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Organizing (in) innovation ecosystems: a definition, new theoretical lenses and a research agenda

Carlotta Cochis and Paula Ungureanu
Department of Sciences and Methods for Engineering, University of Modena and Reggio Emilia, Reggio Emilia, Italy

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Abstract

Purpose – This paper repositions innovation ecosystems as an organizational phenomenon rather than primarily a structural arrangement. By foregrounding ecosystem organizing, it addresses persistent definitional ambiguity and develops a processual definition of innovation ecosystems that captures how coordination is practically accomplished and recurrently renegotiated across heterogeneous actors, technologies and institutional contexts.

Design/methodology/approach – This is a conceptual paper. The argument is developed through a comparative and integrative discussion of existing innovation ecosystem scholarship and relevant organizational perspectives, with particular attention to processual, sociomaterial and institutional interpretations of organizing. On this basis, the paper advances a conceptual reframing and derives a research agenda.

Findings – The paper proposes a definition of innovation ecosystems as socio-technical organizing processes oriented to a shared value proposition under conditions of uncertainty and interdependence. It articulates three complementary conceptual lenses for future research: interdependence as relational and sociomaterial dynamics, orchestration as governance-in-practice and contextual boundaries as institutional embeddedness. It formalizes the integration of these lenses in two propositions and specifies the boundary conditions under which an organizing perspective adds explanatory power. It also outlines theory-informed directions for comparative and process-sensitive empirical inquiry.

Originality/value – The contribution provides an integrated organizational vocabulary for innovation ecosystem research, shifts the analytical focus from structural description to dynamic organizing and offers a conceptual platform for developing sharper theoretical arguments and hypotheses in future studies.

Keywords Innovation ecosystems, Governance-in-practice, Institutional embeddedness, Relational dynamics, Organizational perspective

Paper type Research article

Introduction: why innovation ecosystems matter today

Few concepts have traveled as quickly and proved as useful across audiences as that of the "innovation ecosystem". Over the past 2 decades, the term has become a shared vocabulary through which scholars, managers, and policymakers describe interdependence in innovation: from regional and entrepreneurial ecosystems (e.g. Wurth *et al.*, 2022), to university innovation and entrepreneurial ecosystems (Etzkowitz and Leydesdorff, 2000), to digitally mediated ecosystems shaped by platform leaders such as Apple, Microsoft, and Amazon (Iansiti and Levien, 2004; Parker *et al.*, 2016), and up to decentralized ecosystems (Hsieh and Vergne, 2023; Ungureanu, 2025; Yoo *et al.*, 2024). This rapid diffusion matters not only because the label has "traveled" widely (Suominen *et al.*, 2019), but because it has also expanded the analytical toolkit of innovation studies by foregrounding multi-actor

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coordination and co-specialization as central empirical realities (Baldwin *et al.*, 2024). Building on this growing body of work, we consolidate and sharpen an emerging organizing perspective on innovation ecosystems.

Several macro-trends amplify the importance of innovation ecosystems. First, emerging technologies such as AI, blockchain, and quantum computing demand very specific knowledge and cross-sector expertise that no single organization can provide (De Fano *et al.*, 2026; Troisi *et al.*, 2024). Recent reviews suggest that AI in particular is reshaping how innovation ecosystems are configured, operated, and governed, generating what Secundo *et al.* (2025) have called an "AI innovation ecosystem" in which capabilities, infrastructures, and decision routines are aligned around intelligent technologies (Secundo *et al.*, 2025; Chotia *et al.*, 2025). Second, the "platformization" of industries has shifted competition from firm-to-firm to ecosystem-to-ecosystem. For instance, in generative AI ecosystems, the competition between OpenAI's GPT models, Google's Gemini, and open-source alternatives represents ecosystem-versus-ecosystem battles where control over foundation models, fine-tuning protocols, and safety standards determines innovation trajectories (Altman *et al.*, 2022; Clough and Wu, 2022). In this context, innovation ecosystems are not only sites of collaboration but also arenas of competition, negotiation, and exclusion. Third, rising geopolitical fragmentation and debates over data sovereignty are reshaping who can participate in global innovation efforts (Aaronson, 2021). As a consequence, infrastructure becomes a contested arena where states, firms, and communities struggle over rules, interoperability, and legitimacy. These forces mark a shift from regional clusters to globally distributed, digitally orchestrated networks (Nambisan and Luo, 2021; Bouncken and Kraus, 2021). Cloud platforms, AI models, blockchain protocols, and quantum infrastructures are no longer just tools of innovation; they are its terrain. They enable actors across time zones to co-create in real time and exchange information, yet they also embed collaboration in opaque algorithms, proprietary standards, and coding languages. As a result, what once depended on interpersonal trust and organizational partnership now hinges on access to data, control over digital interfaces, and the ability to operate within complex technological stacks and algorithmic governance. Blockchain-based ecosystems push this shift further, exemplifying how coordination, verification, and value exchange can be organized without centralized authority, making governance itself a core object of innovation (Henfridsson and Bygstad, 2024; Yoo *et al.*, 2024). Explaining thus how ecosystems emerge, evolve, and create value under such contested, multi-jurisdictional socio-technical conditions (Aaronson, 2021) is a central challenge for innovation scholarship.

Despite this growing relevance, much of the literature still approaches ecosystems as structures: relatively stable configurations of actors, roles, and complementarities aligned around a focal value proposition. Strategy research typically conceptualizes ecosystems as alignment structures surrounding a focal firm or platform (Adner, 2017; Jacobides *et al.*, 2018; Thomas and Autio, 2020), while policy and regional studies emphasize the composition of local ecosystems and their institutional infrastructure (Granstrand and Holgersson, 2020). Even when public or non-corporate actors are examined as leaders, such as universities or public research organizations, they are often framed within keystone-style orchestration templates originally developed for large firms (Iansiti and Levien, 2004).

At the same time, an emerging body of work is shifting attention toward how these configurations are enacted, contested, and reconfigured over time. In digital and deep-tech domains, innovation unfolds on top of shared infrastructures (e.g. cloud platforms, communication protocols, web APIs, data standards) that no single actor fully controls (Tilson *et al.*, 2010; Clough and Wu, 2022; Schreieck *et al.*, 2022). Ecosystems may emerge under "sponsor-light" conditions, without a clearly dominant keystone firm, or rely on shifting coalitions of anchors and intermediaries (Daymond *et al.*, 2023; Jaspers and Proff, 2025; Barile *et al.*, 2025). Platform-based ecosystems also reveal these tensions, in which dominant orchestrators create value while constraining complementors' autonomy (Magro-Montero

et al., 2026). In settings of high uncertainty, for instance, mission-driven health innovations in resource-constrained contexts, ecosystem configurations are co-created by multiple interdependent actors rather than designed ex ante by a central orchestrator (Dattee *et al.*, 2018). In parallel, digital infrastructures increasingly embed governance into technical artifacts: interfaces, algorithms, and smart contracts allocate rights and obligations, encode rules, and shape participation (Davidson *et al.*, 2018; Reiter *et al.*, 2024; Zobel and Hagedoorn, 2020). To solve coordination and inequality issues, blockchains propose a view of innovation ecosystems as meta-organizational forms (Jacobides *et al.*, 2018; Kretschmer *et al.*, 2022) in which coordination and value creation are achieved without hierarchical authority, relying instead on complex distributed governance mechanisms and market-like coordination among autonomous actors (Hsieh and Vergne, 2023).

