WOOD2WOOD

A Wood-to-Wood Cascade Upcycling Valorisation Approach

» Deliverable 13.1

End-to-end tracing module and DPP (version1)

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Authors	Nikolaos Kourkoulos (CERTH), Themis Kavour (CERTH)
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Peer Reviewers	1. Artemis Lavasa (DRAXIS) 2. Kostas Chatziioannou (ICCS)

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PROJECT INFORMATION

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0.3	17/04/2025	CERTH	Added content for sections 3,4,5
0.4	02/06/2025	CERTH	Added content for all sections and references
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1.0			Final submitted version
2.0			Revised submitted version (if required)

REVISION AND HISTORY CHART

Dissemination Level		
PU	Public	X
RE	Restricted to a group specified by the consortium	
CO	Confidential, only for members of the consortium (including the European Commission Services)	

Legal Disclaimer

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GLOSSARY OF ACRONYMS

Acronym	Extended Definition
ACID	Atomicity Consistency Isolation Durability
AI	Artificial Intelligence
DPP	Digital Product Passport
GDPR	General Data Protection Regulation
ORM	Object Relational Mapping
QR	Quick Response code
RAG	Retrieval-Augmented Generation
RBAC	Role-Based Access Control
W2W	Wood2Wood
XAI	Explainable Artificial Intelligence

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EXECUTIVE SUMMARY

This deliverable presents the design, development, and preliminary implementation of the End-to-End Tracing Module and Digital Product Passport (DPP) toolkit developed within the W2W project. As part of the project's digital tools for improving circular flows of secondary materials, this toolkit is essential in enabling transparent, traceable, and efficient data exchange related to wood waste materials across their lifecycle—from waste generation to high-value reuse.

The document is organised as follows:

- Section 1: Overview – Provides a general introduction to the deliverable's purpose, audience, and layout.
- Section 2: Introduction – Describes the background and context of the toolkit, its purpose within the framework of the W2W project, and its alignment with project objectives and cascade valorisation goals.
- Section 3: Toolkit Overview – Explains the core concepts, user profiles, use cases of the first version of the DPP and tracing module.
- Section 4: Implementation Status – Describes the current technical implementation, including the product registration module, lifecycle tracking system, and data integrity mechanisms. Also outlines upcoming enhancements and features planned for future versions. Through this section the user is able to understand all DPP current implementation and capabilities, outlining the values gained by integrating to an everyday usage tool
- Section 5: Deployment and Access – Details the technical deployment environment, security protocols, and user access provisions. Users can find out in details why their data are well protected, and which individual has at which part of the application. Establishing ground rules in this section give the confidence to the user to move forward to integrating DPP and all its side features to their production line.

This deliverable marks a key step in demonstrating how digital innovation can unlock the full potential of circular value chains by enabling reliable traceability, decision support, and cross-stakeholder collaboration in the reuse of wood waste materials.

1. OVERVIEW

1.1. OVERVIEW OF DELIVERABLE

This deliverable presents the design, development, and initial deployment of the W2W End-to-End Tracing Module and Digital Product Passport (DPP), a digital toolkit tailored for the management and circular valorisation of wood waste materials. As part of the W2W project's digital innovation suite, this toolkit addresses the need for transparent, reliable, and actionable data sharing across the full lifecycle of secondary wood products. It serves as a cornerstone for enabling traceability, quality control, and process optimization in upcycling and circular wood-based value chains. The toolkit provides a robust digital infrastructure that enables the collection, exchange, and interpretation of data across all phases of wood waste transformation—from collection and classification, to sorting, treatment, reuse, and reintegration into new products. By integrating cutting-edge technologies, such as Explainable Artificial Intelligence (XAI), the tool is not only able to manage multi-source manufacturing data but also support decision-making processes that improve the environmental and economic performance of secondary wood use.

1.2. KEY OBJECTIVES AND EXPECTED OUTCOMES

The End-to-End Tracing Module and Digital Product Passport is designed to address several key objectives aligned with the overarching goals of the W2W project:

- Data Integration & Traceability: Enable reliable data collection and tracing of wood waste materials through multiple life stages and transformations, ensuring visibility from initial recovery to final reuse.
- Interoperability: Develop standardised interfaces and protocols that allow seamless integration with a variety of computer-aided manufacturing systems, sensors, databases, and digital platforms.
- Transparency & Decision Support: Leverage Explainable AI to make data outputs comprehensible to non-experts, enhancing transparency and trust across the value chain.
- Circularity Enablement: Provide stakeholders with real-time and historical data that supports circular business models, sustainability reporting, regulatory compliance, and product innovation.

1.3. INTENDED AUDIENCE

This deliverable targets a diverse but interconnected group of stakeholders, including:

- European Commission and project reviewers: To demonstrate technical progress, alignment with project goals, and the innovative nature of the toolkit.
- Technical partners and digital developers: To provide specifications, architecture, and system logic that facilitate collaborative development, integration, and refinement of the tools.
- Industry stakeholders (e.g., wood processors, recyclers, construction firms): To highlight the practical value of the toolkit in enabling traceable, data-informed operations.

- Policy actors and certification bodies: To illustrate how the DPP contributes to compliance with evolving EU regulations on waste traceability, sustainability, and circular economy.

2. INTRODUCTION

2.1. BACKGROUND AND CONTEXT

The W2W (Wood-to-Wood) project addresses the growing challenge of sustainably managing wood waste derived from construction and demolition (C&D) activities and end-of-life furniture. In alignment with EU priorities on circularity and resource efficiency, the project aims to unlock the full potential of wood waste through cascade valorisation strategies. A critical enabler in this transformation is the ability to collect, trace, and manage data on wood waste materials throughout their lifecycle.

2.2. PURPOSE OF THE TOOLKIT

The End-to-End Tracing Module and Digital Product Passport (DPP) is conceived to enable seamless data collection and sharing throughout the circular value chain. The toolkit ensures that each wood product or component is accompanied by a rich digital profile detailing its origin, composition, treatment history, and suitability for various reuse and upcycling pathways. This traceability enhances transparency, supports quality assurance, and facilitates compliance with environmental and safety regulations.

