

# From ego-systems to open innovation ecosystems: A process model of inter-firm openness

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## Abstract

Existing innovation management literature significantly enhances our knowledge about “*What*” open innovation is and “*Why*” it is crucial for innovating superior products. However, very little is known about the process of “*How*” firms adopt openness. We engage in a qualitative exploratory study using a grounded theory method to understand the process by which firms open and migrate from ego-systems to open innovation ecosystems. This paper reports on our findings from 3 rounds of 54 interviews with managers in the Macquarie Business Park, Australia. The first two rounds ( $n = 22 + 22$ ) describe the openness process, define its qualitatively different phases, and detect critical variables that trigger or inhibit phase transition. In the final round ( $n = 10$ ), member checks verify our interpretive model, revealing that inter-firm openness occurs in four transitory phases—realization, socialization, strategic alignment, and two-way openness. Phase transition starts somewhat spontaneously for firms but gets more complex as they proceed from ego-system to an ecosystem, and the degree of openness increases in each subsequent phase. The study has significant theoretical and practical implications for product innovation management. Interdependence, social exchange, and trust play a significant role in creating open innovation ecosystems. Inter-firm openness follows four interlocking transitory phases—realization, socialization, strategic alignment, and two-way openness. Phase transitions start spontaneously but become complex as the degree of openness increases in subsequent phases.

## KEYWORDS

ecosystem, inclusiveness, innovation, openness

## 1 | INTRODUCTION

The concept of openness is one of the central themes in the last 20 years of innovation literature (e.g., Bogers et al., 2018; Cheng & Huizingh, 2014; Chesbrough 2003; Zobel & Hagedoorn, 2020). At the inter-firm level, openness to

explore and exploit external knowledge resources across various organizational and industrial contexts is pervasive in discussions of innovation studies. Consequently, firms are increasingly adopting open innovation models (Chesbrough et al., 2018; Vanhaverbeke & Cloud, 2014; West & Bogers, 2014). Both scholarly and applied research suggests that

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adopting openness, ranging from closed to multiple levels of openness, is a critical strategic decision for a firm (Alam et al., 2022; Alexy et al., 2018; Almirall & Casadesus-Masanell, 2010; Arora et al., 2016; Boudreau, 2010; Laursen & Salter, 2014; Ritala & Stefan, 2021; Vanhaverbeke et al., 2017). Furthermore, recent research suggests that adopting open innovation strategy simultaneously changes the innovation ecology from ego-systems to open innovation ecosystems (Bogers et al. 2018; Brattström & Faems, 2020; Chesbrough et al., 2018; Fasnacht, 2018; Xie & Wang, 2020). Although innovation ecosystem literature has made significant progress toward understanding the strategic role of openness, one area in which it remains relatively silent is *how* firms systematically adopt openness and evolve from ego-systems to open innovation ecosystems.

An ego-system refers to a traditional rivalrous context in which firms adopt closed innovation strategies that ensure strict control over resources (Lavie, 2006), strong intellectual property (IP) rights (Arora et al., 2016), ego-network stability (Kumar & Zaheer, 2019), and rivalry triggered by competition (Kilduff et al., 2016). Moreover, in ego-systems, new product or process development and related appropriation strategies are mostly confined within the firm's boundaries (Chesbrough, 2003). In contrast, an open innovation ecosystem denotes a participative innovation context in which firms adopt open innovation strategies by sharing knowledge resources across organizational boundaries (Bogers et al., 2018; Chesbrough et al., 2018; Xie & Wang, 2020). The member firms (henceforward ecosystem firms) get input from a wider pool of knowledge resources in a flexible, dynamic, and (re)configurable system of inter-firm interactions. Studies have shown that openness is necessary for ecosystem participation because it builds bridges across organizations, enabling the flow, integration, and aggregation of valuable resources (Cenamor & Frishammar, 2021; Dahlander et al., 2021; Knockaert et al., 2019).

Despite extensive research, widespread application, and the practical relevance of inter-firm openness described in the literature (e.g., Adner, 2006; Bogers, Sims, et al., 2019; Chesbrough et al., 2018; Jacobides et al., 2018; Xie & Wang, 2020), the process of inter-firm openness remains largely unexplored. To address this gap, we use a grounded interpretive approach to develop a process model of inter-firm openness (Gehman et al., 2018; Gioia et al., 2012; Glaser & Strauss, 1967; Strauss & Corbin, 1998). Using a socially constructed view of innovation ecology (Gioia et al., 2012), we examine variations in firms' openness to sharing resources that empirically and conceptually form the basis of creating an ecosystem. How inter-firm relationships evolve with open innovation practices provides a lens to study the etiology of inter-firm openness.

Our findings contribute to innovation ecosystem literature in four ways. First, we demystify the largely implicit

### Practitioner points

- Interdependence, social exchange, and trust play a vital role in creating open innovation ecosystems.
- Inter-firm openness follows four interlocking transitory phases—realization, socialization, strategic alignment, and two-way openness.
- Phase transitions start spontaneously but they become more complex as the degree of openness increases in subsequent phases.

openness construct on which there is little theoretical precedent to guide future empirical investigation. Second, the growing innovation literature categorizes ecosystems based on entrepreneurial activities, digital platform, network structure, interdependent business goals, and market strategy (e.g., Alam et al., 2022; Bogers, Chesbrough, et al., 2019; Jacobides et al., 2018). Because our study focuses on the ecology (rather than types) of ecosystems, it offers an overarching framework that helps consolidate these perspectives across ecosystem research streams. Third, we layout important variables (triggers and inhibitors) mapped into four interlocking transitory phases of openness in chronological order—*realization*, *socialization*, *strategic alignment*, and *two-way openness*. This approach provides a rationale for managers to locate their firm and partners along the openness path and to identify what can accelerate (or decelerate) transition into different phases of openness in innovation. Finally, we decipher phase transitions that start spontaneously but become more complex as the degree of openness increases in subsequent phases. This contribution is important for researchers, managers, and policymakers to consider what variables (contextual factors) may be used as strategic levers to facilitate inter-firm openness.

The paper is organized into four sections. Section one outlines the building blocks of our process theory and clarifies our position on ego-systems and open innovation ecosystems. Section two describes our inductive method of conducting and analyzing 54 interviews, including 10 member checks in Macquarie Business Park (MP), Australia. Section three presents the emergent process model. Finally, section four offers a general discussion, elaborates on our contributions, highlights limitations, and suggests future research directions.

## 2 | THEORETICAL CONTEXT

Process models have been the focus of scholarly discourse among theorists in strategy and management concerned

with organizational level change. In this study, our focus is the state of an innovating firm's openness to other firms as it transforms from one setting (ego-system) to another (open innovation ecosystem). To understand change, many studies employ the evolutionary process view, which argues that firms learn, adapt, and acquire novel variations in their strategy, structure, policies, procedures, technology, or culture at different times through their life span (Hanelt et al., 2020; Santangelo & Meyer, 2017). Evolutionary models apply when multiple firms compete for scarce resources by developing different product innovation methods for a given market under conditions of risk and uncertainty (Santangelo & Meyer, 2017; Van de Ven & Sun, 2011). According to Van de Ven (1992), a process model has three main components—(a) a set of starting conditions, (b) a functional endpoint, and (c) an emergent process of change. We begin by describing these components of our process model in which the “dynamic, unfolding process” is our primary unit of analysis (Goh & Pentland, 2019).

