POLITECNICO DI MILANO

PhD in INGEGNERIA GESTIONALE / MANAGEMENT ENGINEERING - 40th cycle

THEMATIC Research Field: BUILDING INDUSTRIAL RESILIENCE IN THE FACE OF MATERIAL CRITICALITY

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	The twin (digital and green) transition is a crucial enabler for abatement of climate change and ensuring sustainable development at large. This transition depends on a wide range of materials that are deemed to be critical due to their constrained availability, accessibility or affordability. While the current discourse provides valuable implications for identification and mitigation of material criticality, its major limitation lies in the predominant top-down perspective (e.g. analysis at a national rather than a company level). This is problematic because it misses to consider the operational reality of companies and their interdependences that form and drive material flows through supply chains, industrial sectors and geographic regions. Therefore, the project aims to examine the management of critical materials across organizational levels, complementing the current discourse with the bottom-up perspective. This will provide better means to understand a) supply-demand dynamics, related risks and vulnerabilities (identification of criticality), and b) feasibility of resilience strategies and practices (mitigation of criticality). In particular, the project will incorporate: •the systems thinking to examine interdependences within

	and across organizational levels, and their role in identification and mitigation of material criticality (e.g. the rippling of criticality across supply chains and industrial sectors), to examine stakeholders collaborations in building resilience capabilities; •the lifecycle thinking to unfold interdependencies and feedback loops across lifecycle stages, as well as to align mitigation actions; •the transition thinking to monitor the dynamics of the external environment (e.g. market and technological trends), to determine a course of mitigation actions targeting different time horizons, to consider both the magnitude and speed of actions to determine their sufficiency, to monitor the criticality state during the course of mitigation actions.
Methods and techniques that will be developed and used to carry out the research	The mixed method research approach is required to address the research problem. In particular, qualitative research methods (e.g. interviews, case study) are important to examine the nature of interdependences within and across organizational levels in the context of material criticality, and to identify their role in identification and mitigation efforts. The quantitative research methods (e.g. modelling) are important to examine the impact of organizational interdependences on identification and mitigation of material criticality.
Educational objectives	The research is multidisciplinary in nature: the candidate will develop advanced research skills in the areas of critical materials, industrial and supply chain dynamics, system engineering. She/he will learn how to design and conduct a research project, adopting the proper methodologies for data collection and analysis, and to present and publish results in both academic and practitioner outlets.
Job opportunities	The successful completion of the PhD program will open several job opportunities in both academia and

	companies, in research, consulting and managerial roles. The candidate will develop distinctive knowledge to master the key managerial activities and decisions in the arena of natural resource management.
Composition of the research group	1 Full Professors 0 Associated Professors 1 Assistant Professors 1 PhD Students
Name of the research directors	Paolo Trucco, Yulia Lapko

Contacts
paolo.trucco@polimi.it; yulia.lapko@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	0

Additional information: educational activity, teaching assistantship, computer availability, desk availability, any other information
INVOLVEMENT IN OTHER RESEARCH PROJECTS: the PhD candidate will have the opportunity to work on sinergical projects to favour empirical data collection and network development for her career. Projects will give the candidate the opportunity to work in larger research teams, with peers and senior researchers. TEACHING AND TUTORING: the PhD candidate will have the opportunity to be involved in teaching activities, tutoring to master students, tutoring to fresch PhD candidates on administrative processes. COMPUTER AVAILABILITY: individual use. DESK AVAILABILITY: shared use. •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".

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Funding for educational activities: 6.100,00 Euros for three years.