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Luís Bragança · Katerina Tsikaloudaki · Christina Giarma · Ricardo Mateus · Karolos Kontoleon · Rand Askar · Adriana Salles · Camila Cervantes *Editors*

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Preface

As Organisers of ReSBE 2026, we are honoured to present the Proceedings of the International Conference *ReShaping the Built Environment through Sustainability and Circularity*, held in Thessaloniki, Greece, from the 20th to the 23rd of October 2026.

Published in Open Access by Springer, these Proceedings reflect our commitment to making research and practical innovation at the intersection of sustainability, circularity, and the built environment widely available. By ensuring that the contributions can be consulted, cited and applied without restrictions, we hope to support informed decisions and accelerate positive change in the built environment and in society as a whole.

Society and governments require a more efficient, resilient, and regenerative built environment. Buildings and infrastructure shape patterns of resource use, energy demand, carbon emissions, social well-being, and economic development. In this context, the Circular Economy offers a vital framework for decoupling value creation from the consumption of finite resources by extending the service life of products and materials, enabling reuse and recovery, and promoting the valorisation of by-products and waste. Construction and the built environment have therefore become priority areas for policy, research, and professional practice, including within the European Commission's Circular Economy Action Plan. In parallel, the implementation of sustainability principles into the various scales of the built environment remains a primary goal of numerous policies and scientific efforts worldwide. ReSBE 2026 responds to this complex agenda by moving beyond incremental improvement and by advancing transformative approaches that drive systemic change across the design, construction, operation, and renewal of the built environment.

The conference was organised by the Laboratory of Building Construction and Building Physics of the School of Civil Engineering, Aristotle University of Thessaloniki, and the Department of Civil Engineering of the University of Minho, in collaboration with the COST Action CA21103 "Implementation of Circular Economy in the Built Environment – CircularB", with the support of the International Initiative for a Sustainable Built Environment (iiSBE).

ReSBE 2026 also marked an important moment in the journey of COST Action CircularB. Alongside presenting cutting-edge research, the conference provided an opportunity to showcase the Action's achievements, disseminate its results, and celebrate the collective efforts of its international network in advancing circularity in the built environment. More importantly, it created a platform for engaging the wider scientific, professional, and policy communities, fostering new collaborations and extending the impact of CircularB beyond the lifetime of the Action.

Within the ReSBE 2026 programme, the 1SBE event "Sustainability in the Built Environment Supported by Circular Strategies: Theory Meets Practice" further strengthened the conference's international scope. As part of the SBE Conference Series, this event created a forum for dialogue among policymakers, industry representatives, social

partners, and academics, thereby linking scientific knowledge with implementation challenges and opportunities.

ReSBE 2026 was devoted to presenting recent scientific advances, showcasing practical applications that bridge academia and industry, and discussing key issues concerning the contribution of sustainability and circularity to the modern and future built environment, its construction, and its infrastructure. A principal goal of the conference was to foster the exchange of ideas, methods, and evidence in ways that inspired innovative research paths and advanced new collaborative endeavours across disciplines, geographies, and sectors.

The conference received 541 abstracts from 1368 authors across 71 countries. Following a rigorous peer-review process, 335 full scientific papers were accepted for publication and organised into twelve thematic sections:

1. *Circular Design and Construction:* design for adaptability, reuse, and disassembly; material passports; modularity and standardisation.
2. *Sustainable Buildings, Infrastructures and Cities:* sustainability assessment frameworks, sustainable design, construction, operation and management; synergies across scales.
3. *Lifecycle Assessment, Metrics and Monitoring:* whole-life carbon, embodied energy, circularity indicators, benchmarking frameworks, multi-criteria decision-support methods, and AI/IoT-enabled lifecycle monitoring.
4. *Digitalisation and Automation:* BIM-based approaches, digital twins, digital passports, AI-powered tools, and decision-support systems.
5. *Climate Adaptation and Resilience:* climate-responsive design, resilient infrastructure, and nature-based solutions.
6. *Energy and Performance:* net-zero energy, carbon-neutral buildings, renewable energy integration, and smart grids.
7. *Materials and Innovation:* bio-based and regenerative materials, advanced composites, and secondary raw materials through industrial symbiosis.
8. *Urban and Regional Perspectives:* circular cities, heritage regeneration, and urban mining.
9. *Financing and Market Transformation:* circular business models, green financing, and innovative procurement strategies.
10. *Policy and Governance:* regulatory frameworks, certification systems, and leadership for circularity.
11. *Stakeholders and Collaboration Models:* roles, interactions, and governance mechanisms for systemic change.
12. *Societal and Educational Dimensions:* awareness, equity, skills, and capacity-building for sustainable transitions.

