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AN OPEN AND STANDARDS-COMPLIANT PLATFORM FOR PRODUCT DATA TEMPLATES IN DIGITAL CONSTRUCTION

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SUMMARY: *Construction digitalization faces persistent data management and interoperability challenges. Although ISO 19650 streamlines Building Information Modelling (BIM) processes, the lack of standardized data structures hinders efficient information exchange. Product Data Templates (PDTs)(EN ISO 23387:2020, EN ISO 23386:2020) offer a structured framework for product data definition and exchange, addressing this issue by enhancing digital workflows consistency. This paper investigates the development of an open platform for the Portuguese construction industry to create, manage, and query PDTs in alignment with international standards. Key components include a PDT-compliant database, an interface for reviewing and downloading PDTs in digital formats, and an API gateway for integrating PDTs into BIM environments, and integration into buildingSMART data dictionary. The platform supports industry stakeholders by ensuring data consistency, traceability, and regulatory compliance. By providing machine-readable, interoperable data for seamless retrieval, it enhances data exchange and reduces inefficiencies in digital construction workflows. Developed as an open-source solution, the platform is designed for the Portuguese market but can be adapted for use in other regions, ensuring scalability and broader applicability. Future research could focus on a deeper integration with Common Data Environments, the Level of Information Need, and a Linked Data approach to further optimize structured data exchange and automation in BIM workflows.*

KEYWORDS: *Building Information Modelling, Digitalization, Standardization, Product Data Templates, Data Dictionaries.*

REFERENCE: *Mohamad El Sibaii, Jose Granja & Miguel Azenha (2025). An Open and Standards-Compliant Platform for Product Data Templates in Digital Construction. Journal of Information Technology in Construction (ITcon), Vol. 30, pg. 679-710, DOI: 10.36680/j.itcon.2025.028*

1. INTRODUCTION

The construction industry's digital transformation has heightened the demand for efficient data management and interoperability to address increasing project complexity and the need for sustainability and collaboration (Sacks *et al.*, 2018; Karina, Malwina and Josef, 2021; Godager *et al.*, 2022; Tomczak *et al.*, 2022; Calin Boje, Sylvain Kubicki, Annie Guerriero, Yacine Rezgui, 2023; Jeroen Werbrouck, Madhumitha Senthilvel, 2023). Building Information Modelling (BIM) has emerged as a cornerstone of this shift, enabling the creation and management of digital representations of construction projects. While BIM fosters multidisciplinary collaboration and streamlines project workflows, its effectiveness hinges on the availability of reliable, standardized data. A lack of standardization often leads to inefficiencies, miscommunication, and errors throughout the project lifecycle (Soibelman *et al.*, 2008; Lin *et al.*, 2013; Palos, Kiviniemi and Kuusisto, 2014; Hooper, 2015; Bradley *et al.*, 2016; Joblot *et al.*, 2017; Mirarchi and Pavan, 2019; Tomczak *et al.*, 2022; Almeida *et al.*, 2023; Su *et al.*, 2023; Biswas, Sim and Lau, 2024; Long *et al.*, 2024; Sesana *et al.*, 2024).

Despite notable strides in the development of standards and concepts aimed at facilitating and streamlining information exchange, such as Information management using BIM (ISO 19650:2018) and the Level of Information Need concept (EN ISO 7817-1:2024), the construction sector continues to face significant challenges in ensuring seamless data exchange across diverse stakeholders and tools (Dimyadi, Solihin and Hjelseth, 2016; Farghaly *et al.*, 2018; Wu and Zhang, 2019; Mukkavaara and Sandberg, 2020; Meža *et al.*, 2021; Wu *et al.*, 2021; Guyo and Hartmann, 2024; Kaltenegger, Frandsen and Petrova, 2024). These challenges stem from fragmented systems and the complexities of meeting various data requirements, such as sustainability standards, BIM object rules, and European regulations (OBOS, 2018; EPD, 2024; Europa, 2024).

Product Data Templates (PDTs) have been introduced as a solution to these data-related hurdles. Standardized under EN ISO 23387:2020 and EN ISO 23386:2020, PDTs offer a structured approach to organizing and managing construction product data, ensuring traceability, interoperability, and consistency. By addressing the multifaceted data requirements of construction products, PDTs streamline information exchange across stakeholders, software applications, and platforms, thereby supporting the digitalization and lifecycle management of construction projects (Gigante-Barrera *et al.*, 2017; Lucky, Pasini and Lupica Spagnolo, 2019; EN ISO 23386, 2020; EN ISO 23387, 2020; Mêda, Calvetti, *et al.*, 2021; Mêda, Hjelseth, *et al.*, 2021) .

The literature reviewed explores various approaches to the definition and standardization of construction product data, focusing on energy and sustainability analysis in BIM (Kim *et al.*, 2015; Almeida *et al.*, 2023; Carvalho, Bragança and Mateus, 2023; Aragón and Alberti, 2024), data sharing via BIM object libraries (Pasini *et al.*, 2017; Spagnolo *et al.*, 2020), and semantic web technologies (Gudnason and Pauwels, 2016; Kebede *et al.*, 2022; Wagner *et al.*, 2022). Other works highlight frameworks and models for data management and lifecycle integration (Lucky, Pasini and Lupica Spagnolo, 2019; Succar and Poirier, 2020; Tomczak *et al.*, 2024). However, none provided specific datasets or frameworks for standardized construction data.

In this context, the industry has witnessed the emergence of numerous data platforms dedicated to providing specific properties for construction products (Cobuilder, 2019; buildingSMART, 2020; Natspec, 2021; CIBSE, 2023; NBS, 2023; ETIM, 2024). Nevertheless, almost all of these platforms lack standardization in their data and interconnectivity among each other. In this vein, the emergence of data dictionaries, like buildingSMART Data Dictionary (bSDD), have become significantly relevant in addressing these gaps, as further explained in section 2.1. Furthermore, an examination of commercial BIM object repositories reveals significant disparities in data, both among different platforms and even among construction products within the same platform in some cases (NBS, 2021; BIMobjects, 2022; Bimetica, 2024; BIMRel, 2024; bimstore, 2024; Prodlib, 2024). These observations further underscore the prevailing data interoperability gap within the industry.

Nevertheless, it is important to note that the mentioned data platforms and initiatives, which are being developed in various countries, are a substantial stride for the countries they are being developed in, in terms of data standardization, even though most do not adhere to the latest PDT standards due to the recency of these standards. As per EN ISO 23386:2020, the development of data platforms should be tailored to specific national contexts. Therefore, while works abroad offer valuable insights, they do not fully address the unique challenges and requirements of the construction industry in all countries.

Taking all the information into account, the main gap identified is that the landscape of construction data is fragmented and lacks a clear and concrete pathway to an open data management platform that adheres to the latest

PDT standards EN ISO 23387:2020 and EN ISO 23386:2020. This gap has been identified on an international level, but our proposal aims to bridge this gap on a national level by introducing a platform designed explicitly for the Portuguese national context, ensuring relevance, specificity, and compliance with international PDT standards.

Accordingly, the main objective of this paper is to propose an open PDT query platform that adheres to the latest PDT standards EN ISO 23387:2020 and EN ISO 23386:2020, and that provides industry professionals with a chance to interact with compliant PDTs. Following the guidance of EN ISO 23386:2020, this platform will be created for the Portuguese national context, ensuring relevance and specificity to Portugal's construction industry. This objective tackles the main gap identified; however, further details on the complexity of addressing this gap through specific objectives are explained in section 2. In the subsequent sections of this article, we will delve into the intricate dimensions of PDTs and their integration with existing standards and platforms, and then the PDT query platform is proposed.

2. PDTS RELEVANCE, STANDARDS, AND CURRENT DEVELOPMENTS

2.1 Product Data Templates Relevance and Normalization

Standards provide vital guidelines, principles, and benchmarks that ensure uniformity, quality, and safety in construction processes. Figure 1 illustrates the intricate web of standards and their relationship to PDTs within the construction industry. Building on this foundational understanding of standards, it is essential to delve into the two specific EN standards adopted by CEN/TC442 for PDTs EN ISO 23386:2020 and EN ISO 23387:2020.

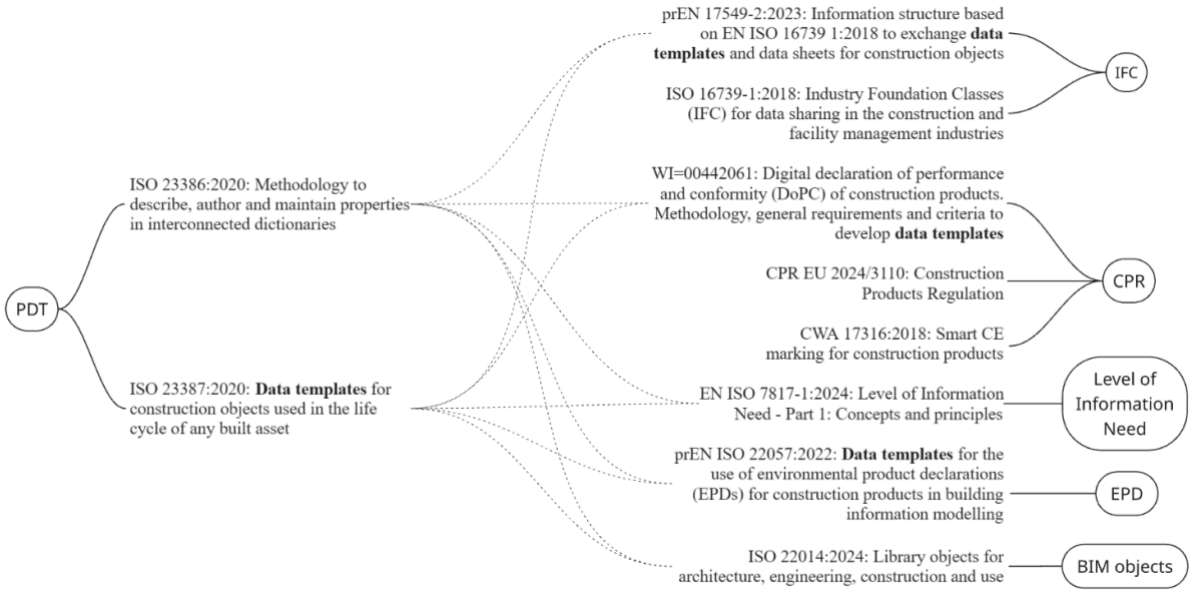


Figure 1: The intricate web of PDT-related standards.

The first is the EN ISO 23387:2020, 'Data templates for construction objects used throughout the life cycle of any built asset in building information modelling (BIM) - Concepts and principles'. EN ISO 23387:2020 standard establishes the principles and structure of data models for building objects. It supports digital processes by creating standard data structures for exchanging information in machine-readable formats. This standard's objective is to ease the use and reuse of information by providing a structure for grouping properties into data structures known as PDTs.

By following this proposed data structure, specific information needs, such as performance data required for CE marking, are systematically addressed through PDTs. Products in the European market must be affixed with a CE marking, proving that they have been assessed to meet high safety, health, and environmental protection requirements. Furthermore, it ensures that defined properties are linked to reference documents, such as standards, which define the methods for measuring these properties. This linkage enhances clarity during information exchanges among stakeholders.

As the foundation of our proposed PDT query platform aligns with the stipulations of EN ISO 23387:2020, it is crucial to acknowledge the evolving nature of industry standards. Notably, EN ISO 23387:2020 is undergoing advancements with the development of a new version, which underscores the need for adaptability in the proposed PDT query platform. The authors of this paper are aware of the nature of these developments and how they would impact the proposed PDT query platform. The detailed requirements of EN ISO 23387:2020 and its possible future developments are elaborated in section 3.1.

The second standard, EN ISO 23386:2020: 'Methodology for describing, authoring, and maintaining properties in interconnected data dictionaries for building information modelling and other digital processes used in construction', plays a crucial role in ensuring interoperability and supporting the creation of robust PDTs. EN ISO 23386:2020 provides a methodology to define and manage the characteristics of construction objects for digital use. Its primary aim is to facilitate the seamless exchange of construction data among various industry stakeholders, enabling its versatile use across different digital tools. As per this standard, the development of data dictionaries and PDTs should occur on a national scale, accounting for the unique characteristics of each country's construction market. The interoperability between data dictionaries is attainable by adhering to EN ISO 23386:2020 guidelines, wherein each definition in a data dictionary receives a unique identifier, facilitating links to other data dictionaries.

Moreover, interoperability between data dictionaries and BIM platforms is indispensable for achieving harmonization across BIM platforms, as they can draw data from unified data dictionaries. Nevertheless, it is noteworthy that the mentioned PDT-related standards do not specify construction product properties and merely provide the guidelines to create and manage them. Construction product data must encompass diverse information types dictated by various stakeholders throughout a project's lifecycle. The challenge for PDT creators lies in precisely defining this requisite data for construction products and their relevant BIM objects that must adhere to stringent information quality and nomenclature criteria per BIM object standards and guidelines (OBOS, 2018; NBS, 2019). In this context, ISO 22014:2024 is relevant as it references PDT standards, reinforcing their role in structuring, managing, and ensuring interoperability of construction product data (ISO 22014:2024, 2024).

The mentioned standards set the stage for advancing data standardization, which helps addressing the complexities of modern construction projects (Hooper, 2015; Amoah, 2022) benefiting design professionals (Tan, Hammad and Paul Fazio, 2013; Ilhan and Yaman, 2016), operation managers (Gudnason and Pauwels, 2016; El Ammari and Hammad, 2019; Cheng *et al.*, 2020; Marmo *et al.*, 2020), and manufacturers (Costa and Madrazo, 2015; Wik *et al.*, 2018; Lucky, Pasini and Lupica Spagnolo, 2019; Spagnolo *et al.*, 2020; Kotecha *et al.*, 2021; Kebede *et al.*, 2022), among other stakeholders. The benefits were explicitly relevant in defining Exchange Information Requirements (EIR) to specify information needs at project milestones, specifically through the new concept of the Level Of Information Need (EN ISO 7817-1:2024), which includes alphanumerical data from PDTs (Bolpagni *et al.*, 2022; EN ISO 7817-1:2024, 2024; Kuzminykh *et al.*, 2024; Oliveira *et al.*, 2024), through the use of formats like Information Delivery Specification (IDS) (Tomczak *et al.*, 2024).

In parallel, BIM platforms can leverage standardized machine-readable data to integrate advanced analytics tools for automating performance, energy, sustainability analysis, and facility management (Jalaei and Jrade, 2013; Kumanayake and Luo, 2017; Farghaly *et al.*, 2018; Nizam, Zhang and Tian, 2018; Honic *et al.*, 2019; Wu and Zhang, 2019; Barbini *et al.*, 2020; Wu *et al.*, 2021; Almeida *et al.*, 2023; Sesana *et al.*, 2024), hence supporting data-informed decisions throughout the construction lifecycle (CIBSE, 2023; NBStoolkit, 2023; Beach *et al.*, 2024). In this sense, PDTs, as standardized, machine-readable data containers, can help give semantic definitions to information within BIM platforms and help with the interoperability of data from different sources that can be used within analytics tools. In this context, interoperability using open formats like Industry Foundation Classes (IFC) can be highlighted. IFC is standardized in ISO 16739-1:2018 and the methods of data exchange of PDTs using this format is standardized in prEN 17549-2:2023 (prEN 17549-1, no date; EN 17412-1, 2020).

Furthermore, in today's construction landscape, comprehensive documentation and efficient information management are paramount. PDTs, with their standardized formats, serve as foundational structures in data documentation initiatives, such as Material Passports and Digital Product Passports (DPP). Material passports focus on material reuse at the end of a product's life. DPP are a standardized repository of digital product information (Adisorn, Tholen and Götz, 2021; Jensen *et al.*, 2023), like CE marking and Environmental Product Declarations (EPDs) data. DPP were recently proposed and approved in the latest amendments from Construction Product Regulation (CPR), and are expected to be mandated in Europe by the year 2028 (Honic *et al.*, 2019;

BAMB, 2020; CPR, 2024; Sanchez *et al.*, 2024). DPP must adhere to open standards, be machine-readable, structured, and searchable (European Parliament, 2023), and PDTs adhere to these requirements set forth for DPP by the CPR (Atta, Bakhoum and Marzouk, 2021; Çetin *et al.*, 2023; Kuzminykh *et al.*, 2024). The draft standard WI=00442061 on the Digital Declaration of Performance and Conformity (DoPC) applies PDT concepts to digitize DoPCs related to CE marking (CEN-CENELEC, 2025). In regard to EPD data, ISO 22057 defines the relevant properties from EPDs to be used in PDTs (EN ISO 22057, 2022).

