

## **CIB Sebestyén Future Leaders Award 2024**

### **Workshop on**

# **“Digital Tools for Circular Economy in the Construction Sector”**

## **Final Report**

### **1. Introduction**

The **Circular Futures Workshop on Digital Tools for Circular Economy in the Construction Sector**, organized by Politecnico di Milano in collaboration with CIB (International Council for Research and Innovation in Building and Construction), is set to take place throughout November 2024. The workshop spans three structured sessions held online, each scheduled on the last three Mondays of November. This setup ensures accessibility to participants worldwide, fostering a global dialogue on sustainability and circularity in the construction sector.

As the construction industry faces increasing environmental challenges, it becomes critical to shift from the traditional linear "take-make-dispose" model to a circular economy framework. This transformative approach seeks to minimize waste, enhance resource efficiency, and promote sustainability by keeping materials and resources in use for as long as possible. Digital tools such as Building Information Modeling (BIM), advanced data analytics platforms, and openBIM solutions are proving to be indispensable in this journey, enabling innovative solutions to manage resources, optimize processes, and implement circular economy principles effectively.

The workshop is designed to bridge the gap between theory and practice by featuring international experts and practitioners from academia, research, and the construction industry. The sessions are structured to provide a combination of keynote presentations, hands-on exercises, and collaborative discussions. This format ensures that participants gain both foundational knowledge and practical skills for implementing digital tools and circular economy principles in construction projects.

### **General Structure of the Workshop**

The workshop is structured into three progressive sessions, each targeting a specific theme related to digital tools and circularity. These sessions will be held online to enable global participation:

1. **Session 1:** Online Webinar with International Speakers
  - This session will provide foundational insights into digital tools for circular economy in construction and their application in real-world scenarios.
2. **Session 2:** Applied Workshop and Hands-on Session
  - A practical session focusing on the application of specific tools and methodologies for circularity, guided by leading experts in the field.
3. **Session 3:** Collaborative Insights on Digital Circular Economy
  - A dynamic and interactive session emphasizing dialogue and co-creation among participants to explore strategies and solutions for circularity in construction.

Each session is designed to feature international guest speakers to ensure a diverse and global perspective. By combining insights from different regions and disciplines, the workshop aims to promote a holistic understanding of circular economy practices. Participants will benefit from engaging with experts who bring unique knowledge and experiences, enabling a well-rounded and impactful learning journey.

Through this workshop, we aim to cultivate a network of professionals committed to advancing sustainability in construction and equip them with the tools and strategies needed to drive meaningful change.

## 2. Sessions Overview

### Session Overview

#### Session 1: Online Webinar with International Speakers

**Topic:** Introduction to digital tools for the circular economy in construction.

**Speakers:**

- **Kaveh Madani:** Full Professor and Director at UNU-INWEH.
- **Naomi Keena:** Assistant Professor at McGill University.
- **Avi Friedman:** Full Professor at McGill University.

The first session of the workshop series was designed to set the tone for the entire program by introducing participants to the fundamental concepts of circular economy and the transformative role of digital tools in the construction sector. The session began with an inspiring inaugural speech by **Professor Kaveh Madani**, who provided a global perspective on the challenges facing the construction industry, including resource depletion, waste generation, and the urgent need for sustainable practices. His talk highlighted the importance of adopting circular economy principles to decouple economic growth from environmental degradation, urging participants to rethink traditional construction models and embrace innovation.

Building upon this foundation, **Professor Naomi Keena** delivered an insightful presentation on the role of digital tools in facilitating circularity, with a particular emphasis on decarbonizing housing. Her discussion covered practical approaches, such as leveraging BIM for material tracking and lifecycle analysis, and explored how digital platforms can enhance the efficiency and sustainability of housing projects. Through case studies, she demonstrated how digital tools are being successfully applied to real-world projects, bridging the gap between theory and practice.

Finally, **Professor Avi Friedman** rounded out the session with a dynamic talk on adaptability and prefabrication in housing design. He emphasized the potential of circular economy practices to create flexible, durable, and sustainable housing solutions, underscoring how modular and prefabricated construction methods can reduce waste and improve resource efficiency. His examples of successful projects illustrated the tangible benefits of integrating circularity into construction processes.

The key takeaway for participants was a comprehensive understanding of the potential of digital tools to drive circular economy practices. By the end of the session, participants were encouraged to critically reflect on their current practices and consider how the concepts presented could be applied to their own work. This session laid the groundwork for the hands-on, practical learning that would follow in the next workshop.

#### Session 2: Applied Workshop and Hands-on Session

**Topic:** Case studies and exercises on information management for circularity.

**Speakers:**

- **Pooneh Maghoul:** Full Professor at Polytechnique Montréal.
- **Nicholas Nisbet:** Vice Chair of BuildingSMART UK&I.
- **Arghavan Akbarieh:** Postdoc at Eindhoven University of Technology.

The second session transitioned from theory to practice, offering participants an interactive and engaging platform to deepen their understanding of digital tools for circular economy. The session opened with **Professor Pooneh Maghoul**, who introduced participants to an innovative digital platform developed by her research group, SIGLab, which focuses on sustainability and resource management in cold regions. Her presentation highlighted the potential of digital solutions to optimize resource use and reduce environmental impacts, showcasing real-world applications of the platform in complex construction scenarios.

Next, **Nicholas Nisbet** provided a detailed exploration of BuildingSMART Data Dictionaries and Information Delivery Specifications. His session was highly practical, offering participants step-by-step guidance on using these tools to standardize data exchange and streamline workflows in construction projects. By focusing on real-life case studies, he demonstrated how these tools can improve collaboration across project stakeholders and enhance efficiency in resource management.

The session concluded with **Dr. Arghavan Akbarieh**, who explored the integration of BIM and openBIM for advancing circular economy practices. Her presentation emphasized the benefits of open data exchange and collaboration, particularly in large-scale construction projects. Through hands-on exercises, participants learned to apply these tools to identify opportunities for material reuse, waste reduction, and lifecycle optimization.

Participants left this session with practical skills and confidence in using digital tools to tackle circularity challenges. The hands-on activities ensured that they were well-prepared to actively engage in the collaborative discussions and co-creation processes planned for the final session. This workshop was a pivotal step in equipping participants with actionable knowledge and tools to drive sustainability in their projects.

