

# Innovation Ecosystems in Italy: Hub-and-Spoke Governance, Territorial Leadership, and Sustainable Pathways beyond the NRRP

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## Abstract

This study analyzes the Italian policy for the creation of Innovation Ecosystems, launched under the National Recovery and Resilience Plan (NRRP), with a focus on the Hub-and-Spoke governance model. In recent years, innovation ecosystems have been increasingly recognized as key instruments for fostering competitiveness, social cohesion, and sustainable territorial development. However, the effectiveness of governance configurations in achieving these goals remains underexplored, particularly in complex and heterogeneous national contexts. The research aims to assess how the Hub-and-Spoke model influences the development of resilient, inclusive, and sustainable territorial innovation systems in Italy. The study adopts a qualitative and comparative approach based on documentary analysis of the eleven approved ecosystems. Six analytical variables are used to examine governance structures, including the degree of centralization, the composition of partnerships, openness to new actors, thematic coherence, and the role of territorial leadership. The findings reveal significant heterogeneity across ecosystems and highlight critical issues, including the concentration of decision-making power in hubs, uneven involvement of local actors, and, in some cases, the dominance of private stakeholders. These dynamics may limit inclusiveness, reduce adaptive capacity, and weaken alignment with territorial priorities, thereby affecting long-term sustainability. The study contributes to the literature on innovation ecosystems and network governance by providing empirical evidence on the implementation of the Hub-and-Spoke model in a national policy context. It also offers practical insights for policymakers, emphasizing the need to strengthen horizontal collaboration, empower territorial leadership, and design governance models capable of ensuring resilience, inclusiveness, and sustainability beyond temporary policy frameworks.

## Keywords

Innovation Ecosystems, Network Governance, Hub-and-Spoke, Territorial Leadership, NRRP Policy.

## Introduction

In recent years, innovation has increasingly been recognized as a strategic lever for addressing economic, environmental, and social challenges. To produce systemic value, however, innovation requires structured forms of collaboration among universities, public institutions, businesses, and local actors. This vision reflects the open innovation and collaborative governance paradigms, which emphasize networks of interdependent stakeholders and shared responsibilities in pursuit of collective goals.

In Italy, the Ministry of University and Research, within the framework of the National Recovery and Resilience Plan, has promoted the creation of eleven Innovation Ecosystems. These ecosystems have been designed around a Hub-and-Spoke governance model, a structure originally developed in sectors such as healthcare and transportation. Its application in public innovation policy, however, remains relatively unexplored and raises questions about its capacity to adapt to the complexity and heterogeneity of the Italian territorial context.

This study addresses these issues by examining the design and governance of the newly established ecosystems. The central question guiding the analysis is how the Hub-and-Spoke configuration adopted in Italy shapes the evolution of territorial innovation ecosystems, particularly in terms of power distribution, local actor engagement, and adaptive capacity to align with the policy goals of

resilience, inclusiveness, and sustainability. This study aims to critically examine the governance configuration of Innovation Ecosystems in Italy, focusing on the Hub-and-Spoke model and its implications for territorial leadership, inclusiveness, and sustainability. The research adopts a qualitative and comparative approach based on documentary analysis of the eleven ecosystems funded under the NRRP, allowing for the identification of governance patterns and structural dynamics across cases.

The paper is structured as follows: the next section reviews the literature on innovation ecosystems and network governance; the methodology section outlines the research design and analytical framework; the results section presents the comparative analysis of the ecosystems; and the discussion and conclusions highlight the main theoretical and policy implications.

## Literature review

Innovation ecosystems have been widely studied in recent decades as key drivers of competitiveness, resilience, and social development. Chesbrough (2003) introduced the open innovation paradigm, highlighting how porous organizational boundaries and the circulation of knowledge across institutions can enhance innovation capacity. Building on this perspective, Carayannis and Campbell (2009) conceptualized innovation within multi-helix frameworks, in which collaboration among universities, industry, government, and civil society creates systemic value. More recently, Autio et al. (2018) have reinforced the idea of ecosystems as dynamic, multi-actor systems whose success depends on effective coordination and governance mechanisms.

From a governance perspective, the literature emphasizes the need for collaborative arrangements. Powell and Grodal (2006) underline the importance of inter-organizational networks in fostering learning and innovation, while Ansell and Gash (2008) stress the role of collaborative governance in addressing complex societal challenges through participation, trust-building, and shared responsibility. Provan and Kenis (2008) provide one of the most influential frameworks for network governance, distinguishing between shared governance, lead organization, and network administrative organization models. They highlight how each configuration involves trade-offs between efficiency, inclusiveness, and legitimacy. Building on this work, Kenis et al. (2019) explore how network governance evolves over time and how centralization and inclusiveness are balanced in practice.

