

Governance of Innovation Ecosystems: Evidence From Lisbon Through the Quadruple Helix Lens

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Abstract: This paper examines how government, industry, academia, and civil society perform their respective roles within the innovation ecosystem of Lisbon, Portugal, focusing on the governance mechanisms that sustain cross-sector collaboration and on how such coordination contributes to fostering innovation. The study adopts a qualitative approach based on semi-structured interviews with eleven key informants drawn from across the four helices, complemented by documentary analysis of public innovation policies implemented in the territory. The analysis focuses on four analytical dimensions: the governance of the public policy cycle, inter-organisational integration, the alignment across funding instruments and strategic priorities, and the extent of civil society participation in decision-making processes. Findings indicate that Lisbon exhibits an institutionally stabilised ecosystem in which the government plays a central coordinating role by designing consistent policy instruments, leveraging national and European resources, and coordinating regional development mechanisms. The private sector demonstrates high capacity for collaboration with universities and research centres, particularly in knowledge-intensive sectors, a dynamic facilitated by a predictable regulatory environment and formal cooperation channels. Non-governmental organisations and other civil society organisations are recognised as relevant stakeholders, especially in social and urban agendas; however, their strategic influence, whilst formally acknowledged, has yet to be decisively embedded in co-productive decision-making processes. The paper argues that innovation processes in the Lisbon ecosystem derive less from individual sectoral excellence and more from structured coordination among the helices. The ecosystem's long-term resilience, however, depends on strengthening the meaningful and substantive participation of civil society organisations and consolidating mechanisms for inter-institutional learning that convert technocratic integration into social co-production. The study's principal theoretical contribution is the empirical operationalisation of the distinction separating procedural and substantive civil society participation as the critical variable differentiating a functional Triple Helix from a realised Quadruple Helix. Practical implications address the redesign of civil society engagement mechanisms and the simplification of compliance requirements that disproportionately burden peripheral ecosystem actors.

Keywords: Innovation Ecosystems; Quadruple Helix; Governance; Civil Society Participation; Lisbon; Innovation Policy

1. Introduction

Innovation ecosystems are no longer adequately understood as the sum of individual organisational competencies. Contemporary scholarship reconceptualises them as products of systemic interactions among heterogeneous actors whose collaborative capacity determines the ecosystem's overall innovativeness (Adner and Kapoor, 2010; Russell and Smorodinskaya, 2018; Granstrand and Holgersson, 2020). This relational turn implies that the unit of analysis shifts from the firm or the university to the governance architecture that coordinates their interdependencies. Within this framing, public policy ceases to be a background condition and becomes a constitutive element of the ecosystem's structure: it shapes incentive systems, defines institutional boundaries, and allocates resources in ways that directly influence the nature and depth of inter-helix collaboration (Edler and Fagerberg, 2017; Koch et al., 2025; Zheng and Cai, 2022).

The Quadruple Helix model, proposed by Carayannis and Campbell (2009, 2012) as an extension of Etzkowitz and Leydesdorff's (1995) Triple Helix framework, incorporates civil society as a fourth, constitutive helix. This addition is not merely additive; it represents a qualitative shift in the conception of innovation governance. Civil society introduces social legitimacy, value plurality, and territorial embeddedness into innovation processes that would otherwise risk remaining technocratically closed. However, empirical research has consistently revealed a structural gap separating formal recognition of the fourth helix and its substantive integration into decision-making processes (Cai and Lattu, 2022; Bellandi, Donati and Cataneo, 2021). This gap — separating procedural participation and co-productive influence — constitutes the central empirical and theoretical problem motivating this study.

Lisbon represents a theoretically pertinent case for examining these dynamics. The Portuguese capital has undergone a substantial institutional transformation over the past two decades, consolidating a network of research institutions, technology companies, startup accelerators, and public innovation agencies that positions it among the more institutionally advanced urban innovation ecosystems in Southern Europe (Vlaisavljevic et al., 2020; Talmar et al., 2020; Koch et al., 2025). At the same time, the persistence of governance fragmentation, human capital absorption paradoxes, and the marginal strategic role of civil society in policy processes makes Lisbon an analytically productive site for stress-testing the empirical applicability of the Quadruple Helix as an analytical lens.

The research question guiding this study is: how do government, industry, academia, and civil society interact to govern the Lisbon innovation ecosystem, and to what extent is civil society substantively integrated into that governance? The study deploys four analytical dimensions — governance of the policy cycle, inter-organisational integration, alignment of funding and strategic priorities, and civil society participation — to structure the empirical analysis. The central argument is that innovation in Lisbon derives less from isolated sectoral excellence and more from structured, institutionally mediated coordination among the helices. This coordinated architecture, while robust, remains incomplete: the Triple Helix is consolidated; the Quadruple Helix is aspirational.