The primary purpose of the toolkit is to digitise and streamline the flow of information across stakeholders involved in the transformation and reuse of wood waste. It provides a comprehensive digital environment where information about the origin, properties, treatments, and environmental impact of wood materials can be securely stored, interpreted, and exchanged.

The toolkit ensures continuous material tracking throughout all transformation stages, enabling users to understand where the material has come from, how it has been processed, and what potential reuse options are feasible. It also functions as a dynamic, structured dataset that travels with the material or product and is updated over time with relevant information.

Moreover, it enhances the quality of decision-making related to reuse and recycling, supports compliance with regulations, and contributes to sustainability assessments and reporting. It is essential component in enabling closed-loop systems where data follows the material just as closely as the physical material itself.

2.3. ALIGNMENT WITH W2W PROJECT GOALS

The toolkit directly supports multiple W2W objectives, particularly O1, O3, O4, O5 and O6. It contributes to the validation of a comprehensive framework for stakeholder interaction and data sharing (O1), enables informed decisions on sustainable upcycling technologies (O3), and provides digital solutions for lifecycle thinking and sustainability assessments (O4). By integrating advanced digital capabilities, the toolkit underpins W2W's vision of a smart, circular wood economy. The toolkit is designed to be tested and validated in real-world settings, offering feedback for iterative

improvement (O5) and the potential standardization of interfaces and protocols will contribute to upskilling stakeholders and influencing broader policy and market practices (O6).

3. TOOLKIT OVERVIEW

3.1. CORE CONCEPT AND GOALS

The central concept of the DPP toolkit is to treat data as a co-product of material flows. In other words, for every physical movement or transformation of wood waste, there should be a corresponding digital record that captures key metadata, transformation context, quality indicators, and environmental performance.

The toolkit aims to:

- Enhance the **digital visibility** of secondary materials and their properties.
- Ensure **traceability** across multiple transformation steps and users.
- Enable **informed decision-making** for reuse, upcycling, and safe disposal.
- Promote **data interoperability** across various systems and stakeholder platforms.
- Support **compliance and sustainability reporting**, including alignment with emerging EU regulations on Digital Product Passports for material streams.

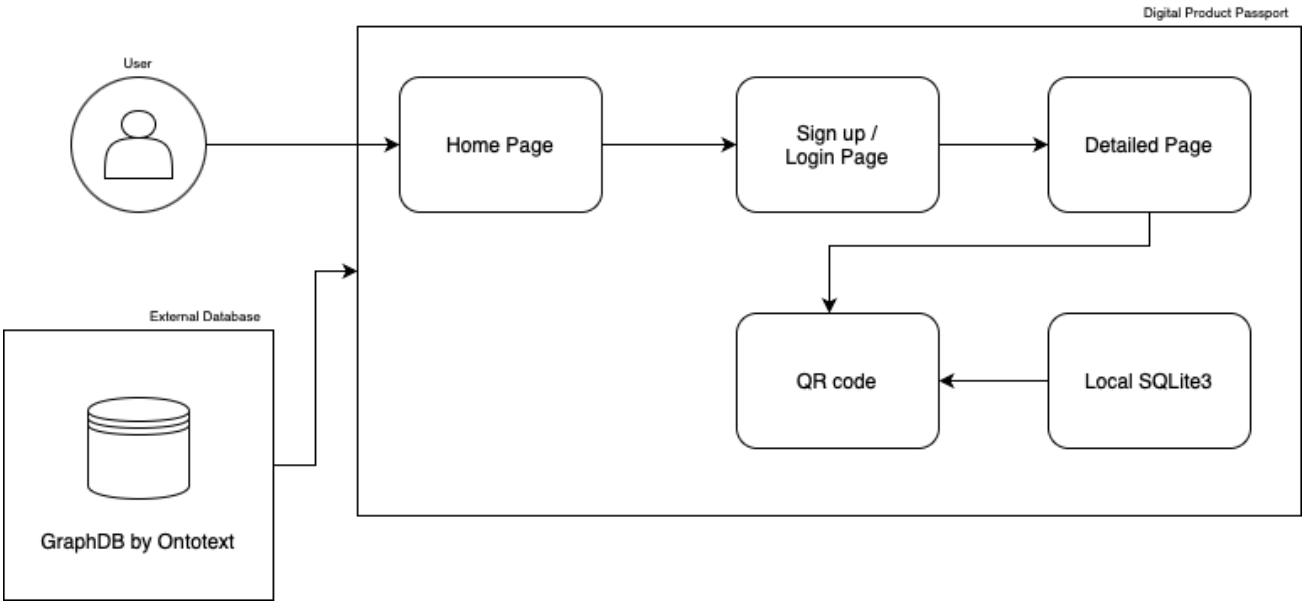
3.2. TARGET USERS AND USE CASES

The End-to-End Tracing Module and Digital Product Passport (DPP) has been developed with a wide range of stakeholders in mind, specifically those involved in the construction, pulp and paper, and chemicals sectors. Under the hood of professionals, the primary users group include industrial operators, manufacturers, recyclers, and technology providers participating in the treatment and upcycling of Construction and Demolition (C&D) wood waste. Additionally, the toolkit supports waste managers, process engineers, and supply chain stakeholders, enabling them to access accurate and traceable data across material flows and transformation stages. For these stakeholders, the DPP offers a powerful digital solution to track product lineage, assess quality and contamination, ensure regulatory compliance, and optimise decisions in cascade valorisation chains. The first group of users is going to have more functionalities than the second one. These functionalities are basically the ability to alter the data and information presents (edit information, add new wood types, remove outdated types of wood, import/export extra data like csv, pdf etc and more). The second group on the other hand contains everyday-simple nonprofessional users who are going to have the ability to view the contained information but are not going to be able to change anything. In case this is necessary it is going to be done by contacting the administration.

The toolkit has been designed in alignment with the Use Cases established within the W2W project.