While PDTs provide a foundation for data documentation, they also play a critical role in fostering interoperability through the use of data dictionaries. EN ISO 23386:2020 defines a data dictionary as a centralized repository housing data-related information, promoting interoperability in the construction industry (EN ISO 23386, 2020). Standardized data dictionaries help organizations describe construction products, systems, and materials, enhancing collaboration (buildingSMART, 2021; Pieter Pauwels, Dennis Shelden, Jan Brouwer, Devon Sparks, Saha Nirvik, 2023; Beach *et al.*, 2024). PDTs conforming to EN ISO 23386:2020 leverage rich data dictionary content, creating a standardized data representation. PDTs can be created within the context of a Data Dictionary to form a Domain that can be used by a specific entity or country. The buildingSMART Data Dictionary (bSDD), a service from buildingSMART that houses different data dictionaries from different domains in their platform, contains examples of PDTs created by organizations for their specific domains (bsDD, 2023).

The bSDD data model follows a hierarchical structure, where each domain (e.g., a dictionary for "doors") includes classifications (e.g., groups of properties) that are further defined by their associated properties (see Figure 2) (buidlingSMART, 2023). These classifications can be classes, reference documents, or groups of properties, among other types. The attributes for each classification and property contain valuable metadata related to the versioning, definition, country of use, and synonyms, including an attribute that connects the Class or Property to reference documents. This structure allows the hosting of PDTs that conform with the PDT standards EN ISO 23386:2020 and EN ISO 23387:2020.

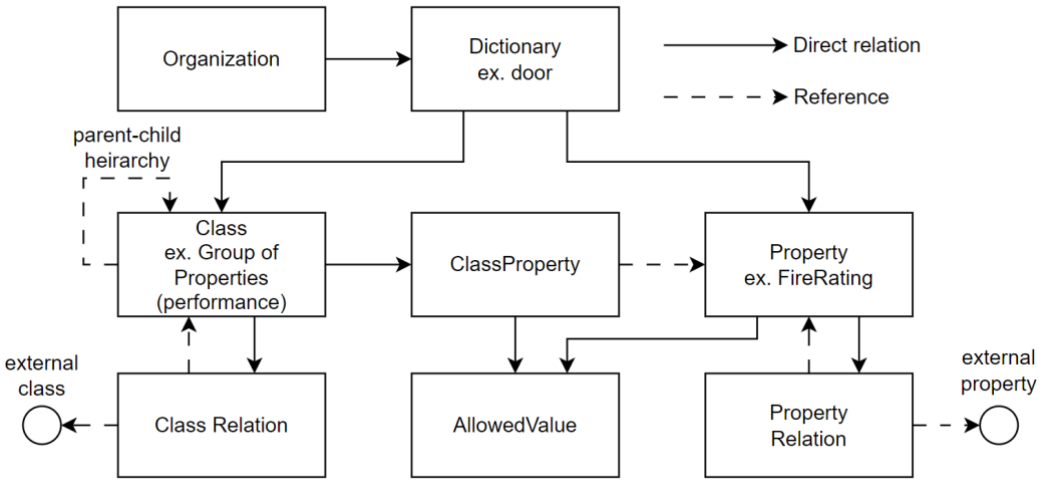


Figure 2: BuildingSMART Data Dictionary model.

Expanding on the role of data dictionaries, the construction industry's digital transformation demands a semantic understanding of data. In that context, ontologies play a pivotal role by formally organizing concepts defining relationships and taxonomies within datasets, and enhancing data semantics (Aaron Costin, Jeffrey W. Ouellette, 2022; Mathias Bonduel, Pieter Pauwels, 2023; Moyano *et al.*, 2023). PDTs serve as ontological constructs, defining the properties of definitions tailored to the construction industry's unique requirements (Katranuschkov, Gehre and Scherer, 2003; Gudnason and Pauwels, 2016; Niknam and Karshenas, 2017; Mathias Bonduel, Pieter Pauwels, 2023). When designed with the principles of Linked Data, which is structured information shared and interconnected using open standards, it boosts interoperability between domains and information systems (Katranuschkov, Gehre and Scherer, 2003; Gudnason and Pauwels, 2016; Pauwels, Zhang and Lee, 2017; Kebede, Moscati and Johansson, 2020; Wagner *et al.*, 2022; Jeroen Werbrouck, Madhumitha Senthilvel, 2023; Yin *et al.*, 2023).

Furthermore, PDTs, with their standardized structure, ease the adherance with semantic web standards such as Resource Description Framework (RDF) and JavaScript Object Notation (JSON) (Gudnason and Pauwels, 2016; Kebede *et al.*, 2022; Jeroen Werbrouck, Madhumitha Senthilvel, 2023; Pieter Pauwels, Dennis Shelden, Jan Brouwer, Devon Sparks, Saha Nirvik, 2023), through the structuring of their data in accordance with the principles and syntax defined by these standards. This helps in data processing by various software applications (Niknam and Karshenas, 2017; Jeroen Werbrouck, Madhumitha Senthilvel, 2023). In this context, developments can be found in the literature on creating ontologies for construction products data that are based on the PDT standards EN ISO 23386:2020, and EN ISO 23387:2020 (Zentgraf, Hagedorn and König, 2022; Filardo *et al.*, 2024).

2.2 Current status of data in existing online platforms

Moving forward, it was essential to review and shed light on the current status of data available for stakeholders within the construction industry. Throughout the research for platforms, Two types were encountered: data platforms and BIM object repositories. Data platforms contained generic data sets encompassing properties for construction elements, while BIM object repositories contained mainly BIM objects of construction products from manufacturers. However, they also had data related to these BIM objects in the form of properties or other forms like PDFs. As noted in Table 1, an analysis was made to understand the nature of the analyzed platforms, to differentiate data platforms from BIM object repositories, national from international, and to analyze the accessibility of these platforms.

Table 1: Online platforms that contained data related to construction products.

Platform Name	Data platform	BIM object repository	National	International	Open access
Arcat (ARCAT, 2024)	x	✓	✓	x	✓
BIM&CO (BIM&CO, 2021)	x	✓	x	✓	✓
Bimetica (Bimetica, 2024)	x	✓	x	✓	✓
BIMHawk (CIBSE, 2023)	✓	x	x	✓	✓
BIMobject (BIMobjects, 2022)	x	✓	x	✓	✓
BIMRel (BIMRel, 2024)	x	✓	✓	x	✓
Bimstore (bimstore, 2024)	x	✓	x	✓	✓
CoBuilder Define (Cobuilder, 2020)	✓	x	✓	x	✓*
datBIM (datBIM, 2024)	x	✓	✓	x	✓
ETIM (ETIM, 2024)	✓	x	x	✓	✓
IFC property sets (buildingSMART, 2020)	✓	x	x	✓	✓
NBS (NBS, 2023)	x	✓	✓	x	✓
NATSPEC (Natspec, 2021)	✓	x	✓	x	✓
Prodlib (Prodlib, 2024)	x	✓	x	✓	✓

✓* Partially compliant

All platforms mainly belonged to one category only, either data platform or BIM object repository. Some of the platforms were deployed on national scales, for example, NATSPEC targeted the region of Australia. Other platforms were deployed on an international scale, such as the IFC, ETIM, and BIMobject. All platforms had open access to the properties of construction objects, some after requiring registration to their platform. Nevertheless, Cobuilder Define platform has some proprietary limitations to the use of its data openly.

In this vein, LEXiCON is a noteworthy initiative, where the creation of a PDTs platform is underway. Even though the initiative has not launched its platform yet, they mention in their latest report, published in 2022, that their PDT creation processes adhere to EN ISO 23387:2020 and EN ISO 23386:2020, through following the data structure of the standards, the addition of relevant attributes to their properties, and by allowing feedback from the industry

(Lexicon, 2022, 2024). Even though, the intiative is very interesting in the context of this paper, until now, no peer-reviewed studies have been published evaluating its implementation or impact.

Additionally, it is worth monetioning that the construction industry has seen a rise in open-source initiatives aimed at improving data management and interoperability. Initiatives such as Speckle, Bonsai, and That Open Company exemplify efforts to enhance collaborative workflows through open-source platforms (Bonsai, 2025; Speckle, 2025; That Open co., 2025). However, these initiatives do not specifically focus on the standardization of construction data, which is the central theme of this study, hence, will not be further mentioned.

Focusing on data platforms, an analysis was made to understand the existing initiatives that aim to provide the industry with standardized properties for construction products and check whether they comply with PDT standards. Table 2 provides a comprehensive overview of the criteria analyzed within various data platforms concerning the availability of essential data within their libraries and data export methods available. Additionally, Table 3 analyses their conformity to PDT standards EN ISO 23387:2020 and EN ISO 23386:2020. This analysis aims to shed light on the capabilities and limitations of these platforms, which are critical for understanding their roles in facilitating efficient data management within the construction industry.

Table 2: Current status of data platforms.

Name of platform	Essential Data in platform					Export	
	DoP	EPD	IFC property sets	Cobie	Classification	Export of data	Export format
NATSPEC	x	✓	✓	✓	✓	✓	CSV, PDF
CoBuilder Define	✓	✓	x	x	✓	✓	CSV
IFC property sets	x	✓	✓	✓	✓	x	x
BIMHawk	✓	x	x	✓	✓	✓	XML
ETIM	x	x	x	x	✓	x	x

In Table 2, it can be noted that each platform contains some of the essential data required for construction objects. The main five types of data selected were performance data from the CE marking that come in the form of Declarations of Performance (DoP), sustainability data that come from EPDs, data from the IFC property sets in the IFC schema, facility management related data from Cobie, and data related to any classification system. The analysis reveals a recurring pattern of data coverage, where specific data categories are present in some platforms while absent in others. This uniformity issue is exemplified by the BIMHawk platform, which incorporates information from DoP and Cobie properties but lacks data on EPDs and IFC property sets. The NATSPEC platform covers EPDs, IFC, and Cobie properties but lacks DoP data. However, this can be related to the national context of the platform, where CE marking is not a requirement in Australia. CoBuilder Define, IFC Property Sets, and ETIM follow suit, each presenting a distinct combination of included and excluded data categories. These findings underscore a noteworthy deficiency in meeting comprehensive data requirements. The absence of specific international standard properties, such as those related to the CE marking, further emphasizes the substantial misalignment between the offerings of some of these platforms and the actual data needs within the industry.

Furthermore, our analysis identified a notable divergence from the latest PDT standards EN ISO 23387:2020 and EN ISO 23386:2020 among all platforms except Define. This noncompliance with the requirements of these standards is detailed in Table 3. The table mentions two major requirements from EN ISO 23387:2020, which are the adherence to the data model proposed by the standard, detailed in section 3.1, and the connection of properties to reference documents. Notably, the absence of a standardized data model and lack of connection to reference documents across most platforms was evident. The lack of adherence to these standards raises concerns about the consistency and interoperability of data on these platforms.

Table 3 mentions two other requirements from EN ISO 23386:2020, which are deployment on a national scale and assigning specific attributes for properties. Regarding the first requirement, only two of the platforms, NATSPEC and Define, were deployed on a national scale, and the others were deployed on an international scale. In regards to the second requirement, which is assigning attributes for properties, it is important to note that these attributes

provide significant benefits to managing data. First, they enhance machine readability through the definition of unique identifiers for properties, which also eases their connection to properties in other domains and data dictionaries. Second, it allows the versioning of properties and provides a historical record of changes for the property.

In this sense, the Define platform complied with the second requirement. ETIM platform provides versioning for their properties on their platform, and they also deployed their classification system on the bSDD, where they defined some attributes for the properties; hence, it was considered partially compliant with this requirement. IFC property sets follow suit as they are also deployed on bSDD. The BIMHawk and NATSPEC platforms did not comply with this requirement. The inability to retrieve historical data poses challenges for users seeking to track changes, assess the evolution of product information, analyze trends over time, or maintain the "golden thread" of information. This limitation underscores a critical aspect of data management currently lacking within some of the assessed platforms.

Table 3: Platforms compliance with EN ISO 23386:2020 and EN ISO 23387:2020.

Platform	EN ISO 23387 requirements		EN ISO 23386 requirements	
	Adherence to database model	Connection of properties to reference documents	Deployed on a national scale	Properties has attributes as per standard
NATSPEC	x	x	✓	x
CoBuilder Define	✓	✓	✓	✓
IFC property sets	x	x	x	✓*
BIMHawk	x	x	x	x
ETIM	x	x	x	✓*

✓* Partially compliant

Looking at BIM object repositories like BIMobjects, NBS library, bimstore, and BIMRel, among others (NBS, 2021; ARCAT, 2024; Bimetica, 2024; bimobject, 2024; BIMRel, 2024; bimstore, 2024; datBIM, 2024; Prodlib, 2024), most of these platforms relied on manufacturer information in the form of attached technical sheets and catalogues. Some platforms, like NBS and BIMRel, provided properties for objects, but there was no unified structure or management for the data as per the recommendations of EN ISO 23387:2020 and EN ISO 23386:2020. As noted in Table 4, most of the platforms lacked essential data, such as DoP, EPD, IFC, and Cobie. Some did contain some of this data but lacked others. The platforms mainly contained proprietary sets of properties that mostly depended on the data the manufacturers provided. These data was mainly present in the form of technical sheets or properties on the platform, however, some platforms also had their data inside their BIM objects like NBS and BIMRel. This analysis mainly highlighted a lack of standardization and disparity of information throughout the BIM object repositories and a total lack of adherence to any of the PDT-related standards. It also shows that manufacturers do not yet give attention to the requirements of data digitalization and the importance of having interoperable data to link the information gap between manufacturers and stakeholders in the construction industry.

This overall analysis of existing data platforms and BIM object repositories sheds light on the gaps identified in this paper, which are (i) the lack of knowledge by industry stakeholders, manufacturers and platform creators on the significance of properly standardized digital data for construction products, (ii) the lack of adherence of existing platforms to the published PDT standards for data management using data dictionaries and PDTs, and (iii) the reality that there is no singular open platform that provides standardized data for construction products in compliance with the latest PDT standards.

Addressing these gaps is essential for guiding the industry towards data management that aligns with the latest PDT standards. This paper initiates a discussion, grounded in scientific research, on how to implement these standards in an open manner that can be adopted widely. The aim is to facilitate a standardized approach to data management in the construction industry. The unified implementation of the latest PDT standards could potentially lead to significant advancements in data management within the construction industry.

Table 4: Current status of BIM object repositories.

Name of repository	Essential Data in repository						Data location	
	DoP	EPD	IFC	Cobie	Proprietary property sets	Classification system	Platform	BIM object
BIMobject	x	x	x	x	✓	✓	✓	x
NBS	✓	x	✓	✓	✓	✓	✓	✓
bimstore	x	x	x	✓	✓	✓	✓	x
Arcat	x	x	x	x	✓	✓	✓	x
prodlib	x	x	x	x	✓	x	✓	x
BIM&CO	x	x	x	x	✓	✓	✓	x
BIMRel	✓	✓	x	x	✓	✓	✓	✓
datBIM	x	✓	x	x	✓	✓	✓	x
Bimetica	x	x	x	x	✓	✓	✓	x

3. PDT PLATFORM

In response to the identified gaps and opportunities, an open PDT query platform is proposed that is constructed on the principles of compliance with EN ISO 23386:2020 and EN ISO 23387:2020. This platform will be developed specifically for the Portuguese national context, ensuring its relevance and specificity to the construction industry in Portugal in accordance with the guidelines outlined in EN ISO 23386:2020, which advocate for the establishment of domain-specific platforms tailored to individual nations. It will also incorporate the requirements for versioning and connectivity with other domains and data dictionaries aligning with the principles outlined in EN ISO 23386:2020. The platform's architecture and data models are thoroughly explained, underscoring their adherence to EN ISO 23387:2020. Compliance with the PDT standards in this context is pivotal in establishing a robust foundation for the platform for effective data management and interchange within the Portuguese construction landscape. However, the significance of this platform extends beyond its adherence to standards.

