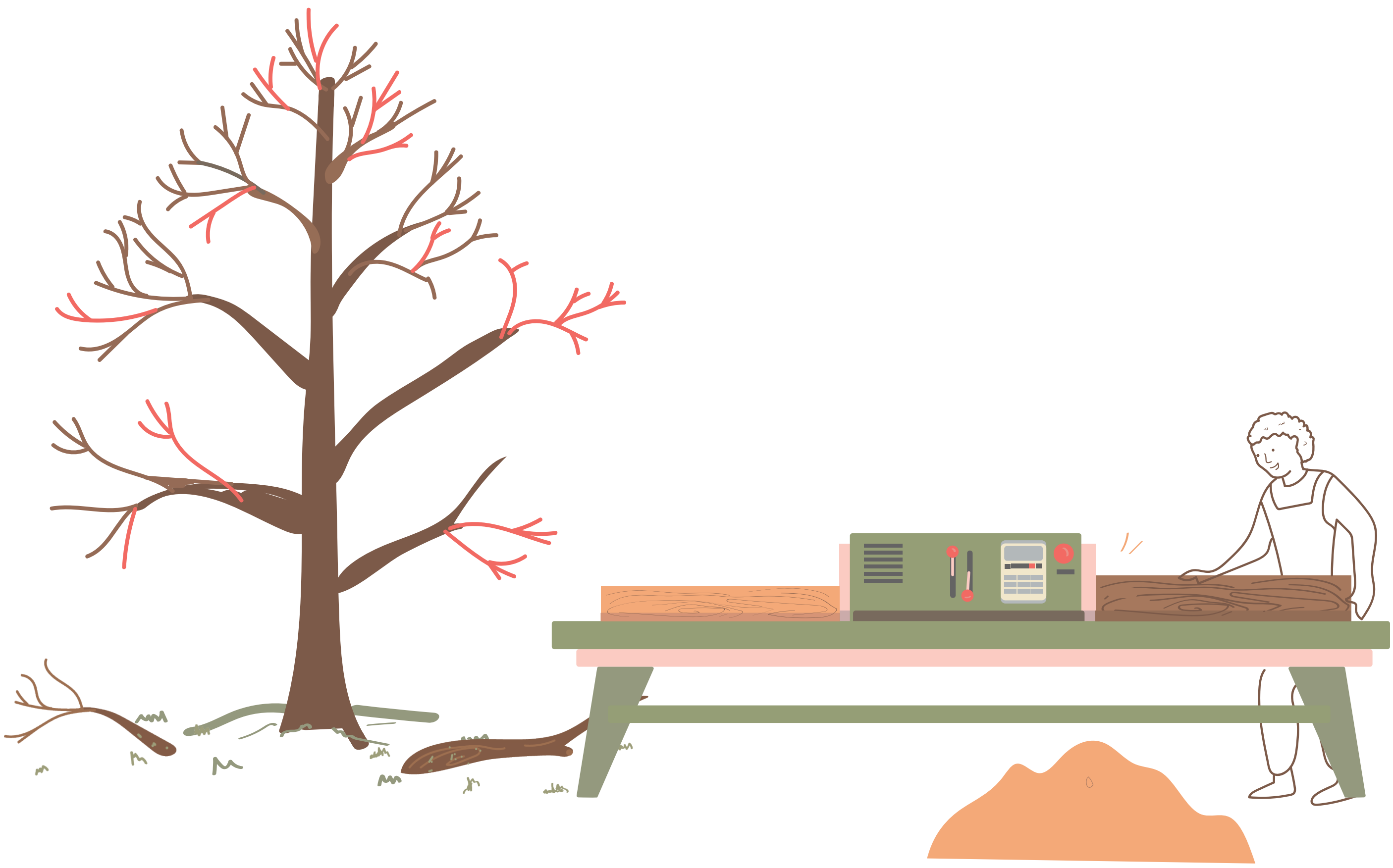
URWOOD

Towards value-added repair in Utrecht Region
with WOOD composite materials



Title: Urwood: Towards value added repair in Utrecht region
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Contents

