



# PhD in INGEGNERIA GESTIONALE / MANAGEMENT ENGINEERING - 40th cycle

**THEMATIC Research Field: CIRCULAR AND SUSTAINABLE AUTOMOTIVE AND MASS ELECTRONICS VALUE CHAINS THROUGH ADVANCED DIGITAL TECHNOLOGIES**

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

<b>Context of the research activity</b>	
<b>Motivation and objectives of the research in this field</b>	<p>Circularity and Sustainability are among the major trends in manufacturing research. Sustainability includes three axes: economic, environmental and social.</p> <p>Circularity strives to reuse, reduce, repair, recycle, refurbish materials and products within and across supply chains, motivating from the fact that our world has limited resources that will soon or later end and this requires circular approaches at all levels.</p> <p>Companies that aim for circularity and sustainability do not want to forget productivity, efficiency, resiliency and customization of their products and services to remain competitive.</p> <p>It is of outmost importance to investigate the role of advanced Industry 4.0 digital technologies and of available data to get the bigger picture, to share information across value chain and to make a more accurate decision making taking into consideration all these aspects properly.</p> <p>Despite the numerous scientific publications that state the importance of digital technologies to enable circular manufacturing, the concrete demonstrations and the extent of the benefits are still limited in number, sector and problem size.</p> <p>All these considerations are even more emphasized in contexts of complex international supply chains, with the presence of many manufacturers, thousands of components, rare materials, such as the automotive and the mass electronics sectors. Additionally, the automotive</p>



	<p>is one of the most relevant sectors for the Italian economy, which motivates the importance of investigating the capabilities of circular manufacturing and of sustainable manufacturing in this sector to grant its competitiveness worldwide in the long term. Automotive is also one of the first sectors of adoption of advanced and innovative technologies, making the perfect context for studying the impact of the digital technologies, with potentials and barriers, and to elaborate and test frameworks of adoption, that could be then readapted to other contexts. Together (and also connected) with automotive, the mass electronics sector is becoming even more strategic for Europe because of the lack of both production capacity and knowledge related with advanced chips and, hence, the huge dependency from extra-EU suppliers.</p> <p>The research investigates the role of Industry 4.0 digital technologies and the enabled use of data, for circular and sustainable manufacturing, with a particular focus on automotive companies, proposing concrete approaches of impact evaluation and decision-making.</p>
<p><b>Methods and techniques that will be developed and used to carry out the research</b></p>	<p>The following methodologies will be applied in the research project:</p> <ol style="list-style-type: none"> <li>1. literature and state of the art analysis in order to map the situation of research at national and international level, from a research perspective and from an industrial perspective;</li> <li>2. launching surveys to gather main potentials and barriers for companies to pursue sustainable operations and to grasp maturity levels in industry;</li> <li>3. developing a framework for possible strategies for circular and sustainable value chains;</li> <li>4. conducting case studies of players in automotive and mass electronics sectors in Italy and abroad to test the framework.</li> </ol>
<p><b>Educational objectives</b></p>	<p>The research aims to contribute to a high-skill profile that is able to:</p>



	<ul style="list-style-type: none"> <li>•enrich awareness and develop critical thinking capabilities regarding the opportunities and challenges opened by the digital transition to circularity and sustainability of manufacturing companies and value chains;</li> <li>•analyse, integrate and contribute to the development of the body of research on circular manufacturing and sustainability in the context of complex value chains;</li> <li>•analyse and evaluate the circular and sustainable manufacturing strategies, practices and their maturity in manufacturing companies and value chains;</li> <li>•develop models and advanced capabilities to support decision-makers in manufacturing companies and value chains to enhance circularity and sustainability.</li> </ul>
<p><b>Job opportunities</b></p>	<p>The opportunities for a PhD graduate in this research area are manifold, in terms of professional development in:</p> <ul style="list-style-type: none"> <li>•Academic and industrial careers in research, innovation and development in the fields of industrial operations, with specific interest for challenges of the twin transitions (digital and green transition) and of circular economy and circular manufacturing;</li> <li>•advisory and consultancy for those companies that want to invest on the next steps of Circular and Sustainable manufacturing: the PhD graduate will be the right person to lead the twin and circular transitions projects in manufacturing companies, acting as "circularity champion", or may be hired by consultancy companies which accompany manufacturing companies in their circular and sustainable transitions through digitization. The possible sectors of employment are multiple, with a prevalence on automotive sector.</li> </ul>
<p><b>Composition of the research group</b></p>	<p>4 Full Professors                  2 Associated Professors                  8 Assistant Professors                  18 PhD Students</p>



<b>Name of the research directors</b>	Elisa Negri, Paolo Rosa
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<b>Additional support - Financial aid per PhD student per year (gross amount)</b>	
<b>Housing - Foreign Students</b>	--
<b>Housing - Out-of-town residents (more than 80Km out of Milano)</b>	--

<b>Scholarship Increase for a period abroad</b>	
<b>Amount monthly</b>	750.0 €
<b>By number of months</b>	6

<b>Additional information: educational activity, teaching assistantship, computer availability, desk availability, any other information</b>
<p>Funding for educational activities for the three years is available.</p> <p>Teaching assistantship: There are various forms of financial aid for activities of support to the teaching practice. The PhD student is encouraged to take part in these activities, within the limits allowed by the regulations.</p> <p>Desk availability: shared use, Computer availability: individual use.</p> <ul style="list-style-type: none"> <li>•Involvement in projects: "For the overall development of their capabilities, PhD candidates will work on sinergical projects to favour empirical data collection and network development for their career. Projects will give candidates the opportunity to work in group (peers and other senior professors)".</li> <li>•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".</li> </ul> <p><b>Funding for educational activities: 6.100,00 Euros for three years.</b></p>