### Session 3: Collaborative Insights on Digital Circular Economy

**Topic:** Open collaborative dialogue for advancing circular economy through digital innovation.

**Speakers:**

- **Giuseppe Loporcario:** Senior Lecturer at the University of Canterbury.
- **Ornella Iuorio:** Associate Professor at Politecnico di Milano.
- **Panel Discussion:** Led by PhD candidates Elena Casolari, Alireza Fereydooni Eftekhari, and Mina Sadat Orooje.

The final session of the workshop was designed to foster collaboration and innovation among participants, building on the knowledge and skills acquired in the earlier sessions. The session began with **Dr. Giuseppe Loporcario**, who presented groundbreaking research on Digital Twin Technology and its application in optimizing low-carbon 3D construction materials. His talk demonstrated how digital twins can simulate material performance, enabling more efficient resource use and better decision-making during project planning.

Following this, **Professor Ornella Iuorio** shifted the focus to practical strategies for integrating circularity into construction design. Her presentation highlighted innovative approaches to design for disassembly and reuse, showcasing real-world examples where circularity principles were successfully applied to minimize waste and extend the lifecycle of materials.

The session culminated in an engaging panel discussion led by PhD candidates **Elena Casolari**, **Alireza Fereydooni Eftekhari**, and **Mina Sadat Orooje**. This collaborative dialogue encouraged participants to share their experiences, lessons learned, and ideas for future directions in digital tools and circular economy practices. Together, they identified key challenges and co-created actionable strategies for advancing circularity in construction.

The key takeaway from this session was the power of collaboration and collective problem-solving in driving sustainable innovation. Participants gained valuable insights into how to approach circular economy challenges from multiple perspectives, leaving the session with a toolkit of strategies and a strong network of like-minded professionals. This session inspired participants to apply what they had learned throughout the workshop in their own projects and organizations, ensuring that the knowledge gained would have a lasting impact.

### 3. Pre-assessment of participants

A registration survey (click this [link](#) to duplicate and use the format) was prepared to acquire the number of participants and collect some data on the audience (country, background, current position and level of confidence of the participants with the proposed topics). The pre-assessment survey was to be completed to enrol in the event and comprises an introduction section describing the structure of the survey and including the privacy statement plus 5 sections, namely *Personal details*, *Participation preferences*, *Your background*, *Your interests*, *Networking*, better described in Figure 1.



## Digital Tools for Circular Economy in the Construction Sector

Workshop Registration Form

Sezione 1

### PRIVACY and SURVEY INFO

#### PURPOSE OF THE SURVEY

We would like to gather some information about the participants to the workshop to tailor our proposal on your needs and level of confidence with circular economy and digital tools. You need to complete the mandatory sections of the survey to enroll in the workshop.

#### STRUCTURE OF THE SURVEY

The survey will take just around 8 minutes. It comprises of four parts:

1. Personal details: this section will help us to understand the age, cultural and educational background of our audience
2. Participation preferences: when you are going to attend and if you will be online or in presence
3. Your Background: the 3rd section delves into your level of confidence with the topics of the workshop
4. Your Interests: the 4th section will provide us some information on the hot topics to be discussed in the workshop
5. Networking: the 5th session is just to understand how to stay in contact with you!

#### DATA PRIVACY STATEMENT

The questionnaire collects personal data that directly or potentially identifies the individuals involved. It is recommended to carefully read the privacy notice before responding to the questionnaire (<https://www.polimi.it/il-politecnico/comunicazione/privacy>). Responding to the questionnaire implies consent to the processing of personal data as indicated in the Article 13 of the EU Regulation 679/2016, General Data Protection Regulation (GDPR).

For any further needs, please contact the Responsible of the research:

Andrea Giovanni Mainini

[andreagiovanni.mainini@polimi.it](mailto:andreagiovanni.mainini@polimi.it)

**Thank you for your time! Can't wait to meet you at the event!**

*Figure 1. Introduction section of the enrolment form with the privacy statement and the introduction to the survey sections.*

A total of 186 answers were collected and most of the people planned to participate to all the 3 sessions, respectively 181 at the 1<sup>st</sup> session, 162 at the 2<sup>nd</sup> session, 159 at the 3<sup>rd</sup> session. The online mode was preferred by the 87% of the participants. A brief analysis of the data collected is here presented, grouped in relation to the survey section.

### Section 1: Personal details

The goal of the first section was to understand the audience's background and assess the diversity of the event's attendees. This evaluation helped shape the format to maximize participant engagement during the events.

The audience's age ranged from under 20 to 64 years old, with the highest concentration between 27 and 35 years. Understanding the age distribution of participants is crucial for planning interactions, determining the complexity of digital tools to be used, and tailoring the level of explanation needed to introduce these tools effectively.

