

Narrative Report — VET Providers Training Course (Ljubljana)

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Executive Summary

The SUSFUR Training Course, held from 22 to 26 September 2025 in Ljubljana, provided a blended learning programme for VET providers focused on circular economy practices in the furniture sector, sustainable materials, the use of reclaimed wood, and modern production technologies. The programme combined expert lectures, study visits to industry sites, and hands-on workshops that culminated in prototype development from reclaimed materials. The course strengthened the capacity of VET providers to integrate sustainability into teaching and to connect learners with industry needs.

1. INTRODUCTION & OBJECTIVES

The training was organized under the SUSFUR project to support capacity building among VET providers in the Western Balkans. The objectives were to:

- Increase technical knowledge on sustainable materials, reclaimed wood, and circular economy principles.
- Develop practical and pedagogical skills for integrating sustainability into VET curricula.
- Strengthen linkages between VET providers and industry through study visits and collaborative workshops.

2. METHODOLOGY & DELIVERY

A blended approach combined classroom lectures and demonstrations, interactive discussions, study visits (Ljubljana Reuse Center and M SORA), and hands-on workshops in the Department's woodworking facilities. Learning resources were prepared in Microsoft Office formats and shared via Teams/SharePoint. A standardized questionnaire (Quality Plan D1.3) was used to evaluate learning outcomes and satisfaction.

3. PROGRAMME & SCHEDULE

The five-day programme (22–26 September 2025) covered the following themes:

SUSFUR Project – Training Program					
Date	22.09.2025	23.09.2025	24.09.2025	25.09.2025	26.09.2025
Time	First Day	Second Day	Third Day	Fourth Day	Fifth day
08:30 – 09:00		Lecture: Recycled Wood in Wood-Based Composites	Study visit: Departure (08:30)	Practical workshop: Introduction	Practical workshop: Third part
09:00 – 10:00			Visit Ljubljana Reuse center		
10:00 – 11:00		Caffe Break	Depart from Reuse Center (11:00)	Caffe Break	Caffe Break
11:00 – 12:00		Contemporary sustainable materials for the surface treatment of wood and for products in the wood industry		Practical workshop: First part	Practical workshop: Conclusion with a presentation of the developed products and Final evaluation group
12:00 – 13:00	Introduction	Lunch	Visit of the company M sora		
	Lecture: Service life of different furniture and wooden products				
13:00 – 14:00		Lecture: New Production Technologies for Furniture Production	Returning to Department of Wood science and technology (15:00)		
14:00 – 15:00	Lunch	Break		Practical workshop: Second part	
15:00 – 16:00	Tour of the laboratories at the Department of Wood Science and Technology, Biotechnical Faculty	Lecture: Designing Furniture from Reused Materials - How to repair furniture with new techniques			
16:00 – 17:00	Lecture: Cascading Use of Wood and Characterization of Recycled Wood on the European Market	Lecture: Materials in furniture production - sustainable materials utilization: wood and other biobased materials recycled materials and sustainably sourced wood			
17:00 – 18:00			Summary of Day One		Summary of Day Two

4. CONTENT HIGHLIGHTS

The first two days of the training course were dedicated to various lectures related to the professional topic of the training course. The lectures were delivered by experts from the Department of Wood Science and Technology, Biotechnical Faculty, University of Ljubljana.

4.1 Service Life of Furniture and Wooden Products (Prof. Miha Humar)

The lecture focused on the concept of service life for wooden furniture and construction elements, distinguishing between aesthetic and functional service life. It explained how inherent material properties, moisture dynamics, and design solutions influence service life. Participants reviewed case studies and long-term monitoring projects that demonstrated the impact of exposure conditions, wood species, and protective measures on performance.

The session introduced model-based prediction methods and the factor approach for quantifying resistance through wetting ability and decay tests. Modern trends were discussed, including the shift away from biocides toward construction-based protection, wood modification technologies, and compliance with EU regulations. Climate change implications and the Scheffer climate index were highlighted as critical factors for future durability design.