The platform's open-source nature, with its codebase shared on GitHub (https://github.com/M-ElSibaii/pdtspt) (GitHub, 2025), is a noteworthy step in the realm of construction data management platforms. This is a significant stride as there is a global lack of open implementations of such platforms. The complexities of structuring a database, implementing versioning and historical records, managing and authoring data, and designing user interfaces are daunting tasks for those stepping into this domain. These aspects, although methodically explained in the standards, have not been technologically implemented and shared openly worldwide.

This paper delves into the particularities of one implementation for one specific country, providing a valuable asset for future implementations. Discussing the optimal way to adhere to the regulations and maintain data contributes to the scarce literature on these unexplored aspects. The transparency of this platform promotes scalability worldwide, allowing for adaptation and implementation in diverse contexts. It facilitates peer review, encourages community engagement and contributions, and fosters a collaborative approach to enhancing the platform's functionalities.

3.1 Data model based on EN ISO 23386:2020 and EN ISO 23387:2020

Several tables were carefully designed in the proposed data model for the PDT platform, each with a distinct purpose for managing PDTs and their related information. The database serves as a data dictionary for storing PDTs adhering to the guidelines and requirements specified in EN ISO 23387:2020 and EN ISO 23386:2020. Moreover, the data model of bSDD was taken into account during its creation to facilitate the integration into it.

EN ISO 23387:2020 Requirements

As per EN ISO 23387:2020, data templates should be standardized and made available across the built environment sector through data dictionaries based on ISO 12006-3:2007 to support digital processes using machine-readable

formats using a standard data structure to exchange information. ISO 12006-3:2007 specifies a language-independent information model that can be used for the development of dictionaries to store or provide information about construction works that support the requirements for implementation concepts in EN ISO 23386:2020 and EN ISO 23387:2020. ISO 12006-3:2007 is now updated to ISO 12006-3:2022, but here we reference the 2007 version once the EN ISO 23387:2020 uses that version, the expected version of EN ISO 23387 should reference the 2020 version of ISO 12006-3.

Table 5: Naming relations between EN ISO 23387:2020 and ISO 12006-3:2007 (adapted from EN ISO 23387:2020).

EN ISO 23387 names	ISO 12006-3 names
Data template	xtdBag
Reference document	xtdExternalDocument
Construction object	xtdSubject
Group of properties	xtdNest
Generic property	xtdProperty
Specific property	xtdProperty
Quantity	xtdMeasureWithUnit
Unit	xtdUnit
Enumerated type value	xtdValue

The structure of the PDT database is based on a diagram (UML) provided in the EN ISO 23387:2020 standard (see Figure 3). This diagram shows how different parts of the data templates are connected. Some terms from the ISO 12006-3:2007 standard were changed to make them easier to understand in the construction industry. For example, "xtdSubject" became "Construction object," "xtdExternalDocument" became "Reference document," and "xtdBag" became "Data template" (see Table 5).

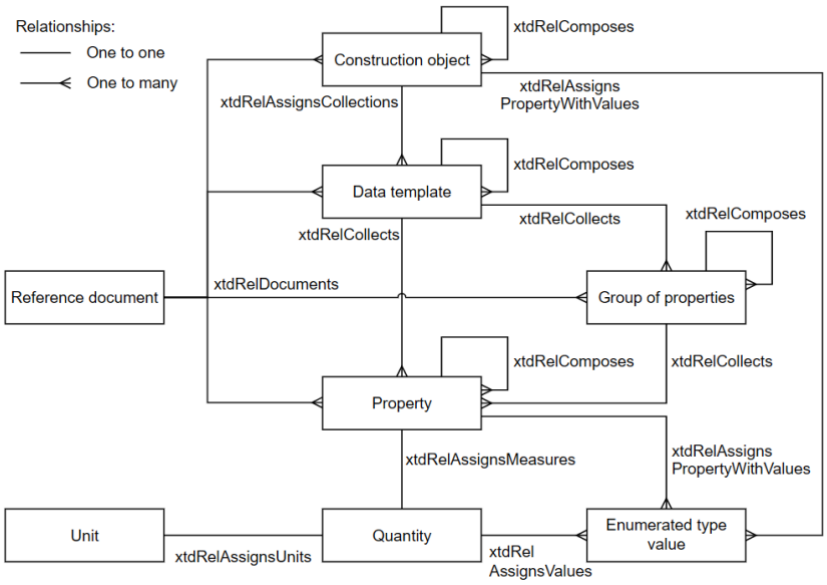


Figure 3: UML diagram of Data Templates adapted from EN ISO 23387:2020.

In this section, we will describe elements in the UML diagram from EN ISO 23387:2020 found in Figure 3 and then discuss their similarities and differences with the proposed data model for the platform, which can be observed in Figure 4. Given the technical nature of this discussion, basic understanding of the standard EN ISO 23387:2020, database structures and UML notations is recommended, as these concepts are essential to accurately interpreting the relationships and entities described. In the UML diagram in Figure 3, a “Construction Object” can be linked to

one or multiple “data templates” through “xtdRelAssignsCollections” relationship. xtdRelAssignsCollections in this context means that a construction object can have information described by one or more data templates. This relationship is reflected in the MySQL data model in the table “Construction objects”, which has a one-to-many relationship with the “Product Data Templates” table, similar to the xtdRelAssignsCollections relationship.

In the UML diagram of Figure 3, a "Data Template" can be linked to one or more "Groups of Properties" and multiple "Properties" through a connection called "xtdRelCollects." This means that a data template can include information from several groups of properties and individual properties. This is reflected in the one-to-many relationship from the Product Data Templates table to the Groups of Properties and Properties table in the data model in Figure 4. Similarly, a Group of Properties can encompass multiple Properties through the "xtdRelCollects" relationship in Figure 3. This is mirrored in Figure 4, where a one-to-many relationship ensures that each Group of Properties serves as a container for multiple Properties.

In the UML diagram of Figure 3, a relationship called “xtdRelComposes” can be observed for Construction Objects, Data Templates, Groups of Properties, and Property. This relation indicates a one-to-many connection within an entity itself. For example, it allows one data template to be made up of several other data templates, facilitating a hierarchical system representation. In the platform data model, this relationship is not represented yet as PDTs for systems were not considered yet; however, to implement this feature in the MySQL database, a junction table would be required to establish these internal links. This table would store references between related instances, enabling structured relationships without altering the main data model architecture.

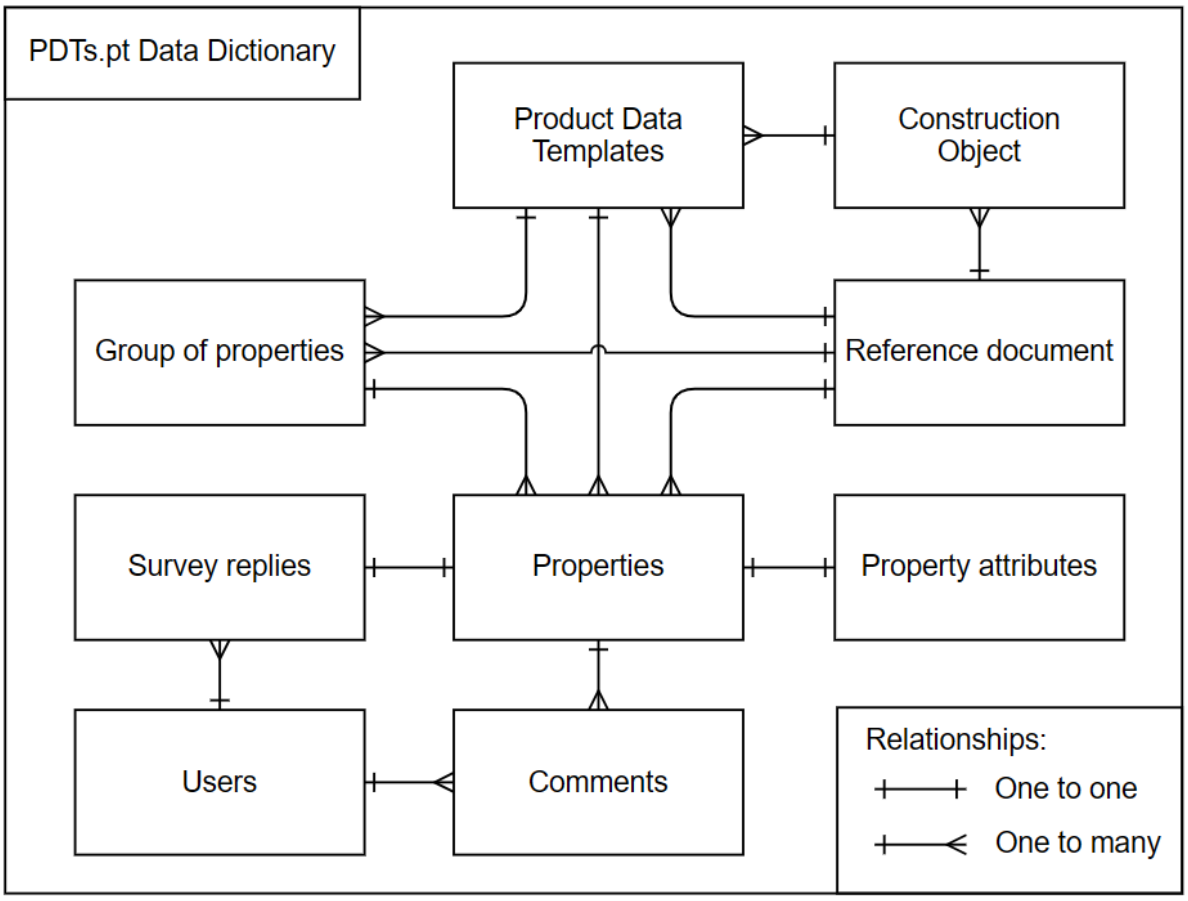


Figure 4: Data model of the PDT platform’s data dictionary.

Finally, In the UML diagram of Figure 3, each “Construction Object”, “Data Template”, “Group of Properties”, and "Properties" can be linked to a "Reference Document" using the relationship “xtdRelDocuments”. This denotes that various elements in the model can be supported by external documentation. In the data model in Figure 4, the

relationship is reflected in the many-to-one relationship from the reference Document table to each of the tables Construction object, Product Data Templates, Groups of Properties, and Properties.

The proposed data model in Figure 4 also contains tables related to the users and their inputs in the platform, such as comments and survey replies, and a property attributes table. The property attributes table in the data model is used as the data dictionary of the properties used in the PDTs domain. In this table, properties are listed, and each property has attributes that are based on the required attributes for properties in EN ISO 23386:2020. Similar attributes are found in the table of Groups of Properties, also based on the requirements for attributes in EN ISO 23386:2020. The Properties table is used to map the product data templates, groups of properties and properties based on their primary keys. The content and function of these tables are described in detail in the next section.

Notably, in the EN ISO 23387:2020 UML diagram in Figure 3, properties are related one to one with Quantities, which are related to units and Enumerated type values. This information is also present in the recommended attributes for properties from EN ISO 23386:2020, which are in the "Property attributes" table. Hence, two methods of presenting this information were considered, either by creating tables for quantities, units, and Enumerated type values in the data model or by adding them within the table "Property attributes". To take this decision, one more factor was taken into account, which is the structure of the data model of buildingSMART Data Dictionary (bSDD), since it is intended to use this service later on to publish the PDT.pt domain (see Figure 2). Accordingly, after analyzing the bSDD data model, which has the data related to Quantities, Units, and Enumerated type values within the attributes of the properties, it was decided to keep this information as attributes in the "Property attributes" table in the data model to facilitate the integration with the bSDD (see Figure 4).

It is important to note that the authors followed the 2020 version of the EN ISO 23387:2020, but as mentioned earlier, it is under revision. The revised version, as per the knowledge of the authors, might contain an additional "Purposes" element in the data model that is connected to the "Data templates" element, among other additions like defining the essential attributes in all the tables of the database. Nevertheless, these changes do not alter the structure of the proposed data model in this paper; they will just require some minor modifications that should not affect its functionality or the flow of data from the database to the online platform.

EN ISO 23386:2020 Requirements

EN ISO 23386:2020 provides guidelines on managing and authoring data dictionaries related to PDTs. Two main requirements are discussed in this section: assigning attributes for properties and groups of properties and creating feedback channels for the industry.

First, regarding assigning attributes to properties and groups of properties. It is noteworthy that these attributes are pivotal in supporting a comprehensive data dictionary for the PDTs platform. They are key to managing, traceability, connectivity of properties and groups of properties to other data dictionaries, and allow for versioning of elements in the data model, as discussed in detail further on.

Accordingly, a fundamental component of the data model in Figure 4 is the attributes assigned to the properties and groups of properties as defined in EN ISO 23386:2020. As mentioned earlier, the properties and their attributes are in the Property Attributes table. This table contains all attributes used in the PDTs data model. However, to allow a property with a certain GUID to be referenced in more than one PDT, the Property attributes table was separated from the "Properties" table that is proposed in the data model of EN ISO 23387:2020. For example, the property "ThermalConductivity" would be used in the Door Data Template (DT) and the Mineral Wool Insulation Board DT; hence, in the property attributes table, there will be one entry for that property with a unique GUID. In the properties table, there will be an entry for each PDT referencing that same GUID.

The properties table references the properties in the property attributes table through the GUID and Id to be able to select a specific version of the property, and the platform extracts the relevant information about the property from the property attributes table using SQL queries in the scripts. However, once the same property in the property attributes table can be referenced in more than one PDT, "Descriptions" related to the property in the specific PDT were added to the properties table. For example, the property Height can be used for the Door DT and the Sink DT. In the property attributes table, height is defined as the vertical elevation of an object. However, when used in the context of the door, it was necessary to specify a specific description, where height usually means the distance from the floor to the lower part of the door frame. This feature allowed the precise meaning of the property to be modified if necessary when used in the context of a specific PDT. This structure of tables aligns with the bSDD

data model in Figure 1, where properties and their attributes in the Property attributes table maps to the Property element in bSDD model, and the Properties table maps to the ClassProperty element in the bSDD model.

By adhering to the guidelines of EN ISO 23386:2020, all elements in the data model have attributes that help in the versioning of these elements. Accordingly, a comprehensive versioning table is provided for properties, groups of properties, and PDTs within the presented platform (see Table 6). This table sets out the conditions of edition (X), version (Y), and revision (Z) for each entity, offering a systematic and transparent insight into the evolution of data. Additionally, when a replacement version is generated for a Product Data Template, Property, or Group of Properties, the preceding version is marked as "Inactive", and the attributes related to the depreciation of the element are recorded for the inactive version. This process ensures a comprehensive historical record of changes and facilitates data traceability.

Versioning is pivotal in ensuring data traceability and maintaining the "golden thread" of information within the construction industry. With the evolving nature of construction projects and the frequent updates in product data, versioning provides a structured approach to track changes, revisions, and updates in PDTs. Versioning of PDTs allows users to follow the lineage of changes made to specific properties or groups of properties. Each version of a PDT captures a snapshot of the data at a particular point in time, creating an audit trail of modifications. This traceability is crucial for quality assurance, compliance, and transparency, as it enables regulators, auditors, and project stakeholders to verify the accuracy and validity of data.

Table 6: Versioning conditions of PDTs, groups of properties and properties.