### Participants Age

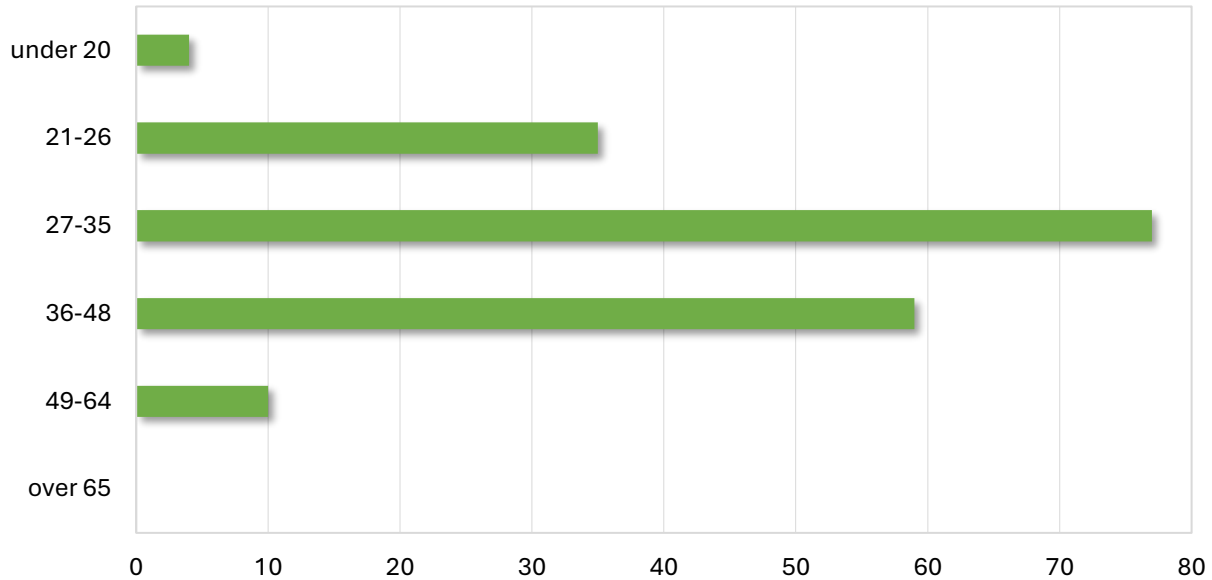


Figure 2. Distribution of participants in relation to age group.

The international scope of the event is illustrated in the map in Figure 3, showing participants from 39 different countries. Most attendees are from Iran and Italy, with strong representation from Canada and the UK as well. The diverse origins of the guests have clearly contributed to the global participation seen at this event.

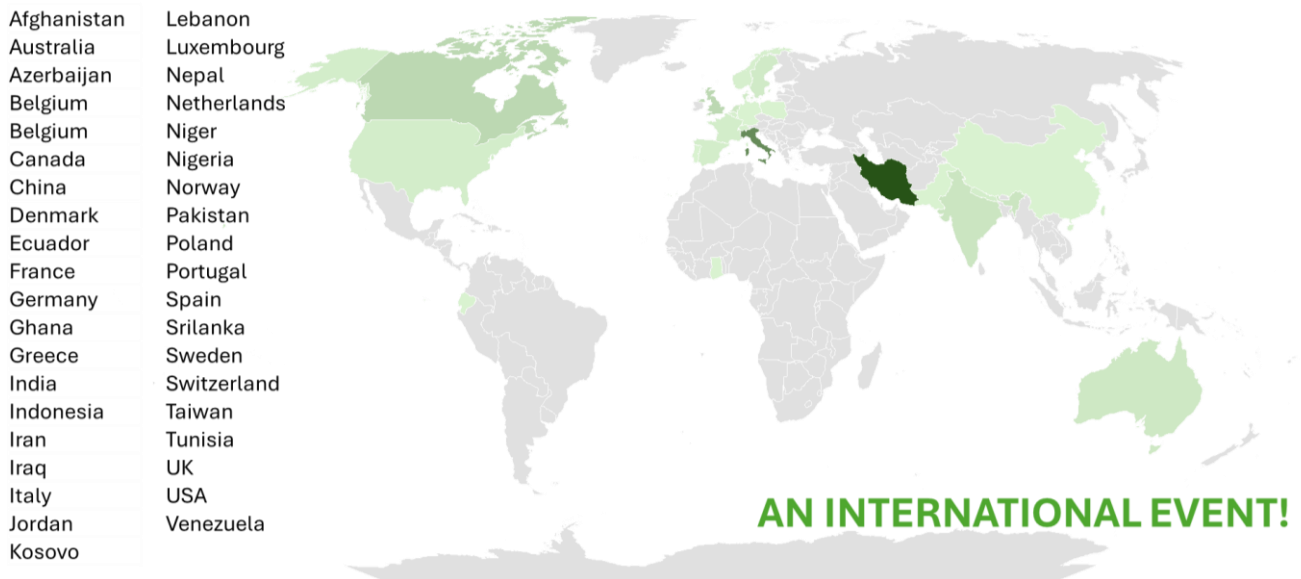


Figure 3. Map plot of the number of participants by living country.

The participants' roles were both in industry and academia, with various levels of expertise from students to managers. Figure 4 represents the composition of the audience, including a breakdown of the roles and sectors

for both industrial and academia participants. The results show the spread interest for workshop topic across the engineering industry.

