Chapter

Assessing Interdependencies in Innovation Ecosystems: Evidence from the Training Partnerships between Big Tech and the University of Naples

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Abstract

In development, social, and management theories, universities have gained increasing relevance as engines of growth and innovation. Alongside private and public agents, universities engage in a collaborative exploration for a shared knowledge base that is not aimed at immediate exploitation. Building upon the notion of knowledge ecosystem, this chapter focuses on the digital training partnerships between the University of Naples and the global hi-tech players of Apple, Cisco, Deloitte, Capgemini, and other advanced manufacturing groups. Through a case study approach, the analysis explores the complementary and competitive relationships emerging within a knowledge-based value creation process, discussing the sustainability of a university-led innovation policy.

Keywords: knowledge ecosystem, university-industry collaborations (UICs), university-led innovation, innovation ecosystem, co-innovation

1. Introduction

The growing importance of innovation as a mechanism for economic development has given rise to a broad strand of studies examining how learning processes get unevenly located in space, within centers of innovative activity commonly considered as innovation ecosystems [1]. Besides market structures, technological capabilities, entrepreneurship, government and regulations, culture, service infrastructure, and human capital, the local presence of research-oriented universities plays a key role in learning and innovation [2–4]. The university goes beyond the traditional duties of teaching and research and assumes an entrepreneurial function for enhancing regional economic development. Companies take on an educational role, training students and workers in the skills set needed for advanced manufacturing. These novel interdependencies create value in the interactive dynamics that engage knowledge-utilizing and knowledge-generating structures [5–7].

Within regional science and innovation literature, knowledge spillovers build on the idea of proximity between firms and universities [8]. In business studies, the notion of knowledge ecosystem points to cognitive assets and participatory processes that create, explore, and use a shared knowledge base for the benefit of all actors [6, 9]. Social policy research identifies universities as situated spaces of learning and contamination between disciplines and territories, where research, teaching, and the third mission align with emancipatory and democratic paradigms. University institutional engagement attempts to relate social groups that lines of spatial, social, and relational segregation separate over time [10, 11]. Social structures of space are not mere containers where university-industry collaborations (UICs) play out, but their constitutive dimensions that interact with interregional disparities, but also intraregional and intra-urban inequalities [12]. Thus, university-led innovation may unfold not only along multiscalar processes across territorial contexts, often peripheral urban areas, but also platforms that relate distant actors and social groups. The digital landscape has allowed for enhanced multisited analysis of problems and relational dynamics that occur in a "g-local" context; hence, interdependencies emerge across both physical and virtual connections that bring high-income and less-developed regions together [13, 14].

This chapter aims to situate the debate on university-led innovation at the nexus of regional development and business innovation studies to understand the multiple factors that affect the sustainability of knowledge-based value creation in university-industry collaborations [15]. By exploring co-innovation, the analysis addresses the following two guiding questions:

- How does a knowledge ecosystem work?

- What are the factors that explain its growth, in less innovative regions?

To answer these questions, I examine the digital training partnerships the University of Naples has established with Big Tech such as Apple, Cisco, Deloitte, Capgemini, and some other advanced manufacturing companies within aerospace, railways, pharmaceutics, and infrastructure. I draw on the extensive fieldwork conducted within the campus of San Giovanni between 2019 and 2022 to examine how local innovative performance has emerged with regional development policy implications [16, 17]. This chapter contributes to three major topics in university-led innovation, that is, university-industry collaborations (UICs), innovation ecosystems, and the models of university system. In addition, assessing multiscalar knowledge-based value creation, this chapter contributes to the emerging literature on the social impact evaluation of the university's third mission (see [18]).

This chapter is organized in four sections. The next section, Section 2, reviews university-led innovation theories, focusing on the logic of the knowledge ecosystem. The research design section, Section 3, describes the case study approach that analyzes the complexity of interdependencies in UICs. The findings section, Section 4, examines UICs, their value creation strategy, and results. In the final section, Conclusion, I will then discuss the implications of the findings for regional development and offer concluding remarks.