Element	Edition (X)	Version (Y)	Revision (Z)
Property V (Y.Z)	n/a	○ Name change ○ Description change	○ Name correction ○ Description correction ○ Attribute change
Group of properties V (Y. Z)	n/a	○ Added property ○ Deleted property ○ Name change of Group of properties	○ New property version or revision ○ attributes change
Product Data Template V (X. Y. Z)	○ Name change ○ Add or Remove Group of Properties	○ new version of Group of properties	○ new version of Group of properties

Second, regarding providing an open channel for feedback on PDTs and in adherence to the mandates outlined by EN ISO 23386:2020, our database design places paramount importance on user feedback. Our schema's "Survey replies" table captures user responses and feedback for specific PDTs. The "Comments" table was created to allow users to comment on PDTs, facilitating discussions and knowledge sharing within the construction community. The "Users" table is central to this structure, which securely manages user credentials and authorization levels. Through this approach, our system actively encourages stakeholders to contribute their expertise and insights, aligning with the principles of EN ISO 23386:2020 and ultimately leading to the refinement and optimization of PDTs.

The content of the tables related to PDTs management can be consulted in Table 7. The Product Data Templates table included attributes like name, description, status, and version. The tables of Groups of properties and Property attributes include attributes from the EN ISO 23386:2020. Several of these attributes are filled out by the user, such as name, description, version, revision, creator's language, etc. However, many attributes are automatically calculated in the platform using specific queries and code. The attributes that are calculated are dictated in the EN ISO 23386:2020 (also marked with an ' * ' in Table 7). Additionally, the standard mandates the filling of some attributes (marked with an ' ^{m} ' in Table 7). It can be noted that the tables include a primary key "Id" and "GUID" to accommodate different versions of any element in the tables, where the GUID remains the same for an entry, but new versions would have new Ids.

Table 7: Content of the tables related to PDT structure in the MySQL database.

Construction Object			
GUID *(Primary key)* * m	constructionObjectNameEn m	descriptionEn m	revisionNumber m
referenceDocumentGUID	constructionObjectNamePt m	descriptionPt m	versionNumber m
Product data templates			
Id *(Primary key)* * m	pdtNamePt m	editionNumber m	status m
GUID m pdtNameEn m	dateOfEdition * m	versionNumber m	descriptionPt m
referenceDocumentGUID	dateOfRevision * m	revisionNumber m	Deprecation explanation
constructionObjectGUID m	dateOfVersion * m	descriptionEn m	Deprecation date
Group of properties			
Id *(Primary key)* * m	definitionPt m	versionNumber m	countryOfUse m
GUID m	status m	revisionNumber m	countryOfOrigin
pdtId m	dateOfCreation * m	listOfReplacedGroupsOfProperties	categoryOfGroupOfProperties m
referenceDocumentGUID	dateofActivation * m	listOfReplacingGroupsOfProperties	
gopNameEn m	dateOfLastChange * m	relationToOtherDataDictionaries	parentGroupOfProperties
gopNamePt m	dateOfRevision * m	creatorsLanguage m	Deprecation explanation
definitionEn m	dateOfVersion * m	visualRepresentation	Deprecation date
Property attributes			
Id *(Primary key)* * m	dateOfLastChange * m	visualRepresentation	namesOfDefiningValues
GUID m	dateOfRevision * m	countryOfUse m	definingValues
namePt m	dateOfVersion * m	countryOfOrigin	tolerance
nameEn m	versionNumber m	physicalQuantity m	digitalFormat
definitionPt m	revisionNumber m	dimension m	textFormat
definitionEn m	listOfReplacedProperties *	dataType m	listOfPossibleValuesInLanguageN
status m	listOfReplacingProperties *	dynamicProperty m	boundaryValues
dateOfCreation * m	relationToOtherDataDictionaries	parametersOfTheDynamicProperty	Deprecation explanation
dateofActivation * m	creatorsLanguage m	units m	Deprecation date
Properties			
Id *(Primary key)* * m	gopID m	referenceDocumentGUID	descriptionPt m
propertyID * m	pdtID m	descriptionEn m	visualRepresentation
Reference documents			
GUID *(Primary key)* * m	rdName m title	description	status

* Calculated attribute / m Mandatory attribute

While our current implementation of the PDT platform's data dictionary relies on GUIDs as unique identifiers, it is noteworthy to highlight emerging trends in the industry, specifically in data dictionaries such as the buildingSMART Data Dictionary (bSDD). the bSDD have adopted URIs (Uniform Resource Identifiers) as unique identifiers. URIs offer the advantage of uniquely identifying elements and serving as direct access points to data through Application Programming Interface (API), facilitating seamless data retrieval, as well as supporting of the principals of linked data. Although our current system utilizes GUIDs, the integration of our domain in a data dictionary like bSDD will require mapping the GUIDs to URIs; however, during preliminary testing, it was noted that this process is seamlessly automated when adding the domain elements in the dictionary; hence the current use of GUIDs does not hinder the integration process with bSDD, and after the implementation, all elements would have GUIDs and URIs. This is also relevant in the definition of properties in IFC format, where the definition of properties using the IfcProperty instance requires the definition of an attribute for the property called Specification. This Specification attribute references a URI that leads to a location with the semantic definition of informative text to explain the property. Accordingly, the assignment of URIs is crucial in that context.

3.2 Platform architecture and framework

The platform designed for displaying, managing, sharing, and gathering feedback for PDTs was methodically constructed using a 3-tier architecture, with distinct technologies assigned to each tier, all integrated within a standardized framework called Laravel (see Figure 5) (Laravel, 2023). Laravel is a free, open-source PHP web framework that provides developers with tools and resources for building modern PHP web applications following the model-view-controller (MVC) architectural pattern. It facilitates the separation of application logic, data handling, and presentation layers, ensuring code organization and maintainability. It is ideal for developing sophisticated and scalable web applications for scientific and data-driven projects. The code can be consulted in the mentioned GitHub page so interested readers can follow along while reading this section.

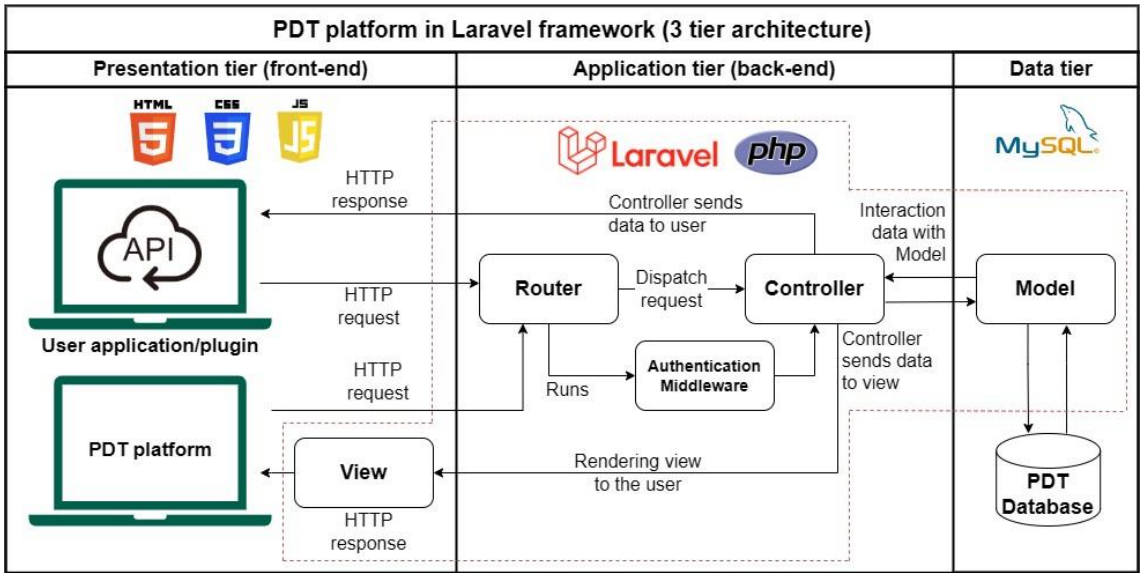


Figure 5: Architecture of the PDTs platform.

At the presentation tier (front-end), the implementation involved using HTML, CSS, and JavaScript to create an intuitive and user-friendly interface. Laravel's templating engine, Blade (Laravel, 2023), enables the creation of dynamic and reusable views, fostering code modularity and reducing redundancy. It helped create the various pages/views of the PDT platform. It allowed the use of similar styles across the pages as it offers template inheritance, enabling the creation of master layouts with placeholders, which can be extended by individual views to maintain a consistent design and structure across the application. The main views included PDTs listing, view and download, comments & review, and API documentation pages. Views for user profile management, contact us, publications and about pages were also developed.

At the application tier (back end), which is built using PHP, the system follows the Model-View-Controller (MVC) architectural pattern. In this structure, controllers handle the application logic and act as intermediaries between the data model and the user interface. When a user makes a request (e.g., via an HTTP request), the controller processes it by interacting with the data model to retrieve or modify data. It then sends the relevant information to the view layer for display. Laravel allows data exchange through different methods, including APIs. Controllers can expose APIs to provide structured data, enabling integration with front-end frameworks or external systems. These APIs handle requests using standard HTTP methods such as GET, POST, PUT, and DELETE, with responses formatted in JSON for efficient communication between the server and client applications, including BIM software. For this platform, only the GET method is used, as users do not have permission to modify or delete data through the API.

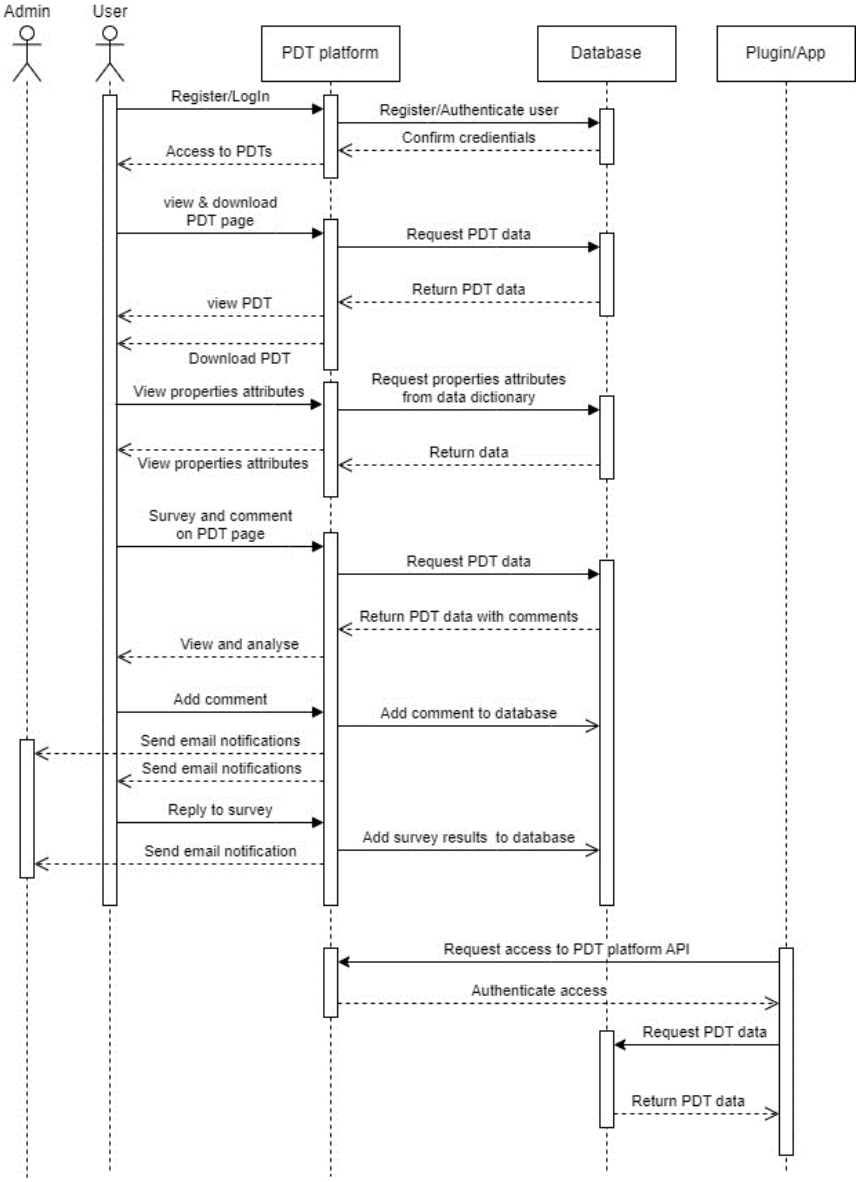


Figure 6: UML sequence diagram of the interaction with the PDT platform.

The router, a fundamental component in Laravel, plays a pivotal role in handling incoming HTTP requests. It dispatches requests to the appropriate controller methods based on defined routes, ensuring that each request is directed to the intended logic within the application. This routing mechanism provides a clear and organized structure for handling different endpoints. Additionally, Laravel incorporates middleware, including authentication

middleware, to enhance security and control access to routes. Authentication middleware validates user credentials and authorizes access to protected resources, adding an extra layer of security to the application. It ensures that only authenticated and authorized users can interact with certain parts of the application, like downloading or commenting on PDTs, contributing to a robust and secure web development environment. This middleware allows only administrators to have access to the database when needed.

In the scope of data management in the data tier within the Laravel framework, MySQL stands as the chosen relational database for storing and administrating PDTs and their associated information, as detailed in Section 3.1. Laravel harnesses the robust support of object-relational mapping (ORM) through its sophisticated implementation known as Eloquent, an expressive active record system. With Eloquent, database tables are seamlessly represented by models, translating the intricacies of the database into a familiar and intuitive object-oriented syntax. This approach significantly streamlines data operations such as retrieval, manipulation, and validation, providing developers with a powerful and efficient means to interact with the database.

The UML diagram in Figure 6 illustrates the workflow of the PDT platform created using Laravel. The platform consists of several key components represented as UML lifelines. The primary components include the "PDT platform", "Plugin/App", and "Database".

```
// Function to get PDT data based on ID
class ProductdatatemplatesController extends Controller
{public function productDataTemplate($pdtID){
// Get product data template, groups of properties based on PDT ID
$pdt = ProductDataTemplates::where('Id', $pdtID)->first();
$gops = GroupOfProperties::where('pdtId', $pdtID)->get();
$allReferenceDocuments = [];
foreach ($gops as $gop) {
// Get properties based on group of properties IDs
$properties = Properties::where('gopID', $gop->Id)->get();
// Get properties attributes
foreach ($properties as $property) {
$propertyAttributes = PropertiesDataDictionaries::where('Id', $property->propertyId)->first();
$property->propertiesAttributesInDataDictionary = $propertyAttributes;
// Collect reference documents GUIDs
$allReferenceDocuments[] = $property->referenceDocumentGUID;}
 // Collect properties in groups of properties
 $gop->properties = $properties;}
 // Fetch reference documents based on collected GUIDs
 $referenceDocuments = ReferenceDocuments::whereIn('GUID', $allReferenceDocuments)->get();
 // Collect groups of properties
$pdt->groupOfProperties = $gops;
// Collect reference documents
$pdt->referenceDocuments = $referenceDocuments;
// Return PDT, groups of properties, properties, properties' attributes, & reference documents
return response()->json(['productDataTemplate' => $pdt]);}
```

Figure 7: Function in the pdt controller ("//" is a comment).

The "PDT platform" lifeline represents the main functionality of the platform, featuring a user-friendly and intuitive interface designed to optimize the user experience and streamline data management for PDTs. This lifeline encompasses various stages like registration and authentication of the user or plugin, viewing PDTs, reviewing and commenting on PDTs, downloading PDTs, and viewing property attributes in the data dictionary. As noted in Figure 6, Email notifications are used to alert administrators and users in the event of a certain activity. For administrators, whenever a user answers the survey in a specific PDT or adds a comment on any PDT, an email is sent with the information on the feedback. It helps the administrators stay on top of feedback and change requests on PDTs. Upon registration, users can click on a notification button on their profile page that permits the platform to send them notifications. Users only receive notifications for comment activities on PDTs they commented on.

The "Database" lifeline represents the storage and retrieval of data within the platform. It stores user credentials, PDT-related data, comments, and survey results. All communications and requests from the users or Plugins

through APIs go through the PDT platform lifeline and then to the Database lifeline, passing through the authentication middleware and controllers, which execute the required queries. An example of a query to extract all the required information from the database from tables productdatatemplates, groupsofproperties, properties, propertyattributes, and referencedocuments, based on the request from the user to see a certain PDT, is shown in Figure 7.