These developments highlight the limits of purely structural, focal-firm views: they remain useful for mapping ecosystem architectures, but they are less well suited to explaining how coordination and authority are produced, maintained, and revised over time. This motivates studying innovation ecosystems as phenomena of organizing. Rather than treating ecosystems as static sets of complementary firms or as mere extensions of a lead firm's strategy, an organizing perspective foregrounds how roles, rules, and resources are configured over time through interaction. It highlights how coordination, power, and value creation emerge from relationships among firms, start-ups, universities, investors, regulators, communities, standards, platforms, and algorithms in contested socio-technical environments (Shipilov and Gawer, 2020; Latour, 2005; Orlikowski, 2007).

This shift in attention exposes a gap in the existing literature. Structural and strategic accounts clarify what ecosystems contain at a given moment, but they offer a thinner account of how coordination, authority, and value creation are produced and sustained over time, particularly in digitally mediated, multi-actor settings under uncertainty. The question we address is how routines, artifacts, and institutional arrangements jointly hold ecosystems together, and how they reallocate roles and authority when conditions shift.

Studying innovation ecosystems through the lens of organization theory is important for at least three reasons. First, it helps us move beyond a narrow focus on structural complementarities to examine how interdependence is enacted in practice, how trust, expectations, and responsibilities are negotiated across organizational and technological boundaries, and how these relational dynamics evolve (Lawrence and Suddaby, 2006; Shipilov and Gawer, 2020; Thomas and Ritala, 2022; Henfridsson *et al.*, 2018). Second, it allows us to reframe ecosystem "orchestration" as governance-in-practice, rather than assuming a single, stable orchestrator: leadership can be distributed, contested, and rotating, and governance mechanisms can be layered across contractual, relational, and infrastructural forms (Reypens *et al.*, 2021; Altman *et al.*, 2022; Reiter *et al.*, 2024). Third, organization theory foregrounds institutional and sociomaterial embeddedness: ecosystems are shaped by regulatory regimes, cultural logics, and technological standards that not only constrain action but actively constitute what forms of organizing are possible (Thornton and Ocasio, 2008; Tilson *et al.*, 2010).

This paper consolidates an organizing perspective on innovation ecosystems and articulates it as an integrated vocabulary. We bring together three strands of organizational scholarship, sociomateriality, governance-in-practice, and institutional embeddedness, and combine them in a single framework that responds to persistent definitional ambiguity in the field. The three strands are not introduced as alternative entry points to ecosystem research but as complementary dimensions of one perspective, each operating at a distinct analytical level. Sociomateriality foregrounds practice: it directs attention to how interdependence is enacted through the entanglement of social relations and material arrangements (Orlikowski, 2007; Leonardi, 2013). Governance-in-practice addresses coordination, asking how authority and direction are produced through distributed, situated work rather than orchestrated by a focal firm (Reypens *et al.*, 2021; Shipilov and Gawer, 2020). Institutional embeddedness situates ecosystems in their wider context, examining how regulatory regimes, cultural logics, and

technical standards constitute the conditions of participation (Hinings *et al.*, 2018; Thornton and Ocasio, 2008). Their combination supports two analytical propositions that purely structural accounts handle less cleanly. First, small changes in technical artifacts can reallocate authority and trust without requiring formal renegotiation of ecosystem architecture. Second, institutional change in adjacent fields can reshape ecosystem participation through infrastructural rather than contractual channels. We formalize these propositions as two combinatory propositions in the closing of the next section. The contribution is therefore an integrated organizing vocabulary that can guide comparative empirical inquiry, generate testable propositions about ecosystem governance, and clarify the conditions under which an organizing perspective adds explanatory power relative to structural accounts. We build on emerging strands that already point in this direction, including work on sponsor-light ecosystem emergence (Song *et al.*, 2024), co-creation under high uncertainty (Thomas and Ritala, 2022), and the role of digital infrastructures and institutional work in embedding governance (Schreieck *et al.*, 2022; Autio and Thomas, 2014; Baldwin *et al.*, 2024; Thomas and Autio, 2020).

We first articulate a process-oriented definition of innovation ecosystems and locate it in relation to existing approaches. We then develop the three analytical lenses, integrate them through Figure 1, and formalize their combination through two combinatory propositions. A research agenda specifies example questions and methodological options for each lens, supported by an updated Table 1. We close with implications for research, practice, and policy, and with a sub-section on the scope and boundary conditions of the proposed framework.

Innovation ecosystem definition

Despite a proliferation of research, there is still no widely accepted definition of what constitutes an innovation ecosystem. While recent syntheses have made important progress in distinguishing ecosystems from networks and platforms by emphasizing configurations of interdependent actors whose complementary contributions are specific to a shared value proposition and must be coordinated under uncertainty (Suominen *et al.*, 2019; Thomas and Autio, 2020; Baldwin *et al.*, 2024), much of the literature still leans on structural metaphors. Recent integrative reviews (Gomes *et al.*, 2018; Silva *et al.*, 2024) further unpack the construct's evolution and identify persistent gaps in how scholars specify ecosystem boundaries, governance, and value flows. An emerging direction is therefore to complement these accounts with an organizing lens that foregrounds process, practice, and socio-technical mediation. Strategy research has productively framed ecosystems as alignment structures (Adner, 2017; Jacobides *et al.*, 2018). Yet, taken on its own, this architectural lens can underplay the processual work through which alignment is achieved, maintained, and renegotiated.

Two theoretical streams have been particularly influential yet only partially explain how innovation ecosystems are formed, stabilized, and transformed in practice. The platform tradition demonstrates how modularity reallocates coordination to interfaces and standards (Gawer, 2014), while organization theory provides microfoundations for knowledge mobilization and boundary-spanning (Cohen and Levinthal, 1990; Dhanaraj and Parkhe, 2006). However, both strands typically treat ecosystems as accomplished facts, configurations to be mapped, rather than as ongoing achievements that must be continually reproduced and adjusted.

Governance research reveals tensions but lacks integration. Concepts such as "managed openness" (Altman *et al.*, 2022) and "selective revealing" (Alexy *et al.*, 2013) highlight strategic paradoxes in sharing versus protecting knowledge, while tiering mechanisms show multi-level coordination in digital platforms (Reiter *et al.*, 2024). Yet these insights are only loosely connected to broader questions of how trust and control migrate from interpersonal relationships to system-level assurances in digitally mediated contexts (Lumineau *et al.*, 2023).