2. Co-innovation and the role of university

In analyzing the role of universities as innovation centers, regional development theories underline the importance of agglomeration economies: firms cluster within a territory where they share knowledge, production inputs, labor market regulations, and production processes. The well-known Triple Helix model by Etzkowitz, Leydesdorff, and others [19] articulates the development of regional hi-tech industry clusters as a networked combination of university, industry, and government organizations collaborating in the promotion of innovation. In these configurations, universities act as intermediaries to transform knowledge into networks of multiple agents [6, 20]—i.e., companies, institutions, research centers, foundations, banks, and international organizations. Carayannis et al. [5] stress that the university is a new type of organization—"capable of higher-order learning, a type of open, highly complex and non-linear knowledge production system" (p. 152). This endogenous role of universities emerges out of recursive linkages in UICs that follow historical trajectories of spatially localized learning.

A key issue of this debate concerns knowledge generation and exploitation within proximity contexts [8, 21]. Productivity gains from UICs are highly localized, with companies situated near universities able to introduce innovations at a faster pace than rivals located elsewhere [22]. Assessing the efficacy of university in regional innovation, the size of the institutions involved is not a key factor [3] nor is the university research intensity or quality [23]. Universities' mission overload may hinder local firms' ability to cooperate or force them to look beyond the region for other suitable universities to interact with.

To understand interdependencies in UICs, business studies draw on the innovation ecosystem theory to reconstruct the variable set of actors, activities, (digital) artifacts, and the complementary and substitute relations, which are key for local innovative performance [14]. Granstrand and Holgersson [24] emphasize that an innovation ecosystem is different from innovation systems broadly considered, in that participants exhibit concomitant collaborative and competitive behaviors. While innovation ecosystems allow for cross-sectoral and cross-regional examination of innovation activities, other conceptualizations are often based on geographical boundaries, labeled using constructs such as national or regional innovation systems [24, 25]. Furthermore, a business ecosystem finds its roots in the idea of value networks of companies that combine skills and assets [6, 24]. In this strand, technology business studies focus on platforms, where data availability builds the infrastructure that facilitates entrepreneurship, new market opportunities, and social impact on businesses and society [26].

Considering the interactions between companies and universities, business studies examine knowledge-based value creation processes leading to invention and commercialization [6, 7, 27, 28]. Knowledge ecosystems aim to create the conditions for the exploitation and the appropriation of the value associated with knowledge, whereas business ecosystems involve the broader scope of knowledge exploitation or the process of invention-to-commercialization [6, 7, 27, 28]. Knowledge ecosystems work in precompetitive contexts, where physical proximity to universities and large firms with established Research and Development (R&D) departments have a positive influence on the focal actor's innovative output [6, 29].

Yet, Stam [4] points out the lacking causal depth and evidence base in ecosystem studies, whereas Clarysse et al. [6] highlight the implicit assumption that business ecosystems are the consequence of setting up a knowledge ecosystem, with universities, public research centers, and businesses that cooperate in early stages of knowledge creation. But, how actors participate in knowledge exploration, how they coordinate actions, and what effects emerge out the cooperation between universities and companies remain still under-researched.

Thus, this chapter seeks to fill this gap drawing on Adner's [30] distinction between the ecosystem as affiliation—that examines interdependencies like other well-established approaches of networks, platforms, markets with multidimensional players—and the ecosystem as structure—that interprets the ecosystem as a variable configuration of activities connected by a value creation strategy. The ecosystem as affiliation focuses on the access to the system and the number of partners, the network density, and actor centrality to understanding growth strategies for an actor or platform to assume weight and power. The ecosystem as structure assesses a value creation strategy based on the need for actors to collaborate. Actor alignment not only mirrors mutually compatible incentives and motivations, but it also verifies the conditions for which partners interpret the multilateral configuration of relationships that cannot be broken down into an aggregation of bilateral interactions [30]. If actors do not express the need to align for sharing strategies, because they are not crucial partners in the value creation process, or because their relations do not question the current alignment, the value-added advantage associated with an ecosystem is not necessarily relevant.