The "Plugin/App" lifeline represents additional functionalities or external plugins that can be connected to the PDT platform. Users can interact with the platform database using these plugins through the API. Once authenticated, a plugin can request data from the database and deliver it to the user through the plugin. An example would be a plugin within a BIM platform that allows the user to extract properties from the platform to include in BIM object's properties in the platform.

A notable feature of our Laravel platform is that all operations and updates on PDTs are performed directly through changes to the database, eliminating the need for HTML, JavaScript, PHP, or other coding interactions. This streamlined approach allows curators or workgroups, such as those in the normalization committees, to manage updates efficiently by accessing the database separately. This means that the platform is designed for users to view, download, and provide feedback on existing PDTs, and it is not designed for users to upload new PDTs to the platform. This setup ensures that the platform remains a robust and user-friendly consultation tool rather than a creation tool for PDTs.

3.3 Platform User Interface

The PDT platform, PDTs.pt, features a user-friendly and intuitive interface designed to optimize user experience and streamline data management for construction PDTs. Here, we present an overview of the key features and functionalities available to users. It is noteworthy that the platform holds several PDTs that were created through several interactions with the industry, and this platform's interface has been tested and used in several interactions with industry professionals to produce the current data templates database. At the time of writing this article, the database included around 50 PDTs like the Master Data Template (DT), Door DT, Sink DT, Mineral Wool DT, Precast Concrete Beam DT, Borehole DT, Rail DT, Sleeper DT, among others. Some papers disclose the process of preparation of some of the data templates presented in the platform (El Sibaii *et al.*, 2022, 2023; Sibaii *et al.*, 2022). The PDTs can be viewed on https:/pdts.pt/dashboard, and a full PDT for the Door element is presented in the Annex in Table A1.

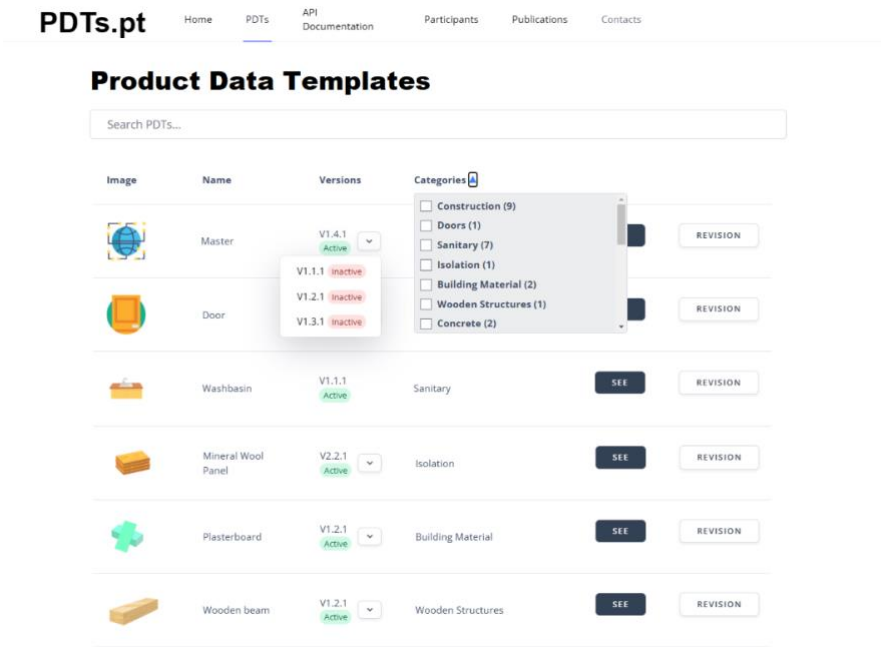


Figure 8: PDT listing page on the PDT platform.

The platform's landing page holds relevant information on PDTs, the initiative, and the participants in this initiative. Without logging in users can access the contact form, the API documentation page, the PDT listing and also the PDT view and download pages, as well as pages of property attributes and reference documents in the data dictionary. When logged in, access is given to the PDT-review and user profile pages. Once the PDT listing page is open, the user is presented with a comprehensive listing of the latest versions of available PDTs in the database, with an image of the construction object, the name of the PDT, the version with a tag stating status, categories and two buttons next to each PDT, View and Review. The page includes a search bar to easily search for PDT, and a catigories column that allows users to filter through categories, where they can select one or multiple categories. In the version column, older versions of a PDT can be accessed through the drop-down button that appears when older versions exist. Pressing on a version of a PDT will take the user to the view and download page of that PDT version (see Figure 8). All the platform user interface images presented were translated to English for the reader's convenience; however, the platform is in Portuguese as it was created for the Portuguese industry.

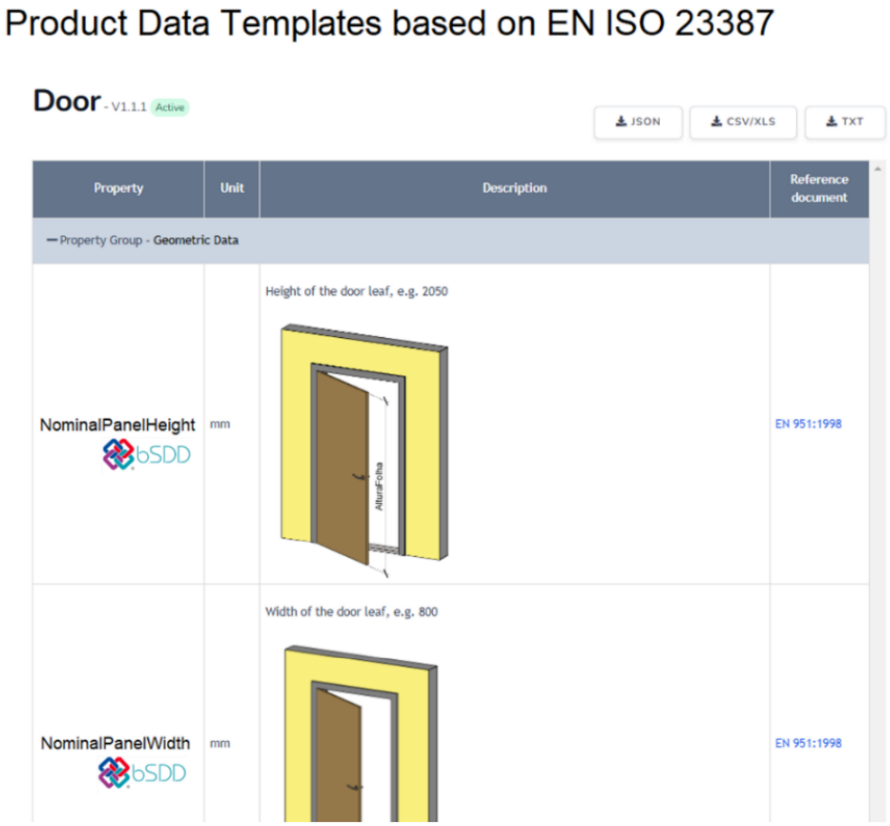


Figure 9: View and Download page in the platform showing visual representations of properties.

Clicking on the View button takes the user to the view and download page of the PDT. This page provides users with a detailed view of the PDT's groups of properties and properties with their units, descriptions, and reference documents. Properties may include visual representation to give details on the property, as shown in Figure 9. Additionally, if the property is mapped to an external data dictionary like bSDD, a logo with a link takes the user to the definition of the property in bSDD platform. At the top of the View PDTs page, the version of the PDT is shown with a status tag and three buttons for downloading the PDT in CSV, TEXT, and JSON files. This feature is essential for users who want to extract the PDT to use and populate without having to work with API if the skills to work with APIs are lacking.

Clicking on the Review button on the main PDT page takes the user to the review and comment page, where users can provide feedback through comments on properties in the PDTs. Another important feature of this page is the survey section, where users can quickly give an opinion on whether they use a property by selecting Yes, No, or No opinion. Collecting this information for properties in a PDT will help give a view of important properties and highlight properties that are not important (see Figure 10).

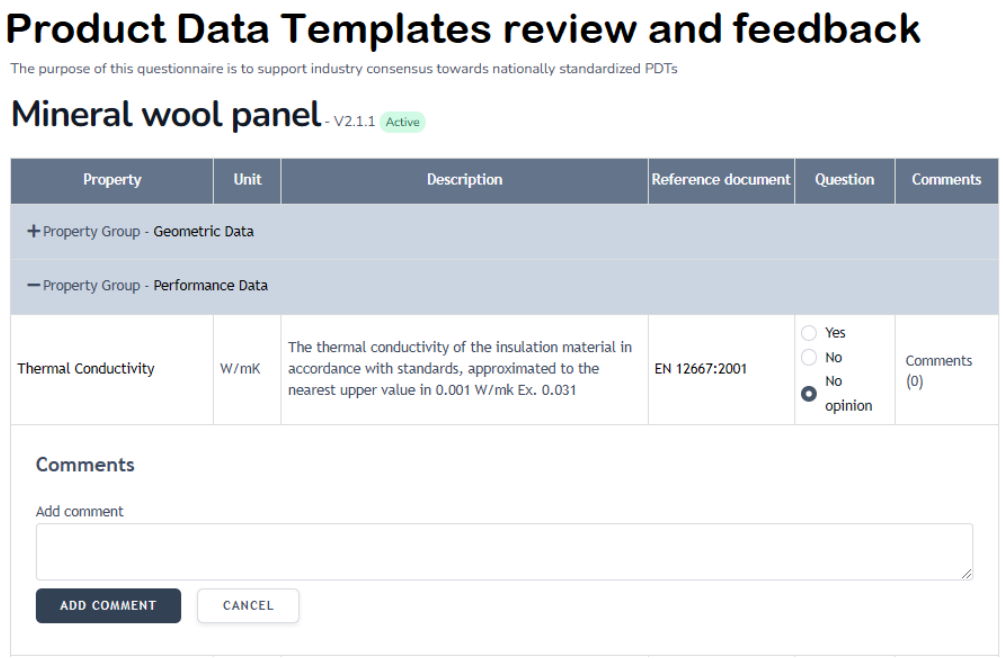


Figure 10: Review and comments page in the PDT platform.

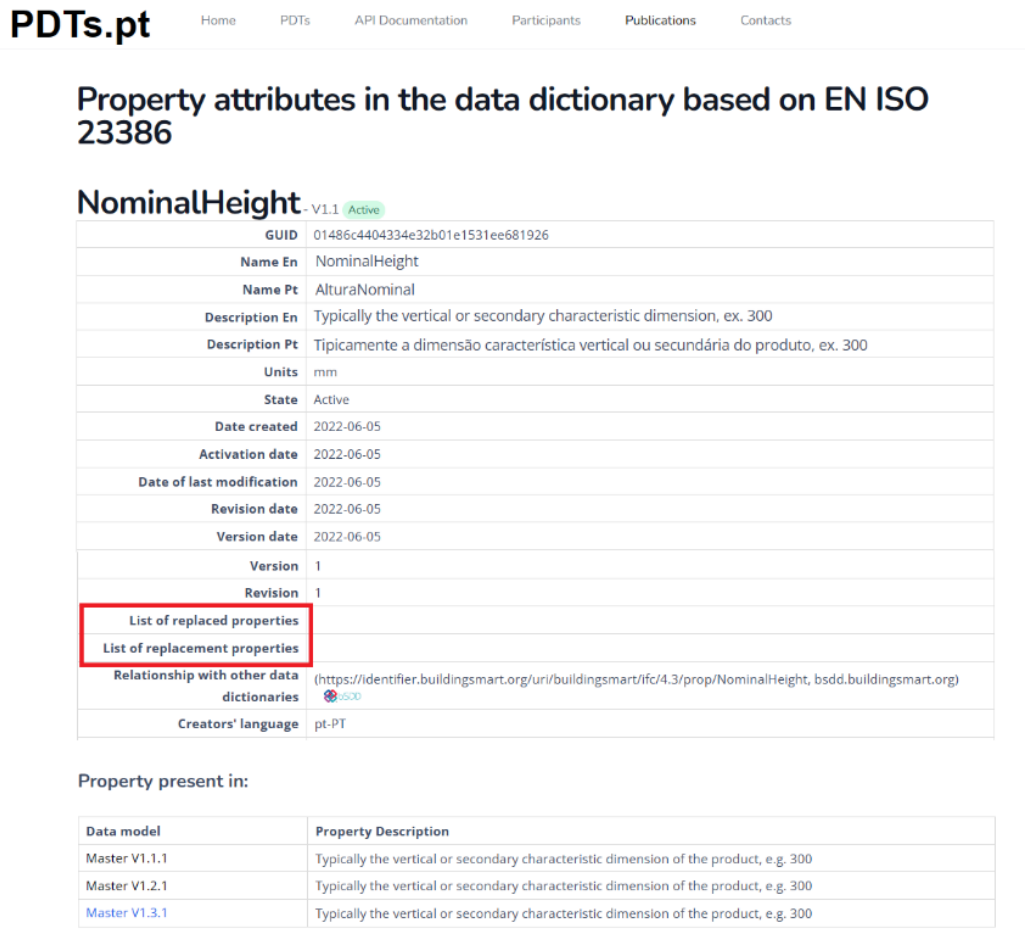
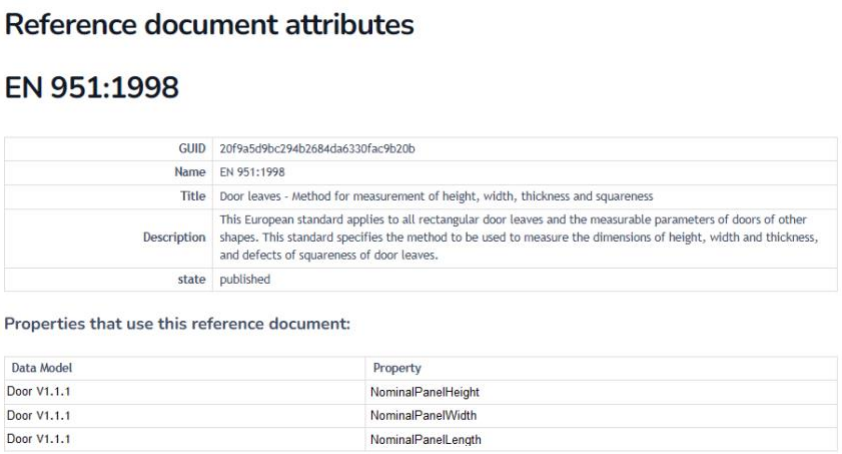


Figure 11: Property attributes page showing the attributes and the table of PDTs that use the property.



Reference document attributes

EN 951:1998

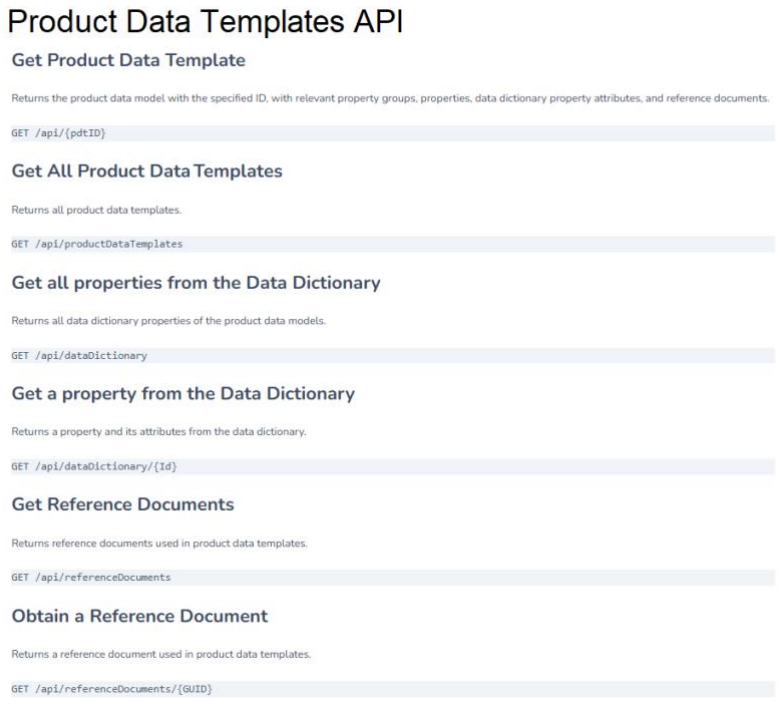
GUID	20f9a5d9bc294b2684da6330fac9b20b
Name	EN 951:1998
Title	Door leaves - Method for measurement of height, width, thickness and squareness
Description	This European standard applies to all rectangular door leaves and the measurable parameters of doors of other shapes. This standard specifies the method to be used to measure the dimensions of height, width and thickness, and defects of squareness of door leaves.
state	published

Properties that use this reference document:

Data Model	Property
Door V1.1.1	NominalPanelHeight
Door V1.1.1	NominalPanelWidth
Door V1.1.1	NominalPanelLength

Figure 12: Reference Documents page.