Process-oriented studies are increasingly offering valuable insights into how innovation ecosystems unfold (Mendling *et al.*, 2020). At the same time, this stream remains fragmented, and a cumulative view of ecosystem organizing is still taking shape. Research on "poor visibility" contexts shows that actors experiment and iterate to stabilize complementarities under uncertainty (Dattee *et al.*, 2018). Lifecycle studies document sequences of interventions over time, rather than ex ante ecosystem design (Daymond *et al.*, 2023). Cases of "sponsor-light" ecosystems also show that ecosystems can co-evolve without a dominant keystone firm (Song *et al.*, 2024), while studies of decentralized ecosystems reveal the paradoxes and whirling trajectories of collaboration, coordination, and collective sensemaking when hierarchical orchestrators are absent and coordination and decision rights are distributed across participants and embedded in shared infrastructures (Ungureanu, 2025; Ungureanu *et al.*, 2025). However, these contributions are still only partially connected, and the cumulative picture of ecosystem organizing remains underdeveloped. Consolidating these insights is a key opportunity for advancing ecosystem research.

The digital transformation intensifies unresolved tensions. Digital infrastructures embed governance in APIs and protocols, making coordination a socio-technical accomplishment (Ungureanu *et al.*, 2025). This also raises fundamental questions about value capture, fragmentation, and competition that current frameworks have only partially addressed (Teece, 2022).

We propose redefining innovation ecosystems as *ongoing organizing processes held together by sustained alignment of interdependent actors through evolving governance, modular infrastructures, institutional practices, and even non-human agents (algorithms, standards) in a socio-technical ensemble*. This definition moves beyond static networks to capture ecosystems as sociomaterial phenomena in which technical affordances and organizational practices co-constitute one another, best analyzed through theories that explain dynamic organizing processes rather than only static structures.

This definition emphasizes that an innovation ecosystem is more than a set of firms: it comprises interactions among heterogeneous human actors (e.g. users, complementors, orchestrators, regulators) and non-human agents (e.g. algorithms, standards, and infrastructures), whose socio-technical entanglement constitutes the ecosystem itself. (Orlikowski, 2007; Autio and Thomas, 2014). It highlights that ecosystems are value networks that enable joint value creation and capture, with fluid and evolving boundaries (Adner, 2017; Autio and Thomas, 2014). Such a composite view clarifies why the innovation ecosystem metaphor applies across clusters, platforms, open-source projects, and sectoral systems (e.g. energy and biopharma).

Recent work increasingly approaches innovation ecosystems as complex adaptive systems in which roles, boundaries, and coordination arrangements are not predefined but emerge through feedback loops, experimentation, and situated learning (Beltagui *et al.*, 2020). From this perspective, governance is less a design choice than a fragile social accomplishment, shaped by asymmetries in resources and power and increasingly mediated by infrastructural arrangements (Shipilov and Gawer, 2020). Ecosystem boundaries, in turn, appear relational and provisional rather than fixed, taking form through recurring interaction patterns, project alignments, and evolving interdependencies (Lykouras and Mora, 2025). These dynamics are particularly salient in digitally mediated ecosystems, where APIs, cloud platforms, and blockchain technologies increasingly encode coordination and control into technical architectures (Orlikowski, 2007). Rather than treating technology as a neutral substrate, this line of work foregrounds ecosystems as sociomaterial configurations in which organizational practices and technical affordances are mutually constitutive and continuously renegotiated (Orlikowski, 2007; Zobel and Hagedoorn, 2020).

Three organizational lenses on innovation ecosystems

As interest in innovation ecosystems grows and the literature expands across strategy, regional studies, and platform research, emerging technologies and new organizing forms raise additional questions about how ecosystems work in practice. Digital infrastructures, AI-based services, and distributed collaboration reshape the conditions under which coordination and governance unfold, entangling organizational practices with technical architectures rather than merely supporting them. In addition to existing structural and strategic perspectives, organizational theory can therefore offer complementary ways of looking at innovation ecosystems.

We outline three organizational lenses that do not replace current structural and strategic approaches but enrich them by treating innovation ecosystems as ongoing organizing processes. The three lenses are complementary dimensions of a single organizing framework rather than alternative entry points, each operating at a distinct analytical level. The first lens, *interdependence as relational and sociomaterial dynamics*, operates at the level of practice. It examines how interdependence is enacted through the entanglement of social relations, routines, and material arrangements, including the digital infrastructures that mediate ecosystem coordination. The second lens, *orchestration as governance-in-practice*, operates at the level of coordination. It examines how authority and direction are accomplished through distributed, situated work rather than orchestrated by a focal firm, and how coordination is layered across contractual, relational, and infrastructural forms. The third lens, *contextual boundaries as institutional embeddedness*, operates at the level of context. It examines how regulatory regimes, cultural logics, and technical standards constitute the conditions of ecosystem participation, and how institutional change reshapes ecosystem boundaries through infrastructural rather than contractual channels. Figure 1 visualizes the three lenses as complementary dimensions of a single organizing framework, with governance-in-practice as the analytical pivot that connects sociomaterial dynamics and institutional embeddedness.

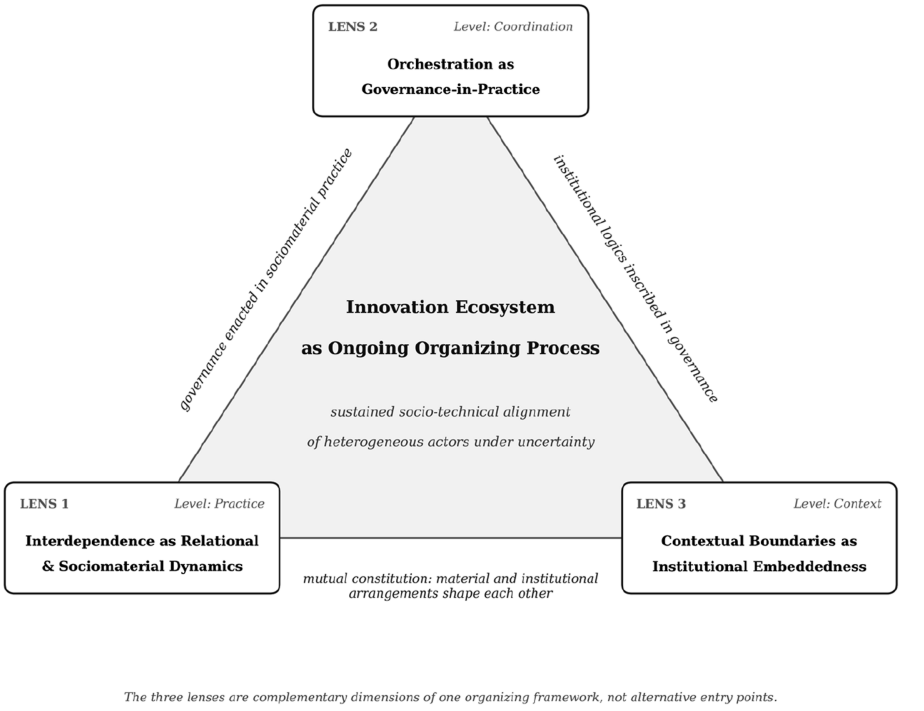

Figure 1. Innovation ecosystem as an ongoing organizing process: three complementary lenses combined into a single framework. Source: Authors' own work