The contributions in these proceedings offer readers a broad and timely overview of the concepts, tools, technologies, policies, and case studies that are shaping the transition towards a sustainable and circular built environment. They address questions of direct relevance to researchers, designers, engineers, architects, policymakers, educators, and industry stakeholders, from whole-life performance and digitalisation to financing models, governance frameworks, stakeholder collaboration, and capacity-building.

Taken together, these contributions demonstrate that innovation, circularity, and sustainability are deeply interconnected. They also show that progress depends not only on technical solutions, but also on new forms of cooperation, new metrics for value and performance, and a shared willingness to rethink established practices. In light of this, the present Open Access publication aims to be a collection of high-quality research and serve as a catalyst for further inquiry, dialogue, collaboration and action.

We extend our deepest gratitude to all authors, the members of the Scientific Committee, the reviewers whose careful work upheld the excellence of the selected articles, and our publishing partners for their invaluable support. May these Proceedings inspire and facilitate the ongoing effort to engineer a sustainable, circular, and regenerative built environment for all.

The Organising Committee,

Luís Bragança
Katerina Tsikaloudaki
Christina Giarma
Ricardo Mateus
Karolos Kontoleon
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Adriana Salles
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Reuse of Post-Event Waste: A Case Study of Circular Design Involving the Academic Community

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Abstract. Temporary events, characterised by their brief timeframes, present considerable challenges in terms of material consumption. Often, the materials used during these events quickly become waste, even though they retain a high residual value that is not exploited for reuse. As a result, these events have a significant impact on the built environment, highlighting the need to rethink cultural, design, and organisational approaches in order to promote systemic change. This article describes a project focused on experimenting with circular design through a specific case study centred on recurring university temporary events organised at the Politecnico di Torino (Italy). This initiative was carried out by a multidisciplinary team of architecture and design students and professors, with the goal of recovering materials from events and making them accessible to the academic community for reuse. The project included an analysis of the actors involved in the process, the quantification of waste, the exploration of opportunities for material recovery, and experimental activities. This research resulted in the development of prototypes and new scenarios for reuse and sharing. The case study provides an opportunity to develop new organisational and management models aimed at extending the useful life of post-event materials, which may be applied in other contexts. Additionally, this initiative offers an educational opportunity to train future professionals through innovative teaching and research-through-design methods, focusing on crucial topics related to the ecological transition and fostering a culture that views waste as a resource.

Keywords: Circular Design · Reuse · Temporary Events · Post-Event Waste · Teaching and Research-Through-Design

1 About Temporary Events and "Cultural Waste": An Introduction

Temporary events, characterised by their brief timeframes, present considerable challenges in terms of material consumption. Often, the materials used during these events quickly become waste, even though they retain a high residual value that is not exploited for reuse [1].

In particular, materials that include graphic elements communicating a coordinated visual identity and event-specific content become obsolete as soon as the event is over.

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As a result, these materials have a significant impact on the built environment [2, 3], highlighting the need to rethink cultural, design, and organisational approaches in order to promote systemic change [4, 5].

This article describes a project focused on experimenting with circular design through a specific case study centred on recurring university temporary events organised at the Politecnico di Torino (Italy) and on the "cultural waste" generated through the production, staging, communication, and use of temporary cultural activities.

This type of waste includes, among others, signage (banners, panels, totems), stage design components, exhibition and stand materials, printed items, and single-use products such as fabric bags, badges, customised lanyards, and accessories. At the end of the event, these materials are typically discarded because they are no longer communicatively relevant, cannot easily be reused, or are not convenient to store and refurbish.