## 2.1 | Ego-system: A set of starting conditions

We conceptualize an ego-system as a traditional business setting in which firms pursue a closed innovation strategy and create competitive advantages by being closed to exchanging productive innovation resources (Chesbrough, 2003; Chesbrough & Appleyard, 2007; Laursen & Salter, 2014). As such, firms stick to a closed model for several reasons, such as easy governance mechanisms (Zobel & Hagedoorn, 2020), low risk of knowledge leakage (Arora et al., 2016), being better protected from imitation (Alexy et al., 2018), low coordination cost (Boudreau, 2010; Greenstein, 1996), greater freedom to establish financial and technological trajectories (Almirall & Casadesus-Masanell, 2010), capturing maximum value from innovation (Foege et al., 2019), and no anxieties related to the vulnerabilities of openness (e.g., Arora et al., 2016; Laursen & Salter, 2014; Ritala & Stefan, 2021; Zobel & Hagedoorn, 2020). Innovating firms operating within an ego-system prefer strong IP rights to protect knowledge and create barriers that sustain exclusivity. Because competitiveness is linked to blocking rivals (Alexy et al., 2018; Barney, 1991), an ego-system typically generates a rivalrous context within which for one firm to win, the other must lose (Pfeffer & Salancik, 1978). Thus, a firm must outperform rivals; its brand or product must dominate the market by capturing greater market share. In other words, the competition in an ego-system shifts market share from one firm to another, which often drives short-term, unsustainable results. Such firms strive to be

autonomous whenever they can and collaborate where they must (Cook, 1977; Galaskiewicz, 1985). Toward this aim, they adopt a closed innovation strategy, which focuses on stability, avoiding the risk of knowledge spillover and vulnerability to competitors, and hence, mostly operate within already established and stable ego-networks (Kumar & Zaheer, 2019).

Over time, stable ego-networks become stale and ossified because the firms' knowledge bases become more similar, producing undifferentiated products (Granovetter, 1973). Working with stale or too similar partners can result in obsolescence, social lock-ins, and reduced innovation (Kumar & Zaheer, 2019). However, to mitigate the negative effects of suboptimal innovation, ego-system firms continue to prefer a rigid proprietary position (Almirall & Casadesus-Masanell, 2010; Tapscott & Williams, 2013). In this context (Figure 1), firms underuse scarce resources because proprietors increasingly block each other. This scenario inadvertently shrinks the pie since firms fail to explore opportunities when useful knowledge is situated across firms that assume proprietary positions.

Owing to limited resources (knowledge and capabilities), firms frequently lack self-sufficiency or self-containment required to offer complex, customized, and integrated products (Williamson & De Meyer, 2012). However, distributed knowledge, complex and customized products, shorter product life cycles, accelerated rates of development, increasing uncertainty, and advancements in social networking technologies encourage firms to use external knowledge. Ultimately, then, a firm must purchase or license technology, processes, and other solutions from outside its ego-network to improve its innovation capabilities (Bogers, Chesbrough, et al., 2019; Enkel et al., 2009; West et al., 2014). In other words, scarcity of resources causes resource dependence (Pfeffer & Salancik, 1978), which a resource-poor, ego-system firm must address through a set of formal transactions with external partners (Das & Teng, 2002). The burden of

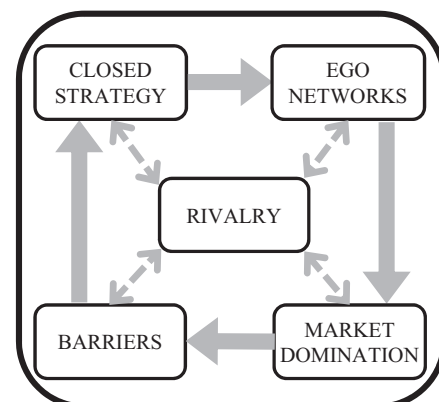


FIGURE 1 Illustrative model of a traditional ego-system

this formalized social exchange, in turn, may lead them toward adopting a more fluid open innovation strategy (Chesbrough & Appleyard, 2007; Knockaert et al., 2019).

## 2.2 | Open innovation ecosystem: A functional endpoint

The term *ecosystem* depicts a network of innovating firms that depend on each other's resources and activities. In innovation research, ecosystem connotes an alignment structure or collaborative arrangement that allows many companies (big and small) to syndicate their offerings into coherent, customer-facing solutions (Adner, 2006; Jacobides et al., 2018). Innovation scholars have studied the ecosystem concept in different contexts, and it is worth discussing those views to map out an overarching conceptual model. For example, researchers such as Rohrbeck et al. (2009), Chesbrough et al. (2014), and Kim (2013) outline a *business ecosystem* in which businesses work cooperatively and competitively to co-evolve capabilities that support product innovation. On the other hand, León (2013) and Xie & Wang (2020) describe *innovation ecosystems* in which the dominant behavior of stakeholders and their supporting activities can be classified as open innovation initiatives. Fasnacht (2019) and Oh et al. (2016) interpret an ecosystem as integrating partners, users, suppliers, and other contributors to an original developer's open innovation process. Likewise, some researchers (e.g., Böhmer et al., 2015) consider ecosystems as *maker spaces* with agile innovation processes that comprise aspects of open innovation. Others have researched the concept under different names such as *value network*, *platform ecosystem*, *entrepreneurial ecosystem*, and *multi-sided market* (Bogers, Sims, et al., 2019).

Each of the descriptions of ecosystems speak to open innovation strategy (Bogers et al., 2018; Chesbrough et al., 2018; Xie & Wang, 2020) and represent “an interdependent network of self-interested actors jointly creating value” (Bogers, Sims, et al., 2019, p. 2). The open innovation ecosystem concept implies that member firms open their boundaries (platform, technology, or innovation venture) to participatory modes of innovation. Every ecosystem firm adds value to the ecosystem and acts as a trusted node that connects to other nodes to link resources, innovate products, and achieve better economies of scale and scope (Bogers, Chesbrough, et al., 2019, Fasnacht, 2018).

Network partners must trust each other to fulfill commitments (Zhong et al., 2017). According to Chesbrough et al. (2018), interfirm trust is an essential element of ecosystem participation as it protects against uncertainties in the exchange phase and facilitates reciprocity. Trust creates openness and plays a central role in establishing,

widening, and deepening inter-firm relationships (Gulati, 1995; Kumar & Zaheer, 2019; McEvily et al., 2017; Zhong et al., 2017). In a trustworthy relationship, ecosystem firms are more socially and psychologically driven to collaborate (Gulati, 1995) and, hence, more likely to benefit from ecosystem participation (Fasnacht, 2018, 2019; Williamson & De Meyer, 2012).

Beyond inter-firm trust, an ecosystem fosters collaboration among many loosely coupled, distributed, but interdependent actors (Knockaert et al., 2019). Collaboration enhances both: (a) the absorptive capacity—a firm's ability to “recognize the value of new, external information, assimilate it, and apply it to commercial ends” (Cohen & Levinthal, 1990, p. 128); and (b) dynamic capabilities—a firm's ability “to integrate, build, and reconfigure internal and external competences to address rapidly changing environments” (Teece et al., 1997, p. 516). An ecosystem firm makes greater use of external ideas and technologies in its core business while letting its unused ideas be available to others (Chesbrough, 2003). In theory, new projects that would otherwise sit idle on a shelf would flourish from collaboration that reaches beyond corporate boundaries to garner and commercialize valuable ideas, resources, technologies, and capabilities from a range of external partners (Chesbrough & Appleyard, 2007; Williamson & De Meyer, 2012).

Trust and reliance on each other stimulate ecosystem firms to share unique resources beyond otherwise short-term horizons (Villena et al., 2019; Zhong et al., 2017). The inbound and outbound sharing of productive resources spur both outside-in and inside-out open innovation (Chesbrough et al., 2018; Fey & Birkinshaw, 2005). Consequently, firms can afford to take more considerable risks, such as launching new products and investing in risky ventures (Kilduff et al., 2016; Luo, 2002; Sitkin & Pablo, 1992).

Finally, as presented in Figure 2, inter-firm transparency—being visible and accessible to each other in the ecosystem, free from deceit and pretense—is crucial to sustaining collaboration. Transparency concerning

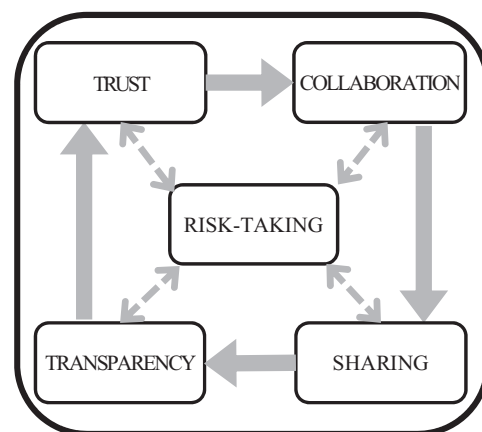


FIGURE 2 Illustrative model of an open innovation ecosystem

shared resources, selection criteria, the development process, expenditure, and the commercialization process is essential, as is the provision of appropriate feedback to contributors (Chesbrough et al., 2018). Transparency develops reciprocity, creating a virtuous cycle of openness. Ultimately, ecosystem firms working in a densely connected network innovate superior products and create sustainable competitive advantages.