4.2 Cascading Use of Wood & Characterization of Recycled Wood (Assoc. Prof. Boštjan Lesar)

The lecture addressed the concept of cascading use of wood, emphasizing its role in the circular economy and resource efficiency. Participants learned about EU waste wood streams, classification categories, and typical contaminants such as coatings, adhesives, and metals. Methods for sorting of recycled wood and fraction analysis were presented to ensure safe reuse in higher-value applications. The session highlighted barriers to recycling, including chemical residues and logistics, and introduced strategies for improving material recovery and quality assessment. Case studies illustrated practical approaches to integrating reclaimed wood into production chains. During the lecture, we discussed with the participants the methods of collecting and sorting waste wood in their respective home countries.

4.3 Recycled Wood in Wood-Based Composites (Prof. Sergej Medved)

This lecture focused on the utilization of recovered wood in particleboard, fibreboard, and wood–plastic composites (WPC). It explained process constraints such as moisture content, contaminants, and particle morphology, and their impact on mechanical properties and formaldehyde emissions. Participants reviewed current industry practices and technological trends aimed at increasing recycled content while maintaining performance standards. The importance of cascade use principles and compliance with sustainability requirements was emphasized.

4.4 Sustainable Surface Treatments & Advanced Finishes (Prof. Marko Petrič)

This lecture examined eco-friendly coating technologies for wood surfaces, focusing on bio-based binders (liquefied wood, natural oils, biopolymers) and functional additives. Advanced methods such as plasma treatment for improved adhesion and weathering resistance, UV-LED curing, and nanoparticle-enhanced coatings were discussed. The concept of debond-on-demand and self-healing coatings was introduced as a means to facilitate reuse and extend product life. Participants gained insight into how surface engineering supports circular economy goals.

4.5 New Production Technologies for Furniture (Prof. Gorazd Fajdiga)

The lecture introduced Industry 4.0 and 5.0 concepts in furniture manufacturing, including computer-integrated manufacturing (CIM), CNC machining, and robotic automation. Key components of CNC systems and their advantages—such as precision, flexibility, and repeatability—were explained. The session highlighted the role of digitalization, data-driven process control, and smart factories in improving productivity, quality, and sustainability. Practical examples demonstrated how automation reduces errors and supports customized production.

4.6 Designing Furniture from Reused Materials and Repair Techniques (Asst. Prof. Mirko Kariž, Prof. Manja Kitek Kuzman)

This lecture explored circular design strategies and repair techniques for extending furniture life. Participants learned about barriers to reuse, such as poor design for disassembly and lack of spare parts, and reviewed solutions based on 3D scanning and additive manufacturing. Case studies showed how digital modeling and 3D printing enable precise replacement of damaged components, restoration of decorative elements, and hybrid repairs combining wood and bioplastic. The session emphasized the importance of inventory management, digital tools, and collaboration networks for integrating reused materials into new designs. Practical demonstrations illustrated hybrid repair

methods and direct 3D printing on wood surfaces, highlighting their potential for sustainable furniture production.

4.7 Sustainable Materials in Furniture Production (Prof. Sergej Medved, Assoc. Prof. Boštjan Lesar)

The session provided an overview of materials commonly used in furniture production, including solid wood, plywood, particleboard, MDF, and advanced composites. Special attention was given to wood–plastic composites and sandwich panels, highlighting their structure, manufacturing processes, and sustainability benefits. The lecture stressed the need for responsible sourcing, lightweight design, and circularity principles to reduce environmental impact. Practical examples demonstrated how innovative material combinations can enhance durability and aesthetics. During the lectures, a comparison was also highlighted between the use of fresh wood for the production of solid wood products and the use of fresh wood for the production of wood composites, followed by furniture manufacturing from these composites.