To illustrate the scale of the problem, in 2024 alone the Politecnico di Torino organised 10 large exhibition installations, including 'Salone dell'Orientamento', 'A&T Automation & Testing Fair', 'Biennale Tecnologia', 'Salone Internazionale del Libro di Torino', and the initiative 'PoliTO for Peace', as well as 15 additional exhibition projects supporting promotional initiatives. These temporary and recurring events produced large quantities of roll-ups, coverings, signage, banners, totems, and other communication materials that are typically not reused.

The project described in this article involved a multidisciplinary team of architecture and design students and professors with the goal of recovering materials from events and making them accessible to the academic community for reuse. The project included: a systemic analysis of stakeholders and materials involved in the process; the exploration of opportunities for material recovery; experimental activities aimed at producing prototypes; and the development of new reuse scenarios.

The exploration of this specific case study represents an opportunity not only to propose new organisational and management approaches to extend the useful life of "cultural waste" that would otherwise be sent to landfill, but also, more broadly, to raise awareness and train future professionals on key issues related to the ecological transition.

Although focused on temporary events, the strategies explored are also relevant to broader building-sector practices, particularly in relation to interior fit-outs, exhibition systems, and temporary installations, where short life cycles and material turnover present similar challenges.

2 A University Case Study: Context, Project and Key Actors

For several years, the Politecnico di Torino has been integrating sustainability principles into its activities in teaching, research, third mission initiatives, and campus management, as explicitly stated in its University Strategic Plan, the institutional document defining the long-term vision and objectives of the university [6].

Among the priority action lines is the responsible management of resources within a circular economy perspective. Following the "reduce–reuse–recycle" approach, actions undertaken across the campus include, for example: plastic-free bars and cafeterias; distribution of reusable water bottles to new students and staff; new waste separation

stations; electronic waste (WEEE) collection; responsible procurement policies; initiatives for reusing post-consumption materials generated by the university. Campus sustainability represents the broader framework within which the project described in this article is situated.

The project investigates post-event waste related to the set-up and communication of large events organised by the Politecnico di Torino and open to the public. In particular, the project focuses on two events: i) 'Salone dell'Orientamento', an annual event designed to guide high school students in choosing their university path through informational stands on bachelor's and master's programmes, thematic meetings, open lectures, and laboratory visits; ii) 'Biennale Tecnologia', a biennial cultural event dedicated to exploring the complex relationship between technology and society and addressing the impact of innovation on the environment, democracy, health, and work through lectures, dialogues, debates, exhibitions, and performances hosted in the university's main venues.

These events, which take place regularly, generate recurring waste materials (flags, banners, panels, etc.) whose graphics make them unusable for subsequent editions. The challenge is therefore to identify ways to reuse and manage these post-event materials within the university, extending their useful life.

The project was developed through the collaboration of multiple actors within the academic community of the Politecnico di Torino. Specifically, it emerged from the collaboration between the University Sustainability Division, which promotes sustainable initiatives and practices within the campus, and students and professors from the Master's degree programmes in Architecture and Design, who developed proposals and scenarios within the course Designing and Developing the Circular Economy (academic year 2024/2025) [7].

The project also benefited from the support of the Exhibition Design, Graphics and Merchandising Office, responsible for exhibition design projects and visual identity for university initiatives, and from the LaSTIn Laboratory (Laboratorio Sistemi Tecnologici Innovativi) of the Department of Architecture and Design, which supports teaching and research activities related to technological innovation and sustainability.

3 Post-Event Materials: Analysis, Design, and Experimentation Activities

The project included field research, desk research, design activities, and laboratory experimentation aimed at giving a second life to the "cultural waste" generated by the university.

Following a teaching and research-through-design approach [8], the design and experimental practice carried out by the multidisciplinary team of students and professors served as a means of generating new knowledge. The objective was not limited to producing final artefacts, but rather to identify new potential processes, new actor networks, and new scenarios for the reuse of post-event materials.