4. IMPLEMENTATION STATUS

4.1. TECHNICAL SPECIFICATIONS



In this section, we examine the technological foundation of the Digital Product Passport (DPP). As previously outlined, DPP is an innovative software solution developed to provide end-to-end digital tracking and traceability for products throughout their lifecycle. By delivering rich, verifiable product information, the system enhances transparency, supports sustainable practices, and promotes circular economy principles. To realize these objectives, a well-considered and future-ready technological stack was essential.

The backend of the DPP is built using Python [1] and the Django framework [2]. Django was selected for since it has a robust and scalable architecture, which offers an extensive set of built-in features, making it highly suitable for integrating and managing various system components and that it is easily to tune and adjust to all widths and heights. Its modular structure, built-in ORM [3], and secure design facilitate efficient data handling, support rapid development, and ensure a scalable solution for large and complex systems like DPP.

For data abstraction and database interactions, SQLAlchemy [4] serves as the ORM. SQLAlchemy provides flexibility for handling complex queries and enables easy interaction between Python objects and relational database schemas. Its ability to operate at both the high-level ORM layer and the low-level SQL layer ensures efficient management of data, enhancing performance and flexibility.

DPP makes use of both PostgreSQL [5] and GraphDB by Ontotext [6] for data storage. PostgreSQL was chosen for its reliability, ACID compliance, and advanced querying capabilities. As a powerful

relational database, it handles structured data efficiently, making it ideal for storing user data, system configurations, and metadata.

On the other hand, GraphDB by Ontotext is utilized to manage semantic data and support the creation of knowledge graphs for the products at hand. GraphDB's ability to model complex relationships and perform advanced reasoning using SPARQL [7] queries makes it an ideal choice for managing interconnected product data, certifications, and sustainability indicators.

Authentication and authorization are handled using OAuth2 [8] and JWT (JSON Web Tokens) [9]. OAuth2 is employed for delegated access control, allowing third-party services to securely interact with the DPP system. JWT is used for stateless authentication, ensuring secure and efficient user authentication across distributed services.

In terms of containerization and deployment, the project recommends using Docker [10] and Kubernetes [11]. Docker is utilized to create consistent, portable application environments, making it easy to replicate the system across different development, testing, and production environments.

Kubernetes provides robust orchestration for Docker containers, enabling automated scaling, self-healing, and effective management of microservices in production.

The Digital Product Passport (DPP) follows a microservices-based architecture, allowing the system to be broken down into small, independent, and loosely coupled services. Each microservice is responsible for a specific domain or functionality, such as user management, data ingestion, or certification validation. This approach enhances maintainability, enables independent deployment and scaling of services, and facilitates parallel development across teams. The microservices model ensures that updates or failures in one component do not affect the entire system, contributing to a more resilient and adaptable platform.

Additionally, DPP incorporates an event-driven design, enabling asynchronous communication between services through events and message queues. This design pattern improves the system's responsiveness and decouples services further, allowing for real-time data processing and better handling of high-throughput scenarios. Event-driven architecture is particularly useful for tracking updates, logging activities, or triggering automated workflows based on changes in the product lifecycle data.

All services within the DPP expose RESTful API interfaces, following established web standards for communication between internal modules and external clients. RESTful APIs ensure consistent, stateless, and scalable interactions, making integration with third-party platforms and services straightforward. This approach supports interoperability, simplifies data exchange, and allows for future extensions without breaking existing functionalities.

Finally, the system is designed with a scalable and modular component structure. Each component or service is encapsulated, promoting reusability and simplifying system upgrades or extensions. New features can be added incrementally without significant refactoring, and existing modules can be optimized or replaced independently. This modularity, combined with the use of containerization tools like Docker and orchestration via Kubernetes, enables DPP to scale efficiently in response to growing data volumes and user demands.

4.2. Current Implementation

4.2.1. Product Registration Module

A digital product passport is an empty app without any data. As a result, we have received the structure of the ontology (from WP4.4) and we filled that with information. We created a toy dataset to build and develop the final product, DPP, and it awaits of real data to be filled with and be used for the purspose it is contructed.

The Digital Product Passport (DPP) is designed with flexibility at its core, enabling it to support multiple product types and categories across various industries. Whether the product is a wooden furniture item, a device with wooden parts, or a wood type in general, the system can adapt its data structure to accommodate industry-specific standards and requirements. This multi-domain compatibility ensures that DPP can serve as a universal infrastructure for traceability and sustainability, regardless of product classification or sector-specific nuances.

Each product registered within the DPP is assigned a unique digital identifier, ensuring distinct traceability and verifiability across the product's lifecycle. This mechanism prevents duplication, supports product authentication, and simplifies integration with other systems, such as logistics, customs, or compliance platforms.

In addition, the system can capture comprehensive product metadata, encompassing a wide range of attributes such as dimensions, weight, manufacturing location, date of production, batch number, certifications, and applicable standards. This rich metadata foundation enhances data granularity, facilitates semantic reasoning, and ensures that all relevant stakeholders—from manufacturers to recyclers—have access to complete and structured information necessary for informed decision-making and lifecycle management.

4.2.2. Lifecycle Tracking System

The core function of the Digital Product Passport (DPP) is its ability to record the complete journey of a product, from manufacturing through distribution, usage, and ultimately to its end-of-life. By collecting and centralizing key data at every stage of the product lifecycle, DPP enables traceability and accountability across the supply chain. This comprehensive lifecycle tracking ensures that each transformation or transaction is digitally documented, fostering transparency and enabling stakeholders to make informed decisions based on accurate, verifiable data.

In addition to lifecycle tracking, the DPP system is designed to monitor and document the environmental impact associated with each product. This includes metrics such as carbon footprint, ecological information, biodiversity, and best sustainability practices of production and usage. By incorporating these environmental indicators, DPP empowers businesses and consumers alike to evaluate products not only by their functionality or cost, but also by their sustainability profile. This information supports regulatory compliance, corporate responsibility initiatives, and environmentally conscious purchasing behavior.