### 2.3 | Emergent process of change from ego-system to open innovation ecosystem

A process model depicts the progression of activities or sequence of events that an organizational entity (openness) undergoes over time and explains how it leads to an outcome (open innovation ecosystem). It includes temporal ordering, conceptualizing events, detecting patterns in events, and probabilistic interaction between entities (Langley, 1999; Mohr, 1982; Van de Ven, 1992). An essential component of process models is that organizational change is not fixed or linear but contains an emergent element, which involves phase transitions as the system's overall structure and function transform into a new regime of behavior. Transition denotes the psychosocial processes involved in responding to or adapting to change (Bridges, 2004). According to Van de Ven (1992), an important yet often less understood feature of a process model is the pattern of underlying transitions. Thus, it is crucial to explore how firms transition between stages or phases of openness. In this study, phase transition means transformation between two qualitatively different states of inter-firm openness in a system. Phase transition is driven by change within input variables (inhibitors and triggers). Inhibitors tend to break down the openness process by preventing phase transitions, whereas triggers motivate firms to overcome or diagnose difficulties, thus helping the transition.

In the next section, our study expands on these insights empirically. The aim is to theorize about openness phases and phase transitions and map the underlying pattern to a cohesive process model of inter-firm openness. To do so, we believe it is necessary to pay attention to the micro-social interactions that inter-firm openness entails because, as Gioia et al. (2012) argue, a process model requires an appreciation of the social world within which it occurs.

## 3 | METHODOLOGY AND RESEARCH DESIGN

Research on the process of inter-firm openness is scarce, so our understanding of it needs theoretical development.

Accordingly, we chose to pursue our study inductively using Glaser and Strauss's (1967) grounded theory approach to explore conceptualizations of the openness process and practitioner narratives about phase transitions. Researchers increasingly recommend this method for building process models (Burgelman, 1983; Corley & Gioia, 2004; Gehman et al., 2018; Langley, 1999). Since a firm's transformation from ego-system to open innovation ecosystem is likely to occur over a long period, a longitudinal processual approach was adopted using retrospective reports (Burgelman, 1983; Miller et al., 1997). Based on a similar approach, researchers have inductively developed process models in digital transformation (Jovanovic et al., 2021), strategic management (Mintzberg et al., 1976; Quinn, 1980), strategic planning (Gluck et al., 1980; Lorange, 1980), and organization development (Greiner, 1972; Laughlin, 1991; Scott, 1971).

Most process phenomena have a fluid character spanning both time and space (Langley, 1999); therefore, process theorization must penetrate the practitioner logic behind the temporal progression in the data. Understanding the reasoning of practitioners calls for an interpretive approach that affords voice to the individuals experiencing them, that is, using mental maps of the practitioners living the phenomena (Dacin et al., 2010; Gioia et al., 2012; Nag et al., 2007). Accordingly, our process data include practitioner stories about what happened, when and how events occurred, what factors accelerated or decelerated open innovation activities, and how these activities and events are ordered over time.

Grounded theory requires that researchers initially set aside the literature on the area under study so that a model emerges purely from data rather than from existing literature (Glaser & Strauss, 1967). However, it allows the use of existing theoretical knowledge "to formulate questions that act as a stepping off point during initial observations and interviews" (Strauss & Corbin, 1998, p. 51). The method requires joint data collection, coding, and analyses until reaching data saturation, that is, when additional data do not refine concepts further (Strauss & Corbin, 1998). Importantly, such rich data enhance understanding of context, which plays a vital role in designing a firm's open innovation strategy. Another essential constituent of a process model is setting out the emerging concepts in motion, for example, dynamic interrelationships (Gehman et al., 2018; Gioia et al., 2012). Grounded theory facilitates "concept mapping" to graphically represent relational dynamics between concepts (Ligita et al., 2020). Accordingly, a parsimonious process theory may be built that does not underplay the dynamism, richness, and complexity of the data and is, therefore, plausible and potentially valuable for others.

### 3.1 | Research context

This study was conducted from July 2017 through February 2020 in Macquarie Business Park (MP), situated next to Macquarie University, Sydney, Australia. The New South Wales State government converted this area from market gardens in 1999 on the lines of the Stanford model to facilitate knowledge exchange between the university and businesses (Pancholi et al., 2018). With innovation motivating its core design, MP specializes in the information technology (IT), communications, medical, and pharmaceutical sectors. Often called *Australia's Silicon Valley* (Ryde, 2019), it features the head offices for Australian Securities Exchange top 100 companies such as Optus, Abbott, Sony, Orix, Fujitsu, Cochlear, AMP Capital, 3M, and Konica Minolta. Despite being a newly developed innovation hub, MP ranks as the 10th highest economic output precinct in Australia and has established itself as a nationally acclaimed research and business hub (Pancholi et al., 2018). It has approximately 2200 businesses (ABS, 2018), including 180 large multinationals and 200 SMEs (Hudson et al., 2019). Overall, it generates \$9.8 billion in gross domestic product annually, with a growth rate of 6.8% (Redrup, 2016; Ryde, 2019). These features also make MP a magnet for entrepreneurs, government institutions, universities, and businesses to connect with start-ups, accelerators, and business incubators (Fennessy, 2019).

The research site (MP) is suitable for both theoretical and practical reasons. It is a significant location of innovation with a high economic growth rate, and it promotes social integration. These features provide an ideal setting in which to study inter-firm openness and innovation ecosystems. Moreover, being a relatively new business hub (about 7 years old), we expected that respondents' views would be less influenced by structural rigidities, ego-networks, and social lock-ins. Kumar and Zaheer (2019) documented the negative impact of these issues in mature networks with persistent partnerships. On a practical note, the precinct has 54% more professionals and 32% more managers than other business areas in New South Wales (Pancholi et al., 2018). Moreover, the researchers' personal networks within MP and its close vicinity enabled multiple rounds of interviews.

### 3.2 | Data sources and procedure

We used interviews<sup>1</sup> to obtain multiple perspectives on how inter-firm openness occurred over time. We also gathered observational field notes and archival data for

<sup>1</sup>Alam et al. (2022) used the same interview sample for scale development work and identified five measurable dimensions of openness, namely: inter-organizational trust, collaboration, sharing, transparency, and risk-taking.

triangulation and added information on key issues (Jick, 1979; Miles & Huberman, 1994). To mitigate retrospective bias in interviews due to memory lapses, faulty post hoc attributions, and social desirability (Golden, 1992; Huber & Power, 1985), we used recommended techniques. These include providing informants with the option of a free research report (Miller et al., 1997), recruiting multiple knowledgeable participants per firm to cross-check information (Glick et al., 1990), focusing on concrete events in the process (Miller & Salkind, 2002), and using archival data to track changes in the development process (Jovanovic et al., 2021).

#### 3.2.1 | Interviews

Between July 2017 and December 2019, we conducted three rounds of interviews ( $n = 54$ ) with managers at MP. The first round of in-depth interviews comprised 22 senior managers. The interviewees were purposively chosen to ensure that they possessed adequate knowledge of and experience with the phenomena under research. The participants were invited via email, and interviews were conducted face-to-face on-site at the interviewees' company. We asked participants to "tell a story" about their firm's transition to open innovation. Specific questions guided their storytelling process, such as which innovation venture led them to engage with other firms; when and how they started knowledge and resource sharing; how they developed trust, how transparency affected collaborations; how did their partners react to vulnerabilities, risk, IP sharing, and competition; and how participants felt about working together. As conceptual categories and themes started to emerge, the interviews became more structured and sampling more selective. Some interviewees also suggested other participants for interviews, rendering our theoretical sampling technique both deliberate and emergent (Dacin et al., 2010).

