DESIGN AND TECHNOLOGY. PEOPLE, SYSTEMS, ENVIRONMENT

PNRR - Eco-Design strategies for the development of the support network of Climate Positive Circular Communities (CPCCs)

Funded By	MINISTERO DELL'UNIVERSITA' E DELLA RICERCA [P.iva/CF:97429780584] Politecnico di TORINO [P.iva/CF:00518460019]
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Context of the research activity	The research was developed within the Project “MICS” Spoke 2 PE11 "Eco-Design strategies: from materials to Product Service Systems – PSS" in the context of the PNRR. The aim is to contribute to the shift towards Circular Economy for made in Italy industrial production through the definition of methodologies and tools. The project is funded under the PNRR M4C2, Investimento 1.3 - Avviso n. 341 del 15/03/2022 - PE0000004 3A-ITALY Made in Italy circolare e sostenibile - CUP E13C22001900001
	The research project is part of the range of challenges at European level which have set in motion policies to contribute to speedy wide-scale implementation of Climate Positive Circular Communities (CPCCs) where people can thrive and prosper for generations to come. The overall aim is to demonstrate and validate attractive, resilient, and affordable solutions for CPCCs that will significantly speed up the deep the deployment of climate measures, also in the industrial sectors. As shown in the framework of the Community challenges and the New European Bauhaus (NEB) project, the wide range of changes underway with the aim of enacting measures and carbon-removal strategies involve the whole of European society through a radical cultural transformation. Starting from this framework, the research project will investigate design processes, technologies, and tools capable of enhancing effectiveness and streamlining processes, thus reducing their impact. The activities will focus

Objectives	specifically on the design of new smart and circular materials, and circular components and systems. The central topic will be related to Eco-design strategies starting from materials and including Product Service Systems through the definition of methodologies and tools. The sectors involved will be those where the circularity of resources can be increased such as: circular materials for macro-sectors involved, new PSS for the reduction of environmental impacts and sustainable behaviour. The actors are also the consumers and, in general, they represent the entire society involved in the definition of eco-design strategies. The activities will focus on the identification and definition of: - methodologies and tools for optimizing the PSS architecture for new, lightweight, energy- and waste-conscious, components, products, and systems; - smart, bio-based and bio-inspired materials and PSS design and finishing for the reduction of energy and raw material consumption and the environmental impact of their existing production processes; - design-driven innovation strategies with reference to circular materials and symbiosis between production chains. The activities will identify design-driven innovation strategies such as: - design-driven entrepreneurship models through Open Innovation and collaborative design projects between Made in Italy manufacturers and innovative technology startups; - design strategies to promote social innovation and drive sustainable behaviour at the level of production systems and society, specifically by drawing on service design methodologies and communication and data visualization design practices. The activities aim to reduce the environmental impact of : - materials through the design and the application of natural, recycled and recyclable materials and the reduction of the number of the same according to the principles of material-driven design, systemic design, and circular design; - component reduction, easy disassembly and replacement according to the principles of disassembling design, design for non-destructive separation, design for recyclability. - finished products through the reduction of energy consumption in the use phase, the ease of remanufacturing, according to the principles and methods bio-based design, bioinspired design, low-energy design, design for longevity. The areas to be addressed and developed in the field of research will be: - production of a geography of eco-design strategies and related methodologies and tools that support all phases of PSS (product services systems) design and life cycle management. - development of a cradle-to-cradle design approach based on new PSS impact assessment models throughout the life cycle up to their potential disposal, recycling, reuse and/or zero-impact regeneration. - development and testing of project actions to promote social innovation and support sustainable behavioural change. Main activities: - analysis of methodologies for architectural design in the PSS (e.g.: zero

	waste and lower energy consumption) design and finishing of smart, bio-based/inspired materials and components. - analysis of Metaverse environments for the development of leaner PSS and tailor-made design methodologies and of integrated systems for eco-efficiency during production. - development of cradle-to-cradle design approaches for PSS reuse, recycling and regeneration, life cycle assessment of such approaches and redesign of production processes (less energy and raw materials).

Skills and competencies for the development of the activity	The candidate should have knowledge and competencies on: - knowledge gained through a course of study related to the research topics; - knowledge of circular economy and sustainability, eco-design strategies and related methodologies and tools, smart, bio-based materials and PSS design. - knowledge of English and Italian language (oral and written) Good knowledge of practical attitude for the research activities and problem solving skills. As the PhD candidate will work with research groups on a multidisciplinary project, he/she must demonstrate adaptability in different environments, and be able to interact positively with the other groups members.