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RESEARCH ARTICLE

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Managing ecosystem emergence and evolution: Strategies for ecosystem architects

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Abstract

Research Summary: While the notion of ecosystems has become prominent in scholarly and practitioner strategy literature in recent years, more can be done to bridge these two communities. In this introduction to the SMS Collection, we interrogate strategy scholarship from the perspective of "ecosystem architects," who are private or public sector actors interested in nurturing and developing a given ecosystem as a whole. In doing so, we collate and discuss key articles published in the journals of the Strategic Management Society which, considered together, shed new light on processes of ecosystem emergence and evolution. We distill a range of insights for ecosystem architect practitioners and outline four strategies for them to create conditions appropriate to their ecosystem and its stage of development.

Managerial Summary: What insights does strategy research offer to practitioners interested in nurturing the creation and ongoing development of a range of different types of ecosystems? In this introduction to the SMS Collection, we distill relevant findings and outline four strategies for public and private ecosystem architects to create conditions appropriate to their ecosystem and its stage of development. Specifically, we outline approaches to create conditions for coalescence,

coopetition, cooperation, and contained contestation within emerging and evolving ecosystems.

KEYWORDS

business ecosystems, ecosystem architects, ecosystem strategy, entrepreneurial ecosystems, innovation ecosystems, platform ecosystems, strategy process

1 | INTRODUCTION

Since Moore (1993) advocated an ecological approach to strategy, the use of the ecosystem label has proliferated and been applied in numerous organizational contexts because of its descriptive accuracy in relation to a range of complex, purposeful, interconnected, heterogeneous systems within and for which strategy is made. In recent years, the notion of "ecosystems" has gained considerable traction in discussions among strategy scholars and practitioners in private, public, and civil society organizations (Adner, 2006, 2017; Altman, Nagle, & Tushman, 2022; Fuller, Jacobides, & Reeves, 2019; Ganco, Kapoor, & Lee, 2020; Iansiti & Levien, 2004; Jacobides, Cennamo, & Gawer, 2018; Mantovani & Ruiz-Aliseda, 2016; Nambisan & Baron, 2013; Rauth, Carlgren, & Elmquist, 2015; Reeves, Lotan, Legrand, & Jacobides, 2019; Shipilov & Gawer, 2020). It refers to "a set of actors that contribute to the focal offer's user value proposition" (Kapoor, 2018, p. 2) but each with "varying degrees of multilateral, nongeneric complementarities that are not fully hierarchically controlled" (Jacobides et al., 2018, p. 2264). This growing interest is acknowledgment of complex economic relations and interdependencies as well as information and resource flows among organizational actors from different sectors and industries: from the rise of new information technology-enabled platform ecosystems (See Kretschmer, Leiponen, Schilling, & Vasudeva, 2022 and Special Issue on "Strategies for Platform Ecosystems," *Strategic Management Journal*, Volume 43(3)) through to increasingly integrated innovation ecosystems coalescing around focal technologies and value propositions (Adner, 2017; Hannah & Eisenhardt, 2018; Kapoor, 2018) as well as local systems for fostering entrepreneurial activity in a specific geographic region (Autio, Nambisan, Thomas, & Wright, 2018; Thompson, Purdy, & Ventresca, 2018).

"Ecosystem" explanations provide practitioners with heuristics to guide action and scholars with metaphors and models to theorize complexity amidst a period of enormous economic change and global connectivity. References to ecosystems grew steadily over the last 20 years in top strategy journals,[1] with this conceptual lens used to examine interconnectivity across a range of domains, including software platforms (Eckhardt, Ciuchta, & Carpenter, 2018; Kapoor & Agarwal, 2017; Panico & Cennamo, 2022; Rietveld, Ploog, & Nieborg, 2020), focal

[1]Between 2002 and 2021, there were 194 articles in 18 top strategy and management journals, which used the term "ecosystem" in the topic field. Of this, 145 articles were published in the 5 years from 2017 to 2021. Our search was conducted on April 22, 2022, using Web of Science and included the following journals: *Academy of Management Journal, Academy of Management Review, Administrative Science Quarterly, Entrepreneurship Theory and Practice, Global Strategy Journal, Journal of Business Venturing, Journal of Management Studies, Journal of Management, Journal of Product Innovation Management, Long Range Planning, Management Science, Organization Science, Organization Studies, Research Policy, Strategic Entrepreneurship Journal, Strategic Management Journal, Strategic Management Review, Strategic Organization* and *Strategy Science*.

hardware technologies (Adner & Kapoor, 2016; Hannah & Eisenhardt, 2018; Kapoor & Furr, 2015; Randhawa, West, Skellern, & Josserand, 2020), entrepreneurial regions (Autio et al., 2018; Cantner, Cunningham, Lehmann, & Menter, 2021; Malecki, 2018; Spigel, 2017), and industrial clusters (Arikan & Schilling, 2011; Baptista & Swann, 1998; Cruz & Teixeira, 2010; Delgado, Porter, & Stern, 2010; Feldman, Francis, & Bercovitz, 2005). Internet search results for "ecosystems" also proliferated during this period,[2] reflecting industry and media interest in a concept that is increasingly featured in businesses' partnering activities (BearingPoint, 2018; Higgins, 2020; Li & Sengupta, 2020; Norma Watenpaugh, 2019), consultants' thought leadership and service offerings (Canning & Kelly, 2015; Pidun, Reeves, & Kunst, 2021; Sengupta et al., 2019; Strategyzer, 2020), and policymakers' efforts to stimulate new, and regenerate existing, industries and technologies (Deloitte, 2019; Kuester, Arya, & Gauthier, 2020; Marco Dondi et al., 2020). Despite the shared, increased interest in ecosystems from scholars and practitioners, more can be done to bridge these communities. Not only could practitioners' questions and priorities fruitfully inform areas of future scholarly inquiry, but researchers' theories and empirical findings could also be translated into actionable terms to inform the practices of strategists who will benefit from new ways to understand and navigate the complex adaptive systems in which they operate.

The journals of the Strategic Management Society (SMS) have been the source of much scholarly attention addressing ecosystems of various kinds. Entrepreneurial ecosystems are systems "of co-located elements where a variety of actors, functions, and institutions interact to support the creation and growth of new ventures" (Thompson et al., 2018, p. 97). As such, they tend to be sector and technology agnostic, producing outputs in the form of start-ups that collectively target a wide range of audiences with value propositions of all kinds (Autio et al., 2018; Thomas & Autio, 2020). In contrast, business ecosystems, innovation ecosystems, and platform ecosystems are "group[s] of interacting firms that depend on each other's activities," with the prefix distinguishing some focal object bringing the firms together materially and conceptually: business ecosystem research centers on a focal firm and its environment; innovation ecosystem research emphasizes novel technologies and the new value propositions associated with them, as well as the constellation of actors involved in value creation; while platform ecosystem research considers how actors organize around a stable core or "platform" technology, which becomes more valuable as complementary components are added to it to generate derivative products (Jacobides et al., 2018, pp. 2,256–2,257; see also Kretschmer et al., 2022). As a result, the outputs of business, innovation, and platform ecosystems tend to be products and services with value propositions targeted at customers or users linked to specific industries or technologies—a more narrow and less diverse set than that making up the potential value proposition audiences of entrepreneurial ecosystems.