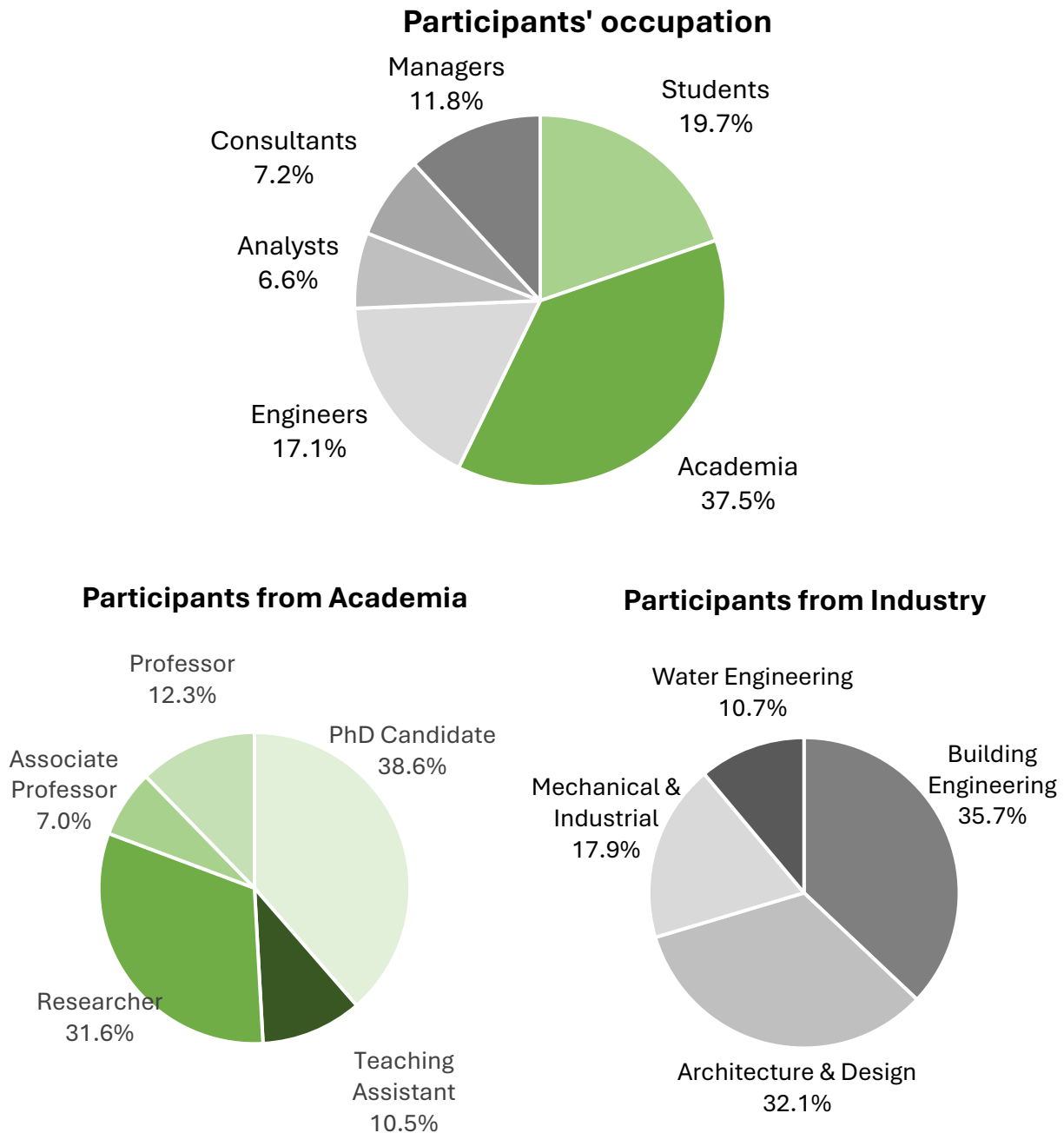


Figure 4. Participants' roles and sectors. Chart 1: roles and expertise of participants. Chart 2: roles of participants from academia. Chart 3: expertise of participants from industry.

## Section 2: Your preferences

This section focused on understanding the preferred mode of participation to the workshop. As indicated by the chart, 88% of respondents chose online participation, while only 4% preferred in-person. The international reach and impact of the workshop were particularly enhanced by the option to hold it online. Additionally, participants expressed interest in attending all sessions.

**Participation mode preferences**

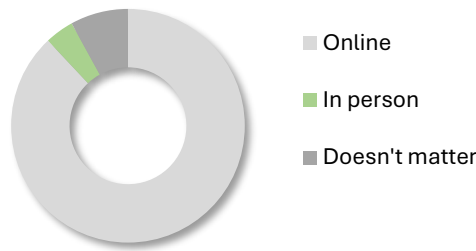


Figure 5. Participation mode preferences.

**Section 3: Your background**

The third section was designed to assess knowledge level on the proposed topics of the participants.

Firstly, the level of confidence with the topics of the workshop was assessed. Three topics were referenced: firstly, *Circular Economy* and *Digital Tools for the Construction Sector*, then also *Digital Tools for Circular Economy*. The three topics scored similar percentages with the latter being the less known. In general, less than 10% of participants never heard of the topics of the workshop, while nearly half were interested in the topic but wanted to improve their knowledge on it. The biggest group is studying or working on circular economy and digital tools, while just few experts participated in the event. Figure 6 details the results on the level of confidence.

**Level of confidence**

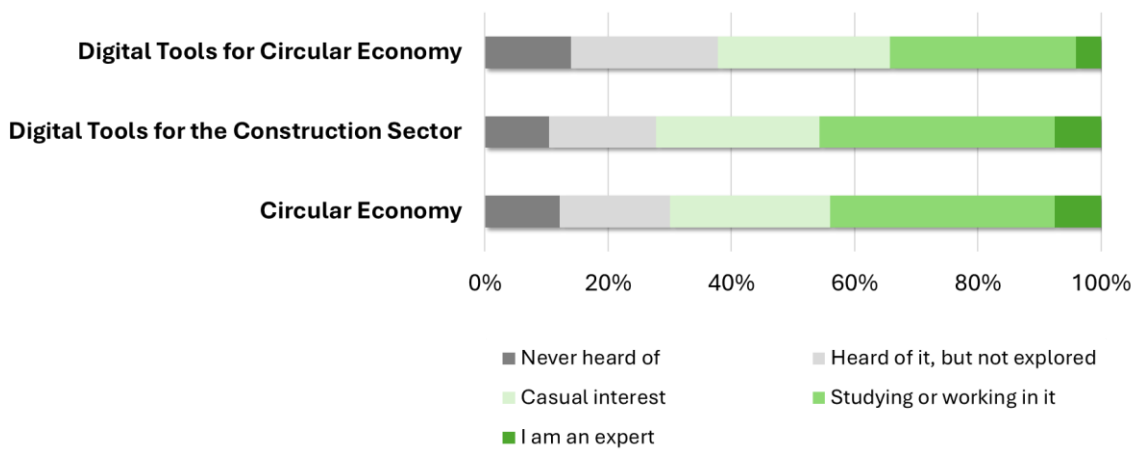


Figure 6. Level of confidence on Digital Tolls for Circular Economy, Digital Tools for the Construction Sector, and Circular Economy.

Moreover, it was asked to the participants which digital tools they are using daily. The questions and the answers are illustrated in Figure 7. The BIM tools scored the highest, followed by data analysis tools such Excel, Python, LCA tools. More specialised tools were also mentioned, such Grasshopper, Madaster, SiMAPro, Oracle, showcasing the presence of highly skilled professionals at the workshop.