Throughout the platform, all properties are hyperlinked to lead to a page that shows the attributes of the properties in the data dictionary based on EN ISO 23386:2020. In this page, a tag on the top indicates whether the property is Active or Inactive. As described in Table 7, most attribute values are manually inserted by the user in the database. However, some attributes are retrieved using MySQL queries. An example is the "List of substituted properties" and "List of substituting properties" properties, which indicate the previous and new versions of the property in view (highlighted in red in Figure 11). In the "RelationToOtherDataDictionaries" attribute a link to a definition of the property in other data dictionaries can be found as seen in Figure 11. The versions of the properties in these attributes are hyperlinked to lead to the page of the attributes of the selected property. At the end of this page, a table shows all the PDTs that include this property and their versions. This information is queried from the database and hyperlinked to lead to the mentioned PDTs (see Figure 11). Similarly, groups of properties are hyperlinked to lead to a page that shows the attributes of the groups of properties in the data dictionary based on EN ISO 23386:2020.



Product Data Templates API

Get Product Data Template

Returns the product data model with the specified ID, with relevant property groups, properties, data dictionary property attributes, and reference documents.

```
GET /api/{pdtID}
```

Get All Product Data Templates

Returns all product data templates.

```
GET /api/productDataTemplates
```

Get all properties from the Data Dictionary

Returns all data dictionary properties of the product data models.

```
GET /api/dataDictionary
```

Get a property from the Data Dictionary

Returns a property and its attributes from the data dictionary.

```
GET /api/dataDictionary/{Id}
```

Get Reference Documents

Returns reference documents used in product data templates.

```
GET /api/referenceDocuments
```

Obtain a Reference Document

Returns a reference document used in product data templates.

```
GET /api/referenceDocuments/{GUID}
```

Figure 13: API gateways as displayed on the PDT platform.

Moreover, on the View and Download page of the platform, the PDT table shows the reference document for each property. When hovered over, the user can see the name of the standard. If the user wants to know more about the standard, they can click to go to the reference documents page. The user can see relevant information about the standard on this page, like description and status. Another important aspect of this page is a feature that allows the user to see all the properties that reference this standard and the PDTs they are in (see Figure 12).

The platform's API gateways are on the “API Documentation” page and are accessible from the navigation bar. On this page, there is a list of API gateways with a description of the output that the user gets after extracting information (see Figure 13 and Section 3.4).

4. CONNECTION TO APPS AND PLUGINS THROUGH API GATEWAYS

The PDT platform establishes seamless connectivity with external applications and plugins through a well-defined API data structure. By exposing specific endpoints, the platform enables external systems to access and exchange data. To begin with, the platform supports various GET requests to retrieve specific information (see Table 8). For instance, the endpoint "/api/{pdtID}" allows external applications to access detailed data related to a specific PDT. The response includes attributes and values associated with the PDT and the corresponding groups of properties, reference documents, properties, and attributes of the properties in the data dictionary.

Similarly, the endpoints "/api/productDataTemplates" and "/api/constructionObjects" provide a comprehensive list of available PDTs and construction objects, including their attributes and values. They allow external applications to query and integrate the platform's PDTs data into their systems. Moreover, the platform's API enables access to information regarding groups of properties and reference documents through the endpoints "/api/groupOfProperties" and "/api/referenceDocuments/{GUID}", respectively. By using these endpoints, external applications can retrieve the attributes and values associated with specific groups of properties and reference documents.

The platform also offers endpoints to access properties information for a more focused view. The endpoint "/api/dataDictionary/{Id}" returns detailed data related to a specific property in the data dictionary, while "/api/dataDictionary" provides a list of all properties present in the data dictionary. It allows external systems to integrate and leverage the platform's data dictionary for standardized data management.

The data exchange through API gateways follows a structured format, where the attributes and values are presented in JSON format. It ensures a uniform and easily interpretable data exchange process, promoting seamless integration with other software tools. External applications can efficiently consume the data, process it, and utilize it in their specific workflows, enhancing productivity and data consistency across multiple platforms.

In this context, the possibility of the integration of the PDTs.pt domain in the bSDD was explored to benefit from the connection to the bSDD API. This connection allows all applications and plugins in the construction industry that already access bSDD for data management to access the PDT.pt domain and seamlessly extract data from it. This step facilitates the connection to other data dictionaries in the industry, which is one of the purposes of adhering to EN ISO 23386:2020. To integrate the PDT.pt domain within the bSDD, several methods can be used like uploading the domain database in JSON format, as described in the documentation of bSDD on their GitHub page, using the Excel sheets that are provided by bSDD, or through the use of external tools like the usBIM.bSDDeditor tool from ACCA software (ACCA software, 2023; BuildingSMART, 2023).

Accordingly, a preliminary script was created to export the PDTs.pt domain from the MySQL database in the bSDD JSON format. It is noteworthy that the consideration of the bSDD data model, in Figure 2, during the creation of the PDT platform data model, in Figure 4, facilitated the process of mapping elements between the two data models. For example, the “Dictionary” element in the bSDD model was mapped to the “PDTs” element in the PDT platform model, the “Class” to the “Group of Properties”, and the “Property” to the “Properties”. Once the JSON file was exported, it was manually uploaded to the bSDD platform. The authors created a domain for the PDT.pt domain in the bSDD test environment as a prototype, and it was confirmed that the domain could be uploaded to the bSDD environment in the future. Once the number of PDTs is richer in the PDTs.pt database, the upload to the bSDD platform will be performed. The PDTs.pt domain in bSDD test environment can be consulted here (https://identifier.buildingsmart.org/uri/pdtspt/pdtspt/0.1).

Table 8: API endpoints and response data structure from the PDTs platform.

API	Data structure
GET /api/{pdtID}	"productDataTemplate": [{"Attributes": "values"}], "groupsOfProperties": [{"Attributes": "values", "properties": [{"Attributes": "values", "propertiesAttributesInDataDictionary": {"Attributes": "values"}},]},], "referenceDocuments": [{"Attributes": "values"},]
GET /api/productDataTemplates	“productDataTemplates”: [{"Attributes": values,}]
GET /api/constructionObjects	“constructionObjects”: [{"Attributes": values,}]
GET /api/groupOfProperties	"groupsOfProperties": [{"Attributes": values,}]
GET /api/dataDictionary/{Id}	“propertyInDataDictionary”: [{"Attributes": values,}]
GET /api/groupsOfProperties/{Id}	“groupOfProperties”: [{"Attributes": values,}]
GET /api/referenceDocuments/{GUID}	“referenceDocument “: [{"Attributes": values,}]
GET /api/dataDictionary	“propertiesInDataDictionary": [{"Attributes": values,}]
GET /api/referenceDocuments	“referenceDocuments “: [{"Attributes": values,}]

5. INITIAL OPERATION FEEDBACK

The platform was first made available to the public at the end of 2021, and since then it has undergone several iterations in its front-end user interface, back-end programming, and data model to become more robust, scalable, and compliant to all relevant PDT standards. The platform’s PDT count, currently at around 50 PDTs, increased as more awareness of PDTs grew in the Portuguese industry through conference contributions, workshops, and direct contact with manufacturers. Additionally, efforts are currently being made within the national Portuguese chapter of buildingSMART, where a working group dedicated to PDTs is being created.

Regarding PDT creation for construction objects, initially PDTs were created for common construction objects and industry experts were sought out to give feedback on relevant PDTs to consolidate the information, and improve as needed. The IFC schema was also used as a reference to create PDTs, as it contains a list of classes that represent a wide range of construction products. Other PDTs were created based on manufacturer interactions and others in the context of research projects, like the rail-related PDTs created in the context of the “RoboShot@FRC - Robotized system for the shotcrete of optimized fibre reinforced concrete in railway tunnels” project (Sibaii *et al.*, 2024).

Table 9: Number of feedback on PDTs and examples from user feedback and corrective actions taken.

PDT	Feedback number	Property	User feedback	Action
Master	21	EPDReference	This is referred to as EPD registration number in EPDs	New name: EPDRegistrationNumber
Ceramic Tile	11	SlipResistance<Standard>	It is better to create a property for each <standard>	New properties: SlipResistanceDIN51097 SlipResistanceENV51097 SlipResistanceENV12633 SlipResistanceBS7976
Door	10	SidePanels	Text in supporting image needs translation	Text in image translated
Rock Wool Insulation	18	ContinuousGlowingCombustion	Manufacturers do not declare this property	Deleted
		HalogenFree	this property is not commonly used in industry	Deleted

Nevertheless, a significant challenge in refining PDTs was the collection and integration of expert feedback. While user feedback has been valuable, obtaining comprehensive expert input remains difficult. The platform's impact is evident through industry engagement on the platform (PDTs.pt), where user feedback has led to key modifications, such as renaming properties, adding new ones, and removing non-relevant items (see Table 9). However, more than 50% of feedback was collected through Excel documents, as stakeholders preferred this familiar format, reflecting a preference for established traditional tools.

Additionally, many professionals struggle to fully understand the implications of EN ISO 23386 and EN ISO 23387, resulting in feedback often limited to immediate concerns. It was observed that effective feedback collection required structured, guided interactions rather than simple requests. This challenge highlighted the need for continuous engagement with industry experts and standardization bodies, which remains a bottleneck in the iterative development of PDTs.

6. DISCUSSION, CONCLUSION AND FUTURE WORKS

This article explored the challenges facing the construction industry amid digitalization, focusing on the critical role of data management and interoperability through Building Information Modelling (BIM). Despite advancements, a lack of standardization hinders the full potential of digitalization. Product Data Templates (PDTs) offer a promising solution, addressing data management issues with standardized approaches. Nevertheless, this paper highlighted challenges such as the lack of adherence to PDT-related standards, the disparity in data quality, and the lack of open data platforms aligned with PDT standards.

To address these issues, This paper develops an open-source PDT query platform in compliance with EN ISO 23387:2020 and EN ISO 23386:2020 to ensure consistency and traceability in construction product data, facilitating seamless integration into BIM environments. Its open-source nature promotes transparency, collaboration, and peer-driven improvements, with the codebase available on GitHub for broader adoption (GitHub, 2025). The platform is built using Laravel, which ensures modularity, scalability, and maintainability. The integration of API gateways further enhances its applicability by enabling smooth data exchange with external applications and BIM tools. Additionally, the provision of PDT downloads in multiple formats (CSV, TEXT, JSON) ensures accessibility for diverse stakeholders. The platform's survey page created a feedback opportunity for industry stakeholders, to improve and adjust PDTs as per the needs of the industry.

This paper demonstrates that the platform is functioning and is operational on PDTs.pt. The platform has already had several interactions with many users and stakeholders from the Portuguese industry, which resulted in refining several PDTs. The viability of the data model in quarrying data from the database to show on the platform, be downloaded in various formats, and be used through a connection with the platform's API was verified. The platform data model was created to be compliant with the PDT standards and adapted to the bSDD data model.

The successful export of the PDTs.pt domain to the bSDD environment demonstrates the platform's scalability and compliance.

Despite these benefits, several limitations must be acknowledged. One key limitation to widespread adoption is resistance to change. Survey responses revealed that more than 50% of stakeholders preferred submitting feedback via Excel sheets instead of using the platform, highlighting an industry reliance on traditional tools. Additionally, continuous engagement with experts remains necessary to obtain comprehensive feedback. Overcoming these challenges will require targeted training programs, industry workshops, and increased awareness campaigns.

Another key limitation is the lack of user profiles with role-based permissions, preventing unauthorized users from adding PDTs. The platform is designed for consultation and feedback rather than open data creation. However, future iterations could introduce a structured contribution system, where authorized managers from designated teams, operating under a national initiative, can develop and submit PDTs for broader review, following the guidelines of EN ISO 23386:2020.

Moreover, the current implementation is tailored to the Portuguese industry, however, with minor adaptations it can be used for broader international scalability. Finally, the ongoing revision of EN ISO 23387:2020 may introduce new data model elements, however, these changes are anticipated and the platform is designed to adapt to these updates.

Future iterations of the platform will focus on enhancing scalability and adaptability. One key area of improvement is the development of a hierarchy-based PDT data model to accommodate a wider range of construction products and facilitate more complex queries. Further research is needed to explore deeper integration with Common Data Environments (CDEs), Information Delivery Specification (IDS) tools, and Level of Information Need frameworks. Additionally, adopting a linked data approach and ontologies could enhance semantic interoperability, enabling more efficient data exchange and automation within emerging digital construction workflows.

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APPENDIX

Table A1 represents the Door Data Template extracted from the Product Data Templates platform PDTs.pt. It contains properties related to the Door element and also properties from the Master Data Template, which are highlighted in light grey.

Table A1: Door Data Template example from PDTs.pt.