Although analytically distinct, with entrepreneurial ecosystems on one hand and business, innovation, and platform ecosystems on the other hand, the empirical reality in which practitioners make strategy is characterized by different types of ecosystems that overlap, intersect, and interpenetrate one another to varying degrees. Start-ups that emerge from a given entrepreneurial ecosystem may, for example, simultaneously become part of one or more pre-existing business, innovation, or platform ecosystems, depending upon their specific user value proposition. And some entrepreneurial ecosystems may be much less sector and technology agnostic

[2]Combined search engine results for the following terms increased more than 350% from 2012 to 2021: "business ecosystem" OR "innovation ecosystem" OR "platform ecosystem" OR "entrepreneurial ecosystem" OR "startup ecosystem." Our search was conducted on April 22, 2022, using Google Trends.

than the conceptual ideal type suggests because, for example, they overlap geographically with business, innovation, or platform ecosystems associated with a regional industrial cluster. In addition, from a research perspective, commonalities across different types of ecosystems have been identified and theorized (see Thomas & Autio, 2020). For both practical and theoretical reasons, therefore, strategy insights drawn from one type of ecosystem may also be valuable in others, which is why we have drawn together research addressing these different types of ecosystems to form this SMS Collection.

In this introduction, we summarize and synthesize a subset of SMS articles addressing ecosystems, to focus on insights from this literature for a specific type of practitioner—one who might characterize themself as an "ecosystem architect" (Snihur, Thomas, & Burgelman, 2018, p. 1300). Ecosystem architects include civic leaders or firm CEOs who aim to bring into existence then nurture the ongoing expansion and development of an ecosystem as a whole, rather than for the narrow benefit of a single or few participants within the ecosystem. Referred to under a variety of labels—such as ecosystem orchestrators (Autio, 2022; Lingens, Miehé, & Gassmann, 2021; Thomas & Ritala, 2022), ecosystem engineers (Johnson, 2011; Sun, Chen, Sunny, & Chen, 2019), ecosystem leaders (Dedehayir, Mäkinen, & Roland Ortt, 2018; Moore, 2016), hubs (Jacobides et al., 2018; Nambisan & Baron, 2013; Rietveld & Schilling, 2021), and focal firms or actors (Adner, 2017; Dattee, Alexy, & Autio, 2018; Ganco et al., 2020)—we use the term ecosystem *architect* as it captures well the design choices that inform their purposive action.

In addition, we distinguish between public and private ecosystem architects. By public ecosystem architects, we mean actors—such as civic leaders—primarily interested in how entrepreneurial ecosystems anchored in specific spatial locations or regions, create value for ecosystem stakeholders without much concern for capturing the value for themselves. For them, much of the value created by an ecosystem resembles a public good. In contrast, private ecosystem architects are interested in both the creation and capture of value by stakeholders—including themselves, notably—brought together around focal firms, technologies, or platforms over which they, as architects, exercise a degree of control that is consequential for the wider business, innovation, and platform ecosystems in which they operate. By introducing this distinction and mapping—public architects to entrepreneurial ecosystems, and private architects to business, innovation, and platform ecosystems—we achieve analytical clarity. But, as we elaborate in our Discussion at the end of our essay, we do so with a caveat: we caution against reifying these associations because different types of ecosystems do in fact overlap both theoretically and empirically.

Despite the strong interest in the ecosystem construct, few attempts have been made to examine the literature on ecosystems from the perspective of this type of practitioner and ask: *what can ecosystem architects learn from existing literature about how to manage processes of ecosystem emergence and evolution*? This lack of processual attention is problematic because ecosystems are dynamic systems in which architects have the potential to shape, but not totally control, emergence, and evolution. We focus on the processual dynamics that constitute ecosystems and shape their continuity or change over time, allowing us to go beyond questions of what ecosystems are and what occurs within them. A processual perspective moves beyond the structure of ecosystems to consider the kinds of activities and interactions that give rise to them and to which they give rise, in a recursive, iterative structuring of ecosystems through firms' strategic action. This processual orientation is of managerial importance because ecosystem outcomes not only arise from organization-level strategic action (Lingens et al., 2021; Masucci, Brusoni, & Cennamo, 2020; Snihur et al., 2018) but, in turn, also enable and constrain

subsequent strategy-making by organizations (Hannah & Eisenhardt, 2018; Khanagha, Ansari, Paroutis, & Oviedo, 2022; Zhang, Li, & Tong, 2022). Therefore, ecosystem architects need to appreciate the processes through which ecosystems emerge and evolve over time to understand how their own actions shape the wider, interconnected system.

In compiling the SMS Collection, we first identified 36 articles related to ecosystems in the journals published by SMS. Next, we reviewed them and focused on a subset of 16 publications that adopt or align well with a processual perspective on ecosystems while also shedding light on key aspects of ecosystem emergence and evolution. In the remaining sections, we outline how these articles inform our understanding of the processual dynamics of ecosystems before distilling a range of insights for practitioners from this rich literature.

2 | EMERGENCE OF ECOSYSTEMS

The first ecosystem stage of development we address pertains to how they *emerge*. Emergence is "a process that involves (a) the creation of novelty, (b) its growth to a salient size, and (c) its formation into a recognizable social object, process, or structure" (Seidel & Greve, 2017, p. 2). The emergence of ecosystems is of interest to ecosystem architects given, on the one hand, the promise of economic and social benefits associated with ecosystems (Acs, Stam, Audretsch, & O'Connor, 2017; Autio, Kenney, Mustar, Siegel, & Wright, 2014; Kretschmer et al., 2022), and, on the other hand, the liability of newness, which is a risk factor that threatens the ongoing functioning of such embryonic organizational forms (Freeman, Carroll, & Hannan, 1983; Singh, Tucker, & House, 1986; Thomas & Ritala, 2022). As Thomas and Ritala (2022) highlight, this risk is particularly high in the context of ecosystems because they must achieve sufficient development and co-alignment of their elements before they are able to deliver on their ecosystem-level value proposition. As a result, understanding how ecosystems emerge is important to ecosystem architects as they seek to nurture ecosystems from birth through growth phases to established, ongoing functioning. Accordingly, we chose eight articles for this SMS Collection to highlight different aspects of emergence across a range of ecosystem types.

- Thompson et al. (2018) trace the emergence of Seattle's vibrant social impact entrepreneurial ecosystem. By tracing social interactions at four levels of analysis (dyad, group, organizational, inter-organizational), they develop a two-stage model of ecosystem emergence. In the first stage, interactions are disparate, distributed, and mostly at the dyad and group level, as would-be ecosystem participants focus on "creating community" by generating shared meanings and developing a common language. Then, as interaction "conventions" develop, these conventions increasingly structure actors' interactions until a phase transition occurs, after which activity coalesces into a recognizable, coordinated social order. Interactions in the second stage are more frequent and formalized, with legally constituted organizations and inter-organizational networks forming to complement dyadic and group-level activities by developing legal infrastructure and generating financial support in ways that reinforce the ecosystem's distinct identity, provide it legitimacy, and sustain resource flows into and through it.
- Goswami, Mitchell, and Bhagavatula (2018) examine the role of accelerators in developing the Bangalore entrepreneurial ecosystem. They explore the process of how accelerators not only support individual new ventures but, in so doing, also contribute to the development the wider entrepreneurial ecosystems in which they operate. The authors find that accelerators intermediate between new ventures and the entrepreneurial ecosystem via four types of

expertise: connecting new ventures to other ecosystem actors, developing individual entrepreneurial ventures, selecting appropriate accelerator participants (mentors and founders), and coordinating mentors and founders based on interests and capabilities. Through these expertise areas, accelerators increase commitment to their entrepreneurial ecosystems, help determine entrepreneurial ventures' viability, and build the ecosystem's entrepreneurial capacity.