The first phase of field research was conducted through interviews with staff from the Exhibition Design, Graphics and Merchandising Office and through on-site observations conducted at the end of Politecnico di Torino events. These activities made it possible to

analyse the organisation of university events, map and represent processes, actors, and materials, and identify inefficiencies and the main types of post-event waste materials.

Event design, organisation, and management are handled by the Exhibition Design Office, which is also responsible for drafting tender specifications and assigning the supply of materials to specialised external companies. According to these specifications, exhibition materials are generally dismantled and disposed of by the suppliers at the end of the event, with landfill as the most common end-of-life destination.

Only a small portion of materials - those considered suitable for experimental recovery projects - is kept and stored within the Politecnico di Torino. However, this practice faces difficulties due to the absence of dedicated storage spaces and the lack of systematic cataloguing, resulting in materials accumulating over time in an uncontrolled way.

Among the most frequently used and quantitatively significant materials in large university events are: 'Piuma' panels, also known as sandwich panels, consisting of a polyester core and two external PVC sheets; Forex panels, a rigid and lightweight plastic material made of expanded or semi-expanded PVC; flag fabric banners, printed on fire-retardant polyester nautical fabric; PVC banners, widely used in exhibitions due to their durability and high print quality (Fig. 1).

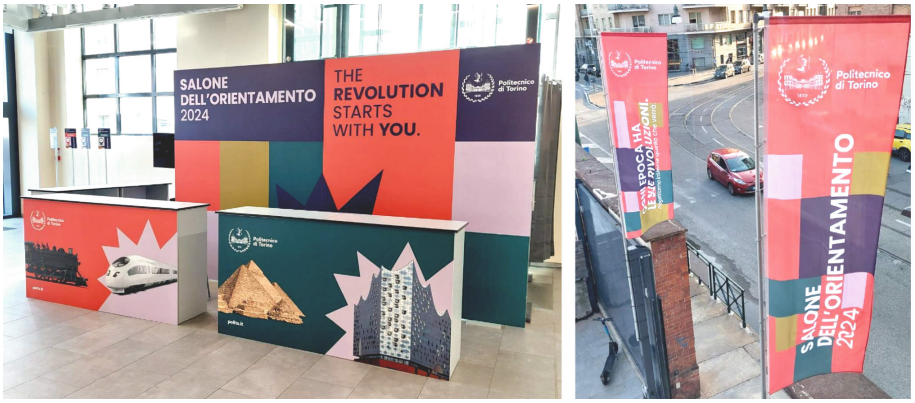


Fig. 1. Example of display materials used for the 2024 "Salone dell'Orientamento" (Careers Fair) at the Politecnico di Torino

These materials present common critical issues: their graphic customisation prevents reuse in subsequent events, and in some cases their multi-polymeric composition makes them difficult to separate and recycle at the end of life.

Although the Exhibition Design Office is working to intervene upstream in the design phase so that exhibition systems can be reused across multiple event cycles, the extreme temporariness of the materials currently used and the absence of consolidated recovery strategies still represent a significant waste of resources.

To identify alternatives to landfill disposal, the field research phase was followed by desk research exploring reuse possibilities through the analysis of international case studies and best practices. These case studies provided references not only for constructive solutions or reuse strategies but also for recovery processes activated through

the involvement of new territorial stakeholders beyond the companies responsible for producing, installing, and dismantling the materials.

In parallel, the available materials were explored through an analysis of their physical and sensory characteristics. The components are highly heterogeneous: rigid materials such as panels and soft materials such as fabrics. Within these categories, materials differ in mechanical resistance, surface treatment, durability, and semantic characteristics. Observation, study, manipulation, and experimentation through cutting, perforating, gluing, and sewing guided the development of design concepts, which were subsequently prototyped at full scale in the laboratory.

The design concepts did not focus exclusively on the development of new objects made from recovered materials but also explored systemic processes and scenarios capable of bringing materials back into circulation. Particular attention was given to identifying new actors to be involved in the process, with a focus on the academic network (students, professors, laboratories, associations, and student teams) and local small enterprises engaged in material transformation.