The second round of interviews with 22 new participants was conducted during April–July 2018. In this round, we sought sources who could speak on specific concepts emerging from our analysis in round one (Glaser & Strauss, 1967). Participants were asked how they visualize a systematic process of inter-firm openness; how they see risk and reliance in open innovation; how they wanted others to reciprocate; how they viewed the role of trust, risk-taking, and transparency in ecosystem participation; and what steps they undertook to balance competition and collaboration. We also asked them to describe how open innovation strategy was implemented, the important challenges faced, and how they were addressed. The first 2 rounds of 44

interviews (lasting between 40 minutes and 1 hour) were audio-recorded and transcribed verbatim, which yielded a 165,000 words dataset. We ceased sampling when our categories were theoretically saturated, and the properties, dimensions, and relationships of categories were stable (Strauss & Corbin, 1998). Held in October–December 2019, the third round of interviews comprised 10 repeat participants as member checks to ascertain the validity of our interpretation and graphic representation of the participants' views. Member checking is a useful technique for exploring the credibility of results in qualitative research (Dacin et al., 2010; Nag et al., 2007). The interviews were of short duration (lasting 15 to 20 minutes) in which we presented participants with the emergent model and invited them to comment on its accuracy. We took handwritten notes to record participants' evaluations, which helped us fine-tune the model, obtain participants' concordance, and derive a phenomenological model grounded in the data.

### 3.2.2 | Observation and archival data

Interviews were supplemented by multiple instances of observation that occurred while shadowing organizational members in informal meetings, presentations, social interactions, and workshops at the Macquarie University start-up incubator. Specifically, we participated in various networking events such as Hackathons, Innovation Showcases, and seminars. Field notes were taken during or immediately after such events. The researchers regularly discussed the interviews and observations, enabling us to hone our interviewing process and understand the data. We also analyzed a range of archival data such as documents from MP's local City of Ryde Council, electronic media, articles in the popular press, newsletters, and bulletins from Macquarie University's corporate engagement and Macquarie Park Innovation District office. These data helped us obtain historical reference points for the state of a firm's openness and develop a comprehensive understanding of the context. Table 1 summarizes our data sources.

### 3.3 | Analytical approach

As we collected qualitative data, we inductively analyzed it, adhering to the established constant comparison technique for grounded theory (Glaser & Strauss, 1967; Strauss & Corbin, 1998). Our analyses comprised four steps. The first step involved open coding of the initial 22 interviews. We performed a microanalysis of these interviews with detailed line-by-line coding (Strauss & Corbin, 1998). These

formed the *first-order codes* that were used to analyze all the remaining interview transcripts, and new codes were added as and when they emerged. Such codes comprised, among numerous others, remarks on the microdynamics of open innovation, social engagement, interdependence, trust, collaboration, competition, and the inflow and outflow of resources. We looked for possible conceptual patterns and regularly discussed the data to facilitate a comparison of the coded documents.

In the second step, we searched for codes across interviews and clustered them into meaningful higher-order abstract nodes. We retained the language used by the participants. Through triangulation (e.g., participants' observation and interviews), we refined the higher-order or tree nodes into a set of first-order categories. The third stage of analysis involved a recursive process; we iteratively moved through our first-order categories to find links between them. These links enabled us to collapse these first-order categories and cluster them into theoretically distinct groups or second-order themes. Regular discussions among the researchers resolved discrepancies about codes and their representative themes. In case of a disagreement, an additional code was assigned.

Finally, in the fourth step, we sorted second-order themes into overarching openness dimensions that helped us theorize the process of inter-firm openness. At this stage, to expand our emergent model, we delved into the data and extant literature in an ongoing manner. To summarize, 384 first-order codes were collapsed into 112 higher-order nodes before being further grouped into 19 first-order categories. These categories were further refined into nine second-order themes and ultimately sorted into four aggregate dimensions in chronological order to depict a firm's progression from ego-system to an open innovation ecosystem. The first dimension underscores a realization of resource dependence. The second dimension emphasizes inter-firm socialization, the third dimension focuses on strategic alignment, and the fourth dimension enunciates two-way openness. Figure 3 illustrates our final data structure, showing the categories, themes, openness dimensions, and triggers and inhibitors that induce phase transition. Table 2 contains representative quotes from interviews as supporting evidence in addition to the data presented in the narrative below.

## 4 | A PROCESS MODEL OF INTER-FIRM OPENNESS

The data structure (Figure 3) forms the basis of our process theorization. However, as Gehman et al. (2018) and Gioia et al. (2012) argue, no matter how vital the data structure might be, it is only a static image of an

TABLE 1 List of interview participants, archival data, and observation

Organization type	Type of interviewee (number of interviews)	Quotes coded
<i>Round 1</i>		
Banking/leasing	Director (1); General Manager (1)	6 + 15
Government	Economic Development Coordinator (2); Architect (1)	19 + 7
Software	Consultant Innovation; (1) Manager (1)	6 + 8
Technology	Innovation Lead (1)	7
Start-up accelerator	CEO (1) Director (1)	9 + 13
Telecommunication	CEO (1); Engineer (1); Consultant (1) Director,	10 + 10 + 11
Pharmaceutical	CEO (1) Innovation lead (1)	12 + 14
Incubation	Manager (1) Director (1)	10 + 12
Conglomerate	Country Manager (1); General Manager (1)	14 + 11
Innovation district	Director (1) Manager (2)	12 + 8
<i>Round 2</i>		
Banking/leasing	CEO (1); Department Head (1); Manager (1)	9 + 7 + 7
Technology	CEO (1) Manager (1)	15 + 7
University	Vice-Chancellor (2); Director (2)	17 + 6
Healthcare	Department Head (1) CEO (1); Vice President (1)	13 + 8 + 4
Pharmaceutical	Director (1); CEO (2)	19 + 7
Telecommunication	CEO (1); Manager (1)	5 + 6
Government	Managing Director (1)	5
Digital marketing/IT	CEO (1); Director (1)	10 + 9
Business chamber	President (2)	16
<i>Round 3 (Member Check)</i>		
Banking	Manager (1)	–
Healthcare	Director (1)	–
Technology	CEO (1)	–
Telecommunication	Innovation Lead (1); Engineer (1)	–
University	Professor (2), PhDs (2)	–
Pharmaceutical	General Manager (1)	–
Total	54	384
<i>Archival data</i>		
	Public records, historical documents from MP's local City of Ryde Council, annual reports, webpage, brochures, editorials in the popular press, newsletters from Macquarie University's corporate engagement office, and bulletins from the office of Macquarie Park innovation district	
<i>Observation</i>		
	Site visits, workshops at the incubator, hackathons, zoom sessions, networking events, innovation showcase, seminars, informal meetings, and formal presentations	

Notes: All participants held management roles, with oversight over collaborations with multiple firms. Hence, they could provide in-depth comments on ecosystems. The numbers reported above denote the role of participants as well as the number of interviews (in parentheses).

inevitably dynamic phenomenon. To convert the static image into a process, it is essential to establish dynamic relationships between the emerging concepts. Toward this aim, our mapping of concepts emerging from grounded theory (Ligita, et al., 2020) and corroboration through member checks resulted in a dynamic process model (Figure 4). Indeed, visual representation of

process data not only enables the presentation of large quantities of information in relatively little space but also supports the development and verification of theoretical ideas (Gehman et al., 2018; Langley, 1999).

In the following section, we describe the transitory phases of openness to allow for a stepwise development of the process model and describe phase transitions.