From Interdependence to Relational and Sociomaterial Dynamics. A growing body of research suggests that intelligent and distributed technologies rarely unfold in linear, predictable, or deterministic ways (Hillebrand *et al.*, 2025; Anthony *et al.*, 2023). Rather than realizing the orderly trajectories envisioned in strategic roadmaps or technological imaginaries, their diffusion is typically marked by indeterminacy, contestation, and unintended consequences. Specifically, although new technologies are often introduced with expectations of efficiency, transparency, decentralization, or human augmentation, their implementation routinely generates friction, contradiction, and paradox in organizational and ecosystem settings (Raisch and Krakowski, 2021; Ramaul *et al.*, 2026). Empirical studies show, for instance, how technologies that promise autonomy simultaneously expand algorithmic forms of control; how efforts to enhance transparency introduce new layers of opacity; how decentralization initiatives often coincide with the recentralization of infrastructural power; and how claims of trustlessness continue to rely on institutional, social, and epistemic foundations. These tensions do not remain confined to technical architectures or formal governance arrangements. They reverberate at the level of everyday organizing, shaping emotional responses, patterns of resistance and acceptance, and ongoing challenges for leadership, coordination, and collective sensemaking in digitally mediated settings (Davidson *et al.*, 2018; Lumineau *et al.*, 2023; Ungureanu *et al.*, 2025).

From an organizational perspective, this highlights the need to examine the *relational dynamics* through which innovation systems and digital ecosystems are enacted. Interdependence, in this view, is not a static alignment of complementary resources, but an ongoing accomplishment, produced through interaction as actors negotiate roles, expectations, and responsibilities under conditions of uncertainty (Piantoni *et al.*, 2023).

To make sense of these dynamics, we call for an organizational perspective informed by a socio-material perspective. This perspective starts from the premise that coordination, governance, and value creation are produced through the ongoing entanglement of social relations and material arrangements, such that technologies cannot be treated as neutral tools or external inputs to organizing (Orlikowski, 2007; Leonardi, 2012, 2013). Applied to innovation ecosystems, a sociomaterial lens directs attention to how digital infrastructures (i.e. algorithms, standards, protocols, and platforms) actively participate in organizing by shaping how actors coordinate, exercise authority, and sustain collaboration over time. Ecosystems, from this viewpoint, are not merely settings in which innovation unfolds, but sociomaterial configurations that condition what forms of interaction, experimentation, and value creation become possible, legitimate, or sustainable.

The case of PSD2 and related open-banking initiatives shows how such relational dynamics are sustained through intertwined social and material arrangements. While standardized APIs formally enable licensed fintechs to access bank data or initiate payments with user consent, interdependence is enacted in practice through a dense sociomaterial infrastructure. Technical elements, such as API specifications, versioning policies, consent flows, uptime dashboards, and security test suites, shape who can complement whom, at what cost, and with which guarantees. At the same time, organizational and regulatory practices (certification regimes, supervisory audits, working groups, and change-management committees) mediate expectations, resolve incidents, and recalibrate responsibilities. Together, these arrangements do not simply implement predefined complementarities; they continuously redefine roles and trust relations in use. Seemingly minor changes in an authentication flow or certification requirement can reallocate work, shift accountability, and move trust boundaries from interpersonal judgment to system-level assurances embedded in infrastructure. Recent scholarship makes this point empirically: in intellectual property platform ecosystems, knowledge acquisition, integration, and spillover are accomplished through digital affordances that knit together heterogeneous actors and continuously redefine the conditions of complementor participation (Ma *et al.*, 2025). Comparable dynamics in mobility ecosystems show that complementors mobilize connectivity technologies through distinct archetype strategies, depending on whether they aim to strengthen or to diversify the host ecosystem's value proposition (Miehé *et al.*, 2023).

In sum, adopting a sociomaterial organizational perspective has important implications for how innovation ecosystems are understood, even before questions of method or research design are considered. It foregrounds governance as a dynamic and relational accomplishment, emerging from ongoing interactions among humans, algorithms, protocols, and infrastructures rather than from centralized orchestration or stable institutional arrangements (Anthony *et al.*, 2023; Bailey *et al.*, 2022; Hillebrand *et al.*, 2025). It can also constitute a privileged lens to bring into view the ambivalent and often paradoxical effects of digital infrastructures, showing how the same technical elements can simultaneously enable and constrain action, distribute and concentrate power, and produce both openness and exclusion (Bailey *et al.*, 2022; Gawer, 2014; Waardenburg *et al.*, 2022). Finally, it sensitizes scholars to the interpretive, evaluative, and emotional work through which actors cope with uncertainty, contest technological outcomes, and sustain collaboration in the face of opaque algorithms, shifting standards, and contested epistemic claims (Orlikowski and Scott, 2023; Lebovitz *et al.*, 2022).

From Orchestration to Governance-in-Practice. Traditional ecosystem work often uses "orchestration" to denote deliberate efforts by a focal actor to design the ecosystem architecture and align complementors (Iansiti and Levien, 2004; Gawer and Cusumano, 2014). An organizational perspective invites a different question: rather than assuming that a central orchestrator designs and controls the ecosystem, we can ask how governance is accomplished in practice, who coordinates whom, through which routines, artifacts, and forums, and with what distribution of power (Magro-Montero *et al.*, 2026; Jaspers and Proff, 2025; Shipilov and Gawer, 2020). Governance, in this view, is not an ex-ante blueprint but the outcome of situated interactions, co-produced through practices, conflicts, and adaptive responses. Even in well-established platform ecosystems, governance operates through layered and evolving practices rather than stable design. In Apple's iOS ecosystem, for instance, governance is maintained through shifting App Store review guidelines, evolving API access policies, and recurrent negotiations between the platform and its complementors over revenue sharing, data access, and feature integration. Each policy update redistributes power and reconfigures complementor strategies, revealing governance as an ongoing accomplishment rather than a fixed structure. Comparable platform-evolution dynamics emerge in mass-market ecosystems: in the Xiaomi case, platform owners and complementors co-produce governance through three distinct synergistic strategies (resource, system, and scenario synergy), responding to market triggers rather than executing a pre-designed architecture (Pei and Dong, 2025).