- Autio et al. (2018) propose a conceptual model that accounts for several structural dimensions contributing to the emergence of entrepreneurial ecosystems. In addition to oft-noted spatial affordances, the authors emphasize the increasingly important enabling role of digital affordances, which also contribute to creating conditions of possibility for the pursuit of entrepreneurial opportunities by startup and scaleup ventures within a defined region. Because its members enjoy exposure to innovations around business processes related to entrepreneurship as well as business model innovations, a diverse set of new ventures—ones that, absent the entrepreneurial ecosystem, may have no connection to each other—are able to benefit from knowledge spillover effects.
- Mathias, McCann, and Whitman (2021) elaborate on innovation benefits and knowledge spillover effects. They explore the benefits of agglomeration, which refers to the geographic concentration of similar firms, in a meta-analysis of 42 studies of agglomeration's impact on the performance of both established firms and young ventures. The authors conclude that although agglomeration—a phenomenon characterizing numerous emerging entrepreneurial as well as business, innovation and platform ecosystems—confers innovation benefits, it does not consistently stimulate superior financial performance. These insights have significant implications for individual firms in the form of an intriguing dilemma—the promise of greater innovativeness for nascent ventures may be associated with poorer performance.
- Hannah and Eisenhardt (2018) conduct a multi-case study of five firms within the U.S. residential solar industry, an innovation ecosystem in which multiple firms, each with different capabilities, economics, and innovation rates, need to contribute complementary components to ultimately produce the final solar product. The authors find that firms in emerging innovation ecosystems adopt three strategies to influence their relationships with complementors/competitors through choices about which components they produce: *component strategies*, where a firm focuses only on a single component in the ecosystem and is therefore entirely reliant on complementors; *system strategies*, wherein firms compete against others for market share around most or all of the components in the system; and *bottleneck strategies*, when firms confront component "roadblocks" that slow the ecosystem's growth.
- Fang, Wu, and Clough (2021) focus on software platform ecosystems to investigate the social manner in which prospective providers of complementary products and services are enlisted to platforms via hackathons and other temporary gatherings. The authors find that platform diffusion among prospective complementors occurs at hackathons via four channels. First, sponsoring hackathons increases awareness and financially motivates the adoption of sponsors' platform technologies. Second, hackathons encourage social learning among platform users. Third, hackathons provide a forum for exchanging knowledge about the adoption and use of a platform technology. Finally, hackathons facilitate social coordination as participants "converge on a forward-looking consensus about which technological platform is likely to become dominant in the future" (2021, p. 242). In sum, hackathons foster the emergence of platform ecosystems by enticing and facilitating complementors to adopt their focal technology platform.

- Khanagha et al.'s (2022) case study of Cisco Systems' shift from cloud to fog computing, which drew on Cisco's existing technology architecture strengths by "managing data via distributed 'mini-clouds' located near the physical devices" (2022, p. 478), shows how increasing competition in an established platform ecosystem can constrain its members while also spurring them to catalyze the emergence of complementary platform ecosystems. Cisco's orientation toward the new fog platform did not undermine the original cloud ecosystem but, rather, entailed a mutualistic platform creation strategy that benefited both ecosystems. The authors identify three elements that enabled the emergence of the complementary ecosystem: material strategies to support cross-compatibility; symbolic strategies to cultivate dual favorability; and institutional strategies to share interconnection between the two platforms during a period of transition.
- Jacobides et al. (2018) synthesize prior research to advance a theory of ecosystems that illuminates their emergence while also explaining challenges associated with coordination, collaboration, value creation/capture, and governance. The authors argue that technological modularity and coordination are crucial interdependent dynamics that influence ecosystem emergence. Their theory suggests that the greater the degree and complementarity of modular elements in an ecosystem, the easier it is for an ecosystem to emerge and evolve.

There are important commonalties across these eight articles. First, the studies draw attention to a variety of enablers and facilitators of ecosystem emergence, such as temporary gatherings (Fang et al., 2021), technological affordances (Autio et al., 2018; Jacobides et al., 2018), intermediating institutions (Goswami et al., 2018), and even competitive pressures (Khanagha et al., 2022). Although diverse, these examples of enablers and facilitators are the kinds of levers that ecosystem architects can pull to initiate or accelerate the emergence of ecosystems. Second, the studies shed light on the changing strategies, structures and social interactions of emerging ecosystems. Examples include the way ecosystem communities and their patterns of interaction are created (Thompson et al., 2018) and coordinated (Goswami et al., 2018), the diffusion and proliferation of ecosystem understandings (Autio et al., 2018; Fang et al., 2021; Mathias et al., 2021), and the strategies of ecosystem actors seeking to create and capture value in and from emerging ecosystems (Hannah & Eisenhardt, 2018; Khanagha et al., 2022). The commonalties across the above eight articles underpin important insights for ecosystem architects navigating and nurturing the emergence of their ecosystems.

3 | EVOLUTION OF ECOSYSTEMS

The second stage of development we outline relates to how ecosystems change or *evolve*. Changes in ecosystems are the result of mutual adjustments inside the ecosystem or multidirectional influences between ecosystem actors and their ecosystem context (Lewin & Volberda, 1999; Van de Ven & Garud, 1994), which has led some researchers to describe the dynamic as "coevolving" (Autio & Thomas, 2014; Basole, 2009; Moore, 1993). Both "technological innovations" and "new styles of management" (Holgersson, Baldwin, Chesbrough, & Bogers, 2022), which refers to innovations in governance, inter-organizational coordination and contracting, can fuel the evolution of the very ecosystem that gave rise to them. In other words, ecosystems are subject to change at the hands of their participants whose innovative technologies and/or business models can reinforce incumbent dominance or reorient ecosystem evolution away from incumbents to challengers (Ansari, Garud, & Kumaraswamy, 2016; Snihur

et al., 2018). As a result, ecosystem evolution is of interest to practitioners and scholars alike. Accordingly, we selected eight articles to shed light on different aspects of evolution dynamics across a range of ecosystem types.

- In their conceptual article, Spigel and Harrison (2018) emphasize the important role of resource flows in shaping the evolution of entrepreneurial ecosystems. The authors formulate a process-based framework to explain ecosystem transformation that highlights ongoing development and flow of entrepreneurial resources such as human and financial capital, entrepreneurial know-how, market knowledge, and cultural attitudes. Because inflows, outflows, and internal circulation of these resources influence how an ecosystem evolves over time, tracking them can help scholars and practitioners distinguish between strong, well-functioning entrepreneurial ecosystems and weaker, poorly functioning ones.
- Nielsen (1988) develops a typology of four cooperative strategies—pool, exchange, de-escalate and contingency strategies—that are suitable for a range of situations characterized in terms of negative, zero or positive sum games and growing, mature or declining industries, and applicable across different ecosystem types. The strategies are relevant to diverse organizations, including new ventures, incumbent companies, government bodies, and nonprofit organizations. Acknowledging both positive and negative public policy implications of cooperative strategies, the study concludes that such strategies generally appear to improve value-added efficiency in most contexts and stages of industry and ecosystem life cycles.
- In contrast, Jones, Leiponen, and Vasudeva (2021) examine the role of conflict in driving the evolution of an innovation ecosystem. The authors use patent litigation data from a mobile telecommunications standards development organization to examine how litigation, surprisingly, leads to increased cooperation between litigant and defendant firms. They find that legal conflict clarifies and accentuates understanding of the distinct and related contributions of competing firms. Thus, post-conflict, ecosystem evolution is driven by increased cooperation between litigants seeking to create expected payoffs in the form of club benefits while simultaneously encouraging cooperation with other parties to lessen their mutual interdependence.
- Wang and Miller (2020) examine book publishers' product portfolios in Amazon's Kindle e-book platform ecosystem and the traditional printed book industry. The authors provide convincing evidence that complementors, that is, firms that provide content to digital platforms controlled by other firms, use their product offerings not only to increase their profits but also to manage their dependency upon these platforms. The reason is that digital platforms act as a double-edged sword for complementors, who face a tension between creating and appropriating value when they provide content for them. This tension animates platform ecosystem evolution, insomuch as the nature of a complementor's engagement with a particular platform arises from strategic considerations of demand for, competitiveness of, and strategic importance of its specific product offerings. In other words, platform ecosystems evolve as complementors continuously work to ameliorate in their favor the balance of bargaining power between them and platform sponsors.
- McDermott, Mudambi, and Parente (2013), in a conceptual paper, link modularity to the evolution of ecosystems, suggesting that vertically integrated Multinational Enterprises (MNEs) can benefit from the knowledge and capabilities of the innovation ecosystems in which their corporate network of subsidiaries operates. They argue that MNEs can transition from being large global value chain orchestrators to more specialized ecosystem actors by reengineering and redesigning products and services of the MNE in the form of modular subassemblies that

can be parceled out to ecosystem partners. Such "strategic modularity" can improve linkages and resource flows among actors, contributing to more openness in innovation systems, value-enhancing cooperative relationships, and social learning across the ecosystem.