Fundamentally, the DPP is built to support circular economic principles. By enabling the reuse, repair, recycling, and repurpose of products and materials, the system facilitates a shift away from traditional linear production models. The semantic structure of the data, combined with traceability and impact insights, allows manufacturers, regulators, and consumers to identify opportunities for circular practices. Whether it's through enabling second-life uses, verifying recycled content, or tracking disassembly instructions, DPP serves as a digital enabler of a more sustainable and regenerative economic model.

4.2.3. Data Integrity and Security

One of the foundational capabilities of the Digital Product Passport (DPP) is the registration of products and the creation of their corresponding digital passports. At the point of entry, key product information, such as unique identifiers, manufacturing details, product description, and product's technical specifications, is captured and stored within a secure and structured digital profile. This process ensures that each item is uniquely traceable and that its associated data can be referenced and updated throughout its lifecycle, establishing a persistent digital identity that travels with the product.

The system also enables detailed material composition tracking, allowing manufacturers and stakeholders to document the specific components and raw materials used in each product. This granular level of insight is critical for evaluating environmental impact, verifying regulatory compliance, and supporting downstream processes such as repair, recycling, and supply chain audits. With structured semantic data and support for ontologies, DPP ensures that material data is both standardized and interoperable across systems.

To further support product longevity and transparency, DPP includes mechanisms for logging repair and maintenance history. Each time a product undergoes servicing, relevant information—such as the date, type of service, replaced parts, and servicing entity—is recorded in the digital passport. This record benefits both consumers and service providers by providing a clear maintenance history, supporting warranty claims, and enabling smarter diagnostics and second-life applications.

Finally, the DPP system provides recycling and disposal guidance, tailored to the specific composition and characteristics of the product. By leveraging its knowledge graph and semantic data capabilities, DPP can offer targeted recommendations for disassembly, recycling pathways, and compliance with local or international disposal regulations. This ensures that products are disposed of responsibly and that valuable materials are recovered, directly supporting sustainability and circular economy goals.

The Digital Product Passport system employs encrypted data storage to ensure the confidentiality, integrity, and security of sensitive information. All data, whether in transit or at rest, is encrypted using industry-standard protocols. This approach safeguards product metadata, user credentials, and transactional records from unauthorized access or tampering. By implementing secure key management practices, DPP provides robust protection against data breaches while maintaining system performance and accessibility. Robust security layers between unregistered users,

registered non-professional users and professional users have been set up to differentiate the type of information available by any type of user.

4.2.4. Users Interface (UI)

In this section, we are going to take a closer look at current User's interface. Currently DPP consists of two different states, pre-logged-in and post-logged-in, each with a variation of pages. Initially, at pre-logged-in state, user can visit pages like W2W Project which the home page of the application.

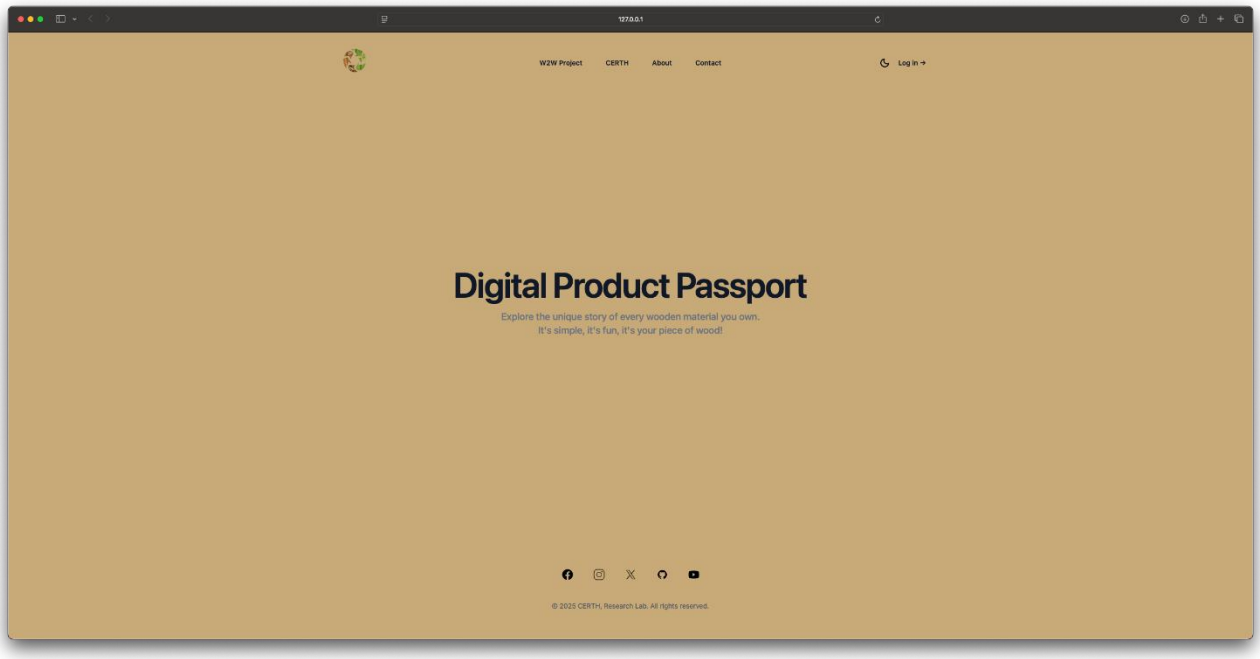


Figure 1: Digital Product Passport Home Page

Other pages a user can visit before logging in are CERTH which is a page with general information dedicated to CERTH which built this application, an About page containing information of the project and the specific task of building the application, a contact page where any user can contact the project's administrators for any questions or concerns, and a log-in/sign-up page.