4 Towards a "Circular" University: Prototypes and Scenarios for the Reuse of Post-Event Materials

Focusing on the academic community - particularly students - made it possible to identify unmet needs related to everyday university life, such as temporary and informal supports for working individually or collaboratively outside classrooms (e.g., portable laptop tables, picnic blankets, desks), as well as the need for low-cost household objects such as lamps, laundry baskets, and storage containers (Fig. 2).

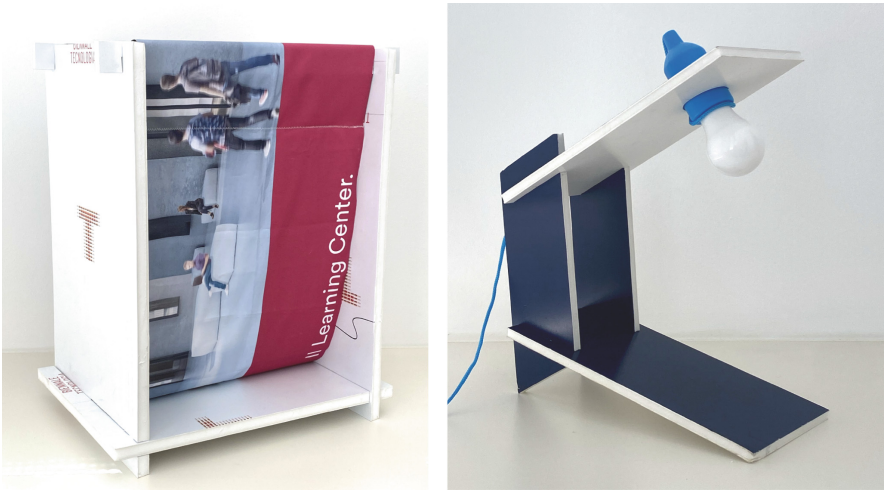


Fig. 2. Examples of prototypes made from post-event waste. On the left, a laundry basket; on the right, a table lamp. Prototypes and pictures by M.E. Cardinale, G. Gaminara, M.G. Romano, S. Rovelli, E. Scarsella, E. Vaira

This led to the development of a catalogue of objects prototyped directly by students with the support of the LaSTIn Laboratory. The prototyping phase allowed the feasibility of design hypotheses to be verified through a material-based approach that prioritised minimising processing steps and optimising the use of available materials. The goal was to avoid generating additional offcuts or waste while ensuring the most efficient possible use of resources and technologies suitable for self-construction and easy replication.

Together with the catalogue of objects, new organisational and management models for reuse were also proposed. Three main reuse modalities were identified.

The first modality involves acquiring post-event materials immediately after the event. Some materials may be booked online before the event and collected during dismantling by student teams for prototyping activities or by professors interested in using the materials in their courses. Individual students may also collect materials and receive assembly instructions to build objects from the catalogue or develop their own projects.

The second modality consists of organising educational and social activities structured as theoretical and practical workshops dedicated to reuse and circularity principles. Participating students produce objects using event materials under the guidance of professors and experienced students. Even simple objects - such as storage containers - can be produced quickly with basic tools, becoming concrete opportunities to learn and experiment with circular design principles in a collaborative environment (Fig. 3).