- Adner and Kapoor's (2010) study of the innovation ecosystem around semiconductor lithography equipment from 1962 to 2005 reveals how challenges confronting actors in this ecosystem have different impacts on innovation depending on whether they occur upstream with suppliers or downstream with complementors. For example, upstream component-related innovation challenges for an electric vehicle might relate to engine transmission technologies, whereas downstream complement-related challenges might relate to engine charging infrastructure. The authors note that advantages accruing to technology leaders can be eroded when challenges confronted downstream by complementors or customers give rise to bottlenecks that slow the learning of technology leaders and afford trailing rivals the opportunity to close in and erode leaders' dominance.
- Adner and Kapoor (2016) explore the evolution of innovation ecosystems through the lens of technology substitution, with evidence from the semiconductor lithography equipment industry. The authors explain how the pace of substitution of incumbent technologies by newer ones depends upon not only the focal competing technologies but also the innovation ecosystems in which they are embedded. Whereas "ecosystem challenges" such as bottlenecks constrain the evolution of a technology's innovation ecosystem, "ecosystem extension opportunities," conversely, fuel it. Challenges and extension opportunities in both the new and incumbent technology's innovation ecosystems, therefore, interact to influence the pace of substitution. When firms producing incumbent technologies capitalize on ecosystem extension opportunities, it improves the relative performance of their incumbent technologies against new challenger ones, which slows the pace of substitution.
- Pierce (2009) examines data on 200,000 car leases between 1997 and 2002 to identify how one core firm's entry and pricing decisions in a business ecosystem can drive exit by complementary firms, thus constraining the ecosystem's evolution. The actions of focal manufacturing firms resulted in lessors forecasting vehicle values well above the actual value of vehicles at the end of lease periods which meant lessors lost money when selling vehicles at lease-end. The author theorizes that dominant focal firms' actions related to product design, product durability, market entry, and subsidization can stir up ecosystem "turbulence" and "generate financial losses and exit for complementary niche market firms" (p. 323). In other words, certain types of "hazardous activities" (p. 343) of core manufacturers can provoke ecosystem-constraining losses and product shakeouts.

These eight articles explore a range of fundamental features of ecosystem change, such as technology substitutes, modularity, conflict, and resource flows, which can spur the evolution of ecosystems and alter the relationships therein. Common to these articles is a preoccupation with how participants act and react in light of changing ecosystem dynamics. These changes, for example, require ecosystem actors to navigate technological (Adner & Kapoor, 2010, 2016), relational (Nielsen, 1988; Spigel & Harrison, 2018), commercial (McDermott et al., 2013; Pierce, 2009; Wang & Miller, 2020) and legal (Jones et al., 2021) issues brought about by evolving ecosystems. These articles also draw attention to the drivers of and ways of coping with ecosystem evolution as well as the changing number and strength of connections within evolving ecosystems; and they offer several insights for ecosystem architects which we now elaborate.

4 | INSIGHTS FOR ECOSYSTEM ARCHITECTS AND THEIR STRATEGIES FOR MANAGING ECOSYSTEM DYNAMICS

We now discuss insights for would-be ecosystem architects drawn from the articles included in this SMS Collection. In doing so, we make several observations of interest to practitioners across the stages of ecosystem emergence and evolution. Our discussion is informed by Spigel and Harrison's (2018) process-based view of entrepreneurial ecosystems, which gives attention to how varying *levels of connectivity* within ecosystems are accompanied by changing *quantities and flows of resources*. Based on similarities and differences between the situations that typically confront public and private ecosystem architects, we outline four strategies for architects to create conditions appropriate to their ecosystem's processual stage, namely: coalescence (for public ecosystem architects in emerging ecosystems), coopetition (for private ecosystem architects in emerging ecosystems), cooperation (for public ecosystem architects in evolving ecosystems), and contained contestation (for private ecosystem architects in evolving ecosystems). Therefore, while Spigel and Harrison describe what happens with regards to levels of connectivity, quantities, and flows of resources across different process stages, we go further in suggesting how to create conditions to foster desirable outcomes. We represent these strategies in Figure 1, summarize our key insights in Tables 1 and 2, and discuss each strategy in more detail below.