Within this debate, the Hub-and-Spoke model has attracted attention for its ability to coordinate large and diverse networks, particularly in sectors such as healthcare and transportation. However, scholars have also noted its limitations, especially its tendency to concentrate decision-making power in the hub, reducing the autonomy of peripheral actors and constraining inclusiveness. These concerns are especially relevant in national contexts characterized by administrative fragmentation and territorial disparities. Beer and Clower (2014) highlight the role of territorial leadership in mobilizing local resources and fostering place-based strategies, while Heifetz et al. (2009) emphasize adaptive leadership as a key factor in enabling actors to respond to complex, evolving challenges.

Despite these contributions, there is still limited critical reflection on how governance models such as Hub-and-Spoke operate in practice within public innovation policies. In particular, little is known about their effectiveness in contexts like Italy, where strong territorial heterogeneity and institutional complexity shape the dynamics of collaboration. This study contributes to filling this gap by examining how the Hub-and-Spoke model has been implemented in the new Innovation Ecosystems promoted under the National Recovery and Resilience Plan, assessing its implications for resilience, inclusiveness, and sustainability.

Recent contributions have further expanded the understanding of innovation ecosystems as territorially embedded and policy-driven configurations, emphasizing their role in fostering resilience, inclusiveness, and sustainable development (Carayannis et al., 2022; Granstrand & Holgersson, 2020; OECD, 2024). In this perspective, governance models are increasingly interpreted not only as coordination mechanisms but as enabling structures that shape power distribution, stakeholder participation, and long-term adaptability.

However, despite the growing body of literature on innovation ecosystems and collaborative governance, limited attention has been devoted to the application of Hub-and-Spoke models within public innovation policies, particularly in complex territorial contexts such as Italy. This gap highlights the need for empirical investigation into how such governance configurations operate in practice and how they influence ecosystem performance in terms of inclusiveness, resilience, and sustainability.

## Research methodology

The research adopts a qualitative, exploratory, and inductive approach to examine the Hub-and-Spoke governance model implemented in the eleven Innovation Ecosystems established in Italy within the framework of the National Recovery and Resilience Plan. The analysis is based on official documentary sources and indirect observation of the ecosystems' organizational structures. The main documents examined include the Public Notice No. 3277/2021 of the Ministry of University and Research, ministerial approval decrees, project descriptions, hub statutes, and institutional web pages. These materials made it possible to identify the actors involved, the distribution of roles, and the legal nature of the leading organizations.

Building on this corpus, the ecosystems were classified and compared using six ex ante-defined variables applied consistently across all cases. These variables include the legal structure and duration of the hubs, the composition of the partnerships in terms of public and private as well as territorial and national members, the diversification of spoke leaders, the degree of governance centralization, the extent of stakeholder engagement at the local level, and the openness of governance structures to new actors. A comparative matrix was developed to ensure uniform application of these criteria and to highlight similarities and differences among ecosystems.

The analytical framework derived from this process links the central research question to observable variables, data sources, and evaluation criteria. Table 1 summarizes this framework, showing how the concepts of resilience, inclusiveness, sustainability, power distribution, openness, and accountability are operationalized within the study.

**Table 1. Analytical framework: from research question to evidence**

| <i>Key concept</i>                   | <i>Observable variable</i>                                                           | <i>Data sources</i>                                         | <i>Criterion of analysis</i>                                           |
|--------------------------------------|--------------------------------------------------------------------------------------|-------------------------------------------------------------|------------------------------------------------------------------------|
| <b>Resilience</b>                    | Duration of the hub, adaptive governance, post-Plan vision                           | Statutes, legal duration, openness to new members           | Long-term, institutional flexibility and diversification               |
| <b>Inclusiveness</b>                 | Composition of partnership (public/private; North/South; local authorities)          | Tables 4–5–6                                                | Presence of peripheral actors, local authorities, and the third sector |
| <b>Sustainability</b>                | Alignment between thematic areas and territorial vocations                           | Table 3, public calls, project guidelines                   | Coherence between mission and local industrial sectors                 |
| <b>Power distribution</b>            | Role of spoke leaders, degree of decision-making centralization                      | Governance analysis – Table 6                               | Autonomy, plurality, and presence of multiple spoke leaders            |
| <b>Openness of governance</b>        | Admission of new members, selection mechanisms                                       | Statutes, legal forms (foundation, consortium, company)     | Accessibility, bottom-up mechanisms                                    |
| <b>Accountability and engagement</b> | Horizontal interactions between spokes, public communication, stakeholder engagement | Official documents, institutional websites, cascading calls | Active participation, involvement of civil society                     |

Finally, it is important to acknowledge the methodological limitations. The study does not include primary data collection through interviews or surveys; it relies exclusively on official documentary sources. While these sources are reliable, they may not fully capture informal dynamics and relational

aspects of governance. Moreover, the inductive approach limits the generalizability of the findings but allows for a detailed preliminary exploration of the phenomenon.

