POLITECNICO DI MILANO

PhD in INGEGNERIA GESTIONALE / MANAGEMENT ENGINEERING - 40th cycle

THEMATIC Research Field: CIRCULAR ECONOMY AND MANUFACTURING EDUCATION: CHALLENGES AND APPROACHES

Monthly net income of PhDscholarship (max 36 months)
€ 1500.0 In case of a change of the welfare rates during the three-year period, the amount could be modified.

Context of the research activity	
Motivation and objectives of the research in this field	Manufacturing sector is facing increasing and pressing sustainability challenges, while the paradigm of circular economy is getting more and more attention and application. In this, individuals and institutions need to be equipped with the proper knowledge and skills, for being able to guide and promote a sustainable shift, minimizing wastes, reducing resources consumption, and mitigating environmental impacts. A dedicated research effort in this domain is needed, and it could seek to enhance the economic competitiveness of manufacturing businesses and industries. By adopting circular economy principles, companies can streamline operations, reduce costs, and access new markets, ultimately improving their long-term viability and competitiveness in a global economy. The PhD project might aim to drive educational reform by integrating circular economy principles into formal education curricula at various levels, from vocational schools to universities. By embedding these concepts into educational programs, future generations of professionals will be better equipped to address sustainability challenges in the manufacturing sector. Research in this field could also contribute to the development of policies and regulations that support the transition to a circular economy in manufacturing. By providing evidence-based insights and recommendations, the project can inform policymakers and advocate for the implementation of supportive policies at local, national, and international levels.

	This PhD research project may seek to foster collaboration between academia, industry, and other stakeholders in the manufacturing sector. By bringing together diverse perspectives and expertise, the project aims to catalyze collective action towards achieving sustainable and circular practices within the industry. Overall, the motivation and objectives of a research project on education in circular economy and manufacturing are interconnected, aiming to drive positive change towards a more sustainable and resilient manufacturing sector.
Methods and techniques that will be developed and used to carry out the research	In the research field of education in circular economy and manufacturing, various methodologies should be employed to address different aspects of the topic. At the time being, these should be the main methodologies to be used: •Literature Review: Conducting a comprehensive literature review is essential to understand the existing knowledge base and identify gaps in research related to education in circular economy and manufacturing. This will help the PhD candidate build upon existing theories, concepts, and findings. •Survey Research: Surveys can be utilized to gather quantitative data on attitudes, knowledge, and practices related to circular economy principles among educators, students, industry professionals, and policymakers. Surveys allow for the collection of large amounts of data from diverse populations, enabling statistical analysis and generalization of findings. Thanks to the CERES project, it will be possible for the candidate to have access to a relevant database of European experts in this field, to invite in the survey. •Interviews and Focus Groups: Qualitative research methods such as interviews and focus groups can provide in-depth insights into the perspectives, experiences, and challenges faced by stakeholders involved in education and practice of circular economy in manufacturing. These methods allow researchers to

	explore complex issues and uncover nuanced viewpoints. Again, the CERES project will provide a unique context, providing proper contacts and occasions (e.g. European Meetings of the CERES project) for planning such interviews and focus groups. •Case Studies: Case studies involve the in-depth examination of specific educational programs, initiatives, institutions, or companies that are implementing circular economy principles in manufacturing education or practice. Case studies provide rich, detailed insights into real-world contexts, enabling researchers to analyze factors influencing success or failure and draw lessons for broader application. The different partners of the CERES project will constitute the first reference list for such case studies. Each of these research methodologies offers unique strengths and limitations, and the PhD candidate will have to plan them accordingly, to employ a combination of methods to address his/her research questions comprehensively. The selection of appropriate methodologies obviously will depend on the specific objectives, context, resources, and constraints of the PhD project.
Educational objectives	The main educational objectives to achieve should be the followings: •Advanced Knowledge Acquisition: Deepen understanding of theories, concepts, and principles related to circular economy, sustainability, education, and related fields through rigorous literature review and engagement with scholarly works. •Research Skills Development: Acquire and refine research skills, including research design, methodology selection, data collection, analysis, and interpretation. Develop proficiency in both qualitative and quantitative research methods relevant to studying education in the circular economy.