4.8 Laboratory Tour – Department of Wood Science and Technology

On the first day, participants visited the laboratories of the Department of Wood Science and Technology. Professors and technical staff provided an overview of the department's research facilities and demonstrated the capabilities of individual laboratories. The tour showcased specialized equipment used for material testing, surface treatment, durability assessment, and advanced manufacturing processes. Each laboratory's purpose and its role in supporting innovation and applied research in the wood sector were explained in detail. In addition to the main research facilities, participants also visited laboratories dedicated to furniture testing, where mechanical performance and safety standards are evaluated. The tour concluded at the department's outdoor testing field, which is used for long-term durability studies. Here, participants observed experimental setups for assessing the service life of wood under various exposure conditions, ranging from standard soil-contact and above-ground tests to full-scale model structures.



Figure 1: Laboratory tour



Figure 2: Test field site of the Department of Wood science and technology

5. STUDY VISITS

5.1 Reuse centre Ljubljana

On Wednesday, 24 September, participants attended a study visit to the Ljubljana Reuse Center. The visit began with an introduction by the center's representative, who explained the operational model and guided the group through various areas where collected items are stored. The center accepts a wide range of reusable products, including textiles, household items, electronic devices, toys, furniture, artworks, and more. Items must be in good condition or have only minor defects that can be easily repaired.

The group then visited the Reuse Coffee Shop, where cleaned and attractively displayed products are offered for sale at very affordable prices. Afterwards, participants explored a shared workshop space showcasing examples of refurbished furniture and observed short demonstrations of repair processes. Staff explained that all materials and tools used for refurbishment are sourced from donations, meaning the center does not purchase supplies but relies on contributions from the public.

Participants found the visit highly engaging and noted cultural differences in second-hand practices. Attendees from the Netherlands highlighted that their country has a much larger network of similar second-hand shops, while such initiatives remain scarce in the Western Balkans.



Figure 3: Depos of reused item in Reuse center Ljubljana



Figure 4: Example of exposition of reused items in reuse center Ljubljana



Figure 5: Presentation of renovation of used furniture

5.2 M sora company, Žiri

At the M SORA company, participants were welcomed by Barbara Šubic, Director of Joinery. She began by presenting the company's profile and its sustainability goals, which include implementing circular economy principles across all operations. According to the company's sustainability strategy, M SORA focuses on environmental responsibility, process optimization, and innovation, supported by initiatives such as energy self-sufficiency through a 758 kW solar power plant, use of wood residues for heating, and digitalization to reduce paper use.

During the visit, participants toured the production facilities for solid wooden windows, as well as wood-aluminium window systems. The entire manufacturing process is organized to maximize resource efficiency and minimize waste, reflecting the company's commitment to circularity and

sustainable development. Special emphasis was placed on sourcing local wood species to reduce CO₂ emissions associated with long-distance transport, such as Siberian Larch from Siberia.

Barbara also presented several projects focused on reusing old wood. In the showroom, participants saw a window manufactured from reclaimed wood and an impressive 2.5-meter-high entrance door clad with reused timber. Despite being made from reclaimed materials, these products remain fully energy-efficient, meeting modern performance standards.

At the time of the visit, the company was installing a new production line for window profiles, demonstrating its continuous investment in technological advancement. The visit provided insight into how sustainability principles are integrated into both product design and operational workflows, making M SORA a leading example of environmentally responsible manufacturing in the region.



Figure 6: Participants in M sora showroom.

