

DESIGN AND TECHNOLOGY. PEOPLE, SYSTEMS, ENVIRONMENT

MUR DM 118 - Development and experimentation of prefabricated building systems based on biobased materials, promoting local supply chain in fragile territories

Funded By	MINISTERO DELL'UNIVERSITA' E DELLA RICERCA [Piva/CF:97429780584] Dipartimento DAD
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Context of the research activity	<p>The research is part of some key themes of the PNRR (National Recovery and Resilience Plan) that concern the use of biobased resources coming from local supply chains and the reuse, recycling and recovery of waste materials according to circular design principles.</p> <p>The main objective is the study and experimentation of prefabricated building components and systems both for the design of modular and disassemble structures for temporary use than as stand-alone solutions for local architecture retrofit.</p> <p>Progetto finanziato nell'ambito del PNRR – DM 118/2023 - CUP E14D23001590006</p>
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	<p>The National Recovery and Resilience Plan (PNRR) highlights the importance of utilizing biobased resources from local supply chains and implementing circular design principles. This research project aims to contribute to these key themes by studying and experimenting with prefabricated building components that incorporate natural materials and pursuing the reuse, recycling and recovery of local materials. Prefabricated systems will be based on high thermo-hygrometric features, as well as sustainable requirements and energy efficiency in a life cycle design perspective.</p> <p>The systems will be tested on case studies, mainly for tourist and educational architectures aimed at regenerating fragile territories (such as coastal areas or alpine regions). The scholarship includes simulation analyses and testing both in labs and in real-scale mock-ups.</p> <p>The main objectives of this research project are as follows: a) State of the art</p>
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Objectives

and critical analysis of the potential of prefabricated building components utilizing natural and recovered materials, focusing on regenerating fragile territories. b) Design and development of modular and disassemble structures for new construction to be used as temporary buildings and the identification of assemblies suitable for retrofitting local architecture. c) Identification and assessment of sustainability requirements for prefabricated systems towards a whole-life carbon approach. d) Characterization of the thermo-hygrometric properties and energy efficiency performance of the developed systems. e) Simulation analyses and testing in laboratory settings to evaluate the performance of the prefabricated components. e) Validation of the performance of the systems through real-scale mock-ups in specific case studies.

The research project will be structured around several key phases, each with a specific focus and objective. The first phase entails conducting an extensive literature review on biobased resources, circular design principles, and sustainable building practices. By delving into existing studies and methodologies, this review aims to establish a comprehensive understanding of the field's current state-of-the-art and identify relevant sources of information.

The second phase centers on material selection and prefabricated system design. Within fragile territories like coastal areas or alpine regions, a specific site will be chosen as a case study. The goal is to identify suitable natural and recovered materials that can be used for prefabricated building components within the selected architectural contexts. These materials will undergo evaluation based on their properties, local availability, and environmental impact. Drawing upon these findings, the research will focus on the design of modular and disassemble structures and envelope assemblies based on these materials. Additionally, climate, architectural and territory conditions of the chosen site will be considered.

The third phase involves the development of a framework for assessing the performance of the prefabricated components. This framework will encompass the evaluation of thermo-hygrometric features, environmental impacts, and energy efficiency. Simulation tools and laboratory testing will be utilized to analyze the performance of the systems under varying environmental conditions. By comprehensively evaluating these aspects, the research aims to measure the effectiveness and sustainability of the prefabricated components.

In the final phase, real-scale mock-ups of the prefabricated components will be constructed. This step allows for a practical assessment of the systems' performance, providing tangible evidence of their capabilities and limitations.

Aligned with the key themes of the PNRR, this research project promotes the utilization of biobased resources, circular design principles, and sustainable building practices. By doing so, it aims to contribute to the development of innovative and low-carbon solutions for regenerating fragile territories such as coastal areas and alpine regions. The prefabricated building components and systems derived from this research will serve as a blueprint for architects, engineers, and policymakers, enabling them to create resilient and energy-efficient structures in line with the principles of a circular economy. Ultimately, the outcomes of this research will provide valuable insights into designing high-performing, environmentally friendly structures with a focus on thermo-hygrometric features, sustainability, and energy efficiency.

Skills and competences

The candidate must be able to demonstrate the following knowledge:

- Knowledge gained through a course of study related to research topics;
 - Knowledge of prefabricated construction, natural materials, circular design.
- Additionally, proven experience in workshop activities and/or fieldwork is

**competencies
for the
development of
the activity**

desirable;

- Knowledge of the performance-based approach in architectural design and assessment of energy-environmental impacts (e.g. sustainability indicators, bioclimatic design, energy performance assessment);
- Skill in the use of Adobe Suite, Office, Cad, 3D software;
- Skill in both spoken and written English and Italian.