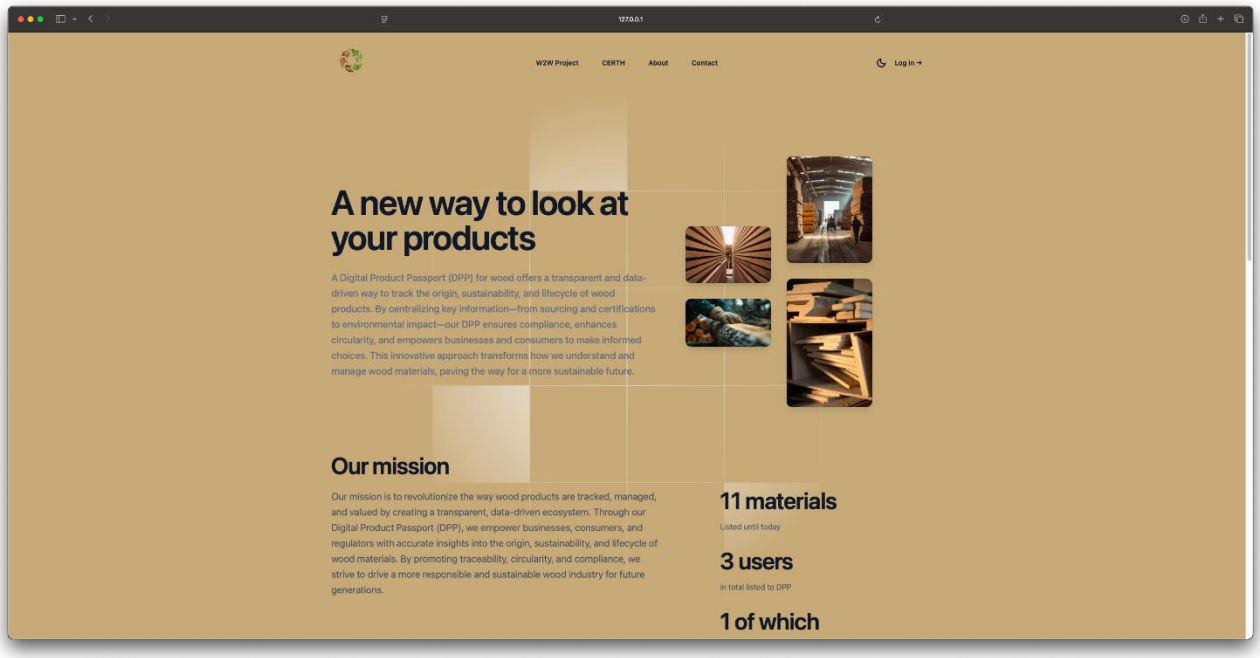


Figure 2: Digital Product Passport About Page

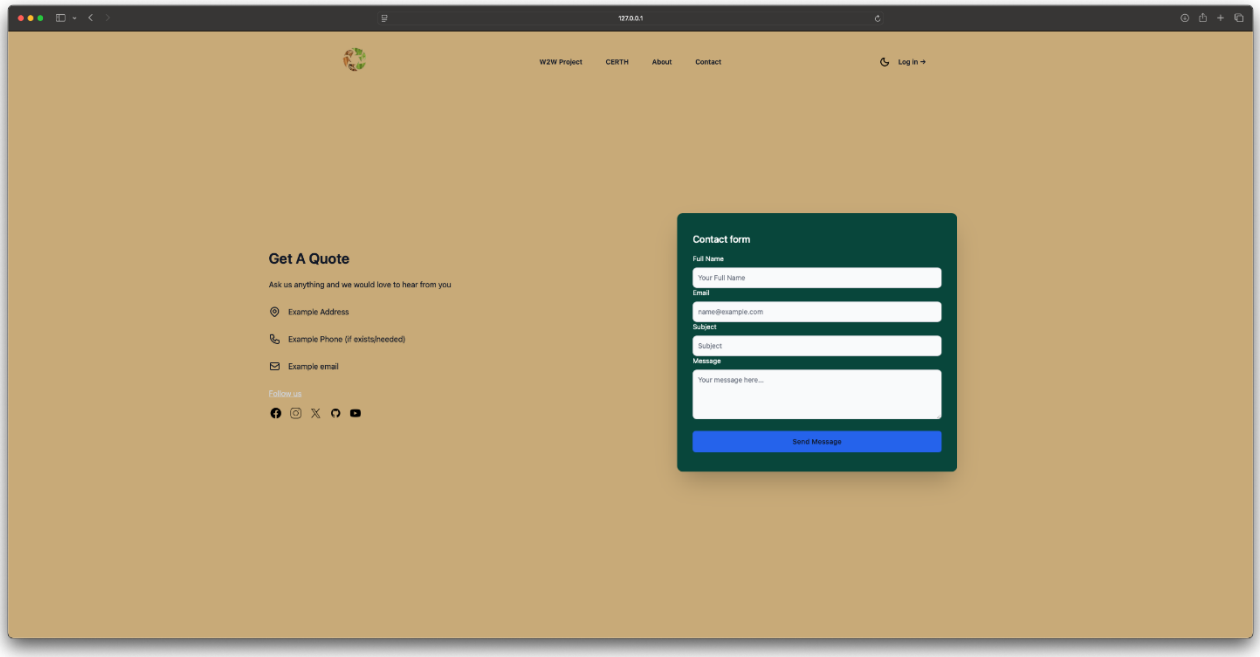


Figure 3: Digital Product Passport Contact Page

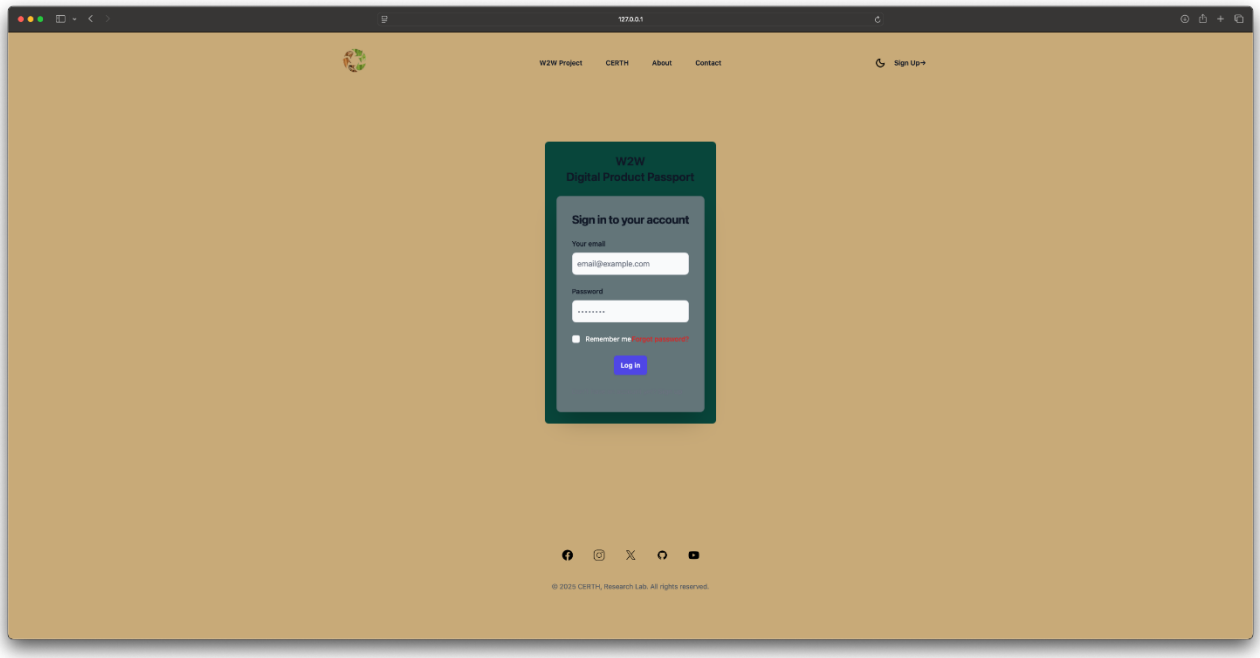


Figure 4: Digital Product Passport Login Page

At post-logged-in stage, user can select the desired product to visit and see detailed information about or create a new named graph of the desired product if that one does not exist. As mentioned earlier, some of the functionalities are available only to professional user. As a result, for the creation