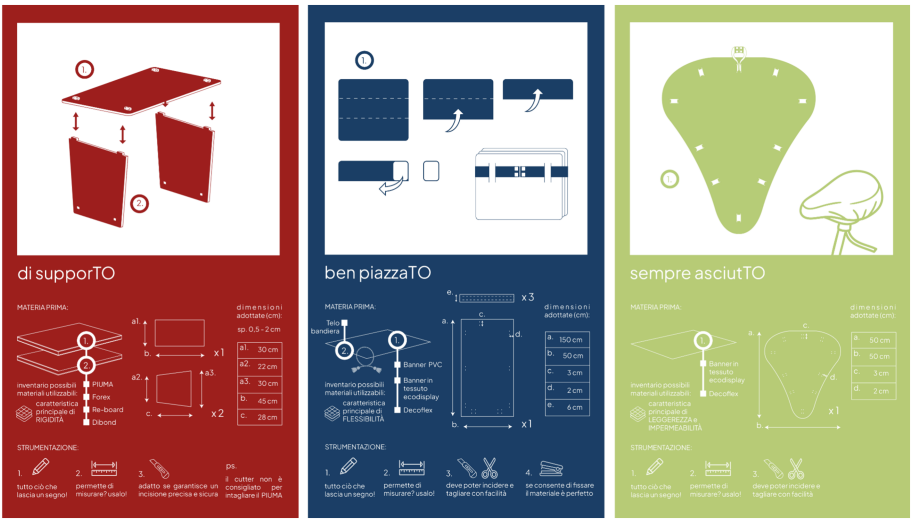


Fig. 3. Examples of assembly instructions for creating objects from post-event waste. Project by A. Cochis, G. Di Lucente, M.V. Nicastro, M. Oberto

The third modality involves the production - supported by the university - of objects useful for everyday campus life, which would then be made available to students through sharing systems. Sharing objects such as portable laptop tables or picnic blankets represents an opportunity to promote a culture of shared use and to move beyond individual

ownership. It also encourages informal moments of study and relaxation, fostering the use of open spaces and social interaction within the academic community.

Prototypes and new organisational and management scenarios were shared with the Exhibition Design, Graphics and Merchandising Office and the Sustainability Division of the Politecnico di Torino. The Sustainability Division will further develop and implement projects beyond the educational context in which they originated by launching several pilot experiments. The first experimentation, related to the reservation of post-event materials, began during the "Salone dell'Orientamento" in March 2026. More than 150 post-event materials - including forex panels, PVC panels, and flag banners - ranging in size from 1000 × 200 cm to 35 × 50 cm, were made available for reservation without usage restrictions. The materials could be reused for teaching activities, design workshops, prototypes and models, as well as personal or social initiatives. Participants were also asked to share photographs documenting the reuse of the reserved materials, which were later published on social media channels. All items were fully booked within a few hours. The success of the initiative, involving professors, students, and laboratories, led to its replication during the "Biennale Tecnologia" event in April 2026.

Additional experiments will be organized by the Sustainability Division as workshops within sustainability-focused festivals, together with the activation of pilot sharing initiatives across different campuses of the Politecnico.

5 Discussion and Conclusion

This project resulted in the development of prototypes and the definition of new scenarios for the reuse and sharing of so-called "cultural waste". The outcomes were presented to the Exhibition Design, Graphics and Merchandising Office and the Sustainability Division of the Politecnico di Torino, initiating a constructive institutional dialogue on the management of post-event materials and their potential reintegration into the university system.

Originating within an educational context, the project is intended to be further implemented and assessed at the institutional level, evolving from a teaching experiment into an operational strategy embedded in university practice. Preliminary results suggest promising impacts in terms of materials diverted from landfill and high participation levels; future developments will include more systematic monitoring of quantities, user engagement, and organisational uptake to assess long-term circularity performance.

The project shows how academic experimentation can contribute to shaping scalable and transferable approaches, potentially adaptable to other cultural contexts. While rooted in a specific institutional context, the proposed scenarios highlight a set of replicable elements - such as stakeholder collaboration, material mapping, and low-threshold access to reuse - that can be adapted to other universities and building-sector practices, where short life cycles and material turnover present similar challenges. Nevertheless, operational aspects (e.g. storage availability and internal governance) remain context-dependent.

From an educational perspective, the initiative supported the training of future professionals through research-through-design methodologies and interdisciplinary learning processes. By engaging with real-world constraints and opportunities related to the ecological transition, students are encouraged to adopt a systemic perspective that reframes

waste as a resource within circular design paradigms. More broadly, the project generates social impacts that extend beyond the students directly involved. By activating concrete practices of reuse and sharing within the university campus, it fosters a cultural shift across the academic community. Sustainability is thus approached not as an abstract principle but as an operational and situated practice rooted in everyday contexts and capable of influencing collective behaviours and ways of thinking.

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