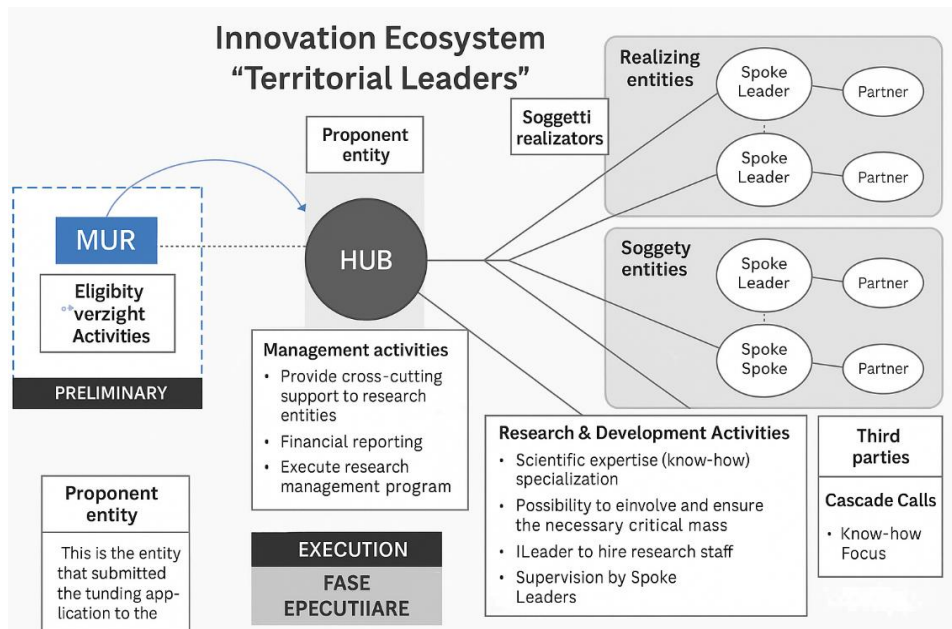


Figure 1. The Model Hub & Spoke: Innovation Ecosystem “Territorial Leaders”

Source: Author’s elaborations

The creation of Innovation Ecosystems – Territorial Leaders (EI-LT) promoted by the Ministry of University and Research was conceived as a large-scale policy intervention aimed at fostering technology transfer, digital transformation, and sustainable development. The ecosystems were designed as multi-level networks combining universities, research centers, enterprises, and local institutions, governed through a Hub-and-Spoke model. In this configuration, hubs are entrusted with administrative and coordination functions, while spokes are responsible for research and innovation activities. As illustrated in Figure 1, this architecture establishes a formal division of roles: the hub ensures financial and managerial accountability, spoke leaders supervise research activities and stakeholder engagement, and affiliated third parties contribute specialized know-how through cascading calls.

Table 2. Distribution of activities between Hubs and Spokes in the EI-LT

| Main activities of the ecosystems                             | Hub | Spoke |
|---------------------------------------------------------------|-----|-------|
| Administrative and management activities                      | X   | X     |
| Recruitment of fixed-term staff                               |     | X     |
| Research projects, including projects open to external actors |     | X     |
| Training activities and activation of doctoral programs       |     | X     |
| Technology transfer activities                                |     | X     |
| Third mission activities                                      |     | X     |
| Public engagement activities                                  |     | X     |
| Support for start-ups and spin-offs                           |     | X     |
| Highly qualified research managers                            |     | X     |

Although this model provides a standardized framework, the comparative analysis of the eleven approved ecosystems reveals strong heterogeneity in both structure and practice. The distribution of activities between hubs and spokes (Table 2) confirms that while decision-making power is formally centralized, most operational functions—research, doctoral training, technology transfer, third mission, and public engagement—are delegated to spokes. This suggests a design that combines central

oversight with decentralized implementation, though the balance between the two is not always consistent.