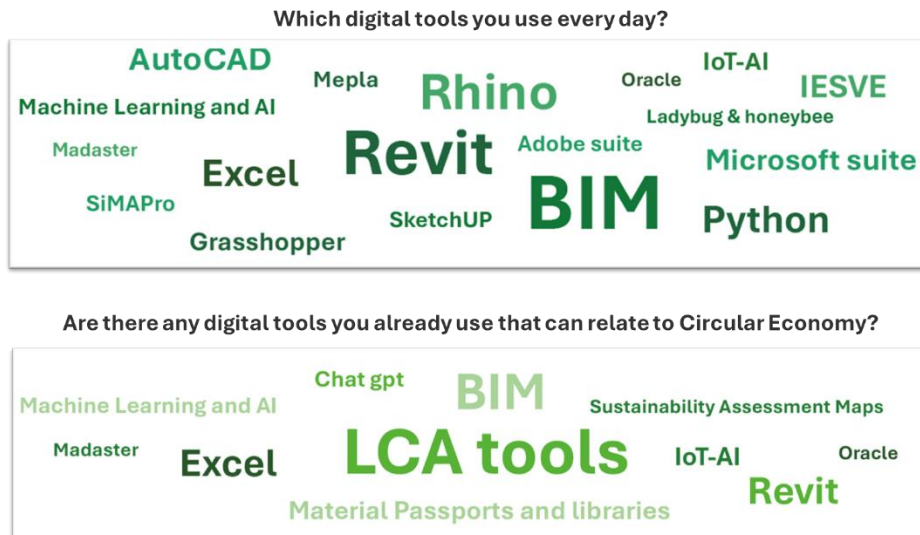


Figure 7. Questions and answers related to the daily use of digital tools.

To conclude Section 3, it was asked “Have you attended any workshops or courses on Circular Economy or Digital Technology?” and the 76% of participants gave negative answer, showcasing the need for more events on these topics.

#### Section 4: Your interests

Section 4 focused on understanding participants' opinions and interests regarding circular economy and digital tools. This assessment aimed to both better target the content of the events and gather insights into participants' perceptions.

The 84% percent of respondents believe that the Circular Economy is a key strategy for societal development, both for environmental and economic reasons. The most challenging areas to address for implementing the Circular Economy were ‘Waste Management,’ ‘Resistance to Change,’ and Consumer Behaviour.’ When it comes to materials, 29% of participants chose plastic, while 26% chose concrete.

Regarding digital tools, participants were asked, ‘To what extent do you think digital tools can improve efficiency in the building sector?’ The results, shown in Figure 8, indicate that while most participants believe digital technologies will significantly enhance efficiency, 15% still rated their expectations low.

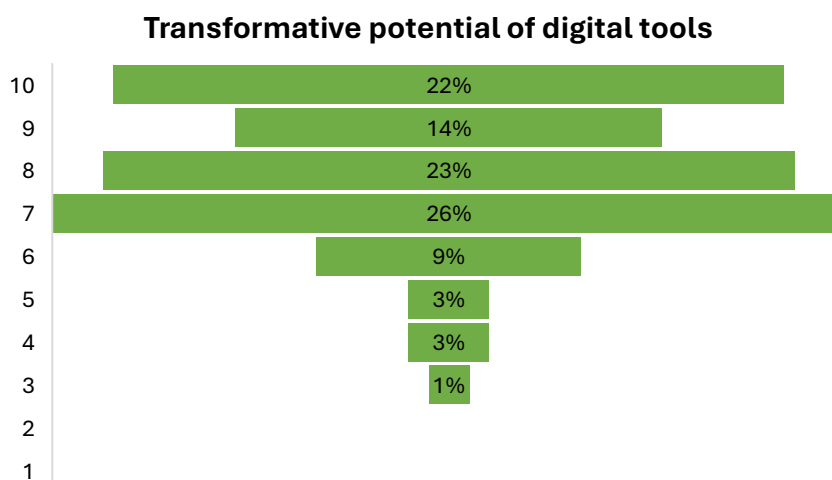


Figure 8. Transformative potential of digital tools for the building sector.

#### Section 5: Networking



Section 5 collected responses on participants' interest in being contacted for future workshops or events, all of which were positive. Most participants heard about the workshop via LinkedIn (75%), while some were directly contacted by one of the invited guests (6%). Additionally, 2% learned about the event through the CIB newsletter. Other social media platforms, such as Instagram (4%) and Telegram (3%), were also mentioned by participants.

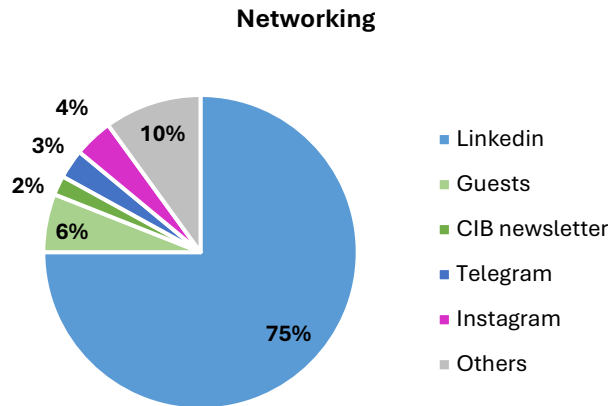


Figure 9. Sources through which participants heard about the workshop, showing the percentage for each platform.

#### 4. Participant Feedback and Event Impact

The number of live attendees decreased over the course of the event. The first session saw 65 participants, while the second and third sessions had 45 and 35 attendees, respectively. As shown in Figure 10, the number of connected participants remained stable throughout each session.

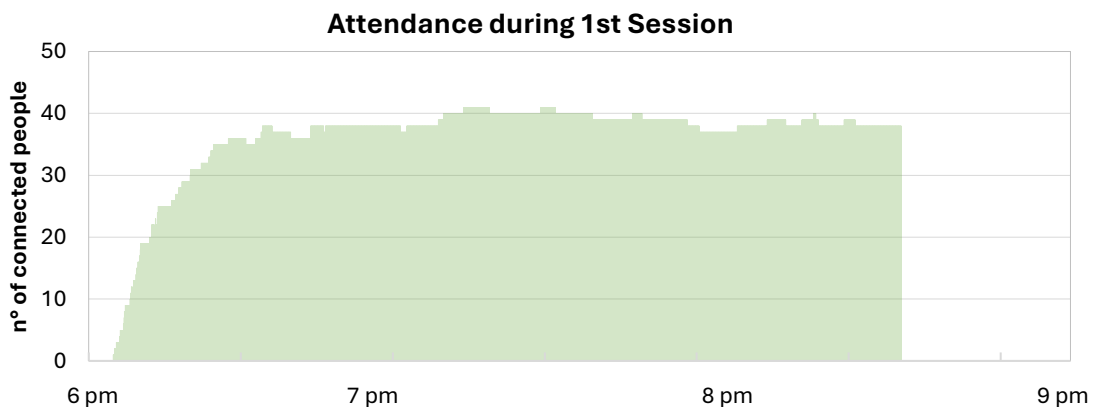


Figure 10. Number of participants throughout the 1st session.