2. Theoretical Background

2.1 Innovation Ecosystems: Systemic Interaction and Governance

The concept of the innovation ecosystem, introduced by Moore (1993) and subsequently developed within innovation studies, describes a dynamic configuration of interdependent actors whose co-evolutionary interactions generate and sustain innovative capacity (Adner and Kapoor, 2010; Gomes et al., 2018). Granstrand and Holgersson's (2020) influential definition characterises it as an evolving set of actors, activities, artefacts, institutions, and relations oriented towards the creation and diffusion of innovation. This definition foregrounds the institutional dimension: ecosystems are not simply networks of organisations but institutionally structured fields whose rules, norms, and coordination mechanisms shape what kinds of innovation are possible and for whom.

Dense relational networks and adaptive coordination among heterogeneous actors are identified as key determinants of ecosystem performance (Russell and Smorodinskaya, 2018; Cai, 2022). In this light, public policy functions not merely as a facilitating instrument but as an architectural force: it constitutes the institutional scaffolding within which actors interact (Zheng and Cai, 2022; Koch et al., 2025). The concept of ecosystem orchestration (Autio, 2022) extends this insight by framing coordination as a deliberate, multilevel process in which certain actors — typically state agencies — assume integrative roles that cannot be reduced to market transactions or voluntary collaboration. Orchestration implies purposive design of interaction rules, resource flows, and feedback mechanisms across the ecosystem.

2.2 Helix Models and the Quadruple Helix as an Analytical Lens

The Triple Helix model proposed by Etzkowitz and Leydesdorff (1995) established the triadic interaction among university, industry, and government as the structural basis of knowledge-based innovation. The model's enduring contribution lies in its emphasis on the relational, processual character of innovation — each helix not only occupies a distinct institutional domain but generates hybrid spaces where new governance forms and knowledge products emerge. Recent scholarship has extended this emphasis on relationality: Zhao et al. (2026) demonstrate that the lateral interactivity of helix ties — the density of social bonds among institutional actors — functions as a catalyst for innovation legitimacy and the institutionalisation of sustainable practices, suggesting that the quality of inter-helix connections matters as much as their structural configuration.

The Quadruple Helix extends this logic by incorporating civil society as a fourth helix (Carayannis and Campbell, 2009, 2012). This extension is conceptually significant because it introduces elements — social legitimacy, value plurality, territorial knowledge, participatory governance — that the Triple Helix treats as exogenous. For Arnkil et al. (2010) and Bellandi, Donati and Cataneo (2021), civil society's inclusion transforms innovation governance from a technocratic enterprise into a democratic one, embedding social accountability into the core of the innovation process. The model becomes particularly relevant in contexts where innovation is deployed for social and territorial ends, where public mediation is required, or where co-production of public value is an explicit policy objective (Cai and Lattu, 2022).

A critical distinction runs through the Quadruple Helix literature: the difference distinguishes the presence of civil society actors in ecosystem structures and their substantive participation in defining innovation priorities. Carayannis et al. (2018) argue that relational density — the intensity and reciprocity of interactions across helices — is a more reliable predictor of innovation capacity than formal actor composition. An ecosystem populated by all four helices but characterised by asymmetric, consultative interactions does not realise the governance potential implied by the model. The Quadruple Helix, in this reading, functions as an analytical lens that asks not merely who is present but how governance power is distributed, and whether civil society shapes agendas or ratifies them post hoc.

For analytical purposes, this study operationalises the Quadruple Helix along four governance dimensions: (i) state coordination of the policy cycle; (ii) inter-organisational collaboration among helices; (iii) alignment connecting funding mechanisms and strategic priorities; and (iv) the depth and quality of civil society participation. This operationalisation follows Cai and Lattu (2022) in treating the framework as a diagnostic instrument rather than a descriptive catalogue of actors.

3. Methodology

This study adopts a qualitative case study design (Creswell and Poth, 2018; Yin, 2018), selecting Lisbon as a theoretically significant case of an institutionally stabilised urban innovation ecosystem in a semi-peripheral European economy. Case selection was theory-driven rather than representative: Lisbon offers the analytical leverage of a context in which all four helices are formally present, enabling examination of the quality — not merely the existence — of inter-helix governance.