**Table 3. Territorial distribution, thematic areas, and objectives of the EI-LT**

| <i>n.</i>    | <i>Ecosystem</i>                                                   | <i>Region</i>                                                                                | <i>Thematic Area</i>                                                           | <i>Objective</i>                                                                                                                                                                                                                                    |
|--------------|--------------------------------------------------------------------|----------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>NORTH</b> |                                                                    |                                                                                              |                                                                                |                                                                                                                                                                                                                                                     |
| 1            | ECOSISTER – Ecosystem for Sustainable Transition in Emilia-Romagna | Emilia-Romagna                                                                               | 5. Climate, Energy, and Sustainable Mobility                                   | Promote sustainable transition and circularity in local production systems by developing innovative technologies to improve environmental conditions, enhance waste management, and increase energy efficiency in industrial supply chains.         |
| 2            | NODES – North-West Digital and Sustainable Ecosystem               | Piedmont, Valle d'Aosta (and neighboring provinces)                                          | 4. Digital, Industry, Aerospace                                                | Foster digitalization and sustainability across key sectors such as advanced manufacturing, sustainable mobility, aerospace, agri-food, tourism, culture, and health, and build collaboration networks among research, industry, and the territory. |
| 3            | iNEST – Interconnected North-East Innovation Ecosystem             | Veneto, Friuli Venezia Giulia, Autonomous Province of Trento, Autonomous Province of Bolzano | 4. Digital, Industry, Aerospace                                                | Create an integrated network for innovation and digitalization to support small and medium-sized enterprises, enhance the competitiveness of local supply chains, and promote digital transition in North-Eastern Italy.                            |
| 4            | MUSA – Multilayered Sustainability Action                          | Lombardy                                                                                     | 5. Climate, Energy, and Sustainable Mobility                                   | Implement integrated strategies for multilayer urban sustainability, addressing urban regeneration, building energy efficiency, sustainable mobility, and overall improvements in urban quality of life.                                            |
| 5            | RAISE – Robotics and AI for Socio-Economic Empowerment             | Liguria                                                                                      | 4. Digital, Industry, Aerospace                                                | Develop and commercialize technological solutions related to robotics and artificial intelligence to address territorial and industrial needs in Liguria.                                                                                           |
| 6            | Rome Technopole                                                    | Lazio                                                                                        | 4. Digital, Industry, Aerospace                                                | Strengthen research and development in energy transition, digital transition, health, and biopharma to improve regional competitiveness.                                                                                                            |
| 7            | THE – Tuscany Health Ecosystem                                     | Tuscany                                                                                      | 1. Health                                                                      | Support innovation in life sciences, integrating research, training, and advanced technologies to improve healthcare services, develop biomedical devices and innovative drugs, and promote population well-being.                                  |
| <b>SOUTH</b> |                                                                    |                                                                                              |                                                                                |                                                                                                                                                                                                                                                     |
| 8            | e.ins – Ecosystem of Innovation for Next Generation Sardinia       | Sardinia                                                                                     | 2. Humanistic Culture, Creativity, Social Transformation, Society of Inclusion | Strengthen small and medium enterprises through synergies between universities, research centers, and the Sardinian entrepreneurial network, fostering co-creation of value and technology transfer.                                                |
| 9            | SAMOTHRAC E – Sicilian MicroNanoTech Research and Innovation       | Sicily                                                                                       | 4. Digital, Industry, Aerospace                                                | Promote advanced training, interdisciplinary research, and technological innovation in the South, focusing on territorial specialization in microelectronics and                                                                                    |

|           | Center                                                                                             |                         |                                              |                                                                                                                                                                                                                                                                                   |
|-----------|----------------------------------------------------------------------------------------------------|-------------------------|----------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>10</b> | VITALITY – Innovation, Digitalization and Sustainability for the Diffused Economy in Central Italy | Abruzzo, Marche, Umbria | 4. Digital, Industry, Aerospace              | micro/nanotechnologies, benefiting local industry and society. Strengthen the diffused economy of Central Italy through digitalization and sustainable innovation, leveraging territorial resources and improving connections among institutions, enterprises, and civil society. |
| <b>11</b> | Tech4You – Technologies for Climate Change Adaptation and Quality of Life Improvement              | Basilicata, Calabria    | 5. Climate, Energy, and Sustainable Mobility | Develop advanced technologies for climate change adaptation and territorial resilience, while improving the quality of life, particularly in Southern regions.                                                                                                                    |

Geographically, ecosystems are unevenly distributed, with seven located in Northern Italy and only four in the South. Thematic specialization is similarly polarized: as shown in Table 3, most ecosystems converge on digital technologies, aerospace, and sustainable mobility, while only one ecosystem focuses explicitly on health sciences. This pattern reflects not only the priorities of the national call but also pre-existing disparities in regional scientific and industrial capacities, raising questions about the alignment with local vocations.