Door Data Template

Door Data Template Version		1.2.1	
Master Data Template Version		1.4.1	
Property	**Unit**	**Description**	**Reference Document**
		Classification data	
Classification<System><Table>Code	Unitless	Classification<System><Table>code : Classification code of the product, ex. ClassificationSecclassProductsNumber = Pr_20_85_08	n/a
Classification<System><Table>Title	Unitless	Classification<System><Table>title : Classification title of the product, ex. ClassificationSecclassProductsDescription = Timber beams	n/a
Classification<System><Table>Version	Unitless	Classification<System><Table>version : Classification system version used, ex. ClassificationSecclassProductsVersion = v1.4	n/a
		General data	
Name	Unitless	Name : The product name shall consist of the following fields: <Source>_<Type>_<Subtype>_<Differentiator_n>, ex. LEDSMART_Luminaire_Interior_1420x37x84mm. For more information, consult the standard draft Building Information Modelling (BIM) - Rules for the Modelling of BIM Objects and the link: https://secclass.pt/wp-content/uploads/2021/10/R_M_ObjectosBIM.pdf	n/a
CommercialName	Unitless	Commercial name : The commercial name of the product, which usually is used to define the product for costumers	n/a
ProductType	Unitless	Product type : The type of the product	n/a
Description	Unitless	Description : A general description of the object	n/a
EPDRegistrationNumber	Unitless	EPD registration number : Registration number of the Environmental Project Declaration document	n/a
ReferenceToOriginalEPD	Unitless	Reference to original EPD : a hyperlink to the original EPD according to standard PCR	n/a
DOPReference	Unitless	DOP reference : Reference of the Declaration of Performance	n/a
UrlDOP	Unitless	URL DOP : A URL to the DoP document (PDF, or digital version)	n/a
		Manufacturer data	
SystemManufacturer	Unitless	System manufacturer : The System manufacturer of the Doorset systems. Ex. Lock manufacturer	n/a
Manufacturer	Unitless	Manufacturer : The organization that manufactured and/or assembled the item	n/a
ManufacturerURL	Unitless	Manufacturer URL : The website of the organization that manufactured and/or assembled the item	n/a
ManufacturerEmail	Unitless	Manufacturer email : The email of the manufacturer	n/a
ManufacturerNumber	Unitless	Manufacturer number : The contact number of the manufacturer	n/a

ModelReference	Unitless	Model reference : The model number or designator of the product model (or product line) as assigned by the manufacturer of the manufactured item, ex. ASMD Metal Door	n/a
BarCode	Unitless	Bar code : The identity of the bar code given to an occurrence of the product	n/a
SerialNumber	Unitless	Serial number : The serial number assigned to an occurrence of a product	n/a
GlobalTradeItemNumber	Unitless	Global trade item number (GTIN) : The Global Trade Item Number (GTIN) is an identifier for trade items developed by GS1 (www.gs1.org), ex. 123456789012	n/a
ProductionDate	Unitless	Production date : The date of production of the manufactured item, ex. 31/12/1999 23:59:59	n/a
AcquisitionDate	Unitless	Acquisition date : The date that the manufactured item was purchased, ex. 31/12/1999 23:59:59	n/a
NetWeight	kg	Net weight : Element net weight excluding shipping packaging, ex. 60 kg	n/a
GrossWeight	kg	Gross weight : Element weight including shipping packaging, ex. 55 kg	n/a
MaterialWeight	Unitless	Material weight : Weight of the referenced material in the product. ex. WoodWeight = 20	n/a
<Material>Origin	Unitless	<Material> origin : Origin of the referenced material ex. WoodOrigin = Portugal	n/a
<Material>DPPurl	Unitless	<Material> DPP Url : The URL that leads to the Digital Product Passport of the selected material	n/a
Packaging<Material>Weight	Unitless	Packaging <material> weight : The weight of the packaging material referenced	n/a
ConceptualCost	Unitless	Conceptual cost : Conceptual cost estimating is done during the pre-construction stage of a project, ex. 200 EUR	n/a
RecordedActualCost	Unitless	Recorded actual cost : the actual cost of the asset , ex. 195EUR	n/a
ReplacementCost	Unitless	Replacement cost : An indicative cost for unit replacement, ex. 200 EUR	n/a
FutureCostAssumptions	Unitless	Future cost assumptions : Costs estimates for maintaining the element during its lifecycle, ex. 50EUR	n/a
ShippingCost	Unitless	Shipping cost : Cost of shipping to installation location	n/a
Constituents	Unitless	Constituents : Optional constituent features, parts or finishes, ex. Door with self closing lock	n/a
Color	Unitless	Color : Color selection for this object, ex. White, Brown, and Black	n/a
Category	Unitless	Category : Category of the product when similar products exist belonging to the same product type. For example ceramic tiles have several categories that can be used in different context. Ex: Floor tile, Skirting, Wall tile, …	n/a
Finish	Unitless	Finish : Characteristic or primary finish of product	n/a
Features	Unitless	Features : Other important characteristics or features relevant to product specification.	n/a
Material	Unitless	Material : Characteristic or primary material of product., ex. Pine wood	n/a
FacilityIdentifier	Unitless	Facility identifier : A unique identifier assigned to a physical location, such as a manufacturing plant, warehouse, or other facility, where specific activities related to a product occur. It is used to trace operations, ensure compliance, and maintain supply chain transparency.	n/a

EconomicOperatorIdentifier	Unitless	Economic operator identifier : A unique identifier assigned to an entity responsible for the product at specific stages of its lifecycle, such as manufacturing, importing, or distribution. It ensures regulatory compliance, accountability, and traceability in the supply chain.	n/a
ManufacturerGLN	Unitless	Manufacturer GLN : GLN- Global Location Number of the Manufacturer. This could be your local or headquarter GLN depending on point of origin, ex. 1234567890123	n/a
DataDeliveryCountry	Unitless	Data delivery country : Country for which data delivery is planned. Territory (i.e. country, state, region) coded according to ISO 3166-1 Alpha2, ex. FR	n/a
DataDeliveryLanguage	Unitless	Data delivery language : Basic language of the data delivery. This element specifies the used languages (acc. ISO 639-1), especially the default language of all language-dependent information, ex. fr	n/a
StartOfValidity	Unitless	Start of validity : The start date of validity of the article, ex. 31/12/1999	n/a
EndOfValidity	Unitless	End of validity : The end date of validity of the article, ex. 31/12/1999	n/a
<Attachment>Url	Unitless	<Attachment> Url : URL to the referenced attachment/digital asset ex. ProductPhotourl = www.manufcaturer.com/product/photo	n/a
DeepLinkUrl	Unitless	Deep link URL : A deep link (URL) redirects to a relevant webpage of the supplier or manufacturer company, where further information on the article may be found, ex. www.company.com/product	n/a
CountryOfOrigin	Unitless	Country of origin : Country of origin is the country where the article was manufactured, or the last essential processing step was completed. Description of the country according to >>ISO-3166-1 Alpha2<< (Country Subdivision Codes). Country codes must be written in 2 capital letters, ex. PT	n/a
LocationOfOrigin	Unitless	Location of origin : The location where the product was manufactured, can be the city or an address	n/a
ProductionProcessSummary	Unitless	Production process summary : Stages of production	n/a
TransportType	Unitless	Transport type : The type of transport used to distribute the product	n/a
PackagingType	Unitless	Packaging type : The type of packaging used for the product	n/a
		Performance data	
WaterTightnessRating	Unitless	Water tightness rating : Water tightness rating for this object. It is provided according to the national building code. ex. Class 3	EN 1027:2016
WindLoadRating	Unitless	Wind load rating : Wind load resistance rating for this object. It is provided according to the national building code. ex. Class 5	EN 12210:2016
MechanicalLoadRating	Unitless	Mechanical load rating : Mechanical load rating for this object. It is provided according to the national building code. ex. Class 2	EN 12400:2002
AcousticRating	W/m²K	Acoustic rating : It indicates the sound transmission resistance of this object by an index ratio (instead of providing full sound absorbtion values). ex. 0.5	EN ISO 717-1:2013
ThermalTransmittance	W/m²K	Thermal transmittance : Thermal transmittance coefficient (U-Value) of an element	EN ISO 10077-1:2017
ThermalTransmittanceSummer	W/m²K	Thermal transmittance summer : Summer thermal transmittance coefficient (U-Value) of the glazing only, often referred to as (U-value)	EN ISO 10077-1:2017
ThermalTransmittanceWinter	Unitless	Thermal transmittance winter : Winter thermal transmittance coefficient (U-Value) of the glazing only, often referred to as (U-value)	EN ISO 10077-1:2017
RadiationProperties	Unitless	Radiation properties : Radiation properties of the product as per relevant standards	EN 13363-1:2003+A1:2007

Infiltration	Unitless	Infiltration : Infiltration flowrate of outside air for the filler object based on the area of the filler object at a pressure level of 50 Pascals. It shall be used, if the length of all joints is unknown. ex. Class 3	EN 12207:2016
FireRating	Unitless	Fire rating : Fire rating for the element. It is given according to the national fire safety classification. ex. Class E	EN 1634-1:2014
SmokeStop	Unitless	Smoke stop : Indication whether the object is designed to provide a smoke stop (TRUE) or not (FALSE). ex. S200	EN 1634-3:2004
AbilityToRelease	Unitless	Ability to release : The Breakout facility of the Doorset systems. ex. Released	EN 1125:2008
SelfClosing	Unitless	Self closing : The self closing class as per related standards. ex. C 4	EN 1191:2012
DurabilityOfAbilityToRelease	Unitless	Durability of ability to release : Durability of the ability to release system ex. release maintained	EN 1155:1997
DurabilityOfSelfClosingAgainstDegradation	Unitless	Durability of self closing against degradation : Durability of self closing system against degradation ex. 5	EN 1191:2012
DurabilityOfSelfClosingAgainstAging	Unitless	Durability of self closing against aging : Durability of self closing system against aging ex. achieved	EN 1191:2012
HygrothermalRating	Unitless	Hygrothermal rating : Resistence against hygrothermal impact from different temperatures and humidities inside and outside. It is given according to the national code or regulation.	ISO 15927-1:2003
SecurityRating	Unitless	Security rating : Index based rating system indicating security level. It is given according to the national building code, ex. classification as per BS EN 1630:2011+A1:2015	n/a
VisibleLightReflectance	%	Visible light reflectance : Fraction of the visible light that is reflected by the glazing at normal incidence. ex. 6	ISO 9050:2003
VisibleLightTransmittance	%	Visible light transmittance : Fraction of the visible light that passes the glazing at normal incidence. ex. 90	ISO 9050:2003
SolarAbsorption	Unitless	Solar absorption : Proportion of the incident solar radiation that is absorbed by a glazing system. It is the sum of the absorption distributed to the outside and to the inside. Note the following equation: SolarAbsorption + SolarReflectance + SolarTransmittance = 1. e.g. 0.3	ISO 12567-1:2010
SolarReflectance	Unitless	Solar reflectance : Proportion of incident solar radiation that is reflected by a glazing system (also called ?e). SolarAbsorption + SolarReflectance + SolarTransmittance = 1. e.g. 0.3	ISO 12567-1:2010
SolarTransmittance	Unitless	Solar transmittance : Proportion of incident solar radiation that passes directly through a glazing system. SolarAbsorption + SolarReflectance + SolarTransmittance = 1. e.g. 0.4	ISO 12567-1:2010
SolarHeatGainTransmittance	%	Solar heat gain transmittance : Proportion of the incident solar radiation that contributes to indoor heat gain. It is the solar radiation that passes directly through (SolarTransmittance), plus the part of the absorbed radiation that is distributed to the interior.	ISO 19467-2:2021
ShadingCoefficient	Unitless	Shading coefficient : The measure of a glass ability to transmit solar heat, relative to the same ability of a 3 mm (1/8 inch) clear, double-strength, single pane of glass. The shading coefficient is being phased out in favor of the solar heat gain coefficient, whose value multiplied by 1.15 is approximately the Shading Coefficient.	ISO 15099:2003
ForcedEntryResistance	Unitless	Forced entry resistance : Classification as per relevant standard	ENV 1627:1999

FireResistantGlass	Unitless	Fire resistant glass : Indication whether the glass is fire resistant (TRUE) or not (FALSE)	ISO 9051:1990
BulletResistantGlazingClassification	Unitless	Bullet resistant glazing classification : Classification as per standard like ISO 16935:2007	EN 1523:1988
		Specification data	
IsExternal	Unitless	Is external : Indication whether the element is designed for use in the exterior (TRUE) or not (FALSE). If (TRUE) it is an external element and faces the outside of the building. ex. FALSE	n/a
PanelPosition	Unitless	Panel position : Position of the panels within the door, so PanelOperation can inform their operation type. The PanelPosition of the door panel has to correspond with the OperationType. Enumerations: LEFT, RIGHT, MIDDLE, NOTDEFINED. PanelPosition should be informed as: <Panel1 position; Panel2 position; ...> Ex. <LEFT; RIGHT>	n/a
PanelOperation	Unitless	Panel operation : It defines the way of operation of the panels, in the order informed in PanelPosition property. The PanelOperation of the door panel has to correspond with the OperationType. Enumerations: SWINGING, DOUBLE_ACTING, SLIDING, FOLDING, REVOLVING, ROLLINGUP, FIXEDPANEL, USERDEFINED, NOTDEFINED. PanelOperation should be informed as: <Panel1 Operation; Panel2 Operation; ...>. Ex. <SLIDING; FIXEDPANEL>	n/a
HandicapAccessible	Unitless	Handicap accessible : Indication that this object is designed to be accessible by the handicapped. ex. TRUE	n/a
FireExit	Unitless	Fire exit : Indication whether this object is designed to serve as an exit in the case of fire (TRUE) or not (FALSE). ex. TRUE	n/a
HasDrive	Unitless	Has drive : Indication whether this object has an automatic drive to operate it (TRUE) or no drive (FALSE) ex. TRUE	n/a
OperationType	Unitless	Operation type : Defines the general layout and operation of the door in terms of the partitioning of panels and panel operations. It defines general information that are detailed by PanelPosition and PanelOperation properties. Enumerations: SINGLE_SWING_LEFT, SINGLE_SWING_RIGHT, DOUBLE_DOOR_SINGLE_SWING, DOUBLE_DOOR_SINGLE_SWING_OPPOSITE_LEFT, DOUBLE_DOOR_SINGLE_SWING_OPPOSITE_RIGHT, DOUBLE_SWING_LEFT, DOUBLE_SWING_RIGHT, DOUBLE_DOOR_DOUBLE_SWING, SLIDING_TO_LEFT, SLIDING_TO_RIGHT, DOUBLE_DOOR_SLIDING, FOLDING_TO_RIGHT, FOLDING_TO_LEFT, DOUBLE_DOOR_FOLDING, REVOLVING, ROLLINGUP, SWING_FIXED_LEFT, SWING_FIXED_RIGHT, USERDEFINED, NOTDEFINED. Ex. DOUBLE_DOOR_SINGLE_SWING_OPPOSITE_RIGHT	n/a
PredefinedType	Unitless	Predefined type : Predefined generic type for the door. Enumerations: DOOR, GATE, TRAPDOOR, USERDEFINED, NOTDEFINED.	n/a
GlazingAreaFraction	%	Glazing area fraction : Fraction of the glazing area relative to the total area of the filling element, ex. 0.1	n/a
GlassType	Unitless	Glass type : The type of glass used. Ex. Clear, Frosted, Darkened, other	n/a
GlassLayers	Unitless	Glass layers : Number of glass layers within the frame. Ex. 2 for double glazing.	n/a
FillGas	Unitless	Fill gas : Name of the gas by which the gap between two glass layers is filled. ex. Argon	n/a
GlassColor	Unitless	Glass color : The color of the glass	n/a

IsTempered	Unitless	Is tempered : Indication whether the glass is tempered (TRUE) or not (FALSE).	n/a
IsLaminated	Unitless	Is laminated : Indication whether the glass is layered with other materials (TRUE) or not (FALSE).	n/a
IsCoated	Unitless	Is coated : Indication whether the glass is coated with a material (TRUE) or not (FALSE).	n/a
IsWired	Unitless	Is wired : Indication whether the glass includes a contained wire mesh to prevent break-in (TRUE) or not (FALSE)	n/a
DoorsetFasteners	Unitless	Doorset fasteners : Products such as Carbon steel masonry brackets. ex. frame adjusters with specialised screw fixings for masonry	n/a
DoorsetGlazing	Unitless	Doorset glazing : General information about glass panels in the door panel.	n/a
DoorsetSealsOrInsertsFrame	Unitless	Doorset seals or inserts frame : Products such as strips and seals for the frame. Ex. Door Sponge Tape	n/a
DoorsetSealsOrInsertsDoor	Unitless	Doorset seals or inserts door : Products like strips and seals for doors. Ex. Adhesive Door Sealer	n/a
ThresholdsBaseStrip	Unitless	Thresholds base strip : Products such as Floor threshold strips.	n/a
ThresholdsWeatherOrSealStripping	Unitless	Thresholds weather or seal stripping : Information about the weather protection of the threshold, such as sealing.	n/a
Hardware	Unitless	Hardware : The Hardware of the Doorset systems. ex. Hardware Set (BR-KL-R1)	n/a
SystemAccessories	Unitless	System accessories : Products such as Anti-finger trap stiles.	n/a
FillerBetweenFrameAndReveal	Unitless	Filler between frame and reveal : Products such as Polyurethane (PUR) expanding foam fillers.	n/a
DoorLeafStructure	Unitless	Door leaf structure : The structure of the door leaf ex. Stile, Moulded, Filling, other	n/a
CasingMaterial	Unitless	Casing material : Information about the material and finishing of the casing. Ex. Painted wood	n/a
PanelMaterial	Unitless	Panel material : The main material composing the door panel, ex. Natural wood	n/a
LiningMaterial	Unitless	Lining material : The main material of the door lining, ex. Steel	n/a
ThresholdMaterial	Unitless	Threshold material : The main material of the threshold, ex. Granite	n/a
OverPanelMaterial	Unitless	Over panel material : The main material of the over panels of the door. Ex. Wood	n/a
SidePanelMaterial	Unitless	Side panel material : The main material of the side panels of the door. Ex. Glass	n/a
		Geometrical data	
NominalPanelHeight	mm	Nominal panel height : Height of the door panel, ex. 2050	EN 951:1998
NominalPanelWidth	mm	Nominal panel width : Width of the door panel, ex. 800	EN 951:1998
Height	mm	Height : Total outer height of the door lining. It should only be provided, if it is a rectangular door. ex. 2100	n/a
Width	mm	Width : Total outer width of the door lining. It should only be provided, if it is a rectangular door. ex. 1000	n/a
Perimeter	mm	Perimeter : Total perimeter of the outer lining of the door. ex. 6200	n/a
Area	m2	Area : Total area of the outer lining of the door. ex. 2.1	n/a
PanelDepth	mm	Panel depth : Depth of the door panel, measured perpendicular to the plane of the door leaf. ex. 50	EN 951:1998
PanelWidth	mm	Panel width : Width of thepanel, given as ratio relative to the total clear opening width of the door. If omited, it defaults to 1, ex. 0.9	n/a

