# IRIC 2025

# BOOK OF ABSTRACTS

16–17 SEPTEMBER 2025
IZOLA, SLOVENIA

InnoRenew CoE International Conference 2025

16–17 September | Izola, Slovenia
Book of Abstracts

Published by
InnoRenew CoE, Andrej Marušič Institute,
University of Primorska Press, Titov trg 5, 6000 Koper, Slovenia

Izola and Koper, 2025

InnoRenew CoE International Conference Series
E-ISSN 2784-6679

Electronic Edition
https://www.hippocampus.si/ISBN/978-961-293-508-5.pdf
https://www.hippocampus.si/ISBN/978-961-293-509-2/index.html
https://doi.org/10.26493/978-961-293-508-5

Kataložni zapis o publikaciji (CIP) pripravili
v Narodni in univerzitetni knjižnici v Ljubljani
COBISS.SI-ID 249204483
ISBN 978-961-293-508-5 (Univerza na Primorskem, PDF)
ISBN 978-961-293-509-2 (Univerza na Primorskem, HTML)

The conference is organized by the InnoRenew CoE, UP IAM, University of Primorska.

IRIC2025 is co-organized by the Ministry of Higher Education, Science and Innovation as part of Science month 2025.

REPUBLIC OF SLOVENIA
MINISTRY OF HIGHER EDUCATION,
SCIENCE AND INNOVATION

2025
science month

# Bottom-up design of a life-saving technology. The lifeshell desk

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Earthquakes continue to destroy poorly constructed buildings. Lifeshell is an affordable wooden piece of furniture designed to shelter people during a building collapse. It offers a temporary solution while waiting for retrofitting. The Lifeshell desk project, developed through a citizen science approach, engages educational institutions to refine the design and its accessories, gathering input from students, teachers, and assistants.

In-school sessions (2-3 hours) combine short lessons with hands-on activities. Each begins with a brief presentation on earthquake risks and the Lifeshell concept. Students then build multi-storey structures using wooden sticks and rubber bands. Working in groups of 2-4, they test their buildings on a shake table, evaluated on aesthetics, height, and sturdiness. This is followed by a lesson on structural engineering and the causes of building failure during earthquakes.

A trainer then shows how variables like building height, mass, and oscillation frequency affect collapse, using model buildings on a shake table. Sessions conclude with a survey on the Lifeshell prototype, a Canva activity on user needs, and a Tinkercad exercise to propose design variations.

Further collaboration took place with institutions such as IED Istituto Europeo di Design, focusing on desk redesign with second-year Product Design students. Their prototypes were tested using Guillotine 2.0, a small-scale impact device with the same image acquisition system used for full-scale tests. A seminar on wood technology supplemented the design phase.

Feedback is assessed and integrated into updated Lifeshell prototypes, making the product increasingly tailored to user needs while raising awareness of seismic safety through active educational participation.

**Keywords**: CLT-structures, furniture, earthquake, bottom-up research, citizen science

**Acknowledgment**: The current Lifeshell project development is funded by the European Union - Next Generation EU*. Authors acknowledge the fundings acquired in late 2023, however they are firmly convinced that the financial resources allocated to the ReArm Europe plan introduced in March 2025 should be more effectively invested in scientific research or other initiatives aimed at ensuring peace and the quality of Life for all mankind.
*via piano nazionale di ripresa e resilienza (PNRR), missione 4 "istruzione e ricerca" - componente c2, investimento 1.1, "fondo per il programma nazionale di ricerca e progetti di rilevante interesse nazionale (prin)". Project code 2022HBXLTR, CUP B53D23006020006.

Lifeshell is under a Creative Commons Attribution 4.0 International License. This ongoing project is based also on the greatly appreciated contributions of Matilde Bognolo, Daniele Casagrande, Ario Ceccotti, Essepi srl, Wancheng Gao, Frank Lam, Gianluca Lopez, Mario Polidori, XLAM Dolomiti spa.

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