Such dynamics become even more visible in decentralized ecosystems, where no single actor holds formal authority. Ethereum, the largest programmable blockchain ecosystem, offers an instructive example. Early on, protocol changes were closely tied to the founder's vision and a small core developer group. Over time, change has been channeled through Ethereum Improvement Proposals (EIPs), public discussion calls, test deployments, and client implementations. The 2022 "Merge" to Proof-of-Stake, for example, required years of EIPs, experiments, and coordination across developers, miners/validators, and application teams. Governance here does not appear as a single decision taken at the top but as a sequence of interactions codified in processes and artifacts (i.e. proposal templates, repositories, testing routines, and communication channels) that make agreement possible. This processual and contested character of governance is also evident in the DAO episode, where the fork/no-fork controversy culminated in a community vote and a controversial hard fork that permanently split the ecosystem into Ethereum and Ethereum Classic (Ungureanu *et al.*, 2025). Similar patterns of asymmetric yet interdependent relationships characterize startup-corporate ecosystems. Felicetti *et al.* (2026) show that governance arrangements rest on the ongoing reconciliation of misaligned resources, time horizons, and risk profiles between large incumbents and digital-native startups. Similar patterns can be observed in other innovation ecosystems. In AI model ecosystems, access and contribution are shaped by API usage limits, safety filters, and documentation routines (e.g. model cards), as well as informal norms within

developer communities and open-source projects (Altman *et al.*, 2022). In nascent entrepreneurial ecosystems, anchor organizations shift roles over time, from convening events to brokering connections to setting standards, while participants adapt and reinterpret rules as uncertainty resolves (Daymond *et al.*, 2023). In financial services ecosystems, complementors are tiered and re-tiered as onboarding, certification, and data-sharing routines are adjusted to align heterogeneous contributors without freezing the architecture (Reiter *et al.*, 2024).

Shared governance and multi-leadership perspectives help to describe these patterns: leadership is distributed and episodic, emerging when particular coalitions mobilize resources around specific issues rather than residing permanently in a single "orchestrator" (Reypens *et al.*, 2021). Extending dynamic capabilities logic to the ecosystem level further highlights how sensing, seizing, and reconfiguring can be performed through distributed routines across firms, platforms, and communities (Marchese *et al.*, 2026; De Fano *et al.*, 2026; Leih and Teece, 2016) Marchese *et al.* (2026) show, for the EdTech sector, that digital technologies underpin distinct dynamic capabilities for ecosystem orchestration, in particular by enabling real-time data exchange and collaborative routines among heterogeneous actors. De Fano *et al.* (2026) similarly find that AI ambidexterity in digital innovation ecosystems is a dynamic capability accomplishment, contingent on the routines firms use to reconcile exploration and exploitation amid technological uncertainty. Collectively, these perspectives suggest that studying governance-in-practice allows us to see not only who is formally in charge, but how coordination and change actually happen, where decisions are taken, how dissent is handled, and how technical and organizational adjustments reinforce or destabilize existing arrangements in innovation ecosystems.

From Contextual Boundaries to Institutional Embeddedness: Ecosystems are often described as being embedded in particular places, for instance, as regional or national formations. This view, inherited from regional innovation systems and entrepreneurship policy, highlights local institutional infrastructures (e.g. universities, public agencies, regulators) that enable collaboration and support entrepreneurial activity (Hinings *et al.*, 2018; Faik *et al.*, 2026; Orlikowski and Scott, 2023). At a comparative scale, Autio *et al.* (2025) show that digital entrepreneurship systems vary across 113 countries along several institutional dimensions, with developing Asian economies displaying differential strengths in physical infrastructure but persistent gaps in cultural and informal-institutional conditions for ecosystem participation. Cross-country evidence from European SMEs reinforces this institutional reading: Khatami *et al.* (2024) show that ecosystem configuration, change, and capability dimensions interact with national institutional conditions to shape smart-product innovation outcomes. In such accounts, context is frequently treated as a relatively stable background: ecosystems are anchored in place, and their evolution is largely subordinated to regional development logics. Recent work, however, increasingly treats institutions and infrastructures as active forces that shape participation, coordination, and value capture over time (e.g. Addo, 2022; Gegenhuber *et al.*, 2022; Cochis and Ungureanu, 2025).

An institutional perspective invites a different emphasis. Rather than viewing context as a backdrop, it foregrounds how regulatory frameworks, cultural–political logics, and technological standards actively shape who can participate in an ecosystem, on what terms, and with which forms of value creation (Ungureanu, 2026; Cochis and Ungureanu, 2025; Thomas and Ritala, 2022). Consider the role of GDPR in European health-tech ecosystems. What appears to be a privacy regulation also reconfigures architecture and roles: only actors with compliant data infrastructures can participate; consent and data-processing rules shape viable business models; and new solutions, such as federated learning, emerge as workarounds to reconcile data protection with data-driven innovation. In manufacturing contexts, big data analytics capabilities interact with environmental regulations to shape green innovation trajectories in similar ways (Mehmood *et al.*, 2025). Mehmood *et al.* (2025) further document measurable effects on both economic and environmental performance, showing how institutional pressures and technical capabilities co-produce ecosystem outcomes. The

institutional density of healthcare ecosystems is particularly visible in cross-border collaboration: Pikkarainen *et al.* (2025) document how academic orchestrators and industry partners negotiate competing ethical, regulatory, and privacy regimes when extending innovation activities to overseas markets, generating governance challenges that local-only ecosystem accounts do not anticipate. The regulation does not simply constrain a pre-existing ecosystem; it helps bring into being new roles and relationships, with data-protection officers, privacy-enhancing technology providers, and compliance auditors becoming central actors who previously played a marginal role in health innovation.

Other contemporary cases show this constitutive dimension. Blockchain smart contracts instantiate rule systems that partially substitute for traditional intermediaries, hardwiring transfer conditions and thereby redrawing institutional boundaries between market, state, and community arrangements (Davidson *et al.*, 2018; Vergne and Swain, 2017). Platform rules and web APIs in travel ecosystems structure how multiple actors (e.g. airlines, hotels, payment providers, third-party apps) integrate and transact without hierarchical control, showing how technical standards can function as institutional arrangements (Gawer, 2014). Data-sovereignty laws fragment global AI ecosystems into regional variants, each characterized by distinct participation rules, data-access conditions, and innovation trajectories (Aaronson, 2021).

Institutional theory offers a set of concepts to analyze these dynamics. Work on institutional logics and institutional work highlights how multiple logics (i.e. market, professional, community, state) coexist and collide in the same ecosystem, and how actors engage in standard-setting, lobbying, and norm entrepreneurship to stabilize particular configurations (Hinings *et al.*, 2018; Thornton and Ocasio, 2008; Lawrence and Suddaby, 2006). From such a standpoint, innovation ecosystems become sites where multiple logics intersect, collide, and hybridize through technological arrangements, as shown by platform-based sharing models (Laurell and Sandstrom, 2017; Mair and Reischauer, 2017), blockchain-based governance mechanisms (Davidson *et al.*, 2018; Vergne and Swain, 2017), and AI-enabled reconfigurations of professional expertise and market models (Bailey *et al.*, 2022; Faraj *et al.*, 2018). Institutional work directs attention to the purposive actions through which actors create, maintain, and transform institutions while engaging with pluralistic and unsettled fields (Lawrence *et al.*, 2009). In innovation ecosystems, this work is increasingly mediated by socio-technical artifacts, such as standards, APIs, smart contracts, certification schemes, and compliance tools, that embed particular institutional logics into everyday practices and thereby shape participation, coordination, and legitimacy (Faik *et al.*, 2020; Zobel and Hagedoorn, 2020). From this perspective, institutional embeddedness is not a contextual condition imposed on ecosystems, but an ongoing organizational accomplishment through which technologies, actors, and logics co-evolve in the formation of new fields. This emphasis on fields also connects innovation ecosystem research to longstanding debates beyond innovation management. In economic sociology, economic action is understood as embedded in concrete structures of social relations (Granovetter, 1985), and fields are seen to change through the shifting interplay of institutions, networks, and cognition (Beckert, 2010). Relatedly, regulatory governance scholarship examines how rules are increasingly enacted through technical and algorithmic systems rather than through legal text alone (Yeung, 2018), mirroring how ecosystem participation is reshaped through infrastructural channels.