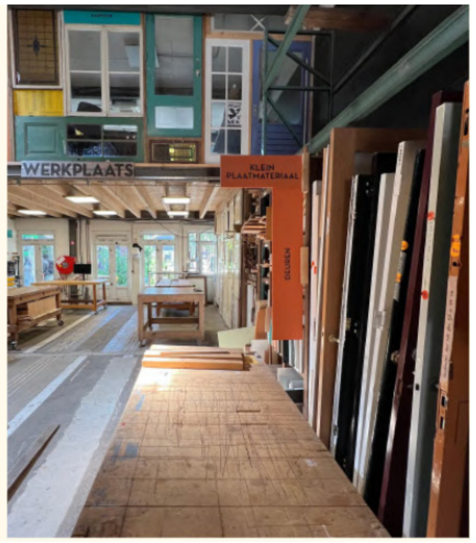
1. What to expect?

Introduction

The URWOOD project transforms low-value wood waste like branches, offcuts, and residues into bio-based composite materials for value-added repair, advancing circularity in the Utrecht region. By merging scientific innovation with community practices, URWOOD creates sustainable alternatives to conventional fillers like epoxy, prioritizing biodegradability, local sourcing, and collaborative co-creation.

This report details a co-creation workshop at Buurman Utrecht, where researchers from Eindhoven University of Technology (TU/e), Wageningen University and Research (WUR), and Utrecht University (UU) partnered with local woodworkers, designers, and upcycling practitioners to test prototype putties and capture practical feedback. The document begins with an overview of the interdisciplinary team, municipal alignment, and local wood resources, followed by pilot research findings from document reviews, interviews, and observations that shaped community engagement opportunities. It then outlines the methodology, including participant recruitment, workshop procedures, and multi-method data collection. Subsequent sections describe the workshop activities: an initial material dialogue through sample handling and discussion, hands-on repair experimentation, and extended take-home testing of three binder formulations—methylcellulose, sodium alginate, and carboxymethylcellulose. Results and reflections present comparative performance insights, user preferences, and refinement directions, while the conclusion explores implications for scalable upcycling that integrates technical, social, and policy objectives.

Through this progression, the report illustrates how participatory methods bridge material science with everyday needs, strengthening circular wood economies in Utrecht and offering models for broader application.



2. Academic stakeholders and context

Who is involved?

The project unites complementary expertise from Industrial Design and Mechanical Engineering at Eindhoven University of Technology (TU/e), Wageningen University and Research (WUR), and Utrecht University (UU) to tackle upcycling challenges in the Utrecht region.

This collaboration integrates strong disciplinary strengths in material science and engineering (WUR, TU/e-ME) with inter- and transdisciplinary approaches (UU, TUe-ID). The consortium actively engages with communities and societal stakeholders, enabling co-creation of alternative futures. The collaboration enables creative solutions that merge insights from chemistry, biology, and engineering with social, experiential, and environmental perspectives, enhancing material properties, resource efficiency, and process optimization from the outset. This design focus strengthens the translation of scientific insights into meaningful, scalable, and sustainable upcycling solutions.

TU/e-ID | Project Co-ordinator

Dr. Bahareh Barati
Expertise: material-driven design, bio-fabrication, value-added repair, co-creation, experience prototyping.

WUR

Dr. Lu Zhang
Expertise: material processing (mechanical and chemical), transforming bio-waste into workable powder and/or paste for (additive) manufacturing.

TU/e-ME

Emma Luitjens
Expertise: biological processes, bio-based economy, societal stakeholder involvement, a system perspective of circular design.

TU/e-ME

Dr. Tomaso Magrini
Expertise: additive manufacturing, materials testing and characterization.