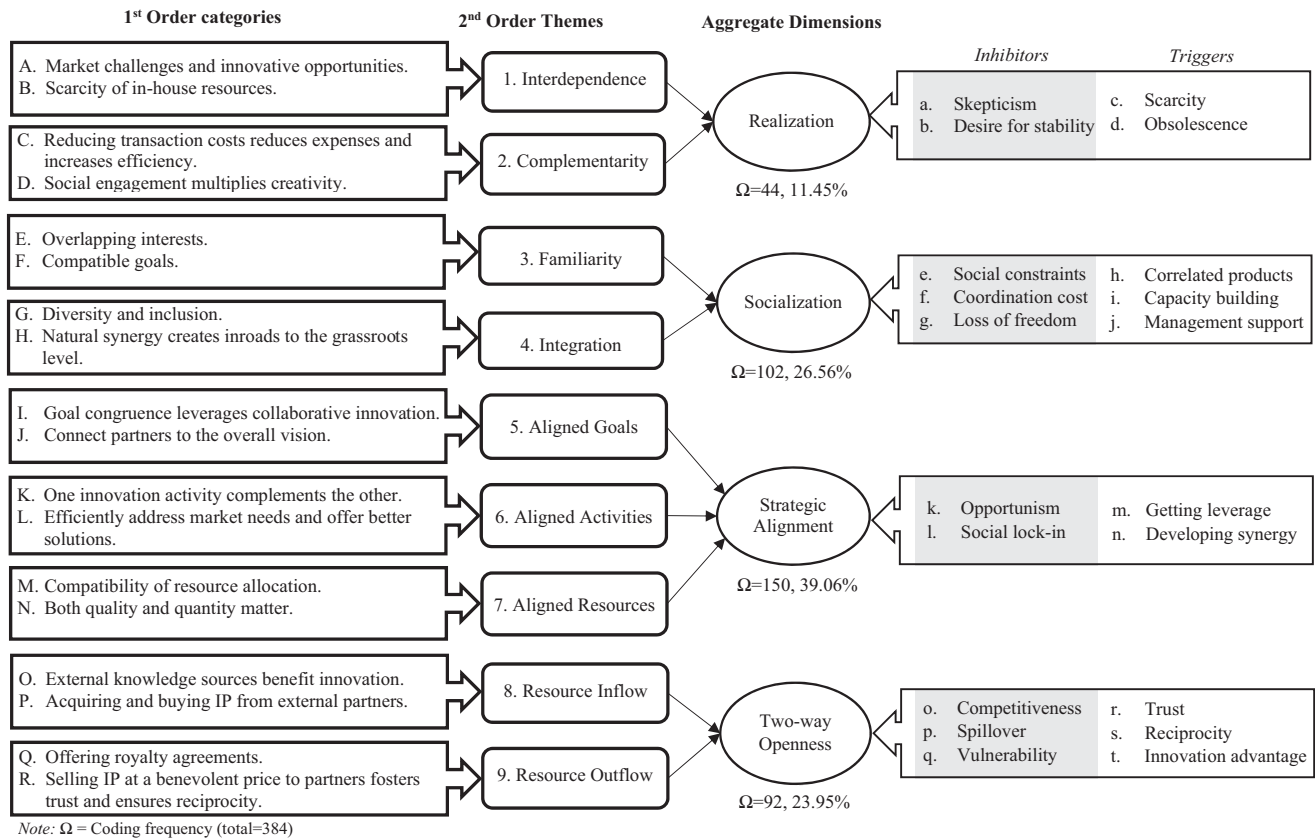


FIGURE 3 Data structure

## 4.1 | Realization phase

More than 90% (49 out of 54) of the interviewees pointed out that openness starts with a realization: the firm realizes that its knowledge is limited, and resources are insufficient for innovating superior products to materialize a focal value proposition. Accordingly, we collapsed 11.45% codes (44 out of 384 codes) into an overarching dimension labeled *realization*. As such, a realization of two critical features echoed across interviews: (a) dependence and (b) complementarity. Respondents agreed that the firm first considers its available resources, and the scarcity of those resources gives rise to awareness about resource dependence. A realization that other firms in possession of needed resources can help the focal firm innovate complex and customized products efficiently and market them effectively. As an Incubator Director highlighted: “A realization that we [firms] cannot do it alone, or doing so will be [very] expensive, brings corporates to the table.” In this vein, a project manager from a telecommunications provider referred to a failed project:

Our project [kept anonymous] stalled because to launch it off the ground on a large scale, we needed new technology and additional

towers, which was so damn expensive. We needed a partner in the Park [MP]. ... I know the one who could help was right next door, but that happened to be our competitor.

The executive-level interviewees were consistent in saying that “We [firms] increasingly depend on each other for new ideas and resources” and that “openness is indispensable to survive.” We categorized all such perceptions under the theme named *interdependence*.

Regarding the second major realization (complementarity), the interviewees pointed out several complimentary benefits of partnerships with other firms such as “technical support,” “unique expertise,” “new ideas,” “value-added features,” “better infrastructure,” “supply chain,” “skilled employees,” and “specialized equipment.” Interviewees frequently told us that collaboration multiplies creativity. Importantly, the complementarity of “reducing transaction cost” was conveyed by 84% of participants (45 out of 54). On this note, a corporate engagement manager stated that “we spend a huge amount on procuring equipment; we can jointly buy and share them, thereby reducing the external outlay.” A salient theme was that, by adopting an open strategy, firms could complement each other’s innovation capabilities and offerings.

TABLE 2 Illustrative quotes from interviews

Dimensions	
Second-order themes	
First-order categories	Illustrative quotes
<b>Realization</b>	
1. <i>Interdependence</i>	
A Market challenges and innovative opportunities	A1. I think the realization of the complexity and the challenges and new opportunities within the markets that we serve is that you do not have all the resources and solutions.
B Scarcity of in-house resources	A2. Invariably, you find someone always has a better model than yours. Innovation these days cannot be developed by a single firm; we have to bring in a higher number of actors.
	A3. We are no longer product sellers; we are solution sellers. They [clients] want us to bring in informatics, change management, and change in areas unrelated to our core business. A lack of these abilities can compromise the value differential of a firm. Hence, it is crucial to collaborate with other parties to help build one solution.
	B1. Organizations have such finite resources, and limited bandwidth to take on new projects or allow the time working on something. Collaborative innovation requires a reallocation of resources as opposed to new resources.
	B2. Given the diversity of challenges and opportunities, no one is going to have all the answers or all the levels of expertise. So, a mutual exchange of knowledge and resources is essential.
2. <i>Complementarity</i>	
C Transaction cost savings increase efficiency	C1. Mostly, companies seek a solution that would benefit every entity while reducing the costs and resources required for delivering different services. This attracts the companies to collaborate toward jointly reducing their transaction cost.
D Social engagement multiplies creativity	C2. Innovation happens through realizing that when we put our resources together, what we have got get multiplied, and we become more efficient.
	C3. Economically how can we be more able to reduce our cost and translate it into benefits for our customers. Those kinds of drivers can help a company to be more competitive.
	D1. We may end up becoming clients of each other's or suppliers to each other ... So it's no good holding on to something.
	D2. It's better to think of what I've got get multiplied.
<b>Socialization</b>	
3. <i>Familiarity</i>	
E Similar issues and overlapping interests	E1. They [firms] come together on some common ground and have some more social interaction. I mean common problems or common benefit, some commonality of familiarity.
F Compatible goals	E2. I think before you get to collaboration, all you need a common purpose, identify a common area of interest.
	F1. I always see a correlation between different firms' products and their customers.
	F2. There's always some degree of overlap in your [firms'] goals. For that, you need to interact with each other or engage without any obligation.
4. <i>Integration</i>	
G Diversity and inclusion	G1. I think one of the great things we have seen is when you bring together people from different firms, backgrounds, experience, and different viewpoints, you get some really interesting ideas because they all have no problem doing it.
H Natural synergy creates inroads to the grassroots	G2. If you actually really want to drive stuff you got to blend multiple expertise, knowledge, and resources into becoming a valuable innovation.
	H1. I think open innovation work when there is a natural synergy. And you [leadership] need to find that natural synergy.
	H2. People at the grassroots have to be involved. Because probably that is where a lot of the actual physical work will happen. So, the will should come from the top, and implemented at the grassroots level.
<b>Strategic alignment</b>	
5. <i>Aligned goals</i>	
I Goal congruence leverages collaborative innovation	I1. You [firms] need to align strategies with collaborators to be able to develop new markets and drive your profits... I think first you need alignment in your strategic goals. Your goal alignment builds momentum for collaborative open innovation.
J Connect partners to the overall vision	I2. If you [firm] are committing to open innovation with others and your goals are not well aligned, you are setting your company up for a terrible fall.
	J1. Partners must feel connected to the overall open innovation vision. This happens when their strategic goals are aligned.
	J2. Alignment of goals help partners understand why the tasks they are doing matter and how they connect with the overall direction of the innovation ecosystem. Lacking alignment, you [firms] waste lots of time in silos, confusion, lower business results.