The methodological implication of this framework is the need to explore the rationale and behaviors of participants to reconstruct the nonlinear, multilayer, and recursive causality associated with ecosystem-based complementary and competitive relationships. The interactions in cooperative, competitive, or antagonist relationships get usually modeled through network links between nodes with attractive and repulsive couplings or positive/negative ties. These structures have layers in addition to nodes and links. Thus, a node in a layer (composing a single network) can get linked to any node in any other layer. Layers represent aspects or features that characterize the nodes or the links that belong to that layer. Links can get partitioned into intralayer links (e.g., links that connect nodes set in the same layer) and interlayer links, which tie nodes set in different layers. Furthermore, network analysis in ecosystem studies involves either whole-network analysis at the macro-level or ego-network analysis at the micro-level. By contrast, macro-level and micro-level networks may include multilevel nodes and interlevel edges. For example, a social network of researchers (micro-level) and a resource-exchange network between laboratories (macro-level) to which the researchers belong constitute a multilevel network with two levels. Few studies have investigated network community analysis at the meso-level [31]. Building upon these theoretical premises, the next section presents the research design examining the knowledge-based value creation process the University of Naples and technology multinationals have pursued through digital training partnerships and what factors have contributed to its growth.

3. Research design and operationalization

The study design integrates a regional development perspective with a complexity-sensitive analysis [32–34] to explore the collaborative and competitive relations

between university and businesses as interdependent situations that emerge, adapt to the context, and take root in some niches within open systems [33, 35–37]. The research is framed around three core assumptions:

- both complementary and competitive contribute to university and intrafirm learning processes that spill over to regional learning;
- knowledge-based value creation does not rely only on embedded collaborative networks, but also on global players that influence knowledge exploration and exploitation patterns;
- university-industry cooperation patterns are scalar knowledge-creation processes that generate interdependencies between partners.

From these assumptions, I have drawn and tested two research hypotheses (RH). The first relates to the alignment between partners that supports co-innovation processes combining international knowledge standards with localized learning (research hypothesis 1 (RH1)). The second descends from the previous: if RH1 holds then, university-business collaborations can expand co-innovation processes, leading to a knowledge ecosystem's growth (research hypothesis 2 (RH2)). The independent variable is, therefore, university-business collaborations that align actors toward a shared strategy of knowledge-based value creation. The dependent variable can be defined in terms of knowledge-based interdependencies relying on partners' alignment. In this regard, complexity theory helps understand UICs as generating interdependent situations rather than the summation of multiple actors and activities [33, 38, 39]. The notion of "emergence" refers to novelty, which does not correspond to the mere sum of its components. In emergent change, the new properties of a phenomenon do not exist in a lower unit of analysis and the observed outcome is not predictable *ex ante* [35, 36]. Thus, the focus of the analysis is on the emergence of multiscalar interdependencies by gathering empirical evidence on UICs' features, actors, and processes.

The operationalization of research rests on a single case study design [40, 41] focused on the Academy system of the University of Naples. The study is based on a naturalistic and interpretative approach to explore knowledge-based interactions, drawing on the perspectives of research participants. My involvement in the University of Naples has facilitated data access and the understanding of salient issues on training partnerships. I conducted a desk review of relevant documentation and 83 semi-structured interviews with university leaders, academy designers, managers, and trainees, administrative representatives and 54 business executives or CEOs of regional firms (see **Table 1**). Between June 2019 and March 2022, in-depth interviewing has allowed for probing the attitudes, beliefs, and motivations of the participants in the campus of San Giovanni of the University of Naples and understand the complexity of their choices and processes of value creation. In-depth interviewing also made it possible to examine participants' responses and to follow up with additional interviewing and single-layer network analysis [17]. This qualitative evidence has added to the desk document review and alongside administrative data that have allowed for reconstructing digital training offerings.

The coding of interview transcriptions has revolved around the theoretical framework of the ecosystem and its value creation strategy, while the economic theory

Interviewee profile	No. of interviewees	Year
University leadership	3	2022
Academy managers	5	2020/2021
University mentors and enterprise tutors	5	2020/2021
Partners' company managers	3	2020/2021
University administrative representatives	3	2022
Trainees	10	2020/2021
CEOs or business owners in the region Campania	54	2020/2021
Total	83	

Table 1.
Interviewee profile.

categories of economies of scope, scale, and network have helped characterize the value creation process within a context of high heterogeneity of agents (see **Table 2**; [30, 42]).