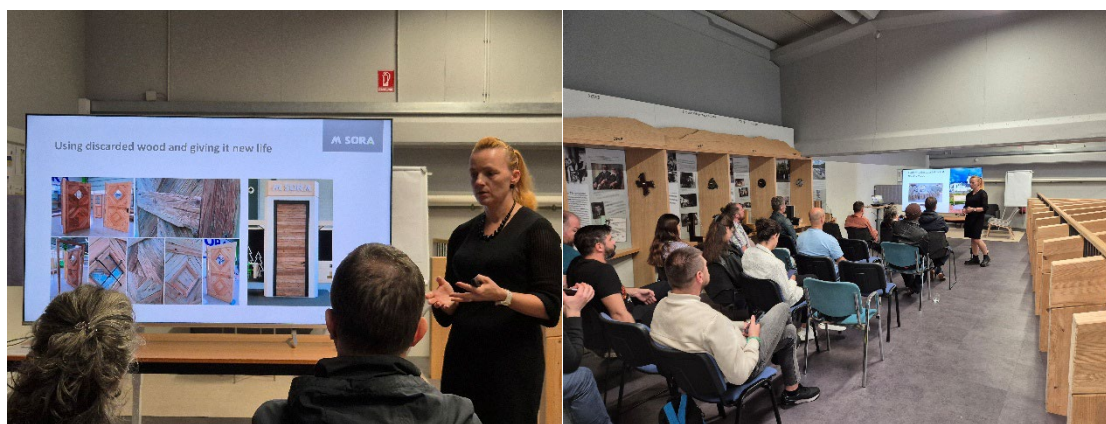


Figure 7: Presentation of M sora director, Barbara Šubic



Figure 8: Separation of different waste in the production at M sora company





Figure 9: Production of wooden windows at M sora company



Figure 10: Window made from recycled wood



Figure 11: Energy efficient door made from reused timber

6. PRACTICAL WORKSHOP

The practical workshop began with participants being divided into small groups. Each group then visited the wood storage area at the Department of wood science and technology, which contained materials from previous research projects, experimental setups, and stock awaiting future studies. In addition, there were pieces of wood that had already been used, primarily as packaging material.

Participants selected individual pieces of reclaimed wood and, within their groups, developed concepts for new functional products. With the support of the department's technical staff and access to woodworking tools, the groups produced several prototypes, including:

- A tea table made from timber that had been stored for over 30 years at the See in Port of Koper.
- Two different stands for seedling cultivation in test tubes, crafted from decayed coloured beech wood.
- A bottle holder designed from reclaimed boards, intended for production using advanced CNC technology. (As the CNC machine was not yet operational, this product remained at the design stage.)

Most prototypes required only final aesthetic finishing—such as sanding and surface treatment—which could not be completed due to time constraints.

The entire process, from material selection to design and fabrication, took place in a highly constructive and collaborative atmosphere. The diversity of the participant group proved to be a significant advantage: while some had extensive woodworking experience, others contributed fresh ideas and creative perspectives. This synergy resulted in innovative and practical outcomes.

Overall, the workshop was considered highly successful, demonstrating the potential of reclaimed and low-value wood for creating new, useful products and promoting sustainable practices in furniture design.



Figure 12: Material selection and product design from low-value and reclaimed wood



Figure 13: Prototype production



Figure 14: Prototype tea table made from timber that had been stored for over 30 years at the See in Port of Koper.