Empirical data were generated through semi-structured interviews with eleven key informants, distributed across the four helices: four from government (national and regional agencies), three from academia (research universities and research centres), two from industry (technology firms and innovation intermediaries), and two from civil society (non-governmental organisations active in urban and social innovation). This composition reflects the structural asymmetry of helix representation in the Lisbon ecosystem and was designed to enable systematic cross-helix comparison rather than quantitative parity (Aguinis and Solarino, 2019). The under-representation of the fourth helix in the sample mirrors its structural position in the ecosystem and is itself an analytical finding.

Interview data were complemented by documentary analysis of primary policy instruments, including the National Recovery and Resilience Plan (PRR), the National Innovation Strategy, the Lisbon Smart City Agenda, and the instruments of principal innovation agencies — ANI (National Innovation Agency), FCT (Foundation for Science and Technology), IAPMEI (Agency for Competitiveness and Innovation), and CCDR-LVT (Commission for the Coordination and Regional Development of Lisbon and Tagus Valley). This triangulation of interview and documentary sources strengthens interpretive validity (Yin, 2018). Data were analysed using qualitative content analysis (Bardin, 2016) with the support of ATLAS.ti software (Frieze, 2019), applying a coding scheme organised around the four analytical dimensions. The interpretive logic followed was abductive: theoretical categories guided initial coding, while emergent themes informed iterative refinement of the analytical framework.

4. Results and Discussion

4.1 State Coordination of the Public Policy Cycle

The Lisbon innovation ecosystem is marked by strong state coordination. National agencies such as ANI, FCT and IAPMEI, together with regional and municipal bodies, organise policy instruments, channel European and national resources, and define conditions for collaboration among government, academia, industry and civil society. This architecture gives stability and direction. Instruments are broadly consistent with European smart specialisation agendas and with the National Recovery and Resilience Plan (PRR). Thus, the state does not merely facilitate innovation; it orchestrates incentives, priorities and formal arenas through which actors interact (Mazzucato, 2018; Koch et al, 2025).

This confirms that public policy is constitutive of ecosystem governance. In Lisbon, the state defines strategic priorities, coordinates resource flows and institutionalises channels of inter-helix interaction. These functions are especially relevant in semi-peripheral innovation contexts, where private investment density and market maturity may be insufficient to sustain systemic coordination without public direction. This interpretation aligns

with the view that policy mixes are complex governance arrangements that shape actor behaviour and institutional learning (Flanagan et al., 2011; Kuhlmann and Rip, 2018).

However, the policy cycle is not equally open across all stages. Interviewees recognised consultations, working groups and formal interaction channels, but these mechanisms often operate after strategic priorities have been defined. Participation is therefore procedurally present but substantively limited. Civil society organisations and smaller firms are more often invited to validate, adapt or implement agendas than to co-define them. Lisbon thus has a consolidated Triple Helix governance base, but its transition toward a fully operational Quadruple Helix remains incomplete.

The analysis also reveals administrative complexity. Multiple agencies and instruments increase delivery capacity, but raise transaction costs for actors with fewer administrative resources, especially small and medium-sized enterprises, social enterprises and non-governmental organisations. The Lisbon case therefore resonates with research showing that innovation policies may unintentionally privilege actors already capable of navigating complex funding and compliance environments (Audretsch et al., 2023).

4.2 Inter-Organisational Collaboration among Helices

Inter-organisational collaboration in Lisbon is institutionally visible and relatively mature. Competitiveness Clusters, Collaborative Laboratories (CoLabs), incubators, accelerators and municipal innovation platforms create repeated interaction among universities, firms, public agencies and intermediaries. These arrangements strengthen knowledge circulation and support innovation in digital services, biotechnology, renewable energy and urban technologies. The academia-industry interface is especially relevant, as universities and research centres provide scientific capabilities while firms and intermediaries translate part of this knowledge into applied projects.

These collaborative arenas show that Lisbon has moved beyond a fragmented collection of innovation actors and developed an ecosystemic architecture. This is compatible with innovation ecosystems as co-evolving configurations of actors, activities and institutions, in which value is created through complementarity and interdependence (Gomes et al., 2018). It also converges with the Triple Helix tradition, which emphasises hybrid spaces and university-industry-government relations as mechanisms for knowledge-based development (Leydesdorff, 2012).

Despite this progress, collaboration remains more project-based than relational. Actors often converge around funded initiatives and disperse when projects end, limiting durable inter-institutional trust. A second tension is temporal asymmetry: academic cycles, organised around multi-year projects and publication requirements, do not always match firms' faster decision cycles. Technology transfer offices, incubation spaces and co-location platforms partly address this gap, but do not fully solve long-term knowledge valorisation. Similar tensions appear in knowledge-intensive entrepreneurial ecosystems, where project-based interaction can stimulate outputs without durable relational embeddedness (Gifford et al., 2021).