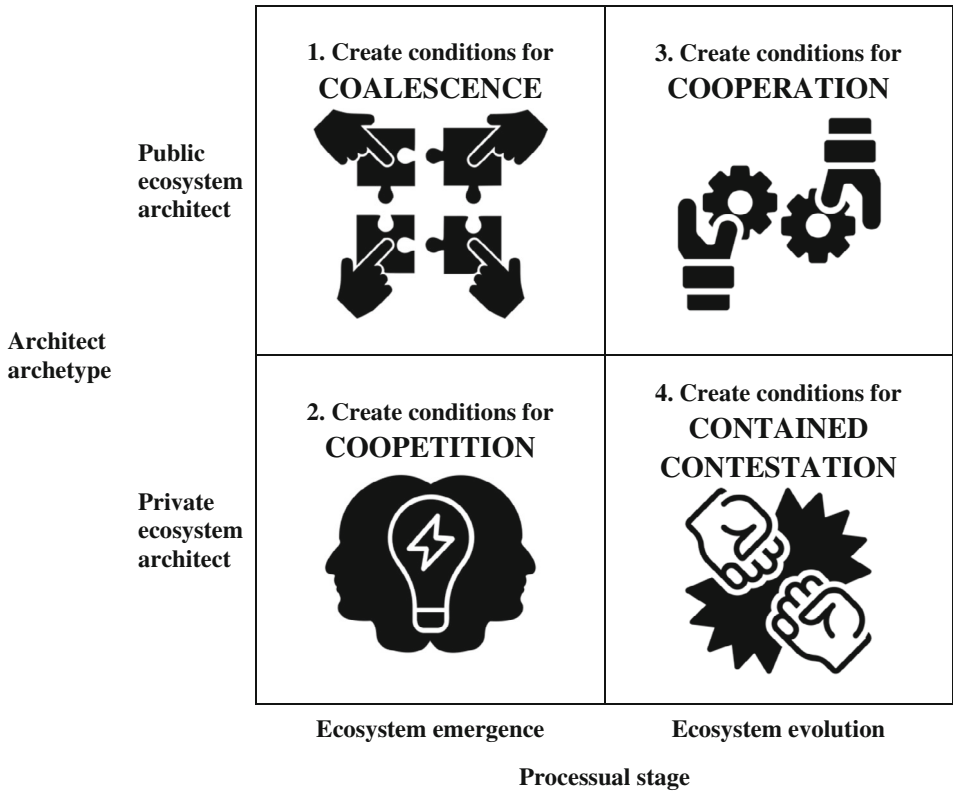

FIGURE 1 Strategies for architects of emerging and evolving ecosystems

TABLE 1 Summary of insights for public ecosystem architects

Ecosystem stage	Key insights	Strategy	Implications for ecosystem architects
Ecosystem emergence	Ecosystem emergence is spatially anchored and enabled by relational connections	*Create conditions for coalescence*, so that ecosystem participants form embryonic relationships and initial mechanisms for interacting	• Encourage new connections among ecosystem participants by initiating and administering programs that bring together disparate actors • Facilitate dialog and nurture trust by hosting forums that allow ecosystem participants to develop shared practices and meanings • Empower other ecosystem actors to create opportunities for further connecting • Role-model attitudes and behaviors that build goodwill among ecosystem actors
Ecosystem evolution	Ecosystem evolution is enabled by adding, strengthening and intensifying connections managed through mutual adjustment	*Create conditions for cooperation*, wherein ecosystem participants pursue compatible goals while exchanging resources and engaging in joint activities	• Provide mechanisms that enable the maturation of cooperative relationships among ecosystem actors, such as identify-reaffirming events, shared infrastructure and governance arrangements that encourage positive-sum thinking • Catalyze ecosystem competitiveness and productivity by broadly disseminating key learnings • Incentivize successful entrepreneurs to remain in and give back to ecosystems through advocating for tax rebates, subsidizing work premises, and creating opportunities for mentoring and governance contributions • Enlist key actors to help clear ecosystem

TABLE 1 (Continued)

Ecosystem stage	Key insights	Strategy	Implications for ecosystem architects
			bottlenecks by convening cooperative forums and incentivizing knowledge sharing

4.1 | Creating conditions for *coalescence*

The articles in this SMS Collection suggest public ecosystem architects interested in promoting the emergence of an entrepreneurial ecosystem ought to focus on *creating conditions for coalescence* of diverse ecosystem actors, which refers to ecosystem participants coming together to form embryonic relationships and a shared identity, as well as initial mechanisms for and understandings of how to go about interacting. In creating conditions for coalescence, public ecosystem architects should nurture connections among actors in the ecosystem built on social relations and attend to flows of social resources such as goodwill.

A key condition for coalescence is the initiation of connections which help enable ecosystem emergence (See Goswami et al., 2018; Thompson et al., 2018). For example, entrepreneurial ecosystem emergence requires nurturing bottom-up relationships from which develop shared meanings and conventions that provide a foundation for subsequent more structured activities and relationships (Thompson et al., 2018). Further, actors such as accelerators play connecting roles that encourage the bottom-up formation of relationships by, for example, helping retain expertise in the emergent context and building commitment to the ecosystem (Goswami et al., 2018). In practice, this involves accelerators enabling coalescence through activities such as cohorts of startups, mentoring programs, advisor networks, and pitch events. Therefore, creating opportunities for actors to form new connections is an important precursor to the emergence of these ecosystems.

The importance of connecting and coalescing in ecosystem emergence has implications for public ecosystem architects, who need to give attention to how to encourage connections that develop into fruitful relationships. Since entrepreneurial ecosystems form organically through bottom-up processes (Thompson et al., 2018), it may be futile for outside actors such as governments to try to impose ecosystem formation through top-down processes. In fact, resources are likely to be wasted if inadequate attention is paid in the earliest days of ecosystem emergence to nurturing social relations, forging a common identity, and capacity building through informal dyadic and group-level activities. Instead, catalysis of ecosystem emergence should focus on making novel connections among disparate actors and sparking new conversations. To do so, public ecosystem architects can initiate and administer projects and programs, which foster novel connections across multiple levels by, for example, drawing on diverse steering committees and working groups from across the nascent ecosystem.

In addition to creating opportunities for connection and coalescence, public ecosystem architects should empower other ecosystem actors to do likewise. For example, accelerators play an important role in intermediating between entrepreneurial ventures and the ecosystem by improving venture validation, generating tangible and intangible infrastructure, and enhancing expertise within and building commitment to the ecosystem (Goswami et al., 2018). Therefore, public ecosystem architects seeking to encourage regional economic and social venture

TABLE 2 Summary of insights for private ecosystem architects

Ecosystem stage	Key insights	Strategy	Implications for ecosystem architects
Ecosystem emergence	Ecosystem emergence is technologically anchored and enabled by transactional connections	*Create conditions for coopetition*, wherein ecosystem participants are simultaneously encouraged to compete and cooperate with each other	• Establish ecosystem governance arrangements that effectively balance the growth of the ecosystem and the commercial relationships between ecosystem actors • Set rules or parameters around ecosystem coopetition to manage transitions between ecosystems • Make ecosystem design choices that support technology modularity and allow for interoperability of production and consumption within the ecosystem • Support temporary gatherings, such as hackathons and events, that allow for social tie formation around emerging platform technologies
Ecosystem evolution	Ecosystem evolution is accompanied by adding, intensifying and increasingly straining relations due to a fundamental tension between value creation and capture	*Create conditions for contained contestation*, so that fruitful outcomes can be achieved from commercial, legal, or political conflicts among ecosystem participants	• Anticipate and delimit areas of potentially destructive conflict by formulating appropriate standards, guidelines, or governing principles relating to the ecosystem • Provide mechanisms for dispute resolution through negotiation, mediation, or arbitration processes • Seek to earn and maintain the trust of complementors by avoiding behaviors that complementors could perceive as opportunistic or predatory • Surface the risk appetites and likely decisions of

TABLE 2 (Continued)

Ecosystem stage	Key insights	Strategy	Implications for ecosystem architects
			ecosystem actors to better anticipate sources of conflict • Consider formal or informal mechanisms to limit the value appropriation power of dominant ecosystem actors

activity should support a range of accelerator programs within entrepreneurial ecosystems to promote socialization and capacity-building. Furthermore, in doing so, ecosystem architects should look beyond accelerator ventures' performance when assessing the success of accelerators. Instead, "government policy makers should judge accelerators based on their expertise; namely, their expertise in building connections, developing founders, coordinating mentorship, and selecting participants (both founders and mentors)" (Goswami et al., 2018, p. 146) as this expertise is instrumental for the emergence of entrepreneurial ecosystems.

In emerging entrepreneurial ecosystems, initial connections function principally to transfer social resources. Whereas connections and relationships are important enablers of ecosystem emergence in general, the nature of the connections in entrepreneurial ecosystems is more socially oriented and technology agnostic compared to business, innovation, and platform ecosystems. The emergence of entrepreneurial ecosystems is supported by embedded, social relations that strengthen the ecosystem and encourage collaboration among actors, which is made easier through, for example, developing shared meanings and conventions (Thompson et al., 2018), building commitment to the ecosystem (Goswami et al., 2018), facilitating knowledge spillovers (Autio et al., 2018), and sharing experience to support the continued growth of the ecosystem (Goswami et al., 2018). Thus, the relationships underpinning the emergence of entrepreneurial ecosystems tend to have a collaborative orientation aligned with a win-win mentality.

The central role played by flows of social resources in emerging entrepreneurial ecosystems calls for ecosystem architects to create conditions for coalescence by facilitating dialog and nurturing trust through, for example, hosting forums that provide opportunities for ecosystem participants to develop shared practices and meanings, forge a common identity, and earn the trust required to access the networks of other participants (Thompson et al., 2018). While "geographical proximity facilitates the build-up of relational trust and increases transparency" (Autio et al., 2018, p. 80), public ecosystem architects can help by role-modeling attitudes and behaviors that encourage ecosystem emergence by, for example, building goodwill among ecosystem actors and attending to the health of the overall ecosystem. In doing so, public ecosystem architects might drive coalescence by appealing to the regional parochialism of ecosystem participants, given the spatially anchored (Thomas & Autio, 2020) and often technology-agnostic nature of such ecosystems. Finally, forming connections and attracting actors to emerging entrepreneurial ecosystems requires learning via horizontal knowledge spillovers—learning that is enabled by specific types of spaces, places, and programs within entrepreneurial

ecosystems (Autio et al., 2018). Public ecosystem architects aspiring to stimulate creativity and innovation within emerging ecosystems should encourage younger ventures to connect among themselves and co-locate their activities to increase knowledge spillover effects. While these activities will not translate into financial benefits for all firms (Mathias et al., 2021), the horizontal knowledge spillovers that they generate can fuel coalescence and, therefore, require the attention of public architects of emerging ecosystems.