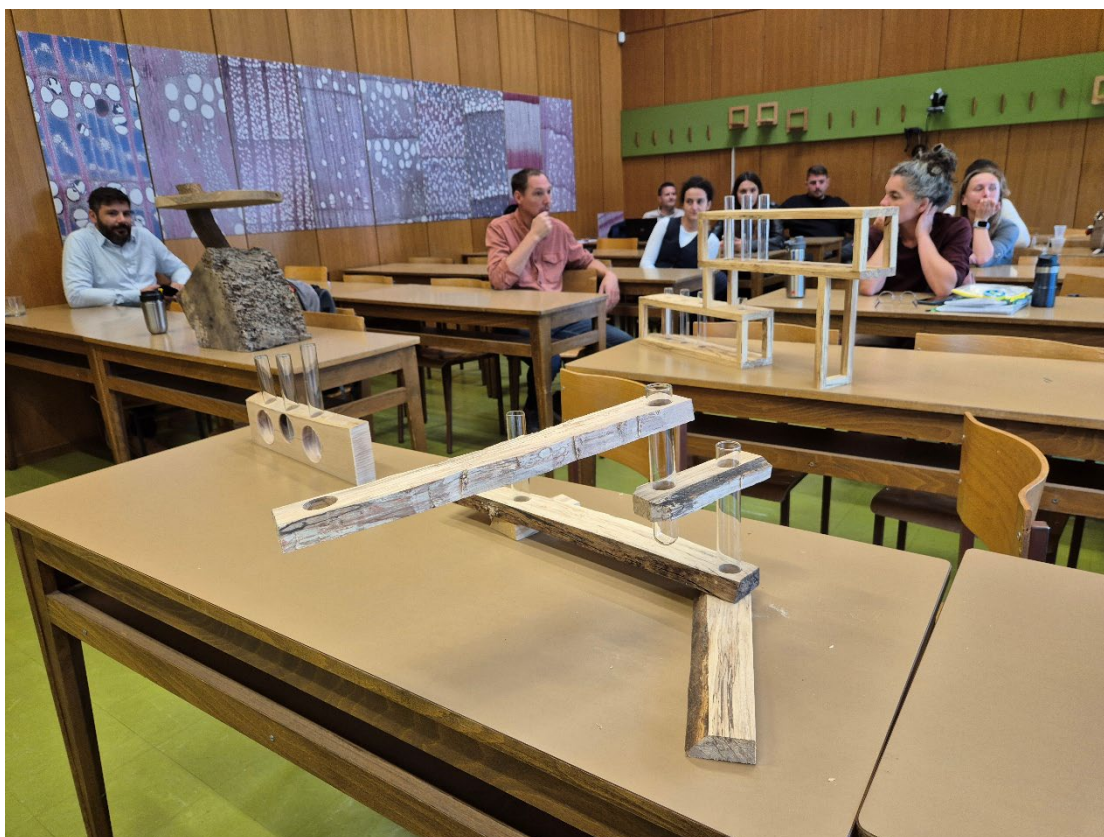


Figure 15: Prototype stands for seedling cultivation in test tubes, crafted from decayed coloured beech wood.



Figure 16: Prototype stands for seedling cultivation in test tubes, crafted from decayed coloured beech wood.



Figure 17: Participants of training course whit developed products

7. EVALUATION

Evaluation used a standardized questionnaire ([Quality Plan D1.3 questionnaire](#)) to capture knowledge gain, satisfaction with methods and materials, and applicability to VET practice. Open debriefs at the end of modules informed immediate improvements.

8. CONCLUSIONS

The course successfully achieved its objectives of strengthening technical knowledge and practical skills in sustainable furniture production. Participants gained hands-on experience in selecting reclaimed and low-value wood, designing functional products, and executing production processes, which demonstrated the practical potential of circular design principles. The collaborative nature of the workshop, involving participants with diverse backgrounds and expertise, proved to be a significant advantage, fostering creativity and innovative solutions.

The practical session highlighted that even materials considered waste can be transformed into high-quality, useful products through thoughtful planning and teamwork. Examples such as a tea table made from timber from sea water, seedling stands crafted from natural beech, and CNC-designed bottle holders illustrated the versatility of reclaimed wood and the role of modern technology in sustainable design.

Next steps include:

- Integrating the developed content and methodologies into VET curricula to ensure long-term impact.
- Sharing all training materials and best practices across the SUSFUR network to promote knowledge transfer.
- Organizing follow-up webinars and workshops to reinforce learning and address emerging challenges.
- Exploring additional industry partnerships to expand opportunities for work-based learning and collaborative projects.
- Continuing to develop guidelines and case studies that showcase successful reuse strategies and innovative applications of reclaimed materials.

9. APPINDEX

Training materials can be found on a link [Presentations Training Course Ljubljana](#).