The civil society helix occupies a weaker position in this architecture. Non-governmental organisations and social innovation actors are present in consultations, urban projects and sustainability agendas, but less often in spaces where priorities are defined. Quadruple Helix governance depends not only on actor presence, but on the quality, reciprocity and intensity of interactions. Lisbon therefore has considerable organisational density, but uneven relational density, consistent with debates on co-evolutionary innovation systems and more advanced Quadruple Helix configurations (Carayannis et al., 2024).

4.3 Alignment Connecting Funding Instruments and Strategic Priorities

The alignment connecting funding instruments and strategic priorities is among the strongest features of the Lisbon ecosystem. European and national programmes give innovation policy clear direction, especially in digital transformation, sustainability, research commercialisation and urban development. Large-scale consortia, mission-oriented calls and PRR-related instruments concentrate resources around strategic priorities, induce cross-sector collaboration and reinforce the state's capacity to orient ecosystem trajectories. Funding therefore operates as a governance device, not only as a financial mechanism.

The PRR and related instruments reinforce strategic selectivity by linking financial support to economic transformation and territorial resilience. This orientation is compatible with the policy emphasis on science, technology and innovation as drivers of long-term transformation (OECD, 2024). It also reflects

ecosystem strategy, in which actors position themselves within interdependent structures of value creation, competition and co-opetition (Ritala, 2024).

At the same time, this architecture creates exclusionary effects. Large consortium-based projects favour actors with administrative capacity, prior experience and established networks. Smaller firms, social enterprises and civil society organisations face higher relative costs in applications, compliance reporting and project management. One government informant stated that bureaucracy has been “installing itself and killing” participation by less-resourced actors. Thus, while funding instruments are strategically aligned at the macro level, they are not equally accessible at the ecosystem level, reproducing participation asymmetries.

The evidence also suggests that funding alignment is stronger in technological and economic domains than in social and democratic dimensions. Instruments mobilise universities, firms and public agencies around innovation performance, but are less effective in enabling civil society organisations to act as agenda-setting actors. Public financing allocates resources and defines which problems are legitimate, which forms of knowledge are valued and which actors become central. Universities therefore contribute not only research, but also mediation, translation and social embedding of knowledge (Thomas et al., 2021).

4.4 Civil Society Participation: From Consultation to Co-Production

Civil society is formally recognised in the Lisbon innovation ecosystem, especially in social innovation, urban development, sustainability and public services. Open science initiatives, municipal innovation districts and participatory forums expand channels through which social actors access knowledge and engage with innovation debates. These developments show movement beyond a narrow technology-centred approach and incorporate elements of social embeddedness.

This movement is consistent with the Quadruple Helix, which extends innovation governance beyond government, academia and industry by incorporating civil society, culture, values and participation. In Lisbon, this fourth helix is recognised but asymmetrically positioned. As Quadruple and Quintuple Helix literature suggests, ecosystems become more resilient when knowledge circulates across institutional, social and cultural boundaries rather than remaining concentrated in technocratic networks (Carayannis and Campbell, 2021; Carayannis et al., 2018).

Nevertheless, civil society engagement remains consultative rather than co-productive. Non-governmental organisations reported being invited to provide feedback, participate in hearings or contribute contextual knowledge after agendas have been designed. They are less often positioned to influence problem definition, priority setting or evaluation criteria. This limits the democratic quality of the Quadruple Helix and the ecosystem's capacity to capture territorial knowledge beyond government, universities and firms. The issue is not civil society's absence, but the limited conversion of presence into governance influence.

This limitation also appears in feedback mechanisms used to evaluate innovation policy. Current indicators privilege outputs such as publications, patents, spin-offs, funded projects and employment. These metrics matter, but do not capture governance capacity, institutional learning, social inclusion or the quality of civil society participation. The result is an incomplete learning cycle: the ecosystem receives strong signals about innovation outputs, but weaker signals about inclusive and socially responsive governance.

Lisbon's human capital profile reinforces this point. The ecosystem has benefited from tertiary education expansion and consolidated research capabilities, but private sector absorption of highly qualified human capital remains uneven (OECD, 2023). Knowledge production alone does not guarantee structural transformation. The ecosystem must strengthen institutional bridges connecting education, research, industry, social needs and territorial development. Trust, reputation and relational continuity are relevant because actors need credible, repeated and socially recognised interactions to sustain collaboration beyond isolated projects (Chaudhary et al., 2024).