In contrast, the number of people watching the recorded sessions increased progressively, indicating a preference for on-demand viewing. The feedback survey highlighted the availability of recordings as a positive aspect of the event's organization.

For each session, participants received both a recording and a feedback survey. The survey assessed the content (Figure 11) and organization (Figure 12) of the sessions. Overall, the feedback was positive across all three sessions, with the highest ratings given to the final session. Notably, feedback improved progressively throughout the event, likely because participants who were uninterested or dissatisfied with the first session chose not to attend subsequent ones.

### How would you rate the organization?

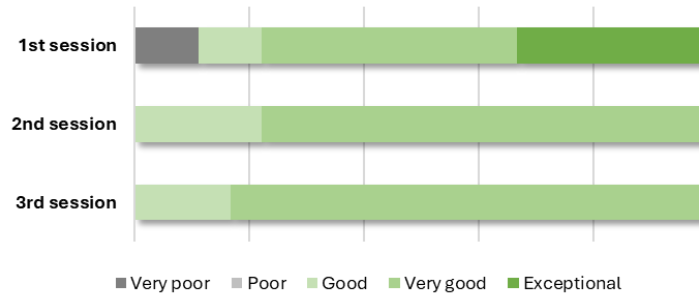


Figure 11. Feedback on the quality of the organization of the 3 sessions.

### How would you rate the contents?

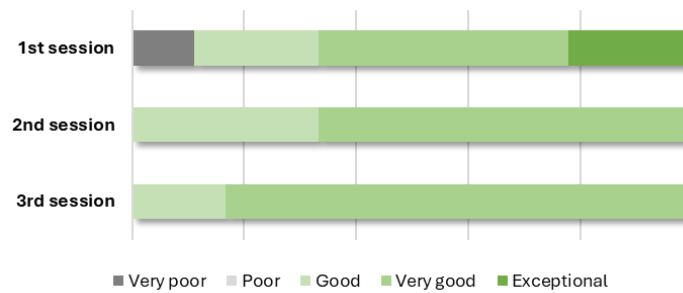


Figure 12. Feedback on the quality of the contents of the 3 sessions.

Respondents generally provided positive feedback on the sessions, highlighting the clarity of the presentations, the appropriate duration of the event, and the level of interaction. Interactive elements, such as polls and open-mic Q&A sessions with speakers, were particularly well-received, as shown in Figure 13. Based on feedback from earlier sessions, the final session was designed to include more interactive components, resulting in 37% of participants reporting full satisfaction.

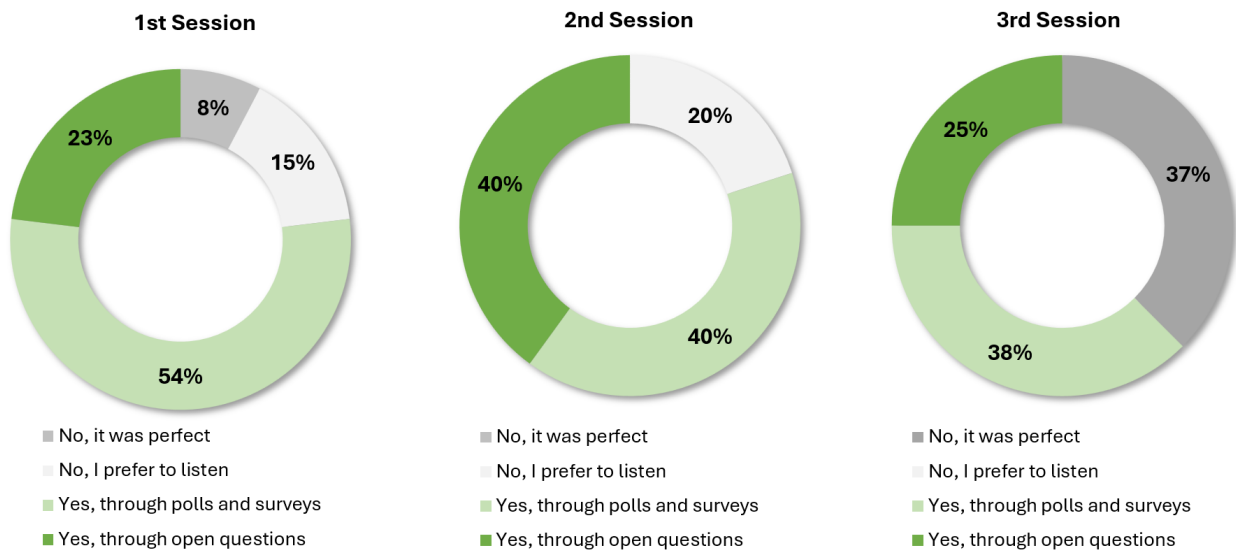


Figure 13. Feedback related to the interaction mode in the 3 sessions.

Table 1 summarizes participants' open-ended feedback on the best and worst aspects of the sessions.

Table 1. Open-ended answers on the positive and negative aspects of the sessions.

	<b>Mention what you liked</b>	<b>Mention what you didn't like</b>
1	Variety of the perspectives	Limited case studies
2	Share the link to DATA HOME BASE	It is not focus on the digital tools
3	It covered very international guests from all over the world	Not enough time for discussion, a panel discussion might be interesting
4	Inspiring presentations and topic explored on multiple fronts	It might be too long, but that is just my opinion
5	I really liked the workshop, especially the practical activities. They were engaging and helpful.	I think the first part about foundation and geography was good for participants with deeper background and should be had a little more interdisciplinary information
6	The Insight of the speakers and real-world experience presentations	Due to the large span of professions in the construction sector, it would be better to categorized by the special sectors like civil, architecture, infrastructures, construction management, ...
7	It was free and easy to access	Personally, I think 3 hours is too long!
8	The informative and practical ideas regarding the digital tools and innovations in circular economy paradigm in construction	More hands-on experience would be great
9	The great speakers, informative and comprehensive presentation with applied projects and finding	I preferred to have more sessions, but each was shorter

The workshop was in general formative, as shown in Figure 14, providing for most participants additional knowledge on the Workshop main themes: Circular Economy and digital tools in the construction sector. Most of participants were enthusiast about the workshop, all answering that they would like to participate in the future workshops organized be student chapter of Politecnico di Milano, on similar topics (56%) or on other topics (44%).

