

PhD in Management, Production and Design

Research Title: Development of a framework for the triple-bottom-line sustainability improvement in manufacturing

Funded by	DIGEP - Department of Management and Production Engineering
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Context of the research activity	<p>The awareness concerning the impact of industrial activities and the growing regulatory pressure on environmental sustainability have led the manufacturing sector to seek for solutions to reduce resource consumption and GHG emissions, for instance by increasing the energy efficiency of production systems and by recycling materials. However, environmental sustainability is only one of the three pillars of sustainable development, which must also include economic sustainability (i.e., the ability of a system to ensure lasting growth in occupation and incomes) and social sustainability (i.e., the ability to guarantee equitable conditions for well-being, health, and education). These issues represent a rapidly expanding branch of industrial and academic research. The literature highlights how different levels of analysis (from the single production process to the entire industrial supply chain) are necessary, and identifies among the objectives of future research the development of sustainable and automated manufacturing systems based on different and integrated technologies.</p>
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Objectives	<p>Despite the research efforts already developed, the way to have a full understanding of the environmental performance of different and/or integrated processes within a product lifecycle is still long. The objectives of the PhD research activities can be resumed as it follows: (1) to identify and tune-up procedures and big-data based acquisition tools for the in-line process monitoring, while accounting for the peculiar resource flows; (2) to further develop the unit process life cycle assessment by empirically and/or</p>
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	analytically modelling the different contributions to the energy/resource requirements and to the environmental impact of different manufacturing routes; (3) to propose decision support tools and guidelines for identifying the most sustainable approach while varying its main factors of influence (such as the batch size, the type and amount of involved materials, the geometrical product specifications and so forth); (4) to transfer the acquired knowledge into the being created Sustainable Manufacturing Lab of the Department of Management and Production Engineering of Politecnico di Torino.
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Skills and competencies for the development of the activity	The PhD candidate should have an in-depth knowledge on the optimization of products (e.g., by means of re-design of manufacturing techniques) and innovative manufacturing processes (such as additive manufacturing) aimed to enhance the environmental, economic, and social sustainability while guarantying the technological performance. A previous research experience focused on both product design and process optimization will be positively evaluated.
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