marie Skłodowska-Curie grant agreement No 101034337

## References

- Buchholz, M. and Lützkendorf, T. (2023) ‘European building passports: developments, challenges and future roles’, *Buildings and Cities*, 4(1), pp. 902–919. <https://doi.org/10.5334/bc.355>.
- Buchholz, M. and Lützkendorf, T. (2024) ‘Building passports in their role as building information systems - background, framework, implications’, in *IOP Conference Series: Earth and Environmental Science*. <https://doi.org/10.1088/1755-1315/1363/1/012107>.
- Carbonari, G. et al. (2020) *Building Logbook State of Play*, Publications Office of the European Union.
- Dictionary, C. (no date) *Cambridge Dictionary - logbook*. <https://dictionary.cambridge.org/dictionary/english/logbook> (Accessed: 17 April 2024).
- Dourlens S. & Carbonari G., De Groot M., Borragán G. & De Regel S., Toth Z., V.J.& G.J. (2021) *Study on the*

- Development of a European Union Framework for Digital Building Logbook - Final Report. Brussels. <https://doi.org/10.2826/659006>.
- European Commission (2014) INSPIRE - D2.8.I.5 Data Specification on Addresses – Technical Guidelines.
- European Commission (2020) A Renovation Wave for Europe, COM(2020) 662 final. Brussels.
- European Parliament and the Council of the European Union (2024) Directive (EU) 2024/1275 of the European Parliament and of the Council on the energy performance of buildings (EPBD), Official Journal of the European Union. Official Journal of the European Union. <https://eur-lex.europa.eu/legalcontent/EN/TXT/PDF/?uri=CELEX:52021DC0550&from=EN>.
- Fauth, J. et al. (2024) Comparative study on building permit processes in Europe - European Network for Digital Building Permit EUnet4DBP Publication Series. EUnet4DBP edn. <https://doi.org/10.5281/zenodo.14178512>.
- GABC and UNEP (2021) The Building Passport: a Tool for Capturing and Managing Whole Life Data and Information in Construction and Real Practical Estate. Nairobi.
- Gómez-Gil, M. et al. (2022) 'The Digital Building Logbook as a gateway linked to existing national data sources: The cases of Spain and Italy', *Journal of Building Engineering*, 63(August 2022). <https://doi.org/10.1016/j.jobe.2022.105461>.
- Gómez-Gil, M. et al. (2024) 'Envisaging a European Digital Building Renovation Logbook: Proposal of a Data Model', *Applied Sciences (Switzerland)*, 14(19). <https://doi.org/10.3390/app14198903>.
- Gómez-Gil, M., Espinosa-Fernández, A. and López-Mesa, B. (2022a) 'Contribution of New Digital Technologies to the Digital Building Logbook', *Buildings*, 12(December), p. 2129. <https://doi.org/doi.org/10.3390/buildings12122129>.
- Gómez-Gil, M., Espinosa-Fernández, A. and López-Mesa, B. (2022b) 'Review and Analysis of Models for a European Digital Building Logbook', *Energies*, 15, p. 24. <https://doi.org/https://doi.org/10.3390/en15061994>
- Gonçalves, J.D.S., Lam, W.C. and Ritzen, M. (2024) 'The Role of Digital Building Logbooks for a Circular Built Environment', in C. De Wolf, S. Çetin, and N. Bocken (eds) *A Circular Built Environment in the Digital Age*. Springer. Springer Cham, pp. 229–243. [https://doi.org/10.1007/978-3-031-39675-5\\_13](https://doi.org/10.1007/978-3-031-39675-5_13).
- Grow, D. (2023) Technical guidelines for Digital Building Logbooks - Guidelines to the Member States on setting up and operationalising digital building logbooks under a common EU framework. Brussels.
- Hwang, S.A. (2024) 'Digital Building Logbooks and Stakeholder Mapping: a Cross-Sectoral Approach To Data Collection and Sharing', in *Proceedings of the European Conference on Computing in Construction*. Chania: EC3 - European Conference on Computing in Construction, pp. 594–601. <https://doi.org/10.35490/EC3.2024.169>.
- Leal, M. and Carreiras, M. (2025) 'Decoding the spatial dynamics of sales and rental prices in a high-pressure Portuguese housing market: a random forest approach for the Lisbon Metropolitan Area', 158(November 2024). <https://doi.org/10.1016/j.cities.2024.105631>.
- LNEC - Laboratório Nacional de Engenharia Civil (2007) Método de avaliação do estado de conservação de imóveis. Lisbon.
- Maduta, C. et al. (2023) 'Towards climate neutrality within the European Union: Assessment of the Energy Performance of Buildings Directive implementation in Member States', *Energy and Buildings*, 301(August), p.113716. <https://doi.org/10.1016/j.enbuild.2023.113716>.
- Malinovec Puček, M. et al. (2023) 'A Data Structure for Digital Building Logbooks: Achieving Energy Efficiency, Sustainability, and Smartness in Buildings across the EU', *Buildings*, 13(4). <https://doi.org/10.3390/buildings13041082>.
- Mêda, P. et al. (2022) 'A Process-Based Framework for Digital Building Logbooks', in EC3 (ed.) *Proceedings of the 2022 European Conference on Computing in Construction*. Ixia: EC3, p. 8. <https://doi.org/10.35490/EC3.2022.183>.
- Mêda, P., Calvetti, D., et al. (2024) 'Data Discovery for Digital Building Logbook (DBL): Directly Implementing and Enabling a Smarter Urban Built Environment', *Urban Science*, 8(4), p. 24. <https://doi.org/10.3390/urbansci8040160>.
- Mêda, P., Fauth, J., et al. (2024) 'Developments in the Built Environment Twinning the path of digital building permits and digital building logbooks – Diagnosis and challenges', *Developments in the Built Environment*, 20(December), p. 16. <https://doi.org/10.1016/j.dibe.2024.100573>.
- Mügge, J. et al. (2023) 'End-of-life decision support to enable circular economy in the automotive industry based on digital twin data', *Procedia CIRP*, 119, pp. 1071–1077. <https://doi.org/10.1016/j.procir.2023.03.150>.
- Nogeste, K. (2015) 'Dual Cycle Action Research: A Doctor of Project Management (DPM) Research Case Study', in Routledge (ed.) *Design Methods and Practices for Research of Project Management*. Beverly Pa. New York: Gower Publishing.
- Owen, R. (2013) *Integrated Design & Delivery Solutions (IDDS)*. Rotterdam.
- Signorini, M., Spagnolo, S.L. and Dejaco, M.C. (2021) 'A Digital Logbook as an Interactive Tool to Fulfil Service Companies' Needs and Requirements in Building Renovations', *IOP Conference Series: Materials Science and Engineering*, 1044(1), p. 012010. <https://doi.org/10.1088/1757-899x/1044/1/012010>.
- van Stijn, A. and Gruis, V. (2020) 'Towards a circular built environment: An integral design tool for circular building components', *Smart and Sustainable Built Environment*, 9(4), pp. 635–653. <https://doi.org/10.1108/SASBE-05-2019-0063>