TABLE 2 Continued

<p>6. <i>Aligned activities</i></p> <p>K One innovation activity complements the other</p> <p>L Efficiently address market needs and offer better solutions</p>	<p><b>K1.</b> The capacity for open innovation stems from a coherent set of interdependent activities and processes that complement one another, synthesize ideas into the business model, and search for novel solutions.</p> <p><b>K2.</b> Without alignment in innovation activities and processes, partners can easily wind up pursuing conflicting priorities—even when there's a clear business strategy.</p> <p><b>L1.</b> We [firms] get market information quickly and realize customers' needs in product design.</p> <p><b>L2.</b> Through coordinated activities, we [firms] are more efficient to satisfy our customers and offer a better solution at a lower cost.</p>
<p>7. <i>Aligned resource</i></p> <p>M Compatibility of resource allocation</p> <p>N Both quality and quantity matter</p>	<p><b>M1.</b> I think you need the mutual commitment of resources to build the momentum behind superior innovation.</p> <p><b>M2.</b> I mean it is crucial for alliance partners to allocate compatible resources. This alignment is often a necessary step to accomplish strategic goals.</p> <p><b>M3.</b> When determining which resources to allocate, one [firm] must consider which are compatible to the strategy. The success of open innovation initiative depends on the resource alignment.</p> <p><b>N1.</b> Committing time, committing valuable resources, and full involvement is what is required. Both type and amount of resources matter.</p> <p><b>N2.</b> To me, it is allocating the right quality and quantity of resources among strategic partners. Be sure to do that with surgical precision so as not to undermine open innovation.</p>
<p><b>Two-way openness</b></p> <p>8. <i>Inflow openness</i></p> <p>O External knowledge source can benefit our innovation</p> <p>P Acquiring and buying IP from external partners</p>	<p><b>O1.</b> I think innovation is a concept that's about innovating not just within your team or even company or even industry but learning and acquiring knowledge from all of those from other areas so that you innovate yourself.</p> <p><b>O2.</b> I think firms that want to succeed in the rapidly changing market have to rely on other's resources to build their capacity. I believe doing that in an active, and strategic way is what's important not as a part-time issue.</p> <p><b>P1.</b> What one industry or a firm might learn about a particular thing might be best learned from another industry or firm. So, go ahead and purchase the IP.</p> <p><b>P2.</b> There's no harm in acquiring a patent from partners for some time to develop our innovation.</p>
<p>9. <i>Outflow openness</i></p> <p>Q Offering royalty agreements</p> <p>R Selling IP at a benevolent price to partners fosters trust and reciprocity</p>	<p><b>Q1.</b> Knowledge acquisition is half openness. True openness is when you share your knowledge with others or license your IP or enter into a royalty agreement with outsiders.</p> <p><b>Q2.</b> I believe in managing assets more effectively but not necessarily holding on to them. If I have got underutilized assets and I have a collaborative partner who could use the assets to complement mutual outcome, of course.</p> <p><b>R1.</b> I believe your outbound sharing of resources creates more possibility for inbound transactions in the future. And if you [firm] favor partners firms by offering a lower price, you develop trust Because morally, it will come back to you as well.</p> <p><b>R2.</b> Look, I think innovation is driven by competition because you must stay alive as an organization. You must continue to grow and maintain market share. I believe that the value in being open and trustworthy partner actually make you [firms] more competitive [...] Your trust relationships is indeed a competitive advantage.</p>
<p><b>Phase transition</b></p>	
<p><i>Inhibitors and triggers</i></p> <p><b>Transition to realization phase</b></p> <p><i>Inhibitors</i></p> <p>a. Skepticism</p> <p>b. Desire for stability</p> <p><i>Triggers</i></p> <p>c. Scarcity of resources</p> <p>d. Obsolescence</p>	<p><b>Illustrative quotes</b></p> <p><b>a1.</b> It will be difficult to commit to underlying change and the accompanying increases in work.</p> <p><b>a2.</b> We suspected it might require outsourcing R&amp;D, which means laying off internal staff.</p> <p><b>b1.</b> I think departure from independence to interdependence is easier said than done. We [firms] are quite uncomfortable with change in routine... we will only change when pushed hard.</p> <p><b>b2.</b> It [change] involves going out of the comfort zone...brings uncertainty and job complexity.</p> <p><b>c1.</b> Realization is mostly triggered by the feeling of being destitute... lack of knowledge, limited resources, and insufficient talent.</p> <p><b>c2.</b> Hard times meeting the key performance indicators brings realization that we [firms] have finite resources and very limited bandwidth of knowledge to take on new projects all alone.</p> <p><b>d1.</b> Much before our new product reaches the desired revenue peak, the technology upon which it was founded expires.</p> <p><b>d2.</b> Telecom sector is progressing faster than ever ... you cannot stay [compete] with outdated technology.</p>

TABLE 2 Continued

<p><b>Transition to socialization phase</b></p> <p><i>Inhibitors</i></p> <ul style="list-style-type: none"> <li>e. Social constraints</li> <li>f. Coordination cost</li> <li>g. Loss of freedom</li> </ul> <p><i>Triggers</i></p> <ul style="list-style-type: none"> <li>h. Correlated products</li> <li>i. Capacity building</li> <li>j. Management support</li> </ul>	<ul style="list-style-type: none"> <li>e1. Social barriers are there such as past relationships, personal vendetta, and enculturation.</li> <li>e2. Working with new partners may invite new tensions.</li> <li>f1. Cost of establishing a new network and shaping new alliances.</li> <li>f1. It [socializing] increases coordination costs, that could be avoided by staying with the old partners.</li> <li>g1. We thought this would make our [firm's] behavior and weaknesses open to unspecified others in the larger business community.</li> <li>g2. It would be difficult for us [original developer] to exercise the freedom... to establish the financial and technological trajectory.</li> <li>h1. We [firms] are not much different; a lot of our products depend on input from others. It's about a shared vision. It's about firms opening their walls and having more touchpoints.</li> <li>h2. Generally, our [firms'] business interests greatly overlap.</li> <li>i1. Socializing with others [firms] improve your capacity to innovate on a regular basis.</li> <li>i2. One organization has one skill set; another one has a different skill set. If we engage them, we can merge these skillsets to develop something innovative. This principle led us to socialize and many players contributed to our products in profound and meaningful ways.</li> <li>j1. But to get to this point [socialization], you need support from senior management, and you need that organizationally to not be confined to a particular unit.</li> <li>j2. At the inter-firm level, it [socialization] is not possible without support from the higher echelon.</li> </ul>
<p><b>Transition to strategic alignment phase</b></p> <p><i>Inhibitors</i></p> <ul style="list-style-type: none"> <li>k. Opportunism</li> <li>l. Social lock-in</li> </ul> <p><i>Triggers</i></p> <ul style="list-style-type: none"> <li>m. Getting leverage</li> <li>n. Developing synergy</li> </ul>	<ul style="list-style-type: none"> <li>k1. Opening a technology, platform, innovation venture, or processes amounts to work under constraints because some decisions that they [original designer] could have made are now taken by partners, who may want to pursue their own interests.</li> <li>k2. Even if collaborating firms have a common interest, their goals may not be fully aligned. Thus, it is hard to achieve the required strategic alignment.</li> <li>k3. We were poor in terms of response from partners.</li> <li>l1. The more you [firm] share resources with others, the more you are locked in the network, and the more difficult it gets to free up those resources to be committed somewhere else.</li> <li>l2. One of the consequences [of strategic alignment] is you [firms] get locked in social contact... there are control problems.</li> <li>m1. I think what grabbed us about strategic alignment was the idea of making greater use of partners' technology in our businesses.</li> <li>m2. I would say a firm must leverage its innovations from the discoveries of others.</li> <li>m3. You are more safe... because you are aligned, you have broader spectrum of expertise, you make quick decisions and take more calculated risks.</li> <li>n1. Beyond getting the leverage from heterogeneous resources, you [firm] also achieve greater synergy.</li> <li>n2. Strategic alignment will develop synergy, and firms will get what they need ... because it will be easier to see what talent is needed, when it is needed, where the talent exists within the alliance, and how to deploy it.</li> </ul>
<p><b>Transition to two-way openness phase</b></p> <p><i>Inhibitors</i></p> <ul style="list-style-type: none"> <li>o. Competitiveness</li> <li>p. Spillover</li> <li>q. Vulnerability</li> </ul> <p><i>Triggers</i></p> <ul style="list-style-type: none"> <li>r. Trust</li> <li>s. Reciprocity</li> <li>t. Innovation advantage</li> </ul>	<ul style="list-style-type: none"> <li>o1. The imitation of open resource [product] erodes competitiveness.</li> <li>o2. Outflow openness diminishes in strong competition.</li> <li>p1. Two-way openness opens the door to knowledge leakage and convergence.</li> <li>p2. You provide a way for knowledge to leak out. Thus, it compromises the distinctiveness of the firm's IP.</li> <li>q1. By allowing inflow, you can efficiently innovate products, and by protecting the outflow, you stay competitive. Also, you get less vulnerable to opportunistic behavior.</li> <li>q2. The original developer will have to allow access to partners that typically work with several others. This means you [firms] are vulnerable.</li> <li>r1. Trust was the stimulus... it [trust] builds confidence that partners will not be opportunistic; they will not exploit our vulnerabilities.</li> <li>r2. By human nature, we [firms] will share resources and allocate time, money, or infrastructure to those we trust—the firm or the project that we trust more.</li> <li>r3. We further developed trust, which enabled us to take the risk of sharing more resources and rely on each other.</li> <li>s1. Trust stimulates partaking and reciprocation".</li> <li>s2. Reciprocal sharing of resources creates an ecosystem, which allows access to more productive resources... enhances innovativeness.</li> <li>t1. The biggest benefit of two-way sharing in gaining innovation advantage.</li> <li>t2. It [two-way openness] has substantial benefits, such as access to unique knowledge resources, opportunity recognition, new product development, and significant innovations.</li> </ul>