Actor–Network Theory further sensitizes us to the heterogeneous "actants" involved, regulations, algorithms, standards, devices, and to the enrolment processes through which they are linked into relatively durable networks (Latour, 2005).

Two Combinatory Propositions on the Contribution of the Framework. The integration of the three lenses supports two analytical propositions that purely structural accounts handle less cleanly. We articulate these as combinatory propositions: theoretical statements that follow from combining the lenses and whose empirical investigation belongs to the research agenda outlined below.

P1. In digitally mediated innovation ecosystems, small changes in technical artifacts (interfaces, standards, audit and consent routines) can reallocate authority and trust among participants without requiring formal renegotiation of the ecosystem architecture.

Proposition 1 follows from combining the first lens (relational and sociomaterial dynamics) with the second lens (governance-in-practice). Whereas structural accounts treat technical architecture as a fixed substrate on which actors align, the proposition is that the substrate itself is an instrument of governance and that minor sociomaterial revisions function as substantive coordination interventions. The proposition is observable in API versioning and deprecation cycles, certification regimes, and platform policy updates.

P2. In digitally mediated innovation ecosystems, institutional change in adjacent fields reshapes ecosystem participation through infrastructural rather than contractual channels, by inscribing new institutional logics into the technical and procedural arrangements that condition ecosystem entry, exit, and contribution.

Proposition 2 follows from combining the second lens (governance-in-practice) with the third lens (institutional embeddedness). Whereas structural accounts treat the institutional environment as an exogenous context, the proposition states that institutional logics are inscribed in technical artifacts and that ecosystem participation is therefore reshaped through infrastructural reconfiguration as much as through contractual or strategic adjustment. The proposition is observable in PSD2-driven open banking, GDPR-driven reconfiguration of European health-tech ecosystems, and emerging AI governance regimes.

Together, the two propositions clarify what an organizing perspective adds. It specifies how technical artifacts and institutional logics jointly produce, sustain, and reshape ecosystem coordination in ways that are not reducible either to contractual alignment or to structural complementarity.

Research agenda

Building on the three perspectives developed above, we outline a research agenda that approaches innovation ecosystems as ongoing organizing processes rather than as stable configurations of actors and technologies. Rather than aiming for exhaustive coverage, this agenda shows how the three conceptual transitions, from interdependence to relational dynamics, from orchestration to governance in practice, and from contextual boundaries to institutional embeddedness, reorient what counts as a meaningful research question, how such questions can be studied, and which empirical settings become particularly revealing (see Table 1).

Viewed through the lens of interdependence as relational dynamics, a first line of inquiry shifts attention from assumed complementarities and generalized trust toward the situated practices through which both are enacted and sustained. Instead of asking whether trust exists between ecosystem participants, research can examine how trust is produced, repaired, or withdrawn through sociomaterial arrangements (Orlikowski, 2007; Lumineau *et al.*, 2023). In API-based software ecosystems, for example, API versioning, deprecation policies, and backward-compatibility decisions become critical sites where trust relations between platform owners and complementors are negotiated over time. Similarly, in decentralized ecosystems such as blockchain-based protocols, trust does not reside solely in formal governance claims or technical guarantees, but emerges from the interaction of code, interfaces, monitoring tools, and community norms (Davidson *et al.*, 2018; Ungureanu *et al.*, 2025). Studying these dynamics calls for methodological approaches that combine qualitative case studies and interviews with digital trace ethnography, such as analyses of code repositories, deprecation logs, and developer discussions, and with multimodal network analyses that layer technical dependencies and social relations longitudinally.

Table 1. Research agenda showing conceptual transitions, lenses, questions, methods and contexts

Transition	Theoretical lens	Example research questions	Innovative methods	Exemplary empirical domains	Key references
Interdependence → Relational Dynamics	Sociomateriality	How do API versioning practices shape trust dynamics between platform owners and complementors? What sociomaterial conditions support trust formation in decentralized ecosystems?	*Digital Trace Ethnography*: Analyze GitHub commits, API deprecation logs, developer forum discussions *Multi-Modal Network Dynamics*: Layer technical dependencies with social ties across time	API-based software ecosystems (npm, PyPI) Blockchain DeFi protocols	Orlikowski (2007), Leonardi (2013), Bailey *et al.* (2022), Ma *et al.* (2025)
Orchestration → Governance-in-Practice	Shared Governance and Multi-leadership	How does leadership emerge in ecosystems without central orchestrators? What routines constitute distributed governance?	*Digital Trace Ethnography*: Follow governance proposals, voting patterns, implementation cycles	Platform cooperatives, DAOs Open-source foundations (Linux, Apache)	Reypens *et al.* (2021), Shipilov and Gawer (2020), Pei and Dong (2025)
	Dynamic Capabilities	How do sensing and learning routines operate across organizational boundaries? What ecosystem-level capabilities enable reconfiguration?	*Experimental Digital Platforms*: Manipulate information sharing rules and observe adaptation	Innovation sandboxes, regulatory testbeds Crisis-response innovation networks	Marchese *et al.* (2026), De Fano *et al.* (2026), Leih and Teece (2016)
Contextual Boundaries → Institutional Embeddedness	Institutional Theory	How are ecosystems legitimized in contested institutional environments? What forms of institutional work support ecosystem emergence?	*Infrastructure Inversion Studies*: Analyze breakdowns and standardization battles *Multi-Modal Network Dynamics*: Track regulatory lobbying networks alongside technical development	Smart city implementations Quantum computing consortia	Hinings *et al.* (2018), Thornton and Ocasio (2008), Khatami *et al.* (2024)
	Actor-Network Theory	How do standards and tools stabilize or destabilize coordination? In what ways do non-human actors participate in governance?	*Digital Trace Ethnography*: Follow protocol fork debates and implementation *Machine Learning Pattern Detection*: Identify how algorithmic decisions shape participation	Web3 governance tokens AI model marketplaces	Latour (2005), Faik *et al.* (2020), Pikkarainen *et al.* (2025)

Source(s): Authors' own work

A second, more explicitly processual line of inquiry follows from treating ecosystems as dynamic relational arrangements rather than lifecycle stages or equilibrium states. From this perspective, key questions concern how ecosystem transitions unfold, how they become recognizable to participants, and how they reconfigure roles and patterns of participation. In deep-tech venture ecosystems, for instance, researchers can investigate what constitutes a tipping point in ecosystem evolution and how such transitions manifest in shifts in contributor engagement, role differentiation, or patterns of coordination. Addressing these questions benefits from combining machine-learning-based analyses of ecosystem trajectories with qualitative process tracing, enabling scholars to identify critical configurations and sequences while remaining attentive to actors' interpretations and responses as transitions unfold.