In summary, public ecosystem architects seeking to encourage the emergence of entrepreneurial ecosystems ought to focus on creating conditions for coalescence by fostering strong, socially oriented connections and resource flows among ecosystem actors.

4.2 | Creating conditions for *coopetition*

The articles in this SMS Collection suggest that, while there are similarities confronting both private and public architects seeking to encourage ecosystem emergence, the added competitive dimension in business, innovation, and platform ecosystems requires private architects to create *conditions for coopetition*, which refers to a dynamic of simultaneous cooperation and competition (See Ansari et al., 2016; Bengtsson & Kock, 2000; Gnyawali, He, & Madhavan, 2006). Private ecosystem architects, like their public counterparts, need to facilitate connections to support ecosystem emergence but, in doing so, need to account for the fact that the connections precipitating emergence in these ecosystems are typically industry- or technology-anchored—that is, revolving around a focal firm and/or its technology—and hence more explicitly transactional in nature than in entrepreneurial ecosystems. As a result, private ecosystem architects need to create conditions that simultaneously encourage competition *and* cooperation among actors in the emerging ecosystem.

In contrast to the socially oriented connections and interactions among entrepreneurial ecosystem actors, business, innovation, and platform ecosystems are associated with more transactional relations wherein formal commercial arrangements govern interactions supporting ecosystem emergence. For example, financial inducements from sponsors of hackathons accelerate platform technology adoption and hence ecosystem emergence (Fang et al., 2021). These types of transactional relations belie tensions between balancing cooperation and competition during the emergence of an ecosystem. Innovation ecosystem emergence is, for example, shaped by different (component, system, and bottleneck) strategies that influence the mix and balance of cooperative and competitive relationships between focal firms and complementors (Hannah & Eisenhardt, 2018). There is, therefore, a coopetitive orientation at play in emerging business, innovation and platform ecosystems, as firms wrestle with balancing cooperation to ensure the overall health of the ecosystem with competition to ensure their own advantageous position within it. This competitive jostling can lead actors to reduce their participation in more contested ecosystems in order to increase their participation in other growing, complementary ones (Khanagha et al., 2022), which is why it is so important for private ecosystem architects to attend to it.

The transactional nature of interactions in technology-anchored ecosystems requires a more directive than facilitative approach by ecosystem architects to support ecosystem emergence, with an overarching intentionality guiding private actors toward more or less competition or cooperation in different parts of the ecosystem (Hannah & Eisenhardt, 2018). This balance between competition and cooperation has consequences for how ecosystems emerge, for example, in terms of where intense price competition might be evident versus where firms might be

inclined to cooperate tacitly by competing on nonmonetary dimensions. Architectural interventions or parameters guide the kinds of strategies firms choose to implement in the nascent ecosystem emergence stage by shaping preferences for cooperation, competition, or both simultaneously. For example, software platform sponsorship or hosting of hackathons builds awareness of the platform technology and facilitates learning around the technology, which positively influences the platform's adoption among hackathon participants (Fang et al., 2021). In this regard, successful platform ecosystem architects create conditions for coopetition, wherein they help other actors in the emerging ecosystem while simultaneously positioning their platform competitively as an ecosystem leader. Private ecosystem architects can therefore accelerate the emergence of software platform ecosystems by supporting temporary gatherings that allow for social tie formation around their own, specific platform technology. The role private ecosystem architects play in the context of emerging platform ecosystems is thus more direct than the role of would-be shapers of entrepreneurial ecosystems.

Connections in emerging business, innovation, and platform ecosystems enable coopetitive resource flows, as actors seek both to help other actors and to outcompete them. Of note is how modularity in technology-anchored ecosystems enables growing numbers of actors to join the technology offering as complementors (Jacobides et al., 2018), thereby accelerating the business, innovation, or platform ecosystem's growth. As a result, Jacobides et al. (2018) emphasize for ecosystem architects the importance of design and, specifically, the design of modular components that allow for interoperability of production and consumption, which enhances an ecosystem's ability to emerge. Architects, therefore, should focus on these design elements to support ecosystem emergence enabled by technology modularity.

While the fact that the technology-anchored nature of emergence in business, innovation, and platform ecosystems requires ecosystem architects to consider the optimal design of the ecosystem's technological core may seem straightforward, less obvious but as important is the requirement to attend to the design of the ecosystem's governance and coordination mechanisms as well. When private actors join an emerging ecosystem as complementors, they bring with them diverse motivations and interests with the potential to combine in ways that surface tensions or generate overt conflict in the ecosystem, thus limiting its expansion. As a result, private ecosystem architects should aim to design ecosystem governance arrangements that effectively balance the growth of the ecosystem with the ongoing viability of ecosystem actors and the commercial relationships linking them. For example, private ecosystem architects may consider how firms under competitive pressure can shift focus and transition to, or even spur the emergence of, complementary ecosystems (See Khanagha et al., 2022). In addition, ecosystem architects might seek to set rules or parameters around ecosystem coopetition to manage these transitions and ensure the overall health of the emerging ecosystem.

In summary, private ecosystem architects need to acknowledge that the technology-anchored and transactional relationships among actors pose notable challenges to achieving the connectivity and resource flows required to sustain emerging business, innovation, and platform ecosystems—a situation that can be addressed by seeking to create conditions for coopetition.

4.3 | Creating conditions for *cooperation*

Our corpus of articles reveals that public ecosystem architects interested in driving entrepreneurial ecosystem evolution need to *create conditions for continued cooperation* of ecosystem

participants in the context of increased and more intense connections. Cooperation in ecosystems refers to actors "pursuing common or at least compatible goals while sharing and exchanging resources and engaging in joint activities" (Hoffmann, Lavie, Reuer, & Shipilov, 2018). Whereas public architects of emerging ecosystems are preoccupied with the coalescence of actors, ecosystem evolution brings with it increased resources and numbers of ecosystem actors with heterogenous interests and ways of working, which make cooperation important to the ecosystem's continued success. Our selected articles indicate that managing increased resource flows and navigating challenges to established ways of interacting are central to ecosystem cooperation.

The evolution of ecosystems involves adding new connections while also intensifying connections formed when the ecosystem emerged. For example, strengthening entrepreneurial ecosystems involves increasing connectivity among new ventures and other ecosystem actors while facilitating more recycling of resources, for example, experienced mentors and skilled workers, as well as generating greater net inflows of additional resources and capabilities, for example, via in-migration and inbound investment (Spigel & Harrison, 2018). Greater connectivity refers to both more dense and intense connections as the number of ecosystem actors increases, and the depth of relationships grows over time. The increasing number and intensity of connections in evolving ecosystems have a notable impact on how new connections are encouraged and absorbed into existing modes of relating and learning, often requiring ongoing mutual adjustment as actors grapple with their ever-evolving ecosystem context.