**How much your knowledge about the following concepts improved?**

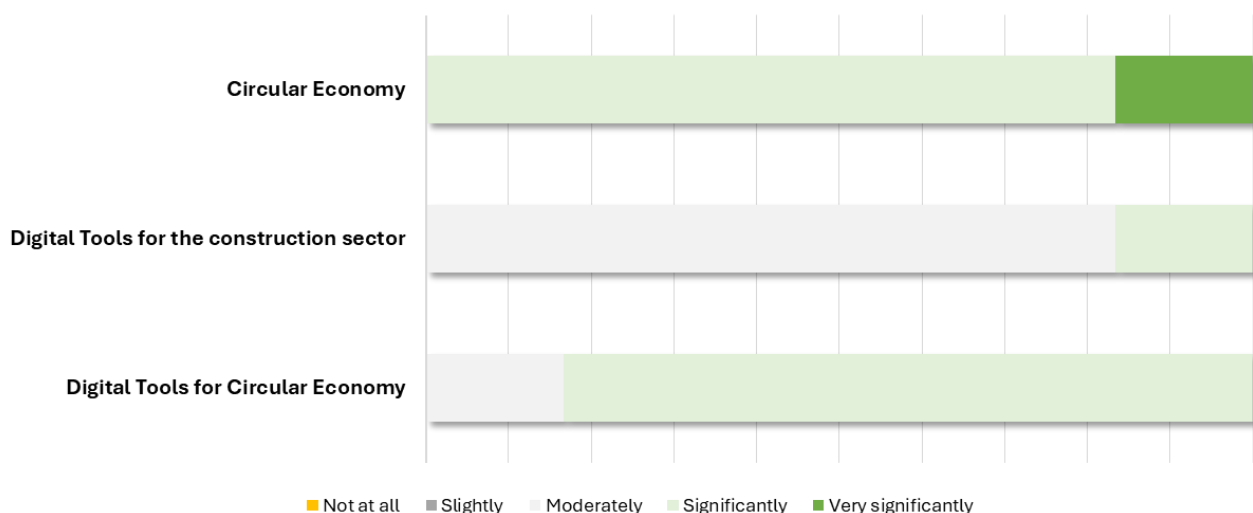


Figure 14. Knowledge improvement on Circular Economy, Digital Tools for the construction sector, and Digital Tools for Circular Economy.

## 5. Conclusion and Future Work

The workshop successfully fulfilled its objective of fostering global dialogue and practical learning on the integration of digital tools and circular economy principles in the construction industry. Organized by Politecnico di Milano in collaboration with CIB, the event brought together participants from different countries all around the world, representing diverse professional backgrounds in academia and industry.

Over three sessions, the workshop provided comprehensive learning experience through keynote presentations, hands-on exercises, and collaborative discussions. Participants gained valuable insights into the concept of Circular Economy itself and also the innovative tools and strategies, such as Building Information Modeling (BIM), openBIM solutions, and digital twin technology, to address pressing challenges like waste reduction and resource optimization in the construction sector.

Key strengths of the workshop included:

1. **Global Reach and Accessibility:** The online format enabled widespread participation, with attendees from multiple continents, enriching the exchange of ideas and perspectives.
2. **Outstanding Speakers and Practical Focus:** Renowned experts shared cutting-edge research and real-world applications, bridging theory and practice effectively.
3. **Participant Engagement and Interaction:** Interactive components, such as hands-on exercises and open discussions, ensured an engaging experience and equipped participants with actionable skills.
4. **Comprehensive Feedback:** Positive participant feedback highlighted the workshop's impactful content, clear organization, and focus on relevant, timely topics.

Looking ahead, future iterations of the workshop can build on this strong foundation by considering the following:

- **Expanding Case Studies:** Including more targeted, detailed case studies for specific sectors within the construction industry to address varying professional needs.
- **Strengthening Follow-Up Engagement:** Creating a platform for ongoing collaboration and resource sharing, such as a dedicated online community or supplementary webinars.

This workshop marks a significant step in promoting sustainability in the construction sector. Its success reflects the value of collaboration across disciplines and geographies, and the insights gained will undoubtedly drive meaningful progress in advancing the circular economy. We are confident that the momentum generated through this event will inspire further innovations and partnerships for a more sustainable future.

## 6. Recordings

Regarding the main objective of organizing this workshop -as the winner of the Sebestyen Future Leaders Award- to collaborate and spread the knowledge among research community, it is a great pleasure to put the long-lasting links of the recordings which make them available to access in the future as the following links:

Link to Session 1: [Session 1 -Circular Futures Workshop - Digital Tools for Circular Economy in the Construction Sector-20241111\\_180415-Registrazione della riunione.mp4](#)

Link to Session 2: [Session 2 -Circular Futures Workshop - Digital Tools for Circular Economy in the Construction Sector-20241118\\_195938-Meeting Recording.mp4](#)

Link to Session 3: [Session 3 -Circular Futures Workshop - Digital Tools for Circular Economy in the Construction Sector-20241125\\_195510-Meeting Recording.mp4](#)

## 7. Team Members

No.	PoliMi Team Members	Role	Contact
1	Prof. Andrea Giovanni Mainini	Coordinator- Assistant Professor	<a href="#">Email</a>   <a href="#">LinkedIn</a>
2	Alireza Fereydooni Eftekhari	Team member- PhD Candidate	<a href="#">Email</a>   <a href="#">LinkedIn</a>
3	Elena Casolari		<a href="#">Email</a>   <a href="#">LinkedIn</a>
4	Mina Sadat Orooje		<a href="#">Email</a>   <a href="#">LinkedIn</a>



## 8. Pictures

Here there are provided some screenshots from the different sessions.