Pilot Research

3.1 Objective:
This pilot research was conducted to explore the opportunities for community engagement around upcycling and circular use of local wood in Utrecht. The aim was to understand the local context, identify relevant stakeholders, and gather insights that can guide the design of the community engagement workshops to inform both technical development and social engagement. The research also seeks to strengthen our project proposal by aligning with municipal objectives and addressing real local needs

3.2 Methodology:
This pilot combined the review of municipality documents with informal interviews and observations of local stakeholders. Key documents reviewed included:

- Municipality project plan (grant proposal) outlining the plan for upcycling centers and circular initiatives in Utrecht
- Research on Local Wood in Utrecht (OSMOS Network, 2021-2022) providing an inventory of local wood resources, usage patterns, and stakeholder engagement recommendations.

Informal interviews and discussions were conducted with local stakeholders, including workshop leaders and organizations involved in wood upcycling, to identify current practices and specific needs.

3.3 Key Findings
3.3.1 Stakeholders and Potential Partners
Several local stakeholders and hubs were identified as relevant for community engagement:

- Buurman Utrecht: Workshop and second-hand construction materials shop; hosts public workshops. Potential location for testing ideas with skilled participants.
- Hof van Cartesius: Circular hub hosting multiple workshops; connects to creative communities.
- Circulaire Werkplaats Utrecht (CWU): Consortium of designers, artists, and students; provides opportunities for collaboration and visibility.
- City Wood Parties (Stadshoutpartijen): Network of organizations processing local wood into products; relevant for sourcing wood and collaborative experimentation.

Informal discussions revealed specific needs among stakeholders:

- Tafelboom: Requires biodegradable fillers/adhesives for repairing high-value furniture made from upcycled wood.
- Level 5: Seeks adhesives for wooden facades in construction projects.
- Buurman: Interested in methods to upgrade wood waste; potential site for hands-on community workshops.

3.3.2 Municipal Goals and Alignment
The municipality aims to enhance circularity in Utrecht through:
- Building two upcycling centers.
- Increasing public awareness through exhibitions, workshops, and tours.
- Promoting local sourcing of wood products, with a target of at least 25% local wood use.

Supporting viable business cases for circularity, focusing on small and medium enterprises (MKBs).

This project aligns with these goals by emphasizing the transformation of low-quality and discarded wood into usable materials, integrating with existing workshops and exhibitions, and strengthening local economic networks.

3 3.3 Local Wood Resources and Opportunities
Key insights from the OSMOS Network research:

- Utrecht has approximately 168,000 living trees; 1,500 are lumbered annually.
- About 80% of lumbered wood consists of tops and branches that are currently underutilized, offering opportunities for circular reuse.
- Annual construction wood waste is 14,000 tons, while annual demand is 110,000 tons, highlighting potential for repurposing.
- Common tree species suitable for experimentation include Ash, Oak, Linden, Maple/Sycamore, Willow, Elm, Beech, and Chestnut.

Based on this, recommendations for community engagement workshops include:

- Focus on low-value wood fractions (branches, offcuts, and recycled wood)
- Explore material properties of local species for potential applications.
- Engage the community through storytelling, contests, and participatory workshops.

3.4 Opportunities for Community Engagement Workshops
Based on the research and stakeholder input, community engagement workshops present an opportunity to test and demonstrate material innovations using low-quality or recycled wood, while also addressing the concrete needs of local makers such as biodegradable fillers, adhesives, and methods for upgrading waste streams. These workshops could be embedded within existing hubs and municipal initiatives, making use of spaces like Buurman, CWU, or Hof van Cartesius.

Beyond technical experimentation, the workshop can highlight circular practices, strengthen local economic networks, and encourage wider public participation through storytelling and hands-on activities. To make this effective, the stream of wood waste should be mapped, technical and experiential characteristics of wood waste from different sources can be explored to guide tinkering activities, and participatory formats that combine experimentation with skill-sharing can be developed. Finally, systematic documentation of outcomes will be essential to support viable business cases and to embed the workshops into broader circular initiatives in the region.