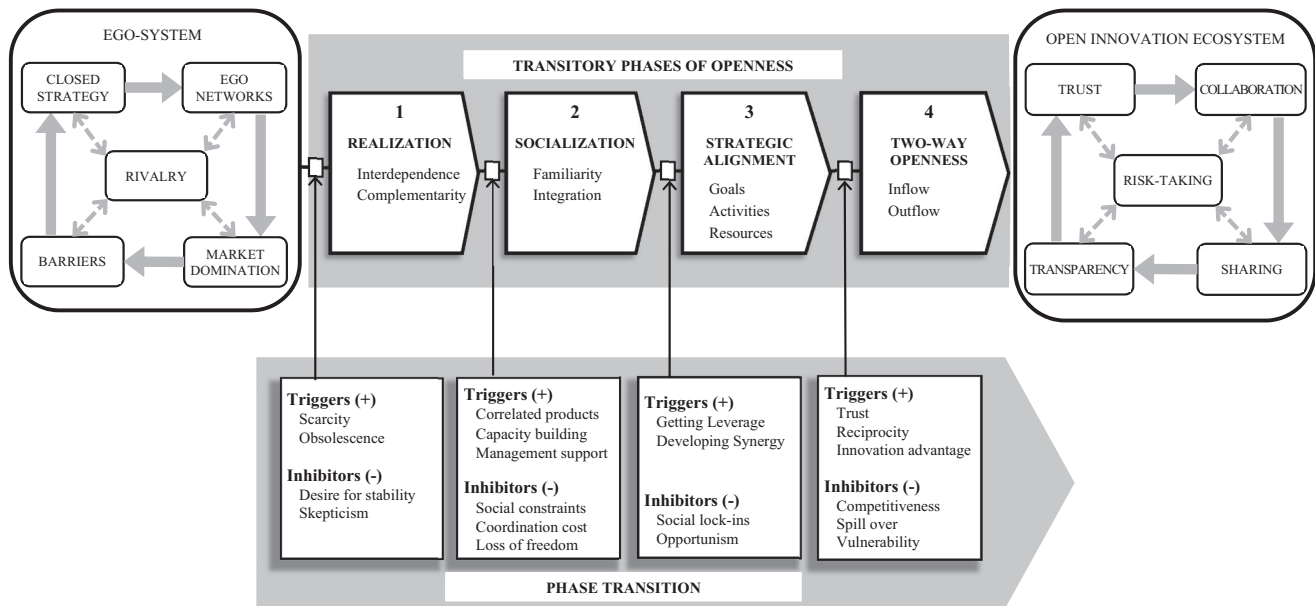


FIGURE 4 Process model of inter-firm openness, showing transition from ego-system to open innovation ecosystem

#### 4.1.1 | Transition into the realization phase

While a realization of interdependence and complementarity occurs naturally, a firm's transition into it from an established ego-system is challenging. One CEO from a technology firm outlined, "I think the departure from independence to interdependence is easier said than done. We [firms] are quite uncomfortable with change; we will only change when pushed hard." Participants indicated mostly psychological barriers including "uncertainty," "different mindsets," "job complexity," "routines," "comfort zone," "departmental constraints," and "resentment." The two most discussed inhibitors were: (a) desire for stability and (b) skepticism, as presented in Figures 3 and 4. As such, firms are forced to let go of stability and are obliged to be comfortable with this change. A senior manager from the State government told us, "even if there is an imminent threat, firms intrinsically resist change, especially when it involves changing routines and going out of the established network ... it is difficult to go out of the comfort zone." The other inhibitor, skepticism, was about the fear of work overload and subsequent job loss. As such, skepticism that "a change will require doing extra work" was a concern noted in several interviews. For example, one middle manager from a start-up indicated that they thought "it will be difficult to commit to underlying change and the accompanying increases in work." There was a belief that the realization phase (interdependence and complementarity) would inevitably change the business model, which would threaten job security. For example, an engineer told us, "We [my colleagues] suspected it might require outsourcing R&D, which means laying off internal staff."

As these inhibitors gained prominence in the data, we started asking interviewees how they overcame such hurdles. Participants indicated that their transition into the realization phase was triggered mostly by feelings of deficiency, for example, "knowledge gap," "obsolete technology," "bounded innovativeness," "technology change," "stalling growth trajectory," "rising costs," "decreasing market share," "talent insufficiency," and "hard times meeting the key performance indicators." Among these triggers, the most prominent were (a) scarcity of resources and (b) obsolescence. One senior respondent (CEO of a telecommunications firm) captured these themes in a revealing quote stating, "much before our new product reaches the desired revenue peak, the technology upon which it was founded expires. We [firms] have finite resources and very limited bandwidth of knowledge to take on new projects all alone." An overwhelming majority of interviewees were wary of fast-paced technological changes because their firms have a hard time addressing customer demand using only their in-house resources. Respondents (45 out of 54) believed that these two triggers often overcome inhibitors leading firms to transition into the realization stage of openness.

#### 4.2 | Socialization phase

Reports of social engagement with other firms were common. Almost all interview participants believed that the realization of interdependence and complementarity coaxes firms to socialize—engage with external organizations. Overall, we grouped 102 out of 384 codes (26.56%) under the aggregate dimension of *socialization*.

Respondents described a range of social factors that we grouped into two broad themes: (a) familiarity and (b) integration. Concerning familiarity, according to more than half of the respondents (30 out of 54), innovating firms are similar in many ways. They face similar problems, their goals are mutually compatible, and so there is always overlap. As one participant (middle manager from Macquarie Park Innovation District) mentioned, “Firms rarely have perfectly aligned goals. However, I always see a degree of overlap between what company A is trying to achieve and what company B is trying to get. The aim is to familiarize with each other.” Some suggested that while familiarity provides a natural synergy for collaborations, firms seldom start collaborating on big projects; they typically begin with small projects, “familiarity helps them to exceed their previous targets.” As one executive from the University’s corporate engagement office pointed out, “firms must start with baby steps; they must have basic familiarity with each other’s resources and capabilities, and how such [collaborative] operations unfold.” At the same time, we interpret interviewees comments to mean that familiarity stimulates symbiosis, which enables firms to engage collaborators from diverse sectors, including “governments,” “regulators,” “community organizations,” the “not for profit sector,” “overseas firms,” and “experts” to bring more “diversity into the precinct.”