To examine both the context and the processes involved in university-business partnerships, the case study design has been appropriate to investigate the nature of partners' collaboration and the results of their cooperation within the campus of San Giovanni in the Eastern part of the city of Naples. This is a peripheral urban area that, thanks to the university infrastructure, has attracted many young students, and commercial and public transport services [12]. The broader geographical context where the University of Naples is located accounts for an industry declining area that is classified as a moderately innovative and less-developed region of the European Union (The Nomenclature of Territorial Units for Statistics – Regions (NUTS 2)), reckoning

Codes and categories of ecosystems	Interview outline
Interdependencies and alignment Focal actors Complementors Embeddedness* Adaptation* Emergence* Cooperation vs. competition*	What are the priorities for each partner?* What are the incentives for each partner?* How are roles assigned?* How is role performance assessed?* How have roles changed within the ecosystem?* Who has access to the ecosystem?* What is the contribution of each partner?*
Value creation strategy* Knowledge exploration* Knowledge exploitation	What are the benefits of digital training partnerships? Why is the knowledge generated innovative? How does participation in knowledge exploration occur? How does competition in knowledge exploration occur? How does university-industry collaboration work?

*Source: Marra [17].

Table 2.
Interview codes and outline.

a high percentage of youth not in employment, education, or training (NEET) and youth unemployment [43]. Thus, the case study offers fruitful insights into regional development and the possibility of gathering information of an exploratory nature that otherwise would not have been possible through other forms of data collection.

4. Complementary and competitive interactions

Research findings support a representation of the Academies as a knowledge ecosystem that engages global players for inclusive, and experiential learning suitable for highly qualified jobs' demand in the region. Academies are schools of innovation aimed at filling the regional digital skills gap through an active labor market initiative for hi-tech job creation. Digital training partnerships have stemmed from the university's collaboration with technology and advanced manufacturing multinationals, leading, between 2016 and 2022, to 12 yearly training courses listed in **Table 3**. Rooted in engineering studies, digital academies have followed a separate track from both undergraduate and graduate courses. The offerings integrate advanced research and teaching experiences in Information and Communications Technology (ICT) design and management and involve university faculty, PhDs, and graduate students who can find opportunities for lifelong learning, teaching, and collaboration with companies. Although academies share digital and soft upskilling curriculums, each school presents its scope and specificity by intersecting Information Technology (IT) instructions with industry applications (see **Table 3** and [17]).

Academy	Year	Application to industry	Private partner
Apple Developer Academy	2016	Digital app and mobile services	Apple
Digita Academy	2017	Digital consulting and software management; Sales force	Deloitte
FS Smart Mobility Academy	2018	Digital application in railway transportation	FS Railway Holding Group
Cisco Networking Academy	2017	Cisco International Lab	Cisco
Aerotech Academy with Leonardo	2019	Aerospace and defense	Leonardo SpA
5G Academy	2019	Telecommunications	Capgemini, Nokia, and Telecom Italia (Tim)
Accenture Cyber HackAdemy	2019	Software management and cyber security	Accenture
Medtronic AdvancedKnowledge Experience (Make)	2019	Digital application in pharmaceutics	Medtronic
The Smart Infrastructure Academy	2021	Infrastructure management through sensors	Autostrade per l'Italia
The Conversion and Resilience Academy (CORE)	2021	Digital applications in public services	KPMG/Exprivia
The Agritech Academy	2023	Digital applications in agri-food	

Source: Author's update on Marra [17].

Table 3.
The academies, their scope, partners, and launch year.*

Global hi-tech partner companies gravitate around the university campus, where the university manages logistics, organization, and knowledge-based exchanges. This proximity assures being part of a dense knowledge-based value creation strategy that also benefits from global networks affecting the local innovative output. In Järvi et al.'s words, this knowledge ecosystem works as an "organization that includes several actors linked by a joint search for knowledge while having an independent agency beyond the ecosystem of knowledge" ([7], p. 1524).

The knowledge-based value creation strategy of the university and its partners builds on sharing resources and capabilities that are not always quantifiable in monetary terms. Although university competencies are not sellable in the marketplace, the exploitation of knowledge created by the Academies occurs through job placement, as soon as trainees complete their training program and enter the labor market. Unlike its partners, the university cannot assure job placement to all trainees, because it is not an actor operating in the labor market. And, precisely for this reason, the university has undergone several pressures to adapt education to partners' fast-changing priorities and diversified participants' needs.