In practice, the transition from orchestration to governance shifts attention from identifying a single coordinating actor to understanding how governance is achieved through distributed leadership, collective capabilities, and situated decision-making (Reypens *et al.*, 2021; Shipilov and Gawer, 2020). Rather than assuming that coordination requires a dominant orchestrator, this perspective invites research into how authority, responsibility, and direction emerge through ongoing interactions among ecosystem participants.

One line of inquiry examines the emergence of leadership in the absence of centralized control. In ecosystems such as platform cooperatives or decentralized autonomous organizations, leadership is often episodic, contested, and tied to specific governance moments rather than formal roles. Research can therefore examine when and how leadership crystallizes around particular issues, such as protocol upgrades, resource allocation, or crisis response, and which governance episodes prove consequential for ecosystem trajectories. A second line of inquiry focuses on the routines that sustain distributed governance over time. In open-source foundations and similar settings, coordination relies on recurring practices such as agenda-setting, code review, voting procedures, release rituals, and conflict-resolution mechanisms. Studying these routines as organizational accomplishments reveals how governance is stabilized without hierarchy and how collective accountability is maintained across heterogeneous actors (Altman *et al.*, 2022; Reiter *et al.*, 2024).

A third, closely related line of inquiry examines sensing and learning across organizational boundaries, particularly in experimental settings such as innovation sandboxes and regulatory testbeds. In these contexts, governance in practice involves not only decision-making but also the ongoing interpretation of signals, feedback, and failures across organizations and institutional domains. Research can explore how ecosystem-level capabilities for sensing, learning, and reconfiguration develop and how they enable coordinated responses in contexts such as crisis-driven innovation networks.

Addressing these questions requires methodological approaches sensitive to process, participation, and temporality. Longitudinal case studies can capture how governance arrangements evolve, while participatory action research allows scholars to observe governance practices from within. Digital trace ethnography by following proposals, voting patterns, and implementation cycles offers fine-grained insights into decision-making in digitally mediated ecosystems. These approaches can be complemented by process mining to trace shifts in resource allocation and coordination during pivots or shocks, as well as by more conventional survey- and interview-based designs.

The transition from contextual boundaries to institutional embeddedness foregrounds how innovation ecosystems are constituted through the interplay of institutional arrangements and socio-technical artifacts, which jointly define who can participate, on what terms, and with which forms of value creation. From this perspective, ecosystems are not merely shaped by institutions but also operate as sites where institutional logics are enacted, recombined, and contested through organizing practices and technological infrastructures (Thornton and Ocasio, 2008; Lawrence *et al.*, 2009).

One line of inquiry therefore examines how ecosystems are legitimized and stabilized in contested institutional environments, such as smart city initiatives or quantum computing consortia, where multiple logics (i.e. market, state, professional, and community) intersect.

Rather than treating legitimacy as an external condition, research can investigate how actors engage in institutional work to align, hybridize, or selectively privilege particular logics during ecosystem emergence and consolidation. This includes examining how narratives, standards, governance arrangements, and technological artifacts are mobilized to render new ecosystem configurations credible and durable, and how such efforts contribute to the formation of new technological fields.

A second line of inquiry focuses on the institutional role of standards and tools in stabilizing or destabilizing ecosystem coordination over time. In settings such as Web3 governance through tokens or AI model marketplaces, standards, protocols, interfaces, and compliance services do not simply support coordination; they embed specific institutional assumptions about authority, accountability, and participation, thereby shaping governance outcomes (Faik *et al.*, 2020; Latour, 2005). Research can explore how these non-human actors participate in institutional work by privileging certain logics, excluding alternative arrangements, or triggering contestation and fragmentation, and how such dynamics influence the trajectory of ecosystem development.

Studying these processes calls for methodological approaches that capture institutional dynamics as they unfold within socio-technical arrangements. Interviews, archival analysis, and comparative case studies can illuminate how actors interpret and negotiate institutional demands, while infrastructure inversion studies focusing on breakdowns, migrations, and standardization battles can reveal moments when embedded logics become visible and contested. These approaches can be complemented by multimodal network analyses that trace the co-evolution of regulatory and technical networks, digital trace ethnography of protocol debates and forks, and machine-learning-based analyses that reveal how technical configurations shape participation patterns and contribute to the consolidation or destabilization of emerging ecosystem fields.

While we have emphasized three organizational perspectives, this agenda is not meant to exclude other theoretical approaches. Work on entrepreneurship in innovation ecosystems, particularly in contexts shaped by emerging technologies and new organizational forms, can enrich these questions by asking: how do entrepreneurs identify and create opportunities within evolving ecosystems, how do they position themselves in relation to platforms and infrastructures, and how does their experimentation reshape complementarities and governance arrangements? In circular economy contexts, startups act as ecosystem enablers through digital technologies and stakeholder orchestration (Cerchione *et al.*, 2026). Likewise, perspectives from innovation and strategy management remain central. Research on open innovation, search and recombination, ambidexterity, platform and ecosystem strategy, coopetition, and dynamic capabilities can all contribute to questions such as: how do firms and other actors design their innovation portfolios, how do they choose ecosystem positions, and how do they respond to technological disruption within broader socio-technical environments? We envisage contributions that connect these strands, rather than positioning them as alternatives.

Overall, these research directions, together with Table 1, serve as a starting point for future studies on how innovation ecosystems are organized, governed, and institutionally embedded in the field of emerging technologies.

Methodological approaches for studying innovation ecosystems

Research on innovation ecosystems has relied on established methods, including qualitative case studies and interviews, comparative multiple-case designs, cross-sectional surveys, static network analysis, and variance-based models. These approaches remain appropriate and necessary for many questions, for instance, when we want to compare ecosystem configurations or assess the association between ecosystem features and innovation outcomes. At the same time, our reframing of ecosystems as ongoing organizing processes invites us to complement these methods with designs and data that more directly capture

temporality, micro-level interaction, and socio-technical entanglement. Below, we highlight a set of methodological options, many of which build on digital traces and computational tools that can be combined with more traditional qualitative and quantitative approaches to study processual ecosystems.

Digital Trace Ethnography combines computational and ethnographic methods to study ecosystem dynamics through digital footprints. By analyzing GitHub commits, API calls, forum discussions, and protocol governance votes, researchers can trace how technical decisions and social negotiations co-evolve. For instance, studying Ethereum's transition to Proof-of-Stake requires following EIP discussions, testnet deployments, validator behaviors, and DeFi protocol adaptations, revealing governance-in-practice rather than formal structure (Geiger and Ribes, 2011; Lazer *et al.*, 2020).