of a new named graph (a.k.a. a new product's page) by a simple user, through contact page, one can contact the administrator of the application and have it created.

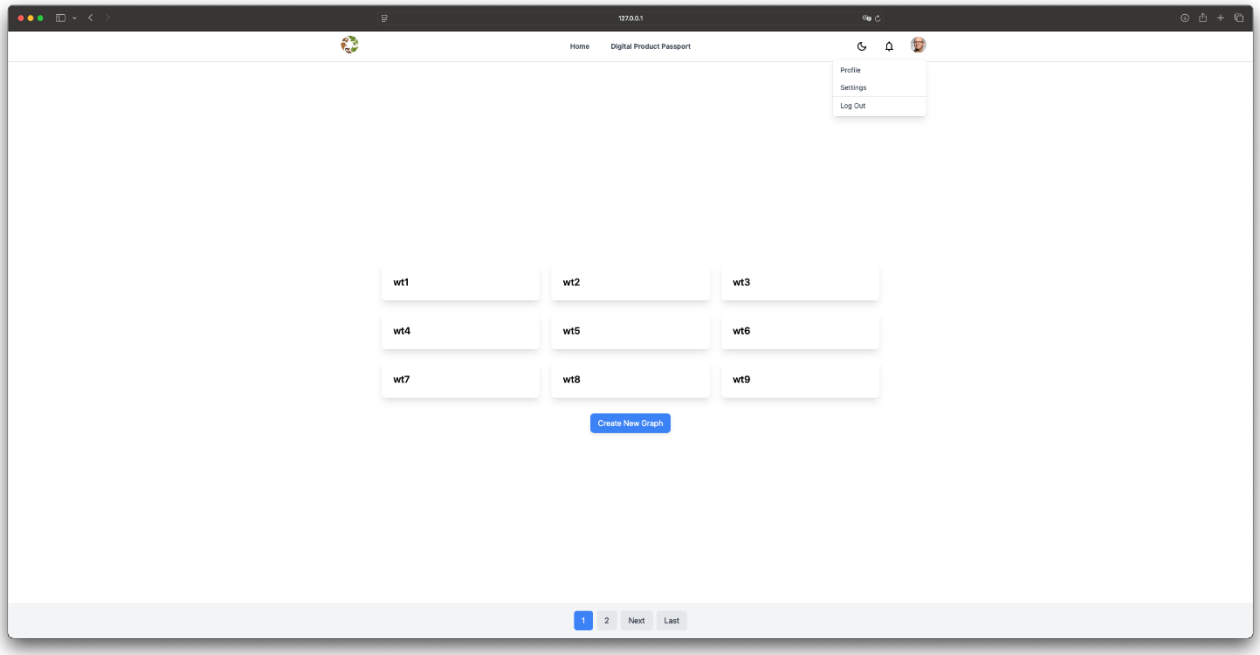


Figure 5: Digital Product Passport Products' Page

By selecting a product, user will be visiting a page containing detailed information of the choice made. There the user can see information on the following sections:

- Raw Material
- Product Information
- Manufacturing Process
- Environmental and Social Impact
- Utilization Information
- End of Life Information