The university has learned to manage the growing complexity of nontraditional-student training as scalable operations that have expanded over time. For instance, following the first year, the Apple Academy has targeted the best performers with The Pier advanced program. Participant selection and the design of the second-year syllabus have involved international nongovernmental organizations (NGOs) working in social impact projects throughout the world. The Digita Academy jointly with Deloitte and Q8 has opened a classroom in the local neighborhood for participants to involve teens at risk in digital learning applications. The FS Smart Mobility Academy and the 5G Academy have implemented a separate track for midcareer professionals, scaling up upstream and downstream training services. All research laboratories localized in the campus have also grown collaborations with local companies (see **Figure 1**).

By conferring scientific and academic legitimacy to the knowledge produced through the Academies, the university has leveraged its influence to perform more efficiently and capitalize on its value-added advantages. In line with Stam [4], the study findings show that partners share skills, activities, organizational and financial resources that are mobilized for the creation and exploitation of knowledge outside the ecosystem.

Traditionally, the university faculties have taken the initiative for building collaborations with industry. Not all potential firm-entrants have got access to the campus. Companies have become affiliates on a case-by-case assessment leading to joint laboratory setup or other types of coproduction training (see **Table 4**). Yet, for the Academies, this sequencing has reversed. Globally reputed hi-tech multinationals have approached the university to explore the potential for collaboration and have localized within the campus with the expectation of additional investments and significant employment effects in the region. In such a configuration, partner alignment mirrors the agreements reached by each partner with the university, including the financial contribution, the flow of activities based on the number of trainees served each year, and the expectations that each actor holds regarding the role of all other partners in the ecosystem. Based on these conditions, as shown in **Figure 2**, Apple is the focal actor among business partners while Deloitte and Cisco—and all other latecomers—are the complementors [42]. As the university has leveled the playing field, opening up the access for collaborations to traditional competitors, this alignment has guaranteed ecosystem growth because all partners have acknowledged roles assigned and performed [30].