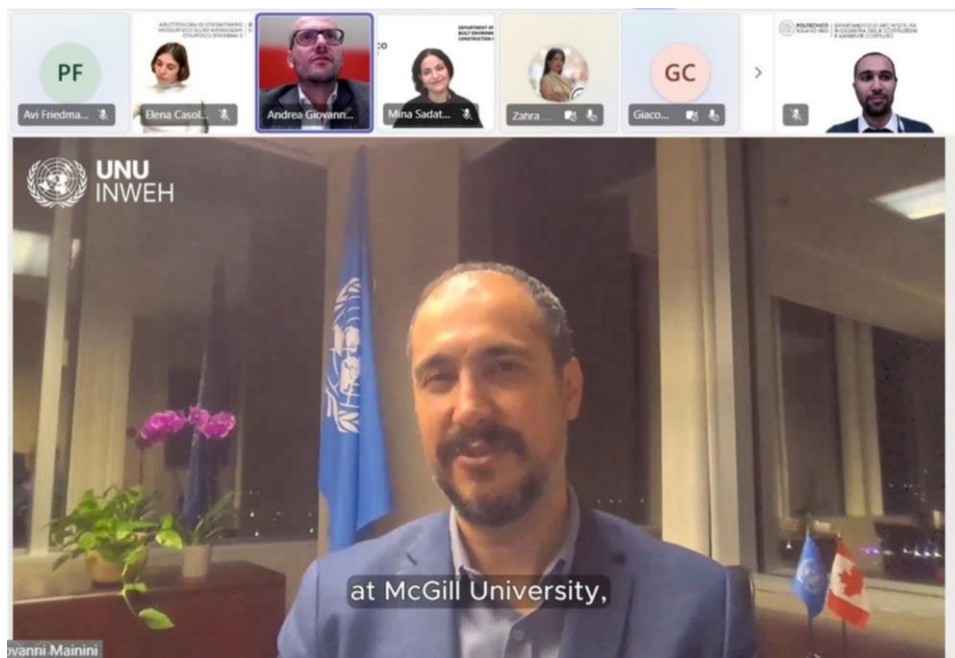


Figure 15: Screenshot from Session 1, Prof. Kaveh Madani



Figure 16: Screenshot from Session 2, Nicholas Nisbet

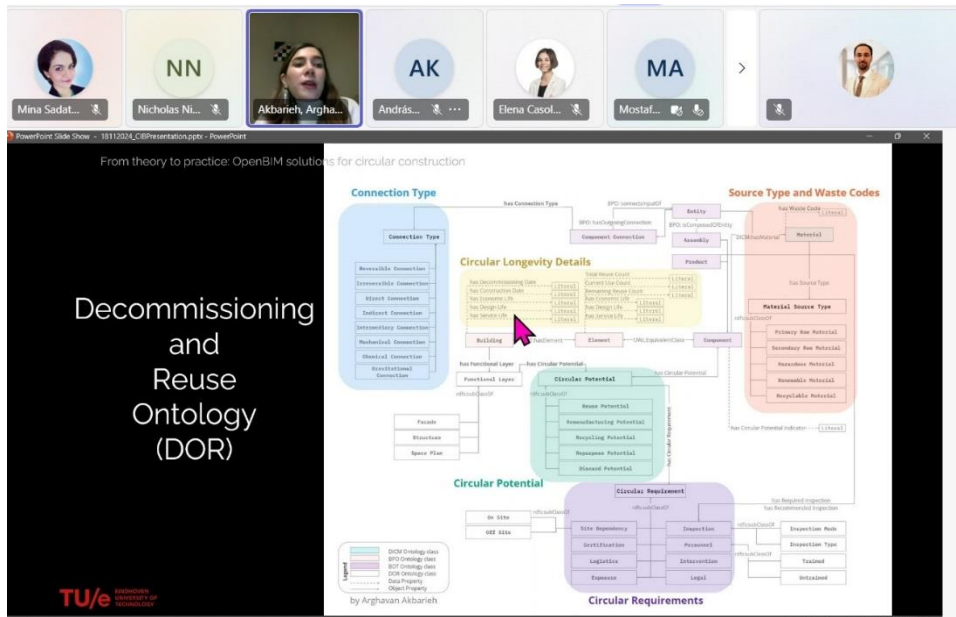


Figure 17: Screenshot from Session 2, Dr. Arghavan Akbarieh

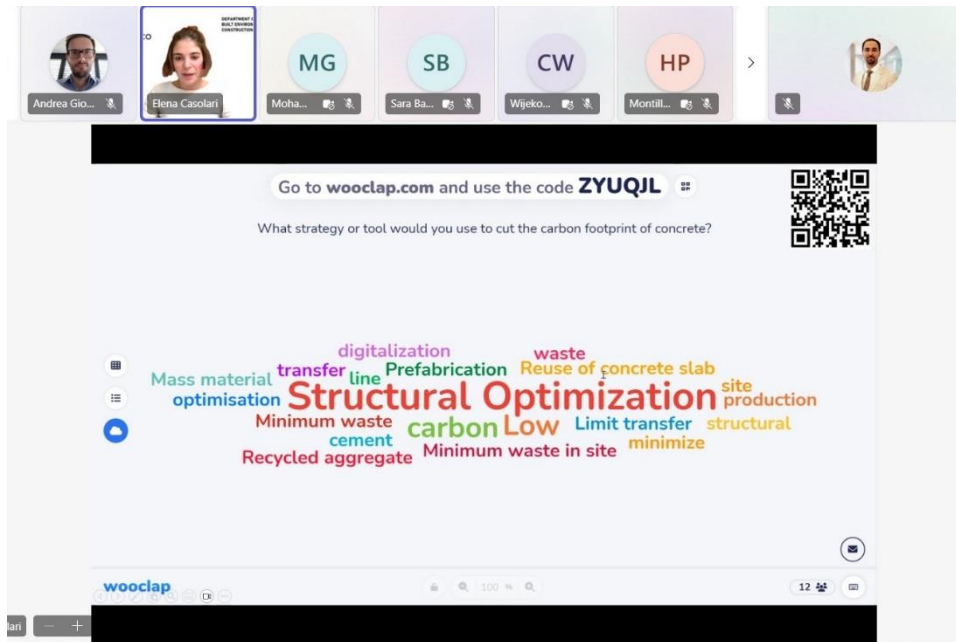


Figure 18: Screenshot from Session 3, Collaborative platform