4

Methodology

Step 1 Particpant Recruitment Finding suitable partici-pants	Step 2 Facilitation & roles Who does what, When & Where?	Step 3 Procedure What will the session look like	Step 4 Data Collection How will data be collected

Photo: De Buurman, Host of the Co-creation
photo taken by De Buurman

4.1

Overview

A co-creation session was held at Buurman, hosted by Eva Timmermans. It was aimed at co-creating knowledge with stakeholders and to explore how URWOOD's objectives could connect with real-world practices, challenges, and opportunities in sustainable wood use. The venue, situated at Het Hof van Cartesius in the Werkspoorkwartier, serves both as a circular building materials store and a makerspace. Buurman collects and resells reclaimed wood and other residual materials from local demolition and construction projects. By extending material lifecycles, offering workshops, and providing accessible facilities for professionals and hobbyists, it embodies the sustainable values at the core of URWOOD.

Invitations introducing URWOOD and the day's program were prepared and distributed. Four participants, each representing different wood-related disciplines, took part in the session. A videographer documented the event. Invitations prepared by the researchers introduced the project and outlined the program. During the session, researchers Emma, Bianca, Maxim, and Bahar facilitated discussions by moving between tables to provide guidance, answer questions, and observe interactions. Each table was supported by a dedicated recorder to capture insights, ensuring that participant contributions were systematically documented.

Fig 1: Invitation for teh co-creation session at Buurman, Utrecht

4.2

Participant Recruitment

Potential participants were identified through local networks and invited via direct contact, email, and social media posts linked to a Google Form. Additional outreach was conducted through partners of the Sluiten van de Houtketen initiative. The recruitment strategy aimed to ensure diversity of professional backgrounds, capturing a wide range of perspectives on material use. Woodworkers, designers, artists, and upcycling practitioners were therefore targeted. Ultimately, four participants agreed to take part in the co-creation session representing distinct practices within sustainable and circular wood use.

Participants were from various organizations, including Circulaire Werkplaats Utrecht (CWU), Noesthout, Haakshout, and individual artists/designers. CWU is a social and creative workshop in Utrecht where discarded materials, particularly furniture, are upcycled into contemporary design objects. The initiative combines sustainability, circularity, and social engagement through collaboration among thrift stores and social reintegration organizations. Noesthout produces locally crafted gifts and promotional items from felled Utrecht city trees. Each piece (e.g., snack boards) is engraved with the tree species, original location, and planting/felling year, combining circular production with social impact through partnerships with local social workshops. Finally, Haakshout is a Utrecht based furniture maker who works with sustainably sourced, locally felled city wood.

4.3

Procedure

The workshop was split into three phases. The first phases provided the participants with a conceptual understanding of URWOOD project outlining the aim to connect woodworking traditions with sustainable innovation. Prepared material samples were presented, explaining the different binder types, their mixtures with wood dust, and potential applications. By demonstrating current uses and possible scenarios, the presentation created a shared understanding and set the foundation for hands-on experimentation. Participants were encouraged to reflect on both the practical and aesthetic aspects of the materials before moving into active engagement.

In the second phase, participants were invited to apply the URWOOD materials directly within a repair context. They selected objects to work on and experimented with the putty kits in two formats: syringes for injecting material into narrow crevices and containers for scooping larger amounts onto surfaces. This allowed the participants to test the material's performance in different repair situations using familiar tools and techniques. Throughout the activity, the researchers offered guidance, answered technical questions, and recorded observations. Participants also documented their process and impressions in a provided reflection booklet, ensuring that insights were captured in real time.

The session concluded with structured feedback and an open discussion. Participants reflected on their experience of working with the materials, addressing aspects such as drying time, ease of use, sanding behaviour, water resistance, and overall aesthetic integration. Comparisons with conventional fillers and epoxy helped to evaluate performance and usability. To extend the testing beyond the session, participants received take-home kits containing syringes, containers, and clear as well as wood-mixed variants of the binders. These kits enabled them to experiment further within their own professional contexts, assess compatibility with their existing tools and workflows, and provide more longitudinal feedback.