LiningDepth	mm	Lining depth : Depth of the door lining, measured perpendicular to the plane of the door lining. If omitted (and with a given value to lining thickness) it indicates an adjustable depth (i.e. a depth that adjusts to the thickness of the wall into which the occurrence of this door style is inserted). ex. 300	n/a
LiningThickness	mm	Lining thickness : Thickness of the door lining. If LiningThickness value is 0. (zero) it denotes a door without a lining (all other lining parameters shall be set to NIL in this case). If the LiningThickness is NIL it denotes that the value is not available. ex. 20	n/a
LiningOffset	mm	Lining offset : Offset (dimension in plane perpendicular to door leaf) of the door lining. The offset is given as distance between the outer face of the wall to the outer face of the lining. ex. 0	n/a
LiningToPanelOffsetX	mm	Lining to panel offset X : Distance between the outer face of the lining to the closest edge of the door panel in the same plane of the door. ex. 30	n/a
LiningToPanelOffsetY	mm	Lining to panel offset Y : Distance between the outer face of the wall to the outer face of the door panel perpendicular to the door plane. ex. 270	n/a
ThresholdDepth	mm	Threshold depth : Depth (dimension in plane perpendicular to door leaf) of the door threshold. Only given if the door lining includes a threshold. If omitted (and with a given value to threshold thickness) it indicates an adjustable depth (i.e. a depth that adjusts to the thickness of the wall into which the occurrence of this door style is inserted). ex. 300	n/a
ThresholdThickness	mm	Threshold thickness : Thickness of the door threshold as explained in the figure above. If ThresholdThickness value is 0. (zero) it denotes a door without a threshold (ThresholdDepth shall be set to NIL in this case). If the ThresholdThickness is NIL it denotes that the information about a threshold is not available. ex. 30	n/a
ThresholdOffset	mm	Threshold offset : Offset (dimension in plane perpendicular to door leaf) of the door threshold. The offset is given as distance to the outer face of the wall. Only given if the door lining includes a threshold and the parameter is known. ex. 0	n/a
TransomThickness	mm	Transom thickness : Thickness (width in plane parallel to door leaf) of the transom (if provided - that is, if the TransomOffset attribute is set), which divides the door leaf from a glazing (or window) above. If the TransomThickness is set to zero (and the TransomOffset set to a positive length), then the door is divided vertically into a leaf and transom window area without a physical frame. ex. 400	n/a
TransomOffset	mm	Transom offset : Offset of the transom (if given) which divides the door leaf from a glazing (or window) above. The offset is given from the bottom of the door opening. ex. 2100	n/a
OverPanels	Unitless	Over panels : The size of the over panels of the Doorset systems. ex. 400 x 900	n/a
SidePanels	Unitless	Side panels : The position and size of the side panels of the Doorset systems. Ex. Left, 40x250; Right, 35x250.	n/a
CasingThickness	mm	Casing thickness : Thickness of the casing (dimension in plane of the door leaf). ex. 50	n/a
CasingDepth	mm	Casing depth : Depth of the casing (dimension in plane perpendicular to door leaf). ex. 10	n/a
GlassThickness1	mm	Glass thickness 1 : Thickness of the first (inner) glass layer. ex. 3	n/a
GlassThickness2	mm	Glass thickness 2 : Thickness of the intermediate glass layers. ex. 3	n/a
GlassThickness3	mm	Glass thickness 3 : Thickness of the outer glass layer. ex. 3	n/a

EgressRequirement	Unitless	Egress requirement : Openning size requirements for door installation	n/a
NominalHeight	mm	Nominal height : Typically the vertical or secondary characteristic dimension, ex. 300	n/a
NominalLength	mm	Nominal length : Typically the larger or primary horizontal dimension., ex. 5000	n/a
NominalWidth	mm	Nominal width : Nominal width of product, typically the characteristic or secondary horizontal or characteristic dimension, ex. 200	n/a
Shape	Unitless	Shape : Characteristic shape of product, ex. Rectangle	n/a
		Facility management data	
WarrantyContent	Unitless	Warranty content : A general description of the content of the warranty.	n/a
WarrantyDurationLabor	Unitless	Warranty duration labor : Duration of labour warranty., ex. 5 years	n/a
WarrantyDurationParts	Unitless	Warranty duration parts : Duration of parts warranty., ex. 5 years	n/a
WarrantyGuarantorLabor	Unitless	Warranty guarantor labor : Email address for the organisation responsible for the labour warranty.	n/a
WarrantyGuarantorParts	Unitless	Warranty guarantor parts : Email address for the organisation responsible for the parts warranty.	n/a
WarrantyStartDate	Unitless	Warranty start date : The date on which the warranty commences, ex. 31/12/1999 23:59:59	n/a
WarrantyIdentifier	Unitless	Warranty identifier : The identifier assigned to a warranty	n/a
WarrantyEndDate	Unitless	Warranty end date : The date on which the warranty expires, ex. 31/12/1999 23:59:59	n/a
IsExtendedWarranty	Unitless	Is extended warranty : Indication of whether this is an extended warranty whose duration is greater than that normally assigned to an artefact (=TRUE) or not (= FALSE), ex. FALSE	n/a
Exclusions	Unitless	Exclusions : Items, conditions or actions that may be excluded from the warranty or that may cause the warranty to become void	n/a
InstallationDate	Unitless	Installation date : The date that the manufactured item was installed (per instance), ex. 31/12/1999 23:59:59	n/a
InstallationLocation	Unitless	Installation location : The location where the product is installed	n/a
		Sustainability data	
EnvironmentalCertification	Unitless	Environmental certification : Environmental certifications aquired for the product ex. PEFC, FSC, MTCC, None, Other	n/a
IsReusable	Unitless	Is reusable : Indication of whether this product is reusable (=TRUE) or not (= FALSE)	n/a
IsRemanufacturable	Unitless	Is remanufacturable : Indication of whether this product is remanufacturable (=TRUE) or not (= FALSE)	n/a
IsUpgradable	Unitless	Is upgradable : Indication of whether this product is upgradable (=TRUE) or not (= FALSE)	n/a
IsRepairable	Unitless	Is repairable : Indication of whether this product is repairable (=TRUE) or not (= FALSE)	n/a
WasteGenerated	Unitless	Waste generated : List of waste generated by the product, including packaging	n/a
ContaminatingWaste	Unitless	Contaminating waste : Identify potentially contaminating waste/substances	n/a
DismantlingMethod	Unitless	Dismantling method : Appropriate dismantling method for each waste (recycling, reuse, repair, resale, restoration, reincorporation, improvement)	n/a

REACHLabel	Unitless	Reach label : Indication as to whether an article or ingredient of an article is subject to the REACH Regulation: articles and ingredients of articles that are listed as substances of very high concern under REACH have to be labelled in the data delivery. Allowed values: yes / no / no data. If REACH is not applicable e.g. services use (no). If REACH info is not available, use (no data).	n/a
REACHListDate	Unitless	Reach list date : Date, on which the product was checked by the manufacturer for REACH.	n/a
SustainabilityPerformance	Unitless	Sustainability performance : Description of the sustainability issue(s) which the object satisfies	n/a
IsItemNew	Unitless	Is item new : Indication of whether this item is new (=TRUE) or not (= FALSE)	n/a
IsItemPartiallyRecycled	Unitless	Is item partially recycled : Indication of whether this item is partially recycled (=TRUE) or not (= FALSE)	n/a
IsItemRecycled	Unitless	Is item recycled : Indication of whether this item is totally recycled (=TRUE) or not (= FALSE)	n/a
ExpectedServiceLife	Unitless	Expected service life : Expected service life in years, ex. 60 years	n/a
FunctionalUnitReference	Unitless	Functional unit reference : Reference to a database or a classification, ex. EPD international	n/a
DangerousSubstances	Unitless	Dangerous substances : Materials used in the product contain or release any dangerous substances as per European or any national standards ex. None	n/a
InertWaste	kg	Inert waste : Quantity of inert waste generated	n/a
AbioticDepletionPotentialForFossilResources	MJ	Abiotic depletion potential for fossil resources : defines the decreasing availability of non - renewable resources as a result of their extraction and underlaying scarcity, relating to fossil fuels	ISO 14025:2006
AbioticDepletionPotentialForNonFossilResourcesMineralsAndMetals	kg Sb eq	Abiotic depletion potential for non fossil resources minerals and metals : defines the decreasing availability of non - renewable resources as a result of their extraction and underlaying scarcity, relating to scarce elements and their ores	ISO 14025:2006
GlobalWarmingPotentialBiogenic	kg CO2 eq	Global warming potential biogenic : covers carbon emissions to air (CO2, CO and CH4) originating from the oxidation and/or reduction of aboveground biomass by means of its transformation or degradation (e.g. combustion, digestion, composting, landfilling) and CO2 uptake from the atmosphere through photosynthesis during biomass growth – i.e. corresponding to the carbon content of products, biofuels or above ground plant residues such as litter and dead wood	ISO 14025:2006
GlobalWarmingPotentialFossilFuels	kg CO2 eq	Global warming potential fossil fuels : it covers greenhouse gas (GHG) emissions to any media originating from the oxidation and/or reduction of fossil fuels by means of their transformation or degradation (e.g. combustion, digestion, landfilling, etc.)	ISO 14025:2006
GlobalWarmingPotentialLandUseAndLandUseChange	kg CO2 eq	Global warming potential land use and land use change : factor describing the potential radiative forcing impact of carbon uptakes and emissions (CO2, CO and CH4) originating from carbon stock changes caused by land use change and land use over a given period of time	ISO 14025:2006
GlobalWarmingPotentialTotal	kg CO2 eq	Global warming potential total : it accounts for the total global warming potential arising from fossil, biogenic and land use and land use change emissions	ISO 14025:2006
TroposphericOzoneConcentrationIncrease	kg NMVOC eq	Tropospheric ozone concentration increase : measure of the amoutn of ozone in the troposphere (at the earths surface) where it causes summer smog	ISO 14025:2006

DepletionPotentialOfTheStratosphericOzoneLayer	kg CFC11 eq	Depletion potential of the stratospheric ozone layer : the relative amount of degradation to the ozone layer a product can cause	ISO 14025:2006
AcidificationPotentialAccumulatedExceedance	mol H+ eq	Acidification potential accumulated exceedance : a measure of the acidification caused to land and water from emissions to air of acidifying substances	ISO 14025:2006
EutrophicationPotentialAccumulatedExceedance	mol N eq	Eutrophication potential accumulated exceedance : a measure of the eutrophication caused by emissions	ISO 14025:2006
EutrophicationPotentialFractionOfNutrientsReachingFreshwaterEndCompartment	kg (PO4)^(3-) eq	Eutrophication potential fraction of nutrients reaching freshwater end compartment : a measure of the eutrophication caused by emissions reaching freshwater	ISO 14025:2006
EutrophicationPotentialFractionOfNutrientsReachingMarineEndCompartment	kg N eq	Eutrophication potential fraction of nutrients reaching marine end compartment : a measure of the eutrophication caused by emissions reaching marine water	ISO 14025:2006
WaterDeprivationPotentialDeprivationWeightedWaterConsumption	m3	Water deprivation potential deprivation weighted water consumption : unit for the impact category water use	ISO 14025:2006
NonRenewablePrimaryResourcesUsedAsAnEnergyCarrierFuel	MJ	Non renewable primary resources used as an energy carrier fuel : Materials such as peat, oil, gas, coal, uranium used (first use) as an energy source.	ISO 14025:2006
NonRenewablePrimaryResourcesWithEnergyContentUsedAsMaterial	MJ	Non renewable primary resources with energy content used as material : Primary resources such as oil, gas and coal, used (first use) for products (e.g. plastic-based products).	ISO 14025:2006
NonRenewableSecondaryFuels	MJ	Non renewable secondary fuels : Non-renewable materials with energy content that have crossed the system boundary between product systems and are used as fuel input (energy source) in another product system (e.g. processed solvents, shredded tyres	ISO 14025:2006
RecoveredEnergy	MJ	Recovered energy : energy recovered from disposal of waste in previous systems, such as energy recovery from combustion of landfill gas or energy recovered from other systems using energy sources	ISO 14025:2006
RenewablePrimaryResourcesUsedAsAnEnergyCarrierFuel	MJ	Renewable primary resources used as an energy carrier fuel : Bio-based materials used (first use) as an energy source and hydropower, solar and wind power used in the technosphere are included.	ISO 14025:2006
RenewablePrimaryResourcesWithEnergyContentUsedAsMaterial	MJ	Renewable primary resources with energy content used as material : Bio-based materials used (first use) as materials (e.g. wood, hemp, etc.).	ISO 14025:2006
RenewableSecondaryFuels	MJ	Renewable secondary fuels : renewable materials with energy content that have crossed the system boundary between product systems and are used as fuel input (energy source) in another product system (e.g. biomass residue pellets, chipped waste wood)	ISO 14025:2006
SecondaryMaterials	kg	Secondary materials : material recovered from previous use or from waste which substitutes primary materials	ISO 14025:2006
ConsumptionOfFreshwater	m3	Consumption of freshwater : net freshwater entering the product system being studied that is not returned to the same drainage basin from which it originated	ISO 14025:2006
NetUseOfFreshwater	m3	Net use of freshwater : freshwater entering the product system being studied that is not returned to the same drainage basin from which it originated. Measured using the principles of water footprint inventory analysis according to ISO 14046.	ISO 14025:2006
HazardousWasteDisposed	kg	Hazardous waste disposed : hazardous waste to final repository	ISO 14025:2006
NonHazardousWasteDisposed	kg	Non hazardous waste disposed : Non-hazardous waste is non-toxic and similar to household waste. It consists of inert waste and ordinary household waste	ISO 14025:2006

TotalRadioactiveWasteDisposedMass	kg	Total radioactive waste disposed mass : The sum, in weight, high-, intermediate- and low-level radioactive waste, conditioned, to final repository	ISO 14025:2006
TotalRadioactiveWasteDisposedVolume	m3	Total radioactive waste disposed volume : The sum, in volume, of high-, intermediate- and low-level radioactive waste, conditioned, to final repository	ISO 14025:2006
ComponentsForReUse	kg	Components for re use : Amount of components which are reused at end-of-life	ISO 14025:2006
ExportedElectricalEnergy	MJ	Exported electrical energy : Amount of electrical energy available in the market after incineration	ISO 14025:2006
ExportedThermalEnergy	MJ	Exported thermal energy : Amount of thermal energy available in the market after incineration	ISO 14025:2006
MaterialsForEnergyRecovery	kg	Materials for energy recovery : Secondary fuels for use in the next product system	ISO 14025:2006
MaterialsForRecycling	kg	Materials for recycling : Secondary material for use in the next product system	ISO 14025:2006
LifeCyclePhase	Unitless	Life cycle phase : The whole life cycle or only a given phase from which environmental data are valid, ex. A1- A3 (Production stage)	ISO 14025:2006
LifeCycleStagesOmitted	Unitless	Life cycle stages omitted : Life cycle stages omitted from the Environmental Product Declaration calculations, ex. B1 - B7 (use stage), C1 - C4 (end of life stage).	ISO 14025:2006
EPDUnit	Unitless	EPD unit : The unit of the quantity the environmental indicators values are related with, ex. 1 piece of steel door	ISO 14025:2006

note: Properties from Master Data Template are highlighted in light grey