MANAGEMENT AND PRODUCTION ENGINEERING

CRT/DIGEP - Science-to-market pathways: Entrepreneurial experimentation through POC programs

Funded By	Dipartimento DIGEP FONDAZIONE CRT CASSA DI RISPARMIO DI TORINO [P.iva/CF:06655250014]

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Context of the research activity	The early-stage nature of research-based inventions—scientific and technological outputs developed by academic researchers—combined with the challenges of assessing their industrial relevance and market potential, introduces significant uncertainty that hinders the creation of value from scientific research. A critical aspect of this challenge involves transitioning from a foundational concept to a viable application in a relevant industrial domain, where principles of use define how the technology may generate value. Proof-of-Concept (PoC) programs have become a cornerstone of science valorization policy in many countries—for example, the ERC Programme under the Horizon 2020 framework and the i6 Green Challenge of Startup America. These programs institutionalize the early-stage valorization of research inventions by requiring scientists to engage in a sequence of actions aimed at resolving uncertainty through entrepreneurial experimentation. Compared to traditional research policies, PoCs represent a fundamental conceptual shift—from a narrow focus on linear technology transfer processes to alternative pathways that foster the active involvement of scientists in knowledge exploration, experimentation, and value creation under uncertainty. This shift is particularly relevant in contexts where valorization paths vary significantly depending on the nature of the research invention. In particular, science-based inventions—especially in the life sciences (e.g., biomedical research) and physical sciences (e.g., semiconductors, cleantech)—are typically characterized by high technological uncertainty and ambiguity regarding their application context. These processes tend to be more costly, exhibit higher failure rates, and require longer timeframes to reach maturity compared to the commercialization of engineering-based or applied research inventions. For science-based inventions, progression along the TRL scale often requires more complex and non-linear mechanisms. PoC programs have proven particularly effective in addressing these challenges, while also playing an instrumental role in developing entrepreneurial

capabilities among scientists and laying the groundwork for academic entrepreneurship.
Despite increasing interest, the effectiveness of PoC programs has primarily been studied at the national or organizational level, whereas relatively little knowledge exists on the PoC process at the project level—largely due to limited access to detailed longitudinal data. A clear knowledge gap remains regarding the microfoundations of science valorization through PoCs—specifically, the actions, processes, and learning dynamics that scientists engage in, and how these contribute both to science valorization and to the development of entrepreneurial capabilities among academic researchers.
The research project will unfold in this context.
The selected PhD candidate will join an interdisciplinary team and benefit from full access to a unique set of resources, including: a) a database of 150 PoC projects across five major Italian universities; b) a project-level dataset on inventions, inventors, and patents; c) documentation of specific PoC projects in the natural and physical sciences (subject to non-disclosure agreements); d) access to additional datasets such as AIDA Bureau van Dijk, ORBIT, SCIVAL, and PATSTAT for secondary data collection; e) access to data from Eurostat and the European Commission for cross-country comparisons (subject to approval); f) international connections and networking opportunities with researchers working on similar topics in European and U.S. universities.
The project aligns closely with the expertise of the team at DIGEP, to which Prof. Paolucci and Prof. Marullo belong. The team has extensive experience in the design and evaluation of PoC programs, and it collaborates actively with several universities and funding authorities that have implemented and monitored PoC initiatives since 20

The goal of the research is to advance the understanding of science valorization, using PoC programs as a natural experimental setting to observe early-stage commercialization dynamics.
More specifically, the research will pursue the following objectives:
1) Investigate the learning processes, team configurations, and strategic actions undertaken by academic researchers within PoC projects, with a focus on how these shape the transition from scientific discovery to innovation and new venture creation.
2) Compare the valorization trajectories of science-based versus engineering-based inventions, analyzing how technological uncertainty, market ambiguity, and intellectual property (IP) strategies influence their respective development paths. This will include the realization of in-depth case studies based on real-world projects in natural science and physical sciences domains.
3) Analyze how PoCs contribute to the development of entrepreneurial capabilities among academic scientists, including their impact on entrepreneurial entry (e.g., spinoff formation) and long-term career trajectories.
4) Explore the role of PoCs as structured learning environments—beyond their financial support function—for opportunity discovery, market validation, and entrepreneurial capability building.
5) Provide evidence-based recommendations to policymakers and university administrators on how to design and tailor PoC programs to the specific needs of different types of research-based inventions (e.g., natural sciences, physical sciences, applied sciences and engineering).
6) Contribute to European policy debates by conducting cross-country comparisons and leveraging administrative datasets (e.g., Eurostat, European Commission) to assess the transferability and scalability of PoC

Objectives	models across diverse research and institutional contexts. The project will adopt a multi-level analytical approach: - At the project level, it will examine PoCs as experimental settings that combine science valorization, entrepreneurial experimentation and collaborative innovation. In doing so, the research will bridge the traditional technology transfer literature with complementary perspectives from the fields of entrepreneurship and open innovation. - At the invention level, the study will analyze patenting strategies and IP management approaches across different types of research-based inventions. PoC participation will be assessed as a "treatment" that may influence these strategies—shaping decisions around IP protection timing, commercialization potential, and licensing outcomes. - At the individual level, the project will examine how engagement in PoC programs affects scientists' career development trajectories. It will also explore broader spillover effects—such as increased university–industry collaboration and the evolving role of researchers as academic entrepreneurs. The primary research setting will be Italian universities, with a particular focus on Politecnico di Torino (PoliTO), where PoC programs have played an increasingly significant role across several research groups in the last 7 years. The project will integrate secondary data collection with primary methods—including interviews and surveys—to produce detailed case studies of selected PoC projects, especially those rooted in science-based fields. Moreover, the project aims to extend its analytical scope to similar PoC initiatives at the European level, taking advantage of international collaborations and comparative research opportunities. The project will directly support ongoing research activities at the DIGEP Department, to which Prof. Paolucci and Prof. Marullo belong, and will also provide strategic insights for other departments at PoliTO engaged in science commercialization. Finally, the research will inform national and European policymakers in designing PoC programs that are better aligned with the diverse characteristics and valorization needs of different scientific fields. It will also contribute to international academic discussions through participation in conferences and collaborations with research groups working on similar themes in both European and U.S. institutions.

Skills and competencies for the development of the activity	We welcome applications from candidates who demonstrate strong independent and critical thinking skills. Applicants should possess a strong background in technology management, innovation management and entrepreneurship, with particular emphasis on academic entrepreneurship. Solid knowledge of statistical methods applied in the field are recommended. Given the international scope and collaborative nature of the research project, a medium-to-high proficiency in English (B2 to C1) is recommended.