Overall, Lisbon presents an orchestrated and institutionally stabilised innovation ecosystem. Coordination among government, academia and industry is comparatively strong, and funding instruments provide directionality. Yet the fourth helix remains structurally peripheral. Two transitions are necessary to realise the promise of the Quadruple Helix: from technocratic integration to social co-production, and from procedural participation to substantive influence over innovation priorities.

5. Conclusion

This study has examined the governance dynamics of the Lisbon innovation ecosystem through the analytical lens of the Quadruple Helix, focusing on four dimensions: policy governance, inter-helix integration, funding-strategy alignment, and civil society participation. Three conclusions emerge from the analysis.

First, Lisbon exhibits an institutionally stabilised, state-orchestrated innovation ecosystem in which innovation capacity derives primarily from structured coordination among the helices rather than from the isolated excellence of individual actors. The government's central coordinating role — operationalised through ANI, FCT, and IAPMEI — has generated a consistent, multi-generational policy architecture aligned with European frameworks. The university-industry interface is functional and growing, particularly in knowledge-intensive sectors. These are the characteristics of a well-developed Triple Helix configuration.

Second, the Quadruple Helix remains aspirational rather than operational in the Lisbon context. Civil society organisations are formally present within the ecosystem's governance structures — they appear in consultation documents, advisory bodies, and strategic planning exercises — but their influence over agenda-setting remains procedurally bounded. The distinction distinguishing formal presence and substantive participation, identified in the theoretical literature as the central analytical challenge of the Quadruple Helix (Cai and Lattu, 2022; Bellandi, Donati and Cataneo, 2021), is empirically confirmed in the Lisbon case. This is not a transitional feature of an ecosystem that will naturally resolve itself over time; it reflects structural asymmetries in governance capacity and institutional access that require deliberate policy redesign.

Third, the study identifies a human capital paradox — high doctoral production combined with low private sector absorption — and a governance fragmentation problem — multiple agencies with overlapping mandates generating disproportionate compliance costs for peripheral actors — that are under-documented in the existing literature on Portuguese innovation governance. These findings contribute to a more detailed understanding of the institutional conditions under which semi-peripheral European ecosystems achieve and sustain innovation performance.

The study's theoretical contribution lies in the empirical operationalization of the distinction distinguishing technocratic integration and social co-production as the critical variable differentiating a functional Triple Helix from a realised Quadruple Helix. The mode of inter-helix integration — not merely its intensity — emerges as a determinant of ecosystem resilience. An ecosystem that integrates all four helices procedurally but excludes the fourth from substantive governance generates structural vulnerabilities: reduced legitimacy, attenuated feedback signals, and inadequate incorporation of the social and territorial knowledge that civil society uniquely contributes.

The study carries practical implications for innovation policy in comparable contexts. Simplification and functional integration of policy instruments would reduce the compliance burden that disproportionately affects smaller actors. More consequentially, the redesign of civil society participation mechanisms — moving from consultation to co-production at the agenda-setting stage — would strengthen both the legitimacy and the adaptability of ecosystem governance. Achieving this transition requires, as Mazzucato and Kattel (2026) argue, a fundamental reconfiguration of public sector capacities: the state must develop not only the administrative infrastructure to coordinate complex ecosystems but also the institutional routines to incorporate social feedback and co-create value with peripheral actors. These recommendations are consistent with the broader argument advanced by Mazzucato (2024) that innovation ecosystems generate inclusive and resilient outcomes only when governance architecture is explicitly designed to redistribute agenda-setting power.

Limitations. The study is based on a single qualitative case, which precludes statistical generalisation; analytical transferability is conditional on the existence of comparable institutional conditions in other contexts. The eleven-informant sample provides systematic cross-helix coverage but cannot exhaust the diversity of perspectives within each helix; the fourth helix is particularly under-represented. The study captures a temporal cross-section of a continuously evolving ecosystem.

Future Research Agenda. Three directions merit priority attention: (i) the mechanisms through which procedural civil society participation may be converted into substantive co-production in semi-peripheral European ecosystems, examined comparatively; (ii) the decoupling linking qualified human capital production and private sector absorption, investigated longitudinally to distinguish structural from cyclical determinants; and (iii) the differential bureaucratic transaction costs generated by complex policy mixes, analysed through governance network methods to identify the institutional configurations most conducive to inclusive ecosystem participation.

Ethics Declaration

This research was conducted in accordance with established ethical standards for qualitative social science research. All participants provided informed consent, anonymity was guaranteed, and data were handled in conformity with applicable data protection regulations. No conflicts of interest are declared.

AI Declaration

Artificial intelligence tools were used in the drafting and editorial revision of this manuscript. All intellectual content, analytical judgements, empirical interpretations, and theoretical arguments are the exclusive responsibility of the authors.

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