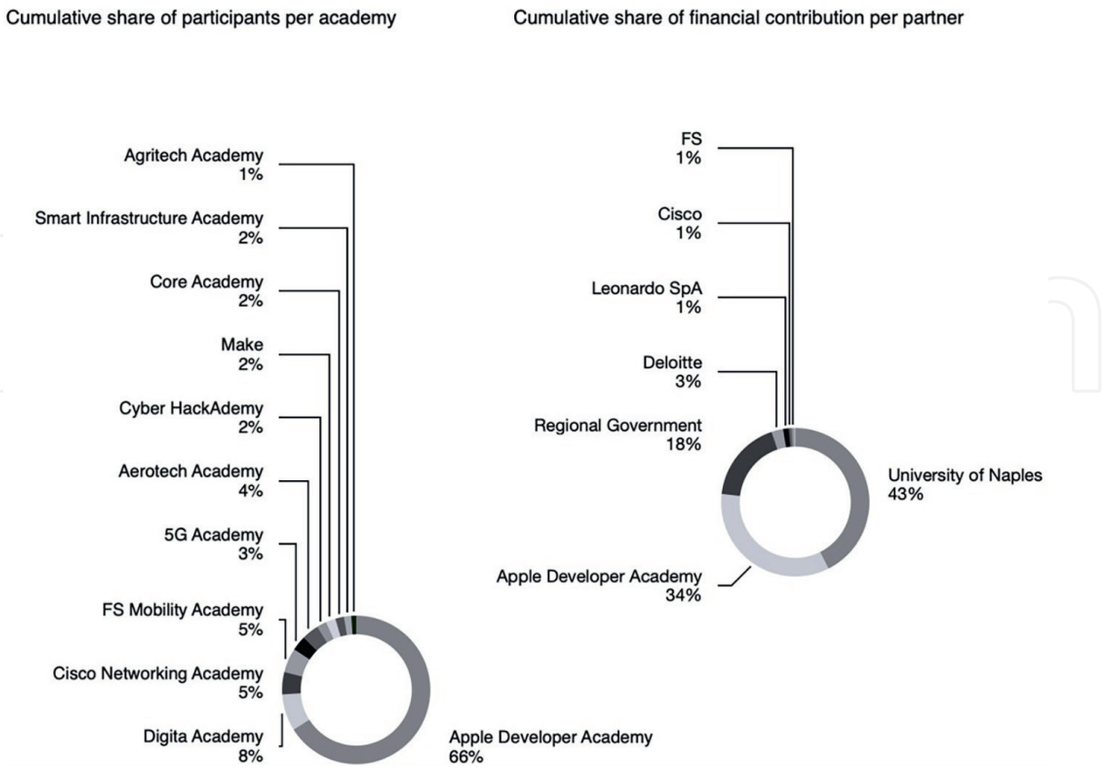

Figure 1.
The network of big tech, industrial manufacturing, and regional companies sampled in the study. Source: Marra et al. [17].

Types of collaborations	Innovation mechanisms	Interdependencies
Hiring university talents	Learning by hiring	Tech skills availability Labor mobility Labor market's efficiency
Challenge-based and business plan competition	Learning by networking	Platforms for sharing information and coordination by regional government and trade association
Corporate training	Learning by training	Investing in R&D and commercialization
Training partnerships	Learning by co-teaching	Degree and intensity of complementarities between companies and universities Previous experiences of cooperation Trust
Joint laboratories	Learning by partnering	Embedded ecosystems

Table 4.
Types of collaboration, co-innovation mechanisms, and interdependencies.

In line with Rybnicek and Königsgruber [14], organizational skills play an important role in knowledge ecosystems, and monitoring administrative processes is key in keeping up with partners' choices and unexpected market opportunities and shocks. The study findings show that partners' cooperation gets assessed on multiple levels. Training offerings undergo a yearly review process to gauge participants' learning outcomes and job placement performance. Space allocation rewards partners who efficiently use the space assigned. If underutilized, the university redistributes the