**Table 4. Ecosystem partners and funding allocations (MUR)**

| <i>EI-LT</i>           | <i>Proponent Institution – Public Administration</i> | <i>Partners</i> | <i>No. of Universities</i> | <i>No. of Public Entities / Research Centers</i> | <i>No. of Private Actors</i> | <i>Funding Allocated (EUR million)</i> |
|------------------------|------------------------------------------------------|-----------------|----------------------------|--------------------------------------------------|------------------------------|----------------------------------------|
| <b>e.ins</b>           | University of Sassari                                | 18              | 4                          | 2                                                | 12                           | 119.00                                 |
| <b>ECOSISTER</b>       | University of Bologna                                | 23              | 6                          | 4                                                | 13                           | 110.00                                 |
| <b>iNEST</b>           | University of Padua                                  | 24              | 9                          | 3                                                | 12                           | 109.87                                 |
| <b>MUSA</b>            | University of Milano-Bicocca                         | 24              | 5                          | 0                                                | 19                           | 1110.00                                |
| <b>NODES</b>           | Polytechnic University of Turin                      | 24              | 8                          | 3                                                | 13                           | 109.99                                 |
| <b>RAISE</b>           | University of Genoa                                  | 25              | 8                          | 1                                                | 15                           | 109.95                                 |
| <b>Rome Technopole</b> | Sapienza University of Rome                          | 25              | 5                          | 4                                                | 16                           | 110.00                                 |
| <b>SAMOTHRACE</b>      | University of Catania                                | 28              | 4                          | 7                                                | 17                           | 119.00                                 |
| <b>Tech4You</b>        | University of Calabria                               | 25              | 8                          | 4                                                | 13                           | 119.00                                 |
| <b>THE</b>             | University of Florence                               | 22              | 7                          | 4                                                | 9                            | 110.00                                 |
| <b>VITALITY</b>        | University of L'Aquila                               | 24              | 10                         | 4                                                | 10                           | 116.00                                 |

Partner composition also varies significantly. Although funding allocations are relatively homogeneous, ranging from €109 to €119 million, ecosystems differ in the weight they attribute to private actors and public research institutions. Table 4 shows that while some cases, such as MUSA, are dominated by enterprises, others, such as VITALITY, maintain a balanced presence of universities and private partners. These divergences illustrate different interpretations of the ecosystem as either an academic-led or market-oriented initiative.

**Table 5. Legal structures and governance models of the Hubs**

| <i>EI-LT</i>           | <i>Legal form</i>               | <i>Openness to new members</i> | <i>Duration</i>             | <i>No. of members</i> | <i>Member types</i>                                     | <i>Territorial members</i> | <i>National members</i> |
|------------------------|---------------------------------|--------------------------------|-----------------------------|-----------------------|---------------------------------------------------------|----------------------------|-------------------------|
| <b>Ecosister</b>       | Foundation                      | Yes                            | 20 years                    | 10                    | Founders                                                | 6 UNI, 1 PR, 3 IR          |                         |
| <b>Vitality</b>        | Foundation                      | Yes                            | Unlimited                   | 9                     | Founders                                                | 8 UNI, 1 IR                | –                       |
| <b>Rome Technopole</b> | Foundation                      | Yes                            | Unlimited                   | 39                    | Founders, Promoters, Associate Participants, Supporters | 9 UNI, 2 PR, 3 IL          | 4 IR, 17 PR, 2 TS, 1 IN |
| <b>Samothrace</b>      | Foundation                      | Yes                            | Unlimited                   | 25                    | Founders                                                | 4 UNI, 17 PR               | 4 IR                    |
| <b>iNEST</b>           | Consortium                      | Yes                            | 10 years                    | 12                    | Founders                                                | 9 UNI, 3 IR                | –                       |
| <b>Tech4You</b>        | Consortium Company (S.c.a.r.l.) | Yes                            | 30 years (until 31/12/2052) | 13                    | Founders                                                | 4 UNI, 1 PR, 4 IL          | 2 IR, 1 TS, 1 IN        |
| <b>MUSA</b>            | Consortium Company (S.c.a.r.l.) | Yes (with 49% PR limit)        | 28 years (until 31/12/2050) | 13                    | Founders                                                | 4 UNI, 2 IL, 2 PR          | 1 IR, 4 PR              |
| <b>THE</b>             | Consortium Company (S.c.a.r.l.) | Yes                            | N/A                         | 12                    | Founders                                                | 7 UNI, 2 IR                | 3 IR                    |
| <b>e.ins</b>           | Consortium Company (S.c.a.r.l.) | Yes                            | N/A                         | 3                     | Founders                                                | 2 UNI, 1 PR                | –                       |
| <b>NODES</b>           | Consortium Company (S.c.a.r.l.) | Yes                            | 6 years (until 31/12/2028)  | 7                     | Founders                                                | 7 UNI                      | –                       |
| <b>RAISE</b>           | Consortium Company (S.c.a.r.l.) | No                             | N/A                         | 8                     | Founders                                                | 1 UNI, 1 PR, 1 IL          | 2 PR, 1 TS, 2 IR        |

