

Comprehensive Framework for Wood Cascade Upcycling Valorisation

Akrivi Korba, Konstantinos Chatziioannou, Georgios Tsimiklis, Angelos Amditis

Institute of Communication and Computer Systems, Athens, Attica, 157 73, Greece

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Presenting author email: akrivi.korba@iccs.gr

Abstract

According to projections, wood supply may be insufficient to meet European demand by 2030¹ due to its increasing use in energy generation, construction materials, and chemicals. Wood is becoming increasingly prevalent in construction and demolition waste (20-30% of total building-related waste) and furniture waste (10 million tons thrown away each year in EU Member States). Recycling these streams can be a valuable and inexpensive raw material source. Waste wood streams, including industrial and urban waste, contain considerable amounts of fossil-based carbon from coatings, paints, plastics, and preservatives that can be recycled using novel methods such as chemical recycling.

The present study as part of Wood to Wood (W2W) project² presents a framework for multi-dimensional cascade valorisation of wood from C&D and furniture waste, consisting of four key components or pillars: a. Advanced separation and sorting technologies, b. Upcycling processes, c. Digital tools to improve circular flows of secondary materials, and d. Supportive framework for policy, market, and skills, that select optimal cascade paths for future uses of wood products and materials.

This approach reduces the need for virgin materials, reduces waste in landfills and incineration facilities, creates value-added products from waste, and promotes closed-loop systems to extend the useful life of materials, supporting the transition to a circular economy. Using the components or pillars, this study aims to create long-term value chains to produce upcycled bio composite building materials.

Methodology

This research employs a multi-method approach to define essential content for the development of a framework for CDW cascade valorisation and recycled wood management, based on multi-dimensional cascade valorisation principles. This includes identifying the stakeholders and their interactions along the wood value chain. A framework for classifying recycled wood will be established, considering the various schemes in the EU. An integrated wood cascade valorisation framework will be created, including proposed technologies for waste management and digitalization, as well as the development of policies, skills, standardisation, and certification. A multi-dimensional method will be used to evaluate the time, value, and function of recycled wood throughout its existence.

Results & Discussion

The current investigation focuses on three major research questions. Initially, the study seeks to identify the key data points seen by stakeholders throughout the wood value chain. The mapping of actors and interactions with key stakeholders will be thoroughly examined to identify the stakeholders involved in each of the value chains covered by this project. A detailed mapping will take place to provide information regarding the stakeholders and their key interactions, taking into consideration that the general actor categories of a value chain are wood waste owners/generators, wood waste sorting and upcycling technology providers, recyclers, product end users, public authorities, and standardization actors.

Secondly, the study will conduct research on aspects related to wood characterization as well as classification schemes at the national level, bringing together contributions and viewpoints from many stakeholders. Based on this, the study will propose a common categorization scheme. Given that different characterization and categorization techniques are used in each nation, this effort intends to provide a standard framework for recycled wood management. This is critical for setting proper standards and regulations for recycled wood products to ensure their safety and sustainability, as these goods may contain dangerous compounds that can seep into the environment or endanger workers and customers. Thus, this project will identify and develop innovative approaches that use clean, waste, and contaminated wood to create high-value goods and contribute to a more sustainable and circular economy.

Nevertheless, an initial study of all potential pathways and valorisation schemes will be undertaken, using the specified feedstock framework for pure and mixed treatment. A list of accessible technologies will be reviewed to identify the requirements and the most effective valorisation pathways. The characterization of the available feedstock, as well as the dynamic LCA computation, will be considered tentatively when selecting each feasible route.

Conclusions

This study investigates the significance of developing a comprehensive framework in the wood value chain, highlighting challenges and critical elements for encouraging upcycling and valorisation operations. The research work is utilizing stakeholder interaction, waste classification schemes, categorization approaches, and analysis frameworks to identify crucial data points and information requirements throughout the wood value chain. The research employs a multi-method approach that is considering the dynamics of the wood value chain to develop a comprehensive framework tailored to the sector's specific demands. Understanding these insights is critical to improving sustainability, resource efficiency, and circularity in the wood industry.

References

- [1] Alex Forrest, Mark Hilton, Ann Ballinger & Daniel Whittaker, Circular Economy Opportunities in the Furniture Sector, European Environment Bureau, (2017).
- [2] [A Wood-to-Wood Cascade Upcycling Valorisation Approach | W2W | Project | Fact sheet | HORIZON | CORDIS | European Commission \(europa.eu\)](#).

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