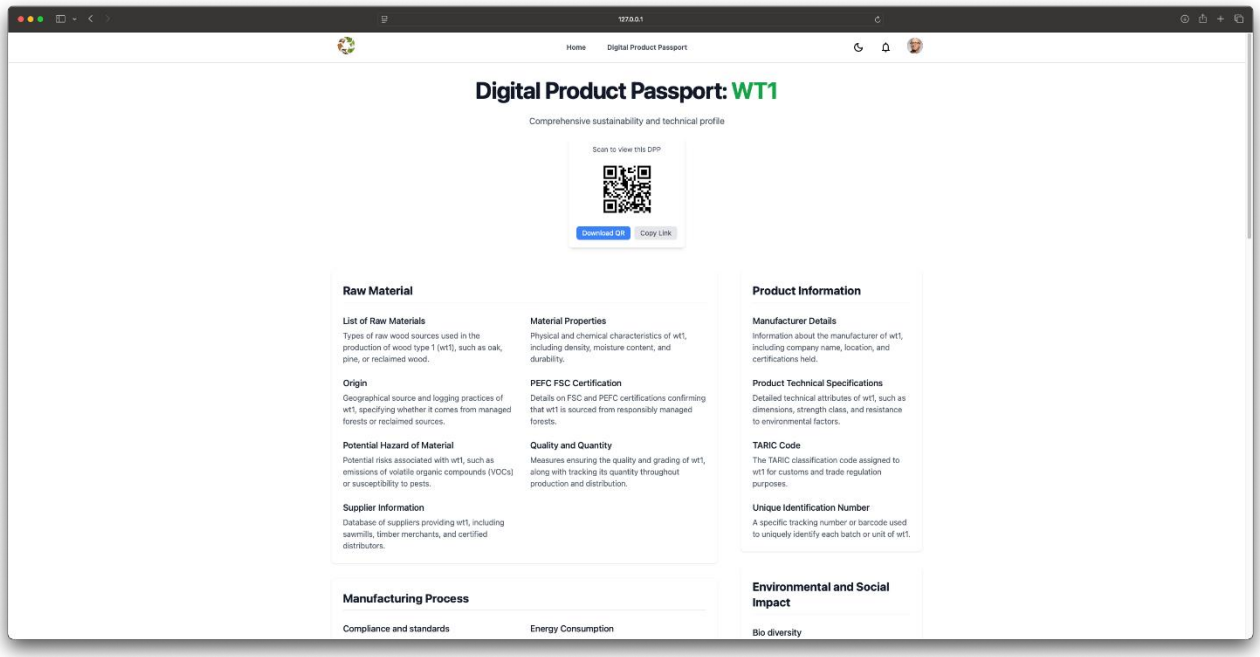


Figure 6: Digital Product Passport Product's profile page

Apart from the information there exist a QR Code to be downloaded and reused for fast navigation to this product's specific page, in case this is needed. Other than that, there are several extra features one can use to enhance the existing information, respectively:

- Download Report (to download existing information and use it offline)
- Update information (to update existing information in case it is considered outdated or not valid, at time)
- Delete Information (to delete existing information in case it is considered outdated or not valid, at time)
- Upload file (in case further information is available to be share in a different file format, PDF, xlsx, csc)

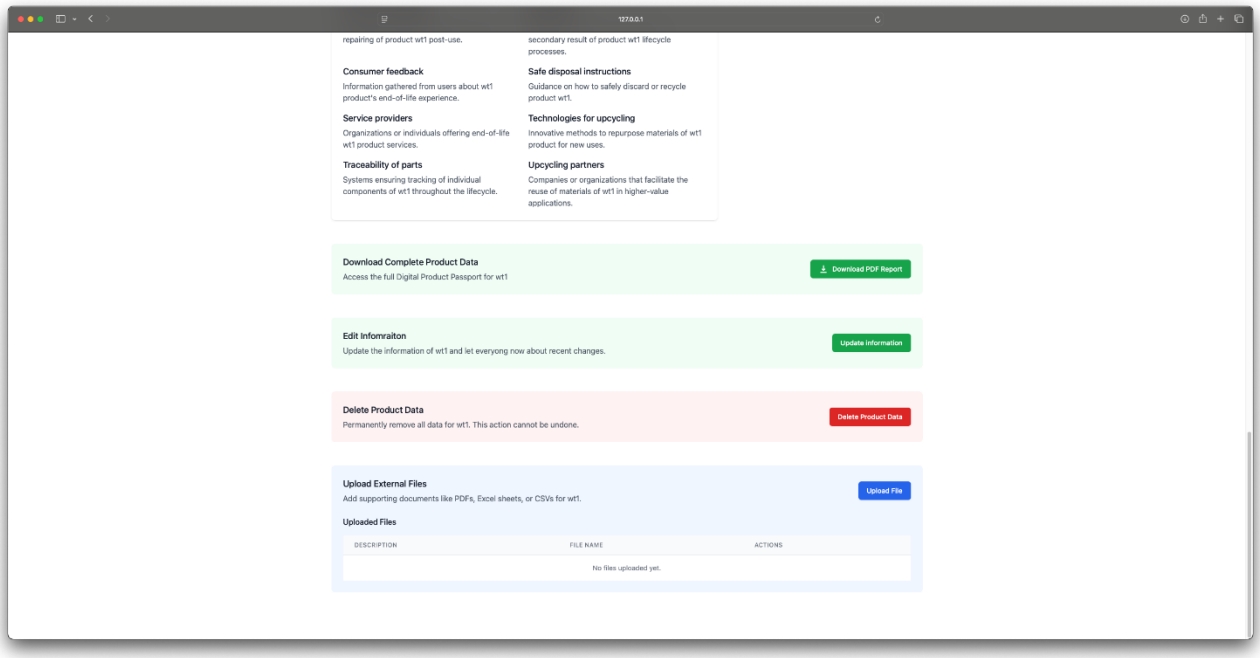


Figure 7: Digital Product Passport Product's User Features.

4.3. Next Developments

To further strengthen its capabilities and value proposition, the DPP roadmap includes several technical improvements aimed at expanding its analytical depth, user interaction, and real-time responsiveness. New features and updated included concerning security, optimization, and users' experience enhancements. Let us take a closer look at the features mentioned earlier.

4.3.5. Planned features for future versions

One of the key future developments is the incorporation of an AI-powered summarization model capable of distilling complex datasets and product information into concise, human-readable summaries. This feature will enhance usability by providing end-users with quick, relevant insights into each product's history, certifications, composition, and sustainability metrics without requiring them to manually sift through extensive records.

A further innovation involves the development of a Retrieval-Augmented Generation (RAG) AI model, allowing users to interact directly with the database through natural language queries. By combining semantic search with generative AI, users will be able to ask detailed questions—such as

- What are the recycled strategies of this product?
- Which products meet certain sustainability criteria?

and receive precise, context-aware answers sourced from the DPP knowledge graph and databases. This feature will make technical product information accessible to a broader audience, including consumers, auditors, and regulators.