Governance structures further highlight this variety. As summarized in Table 5, most ecosystems established foundations or consortium companies, but their openness to new members and long-term sustainability differ widely. Some hubs, like NODES, are time-limited, while others, such as Vitality or Rome Technopole, were founded with unlimited duration. Rome Technopole, in particular, stands out for adopting an inclusive governance model, with 39 members spanning universities, public institutions, private actors, and third-sector organizations—an unusual case of territorial openness compared to the more closed structures of other ecosystems.

**Table 6. The Model Hub & Spoke: Innovation Ecosystem “Territorial Leaders”**

| <b>EILT</b>      | <b>Implementing Entity - (Spoke) PA/PR</b> |                       |                       |                       |                       |                       |                       |                       |                       |                        |
|------------------|--------------------------------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|------------------------|
|                  | <b>Leader Spoke 1</b>                      | <b>Leader Spoke 2</b> | <b>Leader Spoke 3</b> | <b>Leader Spoke 4</b> | <b>Leader Spoke 5</b> | <b>Leader Spoke 6</b> | <b>Leader Spoke 7</b> | <b>Leader Spoke 8</b> | <b>Leader Spoke 9</b> | <b>Leader Spoke 10</b> |
| <b>RAISE</b>     | CNR (9)                                    | ITT (9)               | CNR (9)               | UniGe (10)            | ITT (4)               | n.a                   | n.a                   | n.a                   | n.a                   | n.a                    |
| <b>Ecosister</b> | CNR (13)                                   | UNIMORE (10)          | UNIBO (14)            | UNIPR (10)            | UNIFE (9)             | UNIPR (4)             | n.a                   | n.a                   | n.a                   | n.a                    |
| <b>tech4You</b>  | CNR                                        | UNICAL (8)            | UNIRC                 | Unibas                | UMG                   | UNICAL                | n.a                   | n.a                   | n.a                   | n.a                    |

|                        |                   |              |                   |                    |                  |                                  |                                           |                              |                                  |                               |
|------------------------|-------------------|--------------|-------------------|--------------------|------------------|----------------------------------|-------------------------------------------|------------------------------|----------------------------------|-------------------------------|
|                        | (3)               |              | (5)               | (3)                | (3)              | (7)                              |                                           |                              |                                  |                               |
| <b>MUSA</b>            | UniMiB<br>(7)     | UniMi<br>(9) | PoliMI<br>(10)    | SDA Bocconi<br>(5) | PoliMI<br>(4)    | UniMiB<br>(6)                    | n.a                                       | n.a                          | n.a                              | n.a                           |
| <b>Rome Technopole</b> | SAPIENZA<br>(18)  | TVG<br>(12)  | Roma Tre<br>(9)   | U. Cassino<br>(5)  | U. Tuscia<br>(5) | Sapienza<br>(14)                 | n.a                                       | n.a                          | n.a                              | n.a                           |
| <b>NODES</b>           | Polito<br>(6)     | UniTO<br>(8) | Uninsubria<br>(5) | Univda<br>(4)      | UPO<br>(5)       | Unipv<br>(3)                     | Unisg<br>(4)                              | n.a                          | n.a                              | n.a                           |
| <b>SAMOTHRACE</b>      | UNICT<br>(2)      | UniMe<br>(2) | UNIPA<br>(2)      | <b>CNR</b><br>(4)  | INFN<br>(3)      | <i>STMicroelectronics</i><br>(1) | <i>Meridionale Impianti s.p.a.</i><br>(7) | <i>UPMC Italy</i><br>(7)     | <i>Quantum Leap IPSRL</i><br>(4) | n.a                           |
| <b>iNEST</b>           | Unibz<br>(6)      | UniTn<br>(4) | UNIUD<br>(7)      | U. IUAUV<br>(5)    | UniPd<br>(4)     | U. Ca' Foscari<br>(4)            | Uni Verona<br>(4)                         | Univ Trieste<br>(7)          | SISSA<br>(3)                     | n.a                           |
| <b>e.ins</b>           | UniSS<br>(3)      | UniSS<br>(2) | IZS<br>(4)        | CCIAA<br>(3)       | UniSS<br>(2)     | UNICA<br>(2)                     | UNICA<br>(4)                              | <i>So.G.Aer S.p.A</i><br>(2) | UNICA<br>(1)                     | <i>CYBERTECH S.r.l</i><br>(3) |
| <b>VITALITY</b>        | UnivAq<br>(5)     | GSSI<br>(4)  | UniTE<br>(3)      | UniCh<br>(2)       | UNIVPM<br>(5)    | UNICAM<br>(3)                    | UniMc<br>(4)                              | UWIC<br>(4)                  | UniPG<br>(4)                     | UniPG<br>(3)                  |
| <b>THE</b>             | <b>CNR</b><br>(3) | UNIFI<br>(2) | UNIFI<br>(7)      | UNIFI<br>(5)       | UNIFI<br>(6)     | UNISI<br>(3)                     | UNISI<br>(2)                              | SNS<br>(5)                   | UNIFI<br>(9)                     | SSSA<br>(5)                   |