	•Critical Thinking and Problem-Solving: Cultivate critical thinking skills to analyze complex issues, identify research gaps, formulate research questions, and develop innovative solutions to challenges facing education in the circular economy. •Interdisciplinary Integration: Foster interdisciplinary perspectives by synthesizing knowledge from diverse fields such as education, environmental science, economics, engineering, and business management. Develop the ability to integrate insights from multiple disciplines to address complex sustainability issues. •Communication Skills Enhancement: Enhance oral and written communication skills to effectively articulate research findings, theoretical frameworks, methodological approaches, and practical implications to academic and non-academic audiences. •Ethical Considerations: Understand and uphold ethical principles in research, including integrity, transparency, respect for human subjects, and consideration of environmental and social impacts. Demonstrate ethical conduct throughout the research process, from project design to dissemination of results. •Contribution to Scholarship: Make an original contribution to scholarship by advancing knowledge and theory in the field of education in the circular economy. Produce high-quality research outputs, such as peer-reviewed publications, conference presentations, and doctoral dissertations, that contribute to academic discourse and practice. These educational objectives are designed to provide PhD candidate with a comprehensive and transformative learning experience that equips them to become scholars, leaders, and changemakers in the field of education in the circular economy. By pursuing these objectives, the PhD candidate can contribute to advancing both academic knowledge and societal progress towards a more sustainable and equitable future.

Job opportunities	Pursuing a PhD in the field of education in circular economy and manufacturing can open diverse job opportunities across various sectors. Here are some potential career paths for individuals with a PhD in this field: •Academic Researcher/Professor: Many PhD graduates pursue careers as academic researchers or professors in universities and research institutions. They conduct research, publish scholarly articles, and teach courses related to education, sustainability, circular economy, and manufacturing. •Curriculum Developer/Instructional Designer: PhD graduates can work as curriculum developers or instructional designers, creating educational materials, programs, and courses that integrate circular economy principles into manufacturing education. They may work in educational institutions, government agencies, non-profit organizations, or corporate training departments. •Education Policy Analyst/Consultant: PhD graduates may work as education policy analysts or consultants, advising government agencies, international organizations, and advocacy groups on policies and strategies to promote circular economy education in manufacturing. They analyze policy implications, conduct research, and develop recommendations to support educational reform and innovation. •Sustainability Coordinator/Manager: PhD graduates can pursue roles as sustainability coordinators or managers in manufacturing companies, where they oversee initiatives to integrate circular economy principles into business operations, supply chains, and product development processes. They may develop sustainability strategies, monitor environmental performance, and engage stakeholders to drive continuous improvement. •Government Advisor/Policy Maker: PhD graduates may serve as government advisors or policy makers, shaping national and regional policies on education, sustainability, and circular economy. They provide expert guidance,

	and circular economy. They provide expert guidance, conduct research, and contribute to the development and implementation of policies that promote environmental literacy, innovation, and economic development.
Composition of the research group	4 Full Professors 2 Associated Professors 8 Assistant Professors 8 PhD Students
Name of the research directors	Sergio Terzi

Contacts
sergio.terzi@polimi.it

Additional support - Financial aid per PhD student per year (gross amount)	
Housing - Foreign Students	--
Housing - Out-of-town residents (more than 80Km out of Milano)	--

Scholarship Increase for a period abroad	
Amount monthly	750.0 €
By number of months	6

Additional information: educational activity, teaching assistantship, computer availability, desk availability, any other information
Computer +desk, possibile teaching assistanship. •Involvement in projects: "For the overall development of their capabilities, PhD candidates will work on sinergical projects to favour empiral data collection and network development for their career. Projects will give candidates the opportunity to work in group (peers and other senior professors)". •Teaching and tutoring: "If coherent with the development of their doctoral program, the PhD candidate will have the opportunity to be involved in: teaching activities, tutoring to master students, tutoring to PhD candidates for administrative processes". **Funding for educational activities: 6.100,00 Euros for three years.**