Multi-Modal Network Dynamics extends network analysis beyond static snapshots to capture evolving, multilayered relationships. Temporal network methods track how ties form, strengthen, decay, and reconfigure. Multiplex approaches layer technical dependencies (code libraries), social relationships (developer communities), and institutional affiliations (corporate backing) to reveal how different coordination mechanisms interact and substitute over time (Kivela *et al.*, 2014).

Experimental Digital Platforms create controlled yet realistic environments for studying ecosystem emergence. Researchers can manipulate governance rules, technical architectures, and incentive structures while observing how participants self-organize. Platform experiments bridge the gap between abstract modeling and messy field studies, enabling causal inference about coordination mechanisms (Chen and Konstan, 2015; Salganik, 2017).

Machine Learning for Pattern Detection applies unsupervised learning to identify emergent roles, governance regimes, and innovation trajectories from large-scale ecosystem data. Topic modeling of developer discussions reveals shifting concerns; clustering of contribution patterns identifies actor types; sequence analysis of API evolution exposes architectural politics. These computational methods complement qualitative interpretation in handling ecosystem-scale and complexity (Hannigan *et al.*, 2019).

Infrastructure Inversion Studies make visible the taken-for-granted technical substrates that enable ecosystem coordination. By studying breakdowns, migrations, and standardization battles, researchers expose how APIs, protocols, and platforms shape possibilities. This approach treats infrastructure not as context but as an object of study, revealing how technical choices embed organizational and institutional logics (Tilson *et al.*, 2010).

These methodological options can help researchers complement static pictures of ecosystem architecture with more dynamic accounts of how coordination and governance unfold in practice. By combining computational tools with interpretive depth, they offer concrete ways to operationalize a processual view of innovation ecosystems.

Implications for research, practice, and policy

The organizing perspective on innovation ecosystems advanced in this paper carries differentiated implications for research, practice, and policy. We articulate them separately to make the contribution actionable across audiences and to clarify what an organizing vocabulary enables that purely structural accounts do not.

Implications for Research. For ecosystem scholars, the framework reorients empirical inquiry from architectural mapping to processual investigation. Three methodological consequences follow. First, studying coordination as governance-in-practice calls for designs that capture situated decision-making over time, in particular longitudinal case studies, digital trace ethnography of platform governance, and process tracing of governance episodes. Second, treating sociomaterial entanglement as constitutive invites multi-modal designs that layer technical dependencies (code repositories, API logs, standards documents) with social and institutional ties. Third, examining institutional embeddedness as constitutive supports comparative designs across regulatory regimes and field configurations, where infrastructure

inversion studies and machine-learning analyses of standardization battles complement traditional comparative case work.

Implications for Practice. For managers participating in or orchestrating innovation ecosystems, the framework reframes coordination as ongoing governance work rather than as architectural design. Three concrete implications follow. First, technical artifacts (interfaces, API versioning policies, audit and consent flows) are governance instruments and should be managed as such: minor revisions can reallocate authority and trust without requiring formal renegotiation of contractual relationships. Second, leadership in multi-actor ecosystems is distributed and episodic rather than permanent; investing in routines that sustain distributed leadership over time, including agenda setting, dispute resolution, and release rituals, supports coordination more reliably than appointing a fixed orchestrator. Third, ecosystem participation is shaped by adjacent institutional and infrastructural arrangements; managers who monitor regulatory and infrastructural shifts (privacy regulation, AI governance, payment infrastructure) can anticipate reconfigurations in participation earlier than those who attend only to contractual relationships.

Implications for Policy. For policymakers and regulators, the framework highlights the constitutive role of policy instruments in innovation ecosystems. Two considerations follow. First, infrastructure-level rules (PSD2-style open-banking mandates, GDPR-style data protection requirements, emerging AI governance frameworks) not only constrain pre-existing ecosystems; they also actively create new ecosystem configurations by reallocating who can participate and on what terms. Designing such rules, therefore, requires attention to ecosystem-formation effects, not only to the compliance burden. Second, technical standards are institutional arrangements; standard-setting processes are governance interventions, and policymakers should treat standardization venues as sites of institutional work in which rules are inscribed in artifacts.

Conclusion

This work advances an organizing perspective on innovation ecosystems. Rather than treating ecosystems as stable architectures of complementary actors, it suggests viewing them as processes in which roles, rules, and relationships are continually shaped and reshaped through ongoing interaction among firms, platforms, regulators, and technological infrastructures.

This perspective is articulated through three related reorientations. First, interdependence is treated as enacted in practice rather than assumed as a structural condition: complementarities are produced through relationships, routines, and technical arrangements such as APIs, data standards, and interfaces. Second, orchestration is reframed as governance work rather than design intent. Coordination need not reside with a single focal actor but often emerges through layered, evolving arrangements in which authority is distributed across organizations, technologies, and procedural mechanisms. Third, institutions are treated not as a contextual backdrop but as constitutive elements. Regulatory frameworks, cultural logics, and technical standards play an active role in defining participation, responsibilities, and possibilities for value creation within ecosystems.

For scholars engaging with innovation ecosystems, a processual view shifts attention to temporality, sociomaterial arrangements, and governance as they are enacted in practice, particularly in settings characterized by digital infrastructures and institutional complexity.

Scope and Boundary Conditions. The organizing perspective developed in this paper offers the strongest analytical traction in three settings. First, in digitally mediated, multi-actor ecosystems, where coordination is enacted through technical artifacts and authority is distributed across heterogeneous participants, the framework helps explain how minor sociomaterial revisions reallocate authority and trust without formal renegotiation. Second, in ecosystems undergoing institutional change in adjacent fields, where regulatory regimes and technical standards are inscribed in participation rules, the framework clarifies how institutional change reshapes participation through infrastructural rather than contractual

channels. Third, in ecosystems characterized by high uncertainty, contested boundaries, or the absence of dominant orchestrators, where structural mappings underdetermine actual coordination, the framework provides traction. Conversely, the marginal contribution of an organizing perspective is more limited in mature, well-bounded, single-platform ecosystems with stable architectures, where strategic and structural accounts already provide effective traction. Within this scope, an organizing perspective complements rather than replaces existing approaches: it refines Adner's (2017) alignment-structure account by specifying how alignment is produced over time, complements Jacobides *et al.*'s (2018) ecosystem theory by foregrounding sociomaterial mediation, and extends Thomas and Autio's (2020) organizing typology by articulating analytical levels and boundary conditions. The two combinatory propositions advanced in Section 3 articulate testable directions for future empirical work along these lines, in dialogue with the focused ecosystem lens proposed by Baldwin *et al.* (2024).

The research agenda and methodological directions outlined in this paper are offered as points of departure. Their relevance will depend on how scholars apply them in concrete empirical settings, ranging from AI-related innovation domains and blockchain-based systems to sectoral and regional ecosystems, and on whether they help explain how ecosystems form, persist, and change. By treating innovation ecosystems as dynamic socio-technical arrangements, this paper provides a vocabulary for studying how ecosystems are organized, governed, and institutionally constituted over time.

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Corresponding author
Carlotta Cochis can be contacted at: carlotta.cochis@unimore.it