**Legend:**

- Each row corresponds to one ecosystem.
- Official acronyms indicate spoke leaders (universities or research institutes).
- *Bold italics (in red)* indicate private partners.
- Numbers in parentheses show the number of partners in each spoke.
- Light grey shading highlights institutions that act as leaders in multiple spokes within the same ecosystem.
- Dark grey shading indicates the National Research Council (CNR), which appears in multiple ecosystems.

Finally, the mapping of spoke leaders (Table 6) illustrates both recurring patterns and unique features. The National Research Council (CNR) emerges as a pivotal actor, leading multiple spokes across different ecosystems. Private players such as *STMicroelectronics* and *Meridionale Impianti* also assume leadership roles, signaling an effort to integrate industrial expertise. In some ecosystems, however, leadership is concentrated in a few institutions, with the same university or research body coordinating several spokes. The number of partners per spoke also varies greatly, ranging from small groups of two or three to clusters of more than ten, revealing different scales of collaboration and territorial reach.

Overall, the ecosystems display a tension between formal balance and actual asymmetries. While the Hub-and-Spoke model establishes a clear division of roles, in practice, there is a strong tendency toward centralization in the hubs and variable empowerment of spoke leaders. The geographical and thematic concentration further accentuates pre-existing disparities, suggesting that the model's potential for resilience, inclusiveness, and sustainability depends largely on how governance structures are interpreted and implemented at the local level.

## Discussion and conclusions

### *Critical reflection on the findings*

The comparative analysis of the eleven Innovation Ecosystems – Territorial Leaders (EI-LT) provides an opportunity to reflect on the coherence and effectiveness of the Hub-and-Spoke configuration promoted by the Ministry of University and Research in addressing the goals of resilience, inclusiveness, and sustainability.

Although the model offers a formal structure capable of regulating cooperation between public and private actors, the collected data reveal strong internal asymmetries between hubs and spokes. Decision-making power remains heavily concentrated at the center, while peripheral partners often play a merely formal role. In some cases (e.g., Ecosister, e.INS, THE), power is concentrated in a limited number of actors holding multiple leadership roles simultaneously, undermining the territorial distribution of competences. From a resilience perspective, this concentration may reduce the system's adaptive capacity and its ability to respond effectively to local needs. This highlights the absence of fully operational territorial leadership, thereby reducing the model's transformative potential (Heifetz et al., 2009).

A second element concerns the quantitative dominance of private actors. In the case of MUSA, public research institutions are completely excluded, while ecosystems such as VITALITY display an almost perfect balance between universities and enterprises. In terms of inclusiveness, the lack of a genuinely multilateral vision in governance may limit these ecosystems' ability to address social and systemic challenges, thereby restricting the diversity of perspectives needed for co-creation.

From a temporal perspective, many hubs opted for a legal form of unlimited or long-term duration (beyond 20 years), signaling an attempt at institutional consolidation. However, this was not always accompanied by a sustainability strategy independent of National Recovery and Resilience Plan (PNRR) funds. Only a few ecosystems, such as Rome Technopole, show clear signs of structural openness to external actors, suggesting that long-term sustainability depends not only on formal duration but on the capacity to evolve beyond initial funding frameworks.