In light of these dynamics, public ecosystem architects would do well not only to continue facilitating social connections within the ecosystem, similar to the emergence processual stage, but also, post-emergence, to introduce mechanisms, such as identity-reaffirming events, shared infrastructure or governance arrangements that encourage positive-sum thinking, to support the institutionalization of cooperative relationships among ecosystem actors. One way that architects can strategically create such conditions for cooperation is by contributing to competitiveness and productivity across their evolving ecosystems. Public ecosystem architects can, for example, play a learning catalyst role by disseminating lessons learned in one part of the ecosystem more broadly, thereby overcoming or precluding constraints that could burden the ecosystem as a whole. Further, because increases in the number and intensity of connections in evolving ecosystems can challenge accepted modes of relating formed during nascent stages of ecosystem emergence, Nielsen (1988) stresses the role of regulators and other public servants in eliciting and shaping novel interorganizational cooperative strategies and stimulating new collaborative connections among actors to support ecosystem evolution. Given "[i]nter-organization cooperation can improve efficiency and can make a great deal of short-, medium- and long-term strategic sense in a wide range of environments circumstances" (1988, p. 490), keeping in step with changing dynamics and continuously (re)creating conditions for cooperation is an important role for public ecosystem architects in evolving entrepreneurial ecosystems.

The changing connections of evolving ecosystems are accompanied and even influenced by increased resource flows across the ecosystem. For example, entrepreneurs who develop and then successfully exit new ventures in nascent ecosystems commonly remain in the ecosystem after their success and channel a portion of their newly acquired wealth, time, and accumulated experience into other, often multiple, entrepreneurial activities (Spigel & Harrison, 2018). Because retaining ecosystem resources is beneficial for spatially anchored ecosystems and key to continued ecosystem evolution, public ecosystem architects should create conditions for cooperation to ensure that resources are retained and recycled. An important step in creating these conditions involves architects cooperating with successful ecosystem entrepreneurs who

are well informed and positioned to identify issues encumbering the evolution of the ecosystem (See Spigel & Harrison, 2018). Therefore, public ecosystem architects should incentivize successful entrepreneurs to remain in and give back to entrepreneurial ecosystems through, for example, advocating for tax rebates, subsidizing work premises, and creating opportunities for mentoring and governance contributions. Further, architects may enlist entrepreneurs in more proactive ecosystem stewardship roles, including joint efforts with public agencies to cultivate resources and communities that already exist rather than seeking to create new resources and communities through top-down intervention often favored by governments.

Finally, public ecosystem architects can also mobilize other ecosystem participants to help clear bottlenecks hindering the progress of technologies that are key to the specific ecosystems the architects are stewarding. For example, when there is a threat of industry stagnation in contexts where ecosystem extension opportunities are low and ecosystem challenges are high, ecosystem architects can devise new incentives and mechanisms to help ecosystem members to create and capitalize on opportunities, overcome challenges, or both (Adner & Kapoor, 2016). These mechanisms might include convening cooperative, pre-competitive forums, providing tax incentives to carry out research and development and incentivizing the sharing of technical knowledge. In this way, public ecosystem architects can encourage ecosystem evolution by creating conditions for cooperation among key ecosystem actors.

In summary, healthy evolving entrepreneurial ecosystems are distinguished by increasing and intensifying connections that facilitate both the recycling and net inflow of a growing volume of resources. These shifts in connectivity and resource flows can strain ways of interacting and challenge meanings formed when the ecosystem was nascent, so public ecosystem architects seeking to drive the evolution of ecosystems should constantly attend to and (re)create conditions for cooperation.

4.4 | Creating conditions for *contained contestation*

Like their public counterparts who oversee evolving spatially anchored ecosystems, private ecosystem architects also need to contend with adding and intensifying connections in the growing ecosystems they oversee. However, whereas successful oversight of evolving entrepreneurial ecosystems involves maintaining cooperation among ecosystem members as connections are added, intensified, and strengthened, the competitive tensions underpinning business, innovation, and platform ecosystems, because they can give rise to overt commercial, legal, or political contestation, require architects to limit destructive conflict among members as connections multiply and shift. Therefore, private ecosystem architects need to create *conditions for contained contestation*.

In evolving platform ecosystems, for example, the adding and intensifying of ecosystem connections is typically accompanied by increasingly strained relations (See Jones et al., 2021; Pierce, 2009). This straining occurs because the transactional and technology-anchored connections among actors in business, innovation, and platform ecosystems often give rise to relational challenges, including disruptive competitive behaviors and accompanying power imbalances (Pierce, 2009) as well as legal disputes (Jones et al., 2021), that are underpinned by a fundamental tension between value creation and value capture (Wang & Miller, 2020). Private ecosystem architects must navigate—and help other ecosystem members to navigate—this fundamental tension.

Accepting that some legal contestation in business, innovation and platform ecosystems may be inevitable, ecosystem architects should consider how to create conditions that contain and encourage fruitful outcomes from these disputes. Such optimism is not misplaced, given that legal conflict has been found to be conducive to the productive evolution of an innovation ecosystem (Jones et al., 2021). Therefore, private ecosystem architects need to anticipate and delimit areas of potential legal contest by formulating appropriate "rules of the game" (Jones et al., 2021) and providing mechanisms for dispute resolution through, for example, negotiation, mediation, or arbitration processes. Doing so directs firms to areas of potential conflict around issues from which constructive, value-adding changes in practices can then emerge. These conflicts are a key motor of ecosystem evolution and therefore need to be considered by architects seeking to manage the evolution of business, innovation or platform ecosystems.

As with entrepreneurial ecosystems, the growth of business, innovation, and platform ecosystems is accompanied by increased linkages and resource flows among actors in the ecosystems (McDermott et al., 2013). However, in these ecosystems, there is an acute need to orchestrate resource flows in ways that balance ecosystem actors' incentives for value creation and value capture. For example, platform ecosystem complementors simultaneously seek to maximize profits from the platform while limiting their dependency upon these platforms (Wang & Miller, 2020). Thus, although collaborating with the platform sponsor by providing more content for the platform may allow a complementor to create more value, the extent of their collaboration will not be determined by considerations of value creation only. Rather, the extent of collaboration will be limited by short-term considerations of the complementor's ability to appropriate the value created and long-term considerations of the implications of collaboration for power relations between the complementor and the platform sponsor, given positive network externalities favor the latter.

Because tensions between value creation and value capture are fundamental in business, innovation and platform ecosystems, it may, therefore, be in the long-term interest of private ecosystem architects to establish formal or informal mechanisms to limit the value appropriation power of dominant ecosystem actors, including themselves, over complementors. Formal mechanisms might, for example, take the form of formal governance agreements to which the ecosystem actors are parties, and informal mechanisms may be built into the platform itself to promote ecosystem-enhancing behaviors. Limiting power in this regard is particularly important given strong evidence that some dominant manufacturing firms have inadvertently driven financial losses and product shakeouts in their business ecosystems (Pierce, 2009). In limiting the power of dominant ecosystem actors, architects help contain contestations by earning and maintaining the trust of ecosystem complementors and avoiding behaviors that complementors could perceive as opportunistic or even predatory.

A further way to contain potentially destructive conflict in evolving business, innovation, and platform ecosystems is by managing interdependencies through modularity (McDermott et al., 2013), rather than mutual adjustment as in entrepreneurial ecosystems (see Spigel & Harrison, 2018). Although private ecosystem architects often make the initial strategic decisions to pursue modularity, the success of such a strategy is shaped by other actors' decisions to support modular sourcing based on their individual risk perceptions and risk tolerances (McDermott et al., 2013). Therefore, private ecosystem architects can contribute to creating conditions to contain contestation in evolving ecosystems by surfacing the risk appetites and anticipating likely decisions of ecosystem actors.

In summary, private ecosystem architects need to create conditions for contained contestation of the potentially destructive conflicts that accompany the evolution of the business,

innovation, and platform ecosystems they seek to steward. Given a fundamental tension between creating and capturing value, foreseeing and limiting destructive conflict may even entail establishing mechanisms to limit the value appropriation power of dominant ecosystem actors.