1.4

Data Collection

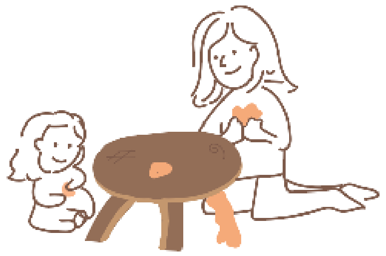
To capture a broad and nuanced set of insights, data were collected through multiple, complementary methods:

- Researcher observations through field notes and direct monitoring of participant activities.
- Participant input recorded in reflection booklets completed during the session.
- Audio recordings of discussions to preserve spontaneous comments and dialogue.
- Semi-structured interviews guided by prepared questions on drying time, aesthetics, processing, and functionality.
- Video documentation to support later review of interactions and material handling.

This mixed-method approach combined practical engagement with in-depth qualitative feedback, enabling the research team to identify key requirements, limitations, and opportunities for further material development.

5

Workshop Activities



1
Material Dialogue

2
Workshop

3
Take-Home Activity

FRAMING THE CO-CREATION ENVIRONMENT AND PARTICIPANT ENGAGEMENT

This sections dives deep into the workshop setup, activities, and execution showing how environment, activities, and materials were arranged to foster engagement. The session balanced demonstration with participant-driven exploration, allowing URWOOD's concepts to be experienced both theoretically and practically. Through visual presentations, curated samples, and hands-on experimentation, participants reflected on their own practices while testing alternative binder materials. The structure emphasized collaboration and sensory experience, linking aesthetic impressions and functional assessments to broader cultural and environmental aims.

5.1

Material Dialogue

The session began with a pitch on URWOOD's relevance for contemporary woodworking practices and its broader societal context, emphasizing both the cultural and environmental dimensions of reusing wood waste. This introduction set the stage by highlighting how the project aims to connect traditional craft with sustainable innovation, offering participants a clear sense of purpose and direction.

Following this, the researchers presented a series of prepared material samples, which served as tangible entry points for discussion. Participants were invited to handle and examine the samples closely, evaluating their composition, texture, and structural qualities. The group reflected on aesthetic aspects such as color, surface finish, and grain expression, while also considering functional properties like strength, flexibility, and durability.

This hands-on exploration encouraged participants to share their first impressions and expectations, creating a dialogue that combined personal intuition with professional insight. The session therefore moved from a conceptual framing of URWOOD's goals toward an interactive and collaborative engagement with material possibilities, bridging theory with direct sensory experience.

Fig 2: - top left: 3d printed exploration; top right: tapioca starch musical instrument; bottom left: wood sculptures; bottom right: mosaic with different inlay applications

5.3

Take-Home Activity

To support extended testing, each participant received:

- Two 100 ml paste syringes
- Three 240 ml putty containers (MC, SA, CMC) in both wood-mixed and clear versions
- A printed process booklet with reflection prompts and a QR code lin king to a personal OneDrive folder for uploads

The take-home kits encouraged participants to apply the materials within their own professional contexts, compare performance to their existing repair techniques, and assess compatibility with their usual tools and finishes. The clear variants provided flexibility to integrate their own wood dust for improved colour and texture matching.