Additionally, efforts will focus on enhancing the granularity of carbon impact tracking. The future system will integrate more detailed emissions data at the component and sub-process levels, allowing for a highly accurate representation of carbon footprint at every stage of the product lifecycle. This level of detail supports more transparent reporting and enables targeted sustainability interventions.

Lastly, the platform will undergo improvements in real-time data synchronization mechanisms. By optimizing data pipelines and incorporating event-driven technologies, DPP aims to ensure that changes in product status, certifications, or metadata are reflected immediately across all relevant components and stakeholders. This real-time capability is critical for maintaining data integrity and supporting timely decision-making in fast-paced supply chain environments.

In pursuit of even greater transparency and trustworthiness, the Digital Product Passport aims to explore blockchain integration to guarantee absolute data integrity and security. By leveraging distributed ledger technology, each transaction or update—whether related to product lifecycle, certifications, or material origin—can be immutably recorded and cryptographically secured. Blockchain can serve as a tamper-proof audit trail, ensuring data cannot be altered retroactively without detection. Implementation may involve using a permissioned blockchain such as Hyperledger Fabric [12] or Quorum [13], enabling fine-grained control over participation and access. Smart contracts can be utilized to automate verification rules, ensuring compliance with sustainability standards and regulatory frameworks.

To enhance the reliability and resolution of product tracking, DPP is also set to design advanced material traceability algorithms. These algorithms will utilize graph structures, probabilistic models, and supply chain input data to map material flow with high precision. By identifying each transformation, a material undergoes—from extraction to component integration and beyond—DPP will enable accurate backward and forward tracing. This will significantly aid in validating claims related to material origin, ethical sourcing, and recycled content, while also supporting dynamic recalculations of environmental impact.

Furthermore, the platform will incorporate AI-driven sustainability recommendations, tailored to each product and supply chain configuration based on historical data and existing knowledge on the field. Leveraging insights from lifecycle analysis, compliance data, and historical environmental metrics, this feature will provide actionable suggestions to improve a product's ecological footprint. For example, it might recommend substituting a high-impact material with a more sustainable alternative, altering packaging options, or modifying distribution logistics. These recommendations can be contextualized by region, regulation, and product category, providing practical guidance aligned with circular economy objectives.

5. DEPLOYMENT AND ACCESS

The Digital Product Passport (DPP) serves as a critical digital enabler within the Integrated Circular Wood Upcycling Platform, providing traceability, transparency, and verified information on wood waste materials throughout their lifecycle as mentioned earlier. To realize its full potential, the deployment and access architecture of the DPP has been carefully designed to ensure reliability, scalability, and secure multi-stakeholder collaboration. This chapter outlines the technical environment for deploying the DPP application and details the comprehensive security protocols and access controls that safeguard sensitive data and manage user permissions effectively.

By leveraging containerization technology and well-defined role-based access mechanisms, the DPP achieves seamless integration with the broader circular economy platform while upholding stringent security and data governance standards. The following sections describe the deployment environment, emphasizing the use of Docker for portability and scalability, followed by a detailed overview of the access control framework, authentication protocols, and data sharing policies critical to maintaining trust and compliance among the diverse stakeholder networks. Together, these components ensure the DPP operates as a robust, secure, and interoperable digital asset within the wood upcycling ecosystem.

5.1. DEPLOYMENT ENVIRONMENT

The Digital Product Passport (DPP) module, developed as a core component of the broader Integrated Circular Wood Upcycling Platform, is deployed leveraging modern containerization technologies to ensure flexibility, consistency, and scalability. Specifically, the DPP will be dockerized, allowing the application to run within isolated, reproducible Docker containers. This container-based deployment approach guarantees that the DPP behaves identically across various development, testing, and production environments, significantly reducing discrepancies due to differences in underlying system configurations.

By utilizing Docker modules, the DPP achieves portability and ease of deployment, particularly on Linux-based distributed systems or gateway devices commonly used in industrial and supply chain environments. This containerization strategy also facilitates the seamless scaling of the DPP services in response to variable workloads, supporting robust and continuous availability.

The deployment strategies have been designed to support smooth interoperability and data exchange with other tools (which is a topic under investigation) between these interconnected modules, thereby fostering a cohesive ecosystem for circular economy practices in the wood waste value chain.

5.2. SECURITY PROTOCOLS AND ACCESS CONTROL

Security and controlled access are paramount considerations in the design of the DPP, given the sensitive and commercially valuable nature of the manufacturing and lifecycle data it manages. To

this end, a comprehensive role-based access control (RBAC) mechanism is implemented, enabling fine-grained management of user permissions.

Distinct user roles correspond to professionals who are involved in the wood waste value chain, including but not limited to wood waste owners and generators, sorting and upcycling technology providers, recyclers, product end-users, public authorities, researchers, and standardisation actors and non-professionals. Each role is precisely assigned permissions that define their access scope—ranging from data viewing and creation to editing, approval, and administrative management—ensuring users interact with the system only within their authorized boundaries.

The DPP is designed to facilitate the secure storage and sharing of manufacturing data related to wood waste materials, while respecting data sovereignty principles. Access rights are carefully defined to ensure that each business or stakeholder along the value chain can access pertinent information relevant to their role and activities. For data classified as "sensitive" or "confidential," additional security measures are deployed in line with the project's risk mitigation strategy and the consortium agreement, thereby safeguarding proprietary information and maintaining trust among participants.

Robust authentication and authorization protocols underpin the system’s security infrastructure. Authentication processes verify user identities with high assurance before granting access, while authorization mechanisms strictly enforce the predefined access rights, ensuring that users can only perform actions and access data permitted by their role assignments.

To support seamless and secure data exchange between the DPP and other platform components or external systems, well-defined interface standards and protocols are utilized. These standards guarantee reliable communication channels that inherently incorporate encryption and secure transmission methods, protecting data integrity and confidentiality throughout its lifecycle.

Finally, the management of knowledge and intellectual property rights (IPR) is carefully integrated within the access control framework. Access to certain data elements within the DPP may be governed by exploitation agreements and intellectual property rights, allowing knowledge producers to retain ownership and control over their proprietary information while enabling compliant sharing and use within the consortium.

6. REFERENCES

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