At the thematic level, there is a strong convergence on the “Digital, Industry, Aerospace” domain, while only one ecosystem focuses on the health sector. This misalignment between territorial priorities and funded initiatives raises questions about the consistency of these initiatives with local vocations. It threatens the principle of territorial resilience emphasized in European strategies, potentially limiting ecosystems' capacity to generate context-specific, inclusive development paths.

In summary, the Italian Hub-and-Spoke model, while formally promoting cooperation, does not automatically ensure inclusiveness, resilience, and balanced decision-making, especially in fragile or peripheral territories. The risk is the reproduction of centralistic dynamics that undermine the potential of distributed governance.

Overall, the findings highlight that the effectiveness of the Hub-and-Spoke model depends on its ability to balance coordination and territorial autonomy, while fostering inclusive participation, adaptive capacity, and long-term sustainability.

### ***Theoretical implications***

This research contributes to the debate on network governance in innovation ecosystems by problematizing the application of the Hub-and-Spoke model in national contexts characterized by strong territorial and institutional heterogeneity, such as Italy. Contrary to what was theorized by Provan and Kenis (2008) and later by Chaminade and Vang (2008), the Italian case resembles more a “hub-dominant” configuration than a genuinely distributed governance. This reveals a limitation of the model in addressing challenges of adaptation, resilience, and local legitimacy, suggesting the need for integration with multi-level or collaborative logics.

The main theoretical contribution lies in showing that, in public contexts marked by high bureaucratization, the Hub-and-Spoke model can become an effective coordination tool only if accompanied by mechanisms of lateral accountability and bottom-up openness. The research also highlights that the model's success depends less on its formal structure than on the operational and relational capacities of territorial leaders to activate meaningful networks on the ground.

These findings also resonate with recent debates on innovation ecosystems as adaptive, place-based governance structures, in which value creation depends on the balance between coordination and distributed agency (Autio et al., 2018; Granstrand & Holgersson, 2020). In this sense, the Italian case confirms that governance effectiveness is closely linked to the capacity to foster inclusiveness, resilience, and long-term sustainability, rather than relying solely on formal organizational models.

Furthermore, the results contribute to the emerging literature on mission-oriented and territorial innovation policies (Mazzucato, 2018; OECD, 2024), highlighting that the success of such initiatives depends on activating multi-level, participatory governance mechanisms that integrate diverse actors and align innovation processes with societal challenges.

### ***Practical and policy implications***

For policymakers, the findings suggest the importance of strengthening horizontal governance among spokes by promoting tools for lateral collaboration, joint project design, and interregional exchange. Reducing dependence on the central hub is essential, as it often assumes an overly dominant role.

Moreover, post-PNRR follow-up policies should support:

- the evaluation of the impacts generated by each ecosystem,
- the promotion of adaptive and territorially rooted organizational models,
- the effective involvement of local actors, not only as executors but also as co-decision-makers.

Disadvantaged regions must not merely be beneficiaries but become co-protagonists in the design and management of innovation strategies. Spoke leaders can play a decisive role if endowed with autonomy, resources, and recognition within the multi-level governance system.

Overall, these implications highlight the need for governance models capable of balancing coordination and autonomy, while explicitly fostering resilience, inclusiveness, and long-term sustainability within territorially embedded innovation ecosystems.

### ***Future research and limitations of the study***

This study has an exploratory and descriptive character, focusing on the structural configuration of ecosystems and their institutional governance. The analysis was based on official documents and organizational data, but longitudinal and qualitative evidence on network effectiveness and on the outputs produced is still lacking. As a result, the findings primarily reflect formal governance arrangements rather than the full range of relational and operational dynamics within the ecosystems.

Future research could include:

- network analysis studies to examine the actual relationships between actors within ecosystems,
- impact evaluations of research outputs and technology transfer,
- comparative performance analyses between Hub-and-Spoke models and polycentric or collaborative governance configurations,
- in-depth case studies with stakeholder interviews to better understand leadership dynamics, inclusiveness, and local participation.

In addition, further research should examine the long-term sustainability and resilience of these ecosystems, particularly their capacity to operate beyond the expiration of PNRR funding. This would help assess whether the model can evolve from a temporary policy instrument into a stable territorial innovation infrastructure grounded in distributed leadership, adaptive learning, and inclusive governance (Liddle, 2010).

Overall, advancing empirical and longitudinal evidence will be essential to better understand how governance configurations influence not only coordination and performance but also the capacity of innovation ecosystems to generate sustainable, territorially embedded value.

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