

Doctoral Dissertation
Doctoral Program in Management, Production and Design (35th Cycle)

**The determinants and effects of creation
and adoption of
Artificial Intelligence
An empirical investigation at
firm and regional level**

By

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Summary

This thesis aims to explore the determinants and effects of the creation and adoption of artificial intelligence technology, focusing on the role of firms and regions in this process. The theoretical approach uses knowledge spillover theories and organizational theories to explain how interactions between different determinants lead to the creation of AI, and the effects that adopting this technology has on firms and regions.

The first part of the thesis adopts a firm perspective. The first empirical analysis considers internal knowledge – investment in internal R&D and information and communication technologies (ICT) - and external knowledge – knowledge spillovers, buying R&D and knowledge collaboration with partners – as key factors affecting firms' adoption of artificial intelligence (AI). By applying the technological-organizational and environmental context (TOE) framework and the recombinant knowledge approach, the thesis investigates the role of the internal and external knowledge context in changing the propensity of firms to adopt AI. In addition, to verify complementarities within the organizational and technological context of the organization, the study also assesses the recombination of knowledge resulting from knowledge spillovers, external R&D acquisition and knowledge collaboration using the recombinant knowledge approach. The recombinant knowledge approach helped test our hypotheses using paired data from two sources, the Innovation Survey and the UK Business Register, over the period 2004-2020.

The second study explores how adopting Artificial Intelligence (AI) technology has affected the relationship between internal and external knowledge resource allocation and firm innovation. Using novel data on 14,143 UK firms from 2004-2020, we consider investment in internal and external R&D and collaboration with external partners as a resource-allocation strategy for innovation. We find a consistent inverted U-shape relationship between internal and external resource allocation and firm innovation positively moderated by AI. In addition, the contribution of AI differs with the type of external collaboration partner for firm innovation. These results call for a fundamental rethinking of the resource allocation mechanisms and strategies used for a firm's innovation.

The second part of the thesis adopts a regional perspective. Here, the creation and impact of AI have been studied following two different approaches.

First, we investigate the role played by university knowledge specializations in the creation of Artificial Intelligence (AI) start-ups. The empirical analysis is grounded in the knowledge spillovers theory of entrepreneurship. It provides evidence of the interplay between the presence of universities and knowledge specializations and the creation of artificial intelligence start-ups located in Italian NUTS3 regions. More precisely, we analyze the mix of different types of university knowledge specializations able to foster

the creation of AI start-ups. The study also proposes an empirical approach to identify and classify innovative start-ups operating in AI domains.

Second, the thesis investigates the role played by Artificial Intelligence, as new key enabling technologies (KETs), in regional branching. Considering its general-purpose properties, we investigate the effect that AI may have on the development of new technological specializations in European provinces. The study's objective is to analyze the impact of the local availability of AI-related knowledge and competencies – measured via patents– on the subsequent evolution in the technological specialization. The empirical analysis is based on a database collecting all patents filed at the European Patent Office (EPO) from 1980 to 2018 and geo-localized at the NUTS3 level. We implement an original methodology to identify AI patents that rely on the presence of specific technological codes and keywords (WIPO, 2019).