5 | DISCUSSION

The articles in this SMS Collection point to specific conditions that ecosystem architects should seek to create to support the emergence and evolution of the ecosystems that matter to them. Public ecosystem architects seeking to encourage the emergence of entrepreneurial ecosystems need to focus on creating conditions for coalescence by nurturing strong, socially oriented connections and interactions among diverse ecosystem actors who tend to be spatially anchored. Private ecosystem architects, on the other hand, should take into account the technology-anchored and transactional nature of relationships that form in emerging business, innovation, and platform ecosystems by creating conditions for coopetition. Moreover, as ecosystems evolve, so do the challenges facing ecosystem architects concerned with their stewardship. Thus, public ecosystem architects need to emphasize creating conditions for cooperation that account for and support the maturation of collaborative relationships in evolving entrepreneurial ecosystems. In contrast, private ecosystem architects need to focus on creating conditions for containing the inevitable contestations that arise in evolving business, innovation, and platform ecosystems due to tensions between creating and capturing value as well as conflicts related to managing dependencies and power relations.

While distinguishing between different ecosystem architects yields actionable insights for practitioners, it is important not to overplay the mapping of particular types of ecosystem architects to specific ecosystems. This is because, in practice and as noted in our Introduction, different types of ecosystems overlap, intersect, and interpenetrate one another, at times making boundaries between each blurred, inconsequential or even nonexistent. As a result, some ecosystem architects identify with and conflate multiple ecosystems. For example, ecosystem actors might simultaneously associate with one or more of a city's entrepreneurial ecosystems, an industry's business ecosystem, a technology's innovation ecosystem, or a product's platform ecosystem. Furthermore, ecosystem actors themselves may not attribute significance to the various ecosystems discussed in the scholarly literature, preferring to describe "their ecosystem" generically. While ecosystem architects may find it practically and politically helpful to position their contributions as publicly or privately oriented, the uncertain boundaries between ecosystem types mean that practitioners of different ilks will likely benefit from strategy insights emerging from various kinds of ecosystems.

Another reason for treating architect-to-ecosystem-type mapping with caution is theoretical, given that various types of ecosystems are similarly marked by the presence of interdependent yet heterogeneous participants co-producing system-level outputs outside of contractual governance arrangements (Thomas & Autio, 2020; see also Adner, 2017 and Jacobides et al., 2018). As a result, efforts to better understand these shared ecosystem features do not necessarily require delineating between public and private ecosystems in order to contribute new knowledge of the phenomenon. On the contrary, insights from the study of one ecosystem type may prompt reconsideration of or shed new light on other forms of ecosystems. In this essay, for example, we demonstrate the benefits of such an approach by extending Spigel and Harrison's (2018) analysis of entrepreneurial ecosystems and connecting it to research on business,

innovation, and platform ecosystems. Specifically, while Spigel and Harrison (2018) describe what happens concerning levels of connectivity, quantities, and flows of resources across different stages of entrepreneurial ecosystem development, we go further in suggesting how to create conditions to foster desirable outcomes in business, innovation, and platform ecosystems in addition to entrepreneurial ones. In doing so, we add nuanced understandings of the role of ecosystem architects and illustrate the benefits of considering together different types of ecosystems.

It is instructive for both empirical and theoretical reasons, therefore, to explore how insights drawn from one type of ecosystem architect may be able to inform strategy-making by the other type. For example, private ecosystem architects stand to learn from how public ecosystem architects initiate ecosystem connections, role-model collaborative behaviors, and host forums to facilitate dialog and nurture trust among ecosystem participants. Moreover, private ecosystem architects may take inspiration from how their public counterparts then sustain and strengthen cooperative relations by incentivizing valuable contributions from successful ecosystem participants and disseminating key learnings throughout and for the benefit of the ecosystem as a whole. Strategies to create conditions for coalescence and cooperation may, therefore, help private ecosystem architects temper the strained relations that often accompany evolving business, innovation, and platform ecosystems. Similarly, public architects should consider the emergence and evolution dynamics of business, innovation, and platform ecosystems as their participants are often also constituents of entrepreneurial ecosystems. Furthermore, although less pronounced, entrepreneurial ecosystems are not immune to commercial, legal, or political conflicts. As a result, public architects can benefit from the expertise of private ecosystem architects in navigating commercial and relational tensions among ecosystem participants by, for example, creating governance arrangements that simultaneously encourage competition and cooperation. We, therefore, see great potential in considering how insights from one type of ecosystem may serve the architects of other ecosystem types.

6 | CONCLUSION

Our summary and synthesis of articles included in this SMS Collection reiterate the importance of forming connections in emerging ecosystems but reveal differences between, on the one hand, entrepreneurial ecosystems, which tend to be spatially-anchored and underpinned by the organic, bottom-up formation of social connections, and, on the other hand, business, innovation and platform ecosystems, which tend to be technologically anchored and formed around transactional relationships. The articles also reveal how connections increase and intensify in evolving ecosystems to give rise to, on the one hand, new challenges to existing collaborative modes of relating and learning in entrepreneurial ecosystems and, on the other hand, strained relations among business, innovation, and platform ecosystem actors torn between collectively creating and competitively capturing value.

At the outset of this review, we intended to include articles from the SMS journals also addressing the decline or demise of ecosystems, logically extending the continuum of the ecosystem's lifecycle. However, we found that, while the existing literature focuses on the emergence and evolution of ecosystems, very little work examines their decline. This absence of extant research opens a promising opportunity for future study as the decline of ecosystems is an important phenomenon for scholarly and practitioner attention, and its study could build upon notions of ecosystem resilience (Iansiti & Levien, 2004; Thomas & Autio, 2020).

While response diversity (Zhu & Iansiti, 2012) encourages ecosystem resilience (Roundy, Brockman, & Bradshaw, 2017; Thomas & Autio, 2020), less is known about how to rejuvenate ecosystems in decline. The triggers of decline might be unintentional ecosystem-wide disturbances, such as the impacts of exogenous shocks or crises on ecosystems (Wenzel, Stanske, & Lieberman, 2021). The COVID-19 pandemic, for example, has led to the rapid decline of some ecosystems dependent on travel and mobility (Belhadi et al., 2021; Floetgen et al., 2021; Ratten, 2020) while enabling rapid emergence in other domains (George & Koh, 2021; George, Lakhani, & Puranam, 2020; Gkeredakis, Lifshitz-Assaf, & Barrett, 2021; Hossain, 2021). Alternatively, decline may inadvertently arise endogenously because of insufficient attention by ecosystem architects to "hazardous activities" of central actors in the ecosystem (Pierce, 2009). In both situations, the conditions that characterize—or that could help to predict and prevent—the decline of ecosystems are not well known. Similarly, scholars might consider resistors to decline—factors that support ecosystem resilience amid pressures to decline—and how they relate to key dimensions highlighted in this SMS Collection, such as ecosystem connectivity and resource flows. Examining these dynamics would offer a more nuanced processual understanding of ecosystem dynamics under pressure and could provide insights into the broader understanding of the lifecycles of ecosystems.

In summary, the diverse studies we have collated from SMS journals collectively cover numerous aspects of emergence and evolution across a diverse range of ecosystems. Given intensifying practitioner and scholarly interest in ecosystems, we hope that our treatment of the 16 published articles making up this SMS Collection, many of which already are or are likely to become classic studies in the field, can fruitfully inform future ecosystems research of much importance to both practitioners and scholars alike.

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DATA AVAILABILITY STATEMENT

Data sharing is not applicable to this article as no new data were created or analyzed in this study.

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