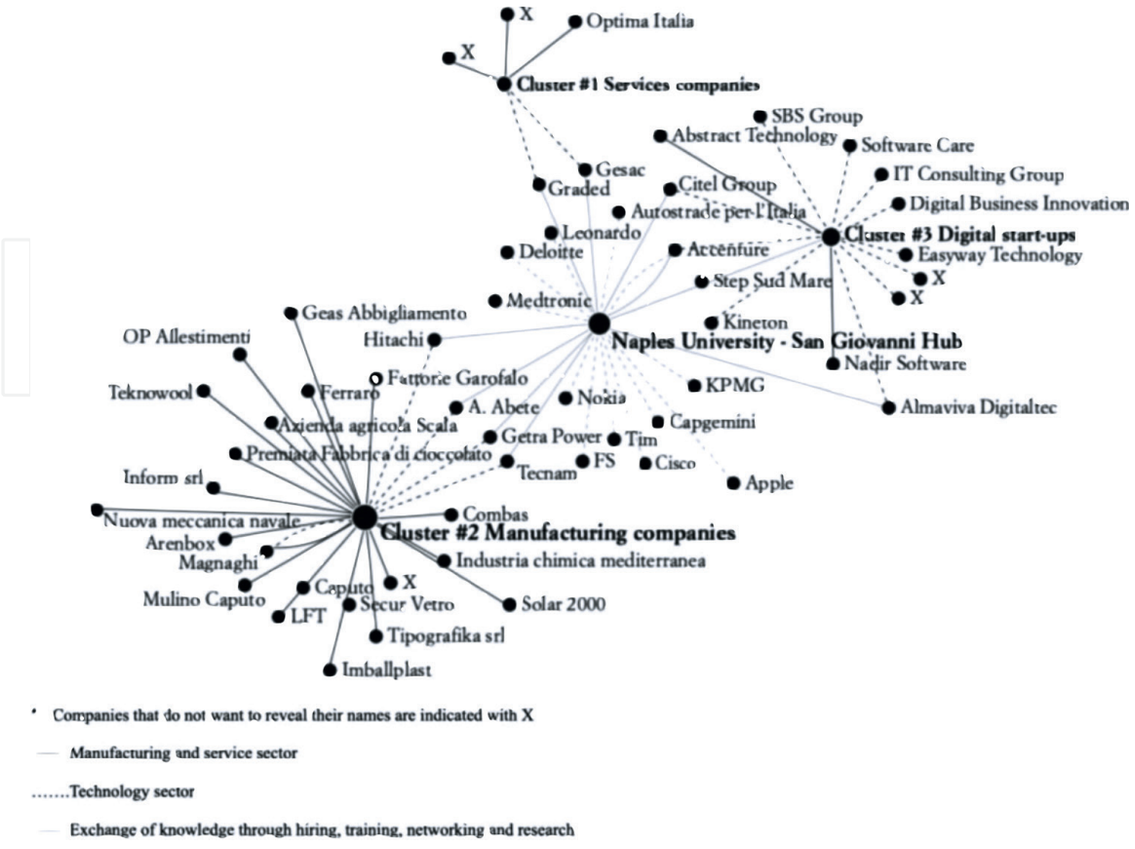

Figure 2.
Cumulative share of participants by academy and financial contribution by partner (2016–2023).

premises to meet newly emerging needs. Thus, the exchange of resources depends not only on trust and network relations, but also on the relative efficiency to adapt to contexts ([4]; see also [17]).

The university decision-making roles have rested on a results-driven management approach rather than the formal governance hierarchy to effectively address co-innovation risks, including the gaps and inconsistencies in role expectations and performance. A co-innovation risk has first comprised completing both facilities and procedures to host training activities to assure highly interactive learning. The open classrooms with modular tables, screens, blackboards, and coaches that furnish all soundproofed environments within the premises accommodated learning needs, social interactions, and networking. The recruitment of mentors and tutors tested for their technical competence also assured interpersonal skills for team and group management. Another co-innovation risk has involved addressing the priorities for some partners that others did not share. Collaboration with Apple, for instance, was conditional on the confidentiality of all teaching materials, whereas Deloitte's priority was to introduce as many class tutors as possible to manage peer interaction.

Other co-innovation risks have involved inconsistent expectations of partner alignment. The challenge of coordinating multilateral relations has entailed not only managing cooperation with and among the partners but also their competitive pressures. Both complementary and competitive relations have affected value creation for end-users. Competition also involves the closer knowledge ecosystems of training partnerships. For instance, the network of companies linked to the Digita Academy cooperates in the training delivery but competes to attract the best participants in applied research activities. With a hundred companies involved in the training, the

Digita Academy benefits from Deloitte's established reputation within the proximity and global marketplace. This network supports Deloitte's alignment in the ecosystem and contributes to Digita's role and activities and the collaborations learners develop with businesses for their project work. The access to these networks makes it possible to mobilize resources and capabilities for local innovative performance.

Competition within Digita's network feeds back on the ecosystem partners. Over 2019, Accenture, being an external competitor that was hiring Apple and Digita trainees, has become a new partner by creating the Cyber HackAdemy. This transformation shows—according to Adner [30]—that competition operates on two levels. Within the ecosystem, to secure activities, positions, and roles, competition affects the distribution and capture of value among partners. Through the ecosystem, competition between actors influences the creation and acquisition of value compared to rivals' constellations both inside and outside the ecosystem [30]. Although these levels are separated, they interact: the study findings show that partners' competitiveness grows with new entrants, but their participation in creating knowledge, the value of this knowledge, the rarity, and inimitability of these resources and products contribute to their complementarity.

The latter also confirms that an ecosystem is a community in constant transformation that has to create new value through collaboration over competing alternatives [44]. It is not individual firms but entire networks of companies that compete with one another in what is called the networked economy [45]. This nested nature of ecosystems and the fact that they consistently need to evolve and adapt underline the fact that transformation is a key concern in understanding the success and failure of ecosystems [46, 47].

Considering the collaborations through a single-layer network analysis between the university and the sampled local companies, interdependencies emerge within processes of (i) recruiting trainees who complete their digital training; (ii) taking part in the yearly initiatives (such as business fairs, hackathons, boot camps, and roadshows) associated with digital instruction; (iii) partnering to deliver digital training offerings outside traditional university courses; and (iv) cofinancing joint laboratories for measurement, quality assessment, certification, and concept-proofing [17].