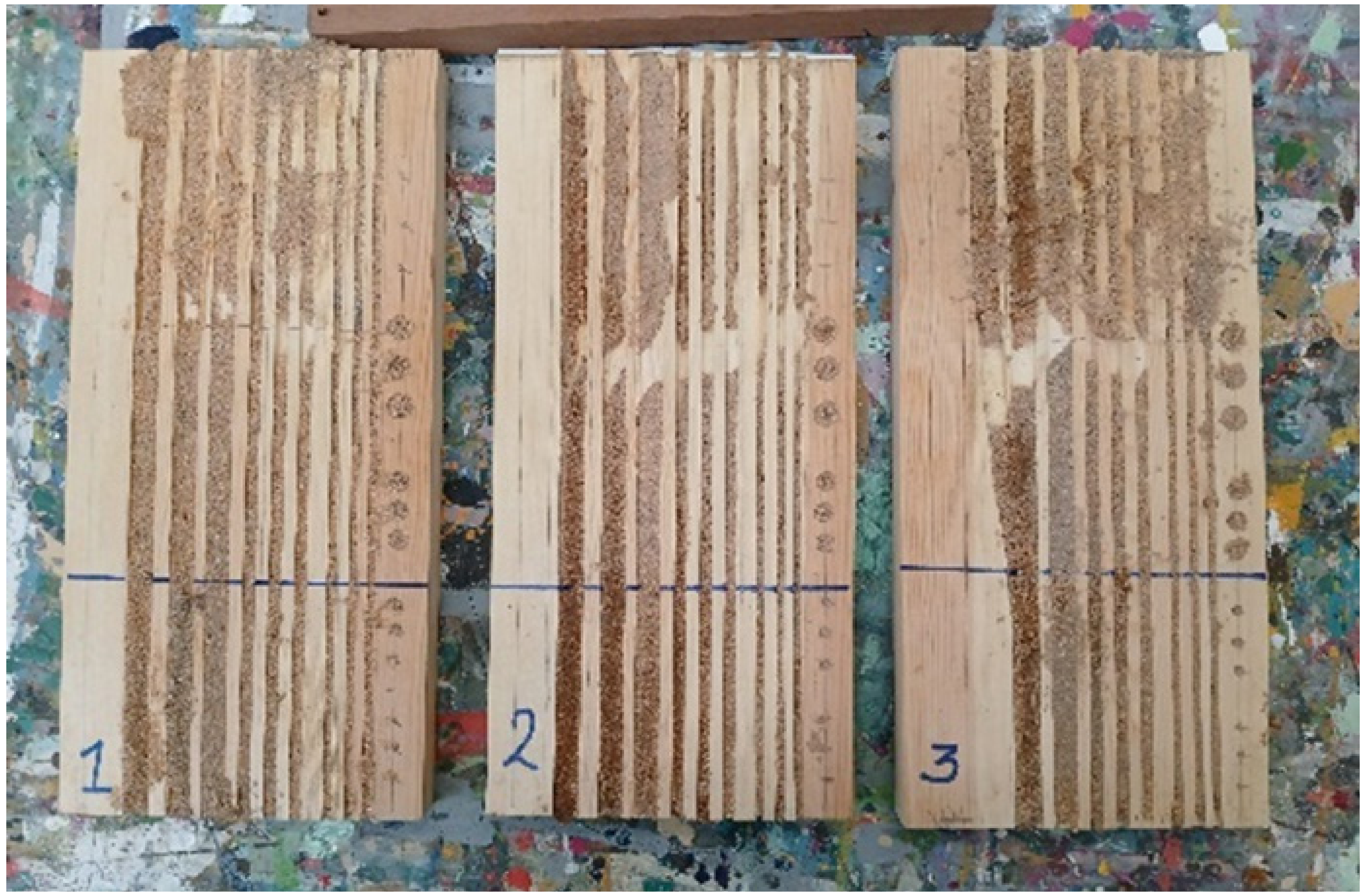


Fig 4: Samples created by the participants during the take-home activity

6

Results and Reflections

6.1 Findings from the workshop:

The workshop discussions revealed both preferences and critical requirements for the development of alternative wood fillers. Epoxy emerged as the material of reference, valued for its ease of application, consistent results, strength, and water resistance. Participants indicated that achieving qualities comparable to epoxy should be a benchmark for further material development. At the same time, they noted specific shortcomings in the provided samples. The test pieces were perceived as overly plastic-like in appearance and sound, which undermined their resemblance to wood. Particle sizes were judged too coarse, affecting the finish and texture, while sanding results raised curiosity about whether finer grits, such as 180 (a standard in practice), might produce a smoother outcome. Color and texture control were also recurring themes. Matching wood grain using conventional wood glue and dust was described as difficult, prompting participants to favor contrasting colors instead. A transparent binder was therefore highlighted as desirable, as it would enable users to introduce their own wood dust to achieve greater continuity with the surrounding material.