For each type of collaboration mentioned, **Table 4** epitomizes the sources of interdependencies and the learning and innovation mechanisms that can get strengthened in the region. In learning by hiring, crucial are tech skill availability, labor mobility, and the labor market's efficiency in the region. In learning by partnering, essential is the existence of an entrepreneurial ecosystem interfirm links that share business and commercialize their products, besides knowledge-based connections with the university. The study findings highlight that although university-business collaborations have increased, competitive pressures persist at the territorial level because of the limited experiences of cooperation among the firms located in the region [17].

Thus, the academy system has created several partnerships operating at the local and global levels, but business cooperation networks remain modest among regional companies [17]. **Figure 1** represents the network that includes all sampled companies and their relationships with University of Naples, besides global partners. Since the degree of relatedness among the sampled firms is low, this networked representation features bilateral alliances rather than a multilateral configuration of a knowledge ecosystem.

To recap: The case study examined has presented a co-innovation process involving multinational technology companies and the university operating in a less innovative European region. The evidence confirms the first hypothesis of this study concerning the alignment between partners. The study findings show that

both the University of Naples and Apple were focal actors capable of generating a knowledge-based value creation strategy that has attracted other global players as complementors. A knowledge ecosystem has emerged showing both complementary and competitive relationships in knowledge exploration. Competitive pressures have also led players to focus on short-term benefits rather than the sustainability of the value created [4, 30, 48]. Thus, the future of cooperation requires identifying and performing new critical functions, such as the scouting of potential new entrants, the interaction with new affiliates, the change in resource allocation priorities, and further scaling up training offerings facing demand saturation.

The second hypothesis concerning the strengthening of university-industry collaborations is only partially confirmed. As examined elsewhere [17], the knowledge ecosystem includes all multinationals partnering with the university. This finding suggests that when it comes to cooperation networks, knowledge stemming from nonlocal sources is crucial for innovation [49] and extra-cluster linkages are important for innovation [50] and might even be crucial for cluster firms to avoid lock-ins [51]. However, although the academy system has created several partnerships operating at the local and global levels, interfirm links in cooperation networks with regional companies are still modest [17]. A clear sign of persistent competitive pressures, lacking networked relationships among local firms, may lead to knowledge exploitation at the expense of long-term knowledge creation and sharing [4, 52]. This finding confirms that spatial interaction per se does not automatically induce knowledge spillovers or innovation diffusion and warns that even short-term favorable results may turn into development traps [13, 53]. Finally, in assessing the university societal impact, the recursive experiences of collaborations question linear causal inference models, paving the way for multilayer network analyses to explore the multilateral and multilevel logic of cooperation in knowledge ecosystems. The multilevel network analysis makes it possible not only to take a snapshot of existing complementarities but also to simulate potential connections to be activated through meso-level policy interventions.

5. Conclusions

The growing interest in university-led innovation was investigated with the prism of the knowledge ecosystem that has helped reconstruct the experience of collaboration between the University of Naples and several global IT and large manufacturing players. Creating a learning space within a g-local context, the knowledge ecosystem observed in the case analysis has grown through an efficient and inclusive organization. This has oriented toward a more performance-based resource allocation, management, and coordination system that has mostly innovated the training approach to nontraditional students of large and generalist university based in a dense urban and less-developed area. Multilateral relationships between the university and its global and regional partners have developed complementarities, but competition within, across, and outside the ecosystem may compromise the sustainability of knowledge-based value creation. In the uneven development context of co-innovation, the presence of the university can enhance multiple innovation mechanisms that create value at different scales. Multiscale value creation processes require investigating embedded, adaptive, and emergent complementarities that encompass only some actors in some niches of the system. A multilayer network analysis focused on the meso-level can identify communities in the ecosystem and recognize the strategic role of actors within them.

The study presents some limitations. In qualitative analysis, results are interviewee-contingent and context-specific findings. Interviewee cognitive dissonance could cause inaccurate assessments of knowledge-based cooperative processes, motivating them to report changes that brought beliefs and behaviors into alignment, thus potentially overestimating (or underestimating) knowledge sharing and collaborative practices. Retrospective reports are themselves errorprone, as respondents could inflate their current standing or implicit theories assuming value creation. Although a single case study analysis precludes any generalizability of results, the rich evidence base associated with the case highlights lessons learned for similar situations.

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