In terms of performance requirements, participants emphasized three priorities: simplicity of application, drying times within a single day, and material properties at par with epoxy, particularly in strength, sandability, and surface consistency. Water resistance was also seen as essential, either through intrinsic waterproofing or through compatibility with natural finishes such as oils. Alongside these functional demands, participants also speculated on potential applications beyond conventional repair. Suggestions included playful and educative uses—such as a malleable “Play-Doh”-like material for children or workshops—as well as veneer or surface treatments that could impart a wood-like appearance to non-wood substrates.

"Sometimes it is very tempting to use epoxy, but we try to keep that away from our practice — both for nature and for the people who work with it."

6.2 Findings from the Take-Home Activity

The take-home tests with three different putty formulations provided more detailed insights into material performance under real-world conditions.

Methylcellulose (MC) was consistently regarded as the most reliable of the three options. It adhered well to both shallow and deep fills, with minimal shrinkage and stable curing. Even in cavities as wide as 12 mm and as deep as 6 mm, the filler remained firm and only slightly compressible. A second application reduced shrinkage further, resulting in a more durable fill. Participants noted that the material was predictable to handle, pressing smoothly into cavities without pulling away. Once cured, it maintained structural integrity under sanding and produced an even surface, although larger particle sizes still affected the visual smoothness. When finished with oils, the putty accepted treatment evenly without major texture changes.

Sodium Alginate (SA) produced a harder fill than CMC and in thin layers was sometimes comparable to MC in surface hardness. However, it was more brittle and less forgiving, particularly in deeper or wider fills. Shrinkage was greater than with MC, and adhesion was inconsistent, with some cured fills detaching from cavity edges. Sanding revealed further weaknesses: surfaces and edges were prone to chipping, and the overall cured texture lacked uniformity. These limitations reduced its perceived suitability for practical repairs, though its hardness suggested potential in more controlled or niche applications.

Carboxymethylcellulose (CMC) performed the least favorably. It cured to a brittle, inflexible texture that fractured under stress rather than compressing. Shrinkage was significant, especially in cavities deeper than 4 mm, and multiple layers were often required to restore a level surface. Under sanding, edges chipped easily, and fractures across the surface made it difficult to achieve a flush result. In wider cavities, small cracks appeared after curing, further undermining performance. While participants considered it potentially useful where rigidity is essential, overall it was rated lowest for functional repair applications.

"You can also test the hardness, because in real use it matters whether it feels the same as the surrounding wood or if there's a strange difference."

6.3 Reflections

Taken together, the workshop and take-home activities underscored several preliminary directions for future development. Key directions include refining binder transparency, reducing particle size, and enhancing flexibility to balance strength with resilience. Importantly, the results show that professional users are receptive not only to functional replacements but also to new applications that engage communities, education, and circular design. This opens pathways supporting material innovation that delivers both technical performance and broader social value.

Supporting the development and uptake of such materials aligns directly with policy priorities on circularity, climate action, and social value creation. Investment in pilot programs, partnerships with maker spaces, and integration into public projects can accelerate both material development and community adoption. This can ensure that technical innovation translates into tangible public benefit.

7

Conclusion

The URWOOD co-creation workshop demonstrated the value of engaging local practitioners in shaping sustainable material innovations. By combining academic expertise from TU/e, WUR, and UU with the practical knowledge of woodworkers, designers, freelancers, and upcycling initiatives, the project created a shared space for testing, critique, and envisioning new possibilities for circular wood filler.

The results confirm that while epoxy remains the reference standard, there is strong potential for bio-based alternatives, particularly methylcellulose. These can deliver reliable performance when further refined for transparency, particle size, and flexibility to meet the needs of the users.

Beyond technical validation, the workshop highlighted the importance of embedding material innovation within community practices. Participants did not only assess usability and performance; they also identified new applications that connect to education, creativity, and social engagement, thereby becoming tools for awareness on the circularity of materials.

Nonetheless, the participants wanted a solution that could directly replace the current epoxy putty. This however, is not aligned witht he scinetific interests.