The second consistent insight among interviewees was about integration. As one of the informants (CEO of a healthcare firm) replied, “We [firms] must work as a system that integrates all the innovation players and innovation actors... the more the firms integrate at multiple levels, the better they align multilateral interdependencies and identify areas of greater leverage.” Many other participants highlighted how they achieved integration. For example, the R&D manager from a healthcare company said, “We got great leverage by integrating research activities and manufacturing process with partners.” Likewise, an IP manager from a local software firm explained, “Actually, you [firms] bring people from different firms, backgrounds, experience, and viewpoints. You get some interesting ideas because they all have different solutions to the problem.” When probed further, many interviewees (28 out of 54) emphasized that internal integration is equally important because it contributes toward creating synergy and developing inroads to the grassroots level. As one senior manager (a software consultant) said, “It’s got to go everywhere, the departmental level and further down to the people involved ... the omission of people at the grassroots can derail a project or make the viability of the project much less sincere.” Likewise, a senior incubator manager claimed:

It will be very difficult to deliver something of real value if it [open innovation activities] does not take internal stakeholders on board. If a firm is not open among its own employees, bringing in external stuff from the outside won’t make much difference. You’ve got to involve everyone; it’s got to go through the whole firm.

#### 4.2.1 | Transition into socialization phase

Having realized the potential of interdependence and complementarity, transition into the socialization phase is a challenging but natural task for a firm; it is marked with resistance and emotional upheaval. Participants pointed out several hurdles that they had faced such as “social anxiety,” “past relationships,” “embeddedness,” “personal vendetta,” “cost of establishing a new network,” “shaping new alliances,” “enculturation,” “losing freedom,” and “ceding control.” The most discussed inhibitors were: (a) social constraints, (b) coordination cost, and (c) loss of freedom, as presented in Figures 3 and 4. As one senior manager from a digital marketing firm said, “Working with new partners may invite new tensions and increase coordination costs, that could be avoided by staying with the old partners.” Stipulating social constraints, a middle manager from a leasing company said, “we thought this would make our [firm’s] behavior and weaknesses open to unspecified others in the larger business community.” Many were concerned about a loss of freedom. For example, an IP manager replied, “we thought it would be difficult for us [original developer] to exercise the freedom to establish the financial and technological trajectory.”

Given the subtractive nature of these inhibitors and the consequent divestiture of freedom, it is not surprising that strong process drivers were needed. When asked about how they overcame such hurdles, interviewees discussed triggers that had propelled them [firms] into the socialization phase, such as “support from senior management,” “firms’ overlapping interests,” “correlated products,” “improving innovativeness,” and “higher productivity.” Most prevalent across interviews were statements about three important triggers: (a) correlated products, (b) capacity building, and (c) management support. For instance, regarding correlated products, the country manager of a multinational firm said, “We [firms] are not much different; a lot of our products depend on input from others. It’s about a shared vision. It’s about firms opening their walls and having more touchpoints.” Correlation in products enhances firms’ innovative capacity. An executive VP of a healthcare firm summarized the belief about capacity building by saying that:

One organization has one skill set; another one has a different skill set. If we engage them, we can merge these skillsets to develop something innovative. This principle led us to socialize and many players contributed to our products in profound and meaningful ways.

It was, however, clear that unless the leadership supports social engagement, things do not change. As a project manager from the telecommunication firm said, “But to get to this point [social engagement], you need support from senior management, and you need that organizationally to not be confined to a particular unit.”

### 4.3 | Strategic alignment phase

Realization and socialization provide the basis for openness, but firms do not yet have the connectivity to start open innovation. They need *strategic alignment*. This aggregate dimension comprised 150 out of 384 (39.06%) codes. The majority (48 out of 54 participants) expressed their views on how they achieved strategic alignment and why it was required for “joint venture,” “partner selection,” “integrating activities,” “resource allocation,” “governance mechanism,” “co-branding,” and “the extent of sharing IP.” Regarding the specific domains of strategic alignment, participants offered many ideas, including “social alignment,” “entrepreneurial alignment,” “intellectual alignment,” “operational alignment,” “market alignment,” and “infrastructure alignment.” A general premise was that realization and socialization enable firms to develop positive expectations of each other, encouraging them to step forward with a shared entrepreneurial approach to align their goals. Then, depending on their goal alignment, they align innovation activities and processes that lay the foundation for sharing resources required to achieve those goals. Accordingly, we categorized all these thoughts under three main themes: (a) alignment of goals, (b) alignment of activities, and (c) alignment of resources.

Our interviewees considered goal alignment as a hallmark of open innovation. The notion of goal alignment was more pronounced in middle and senior managers’ thoughts, all of whom came from large, well-known multinational firms. The CEO of a leading telecommunication company said, “Basically, you [firms] make alliances to achieve a common goal, which is to create value that was otherwise not possible working alone. For this to work, you must align your strategic goals.” Goal alignment provides a natural synergy that cascades down to the alignment of all other activities and processes. The leaders need to articulate the goals clearly,

and these goals need to be well aligned with alliance partners’ goals. Participants believed that better product innovation, successful marketing, and efficient commercialization, in turn, require alignment of activities among partner firms. Therefore, “they [firms] aligned their activities and processes to be able to blend multiple expertise, knowledge, and resources to innovate better products.” As one respondent (department head from a healthcare firm) said, “open innovation may thrive or fail depending upon how well partner firms orchestrate their activities and resources. This is one of the common areas where most firms fail.”

#### 4.3.1 | Transition into strategic alignment phase

Respondents faced many challenges achieving strategic alignment such as “goal orientation,” “control problems,” “social lock-ins,” and “partner’s opportunistic behavior.” Interviewees repeatedly discussed two inhibitors: (a) opportunism and (b) social lock-in, as depicted in Figures 3 and 4. Regarding opportunistic behavior, one participant (innovation lead from a pharmaceutical company) suspected that “opening a technology, platform, innovation venture, or processes amounts to work under constraints because some decisions that they [original designer] could have made are now taken by partners, who may want to pursue their own interests.” Moreover, a banking manager pointed out, “even if collaborating firms have a common interest, their goals may not be fully aligned. Thus, it is hard to achieve the required strategic alignment.” Concurrently, many felt that when firms rely on alliance partners’ inputs, they become locked into social ties and do not receive their due share. As one marketing manager from a startup complained, “We were poor in terms of response from partners.” Importantly, and adding to the tension, a senior executive from a healthcare firm believed, “The more you [firm] share resources with others, the more you are locked in the network, and the more difficult it gets to free up those resources to be committed somewhere else.”

To allay the above concerns, interviewees pointed out important triggers that helped transition into the strategic alignment phase, including “optimizing skills and talents,” “reducing transaction cost,” “eliminating wasted resources,” “quick decision-making,” “clear allocation decision,” “less confusion,” “greater resource visibility,” and “safer risk-taking.” At the core, all these triggers had to do with: (a) acquiring leverage from a broader pool of expertise and (b) developing synergy by optimizing talents and skills. To leverage a range of expertise, the innovation manager from a technology firm held that “I think what

grabbed us about strategic alignment was the idea of making greater use of partners' technology in our businesses. I would say a firm must leverage its innovations from the discoveries of others." Beyond getting the leverage from heterogeneous resources, a firm might also achieve greater synergy. For instance, the President of the local Chamber of Commerce summarized the notion of synergy, saying that "Strategic alignment will develop synergy and firms will get what they need ... because it will be easier to see what talent is needed, when it is needed, where the talent exists within the alliance, and how to deploy it."

#### 4.4 | Two-way openness phase

Participants were keenly aware of the implications associated with inter-firm openness and what they mean for sharing resources. Interviewees used terms such as "obtaining resources," "granting resources," "reciprocal," "trust-driven," "strategic," and "cautiously planned." A critical unifying theme was that openness is a continuum, and the degree of openness depends upon the "type of project," "context," and, most importantly, "inter-firm trust." When we probed further, the majority pointed toward the existence of a clear distinction between inflow and outflow openness, that is, allowing the inflow and outflow of productive resources. We grouped 92 out of 384 codes (23.95%) under the two-way openness dimension. This distinction was outlined by open innovation researchers in the case of inbound and outbound innovation (Cheng & Huizingh, 2014; Enkel et al., 2009; Greul et al., 2018; West & Bogers, 2014). Accordingly, we categorized two main themes that determine a firm's openness in innovation: (a) inflow openness and (b) outflow openness.

Inflow openness refers to a firm's proclivity to obtain resources from a range of players such as suppliers, customers, competitors, universities, and public institutions. As might be expected, participants considered inbound activities a rich source of innovative ideas. As one participant (CEO) from a telecommunication firm acknowledged, "When I think about open innovation, it is about drawing ideas and inspirational contributions from all the 9000 employees in my firm ... and from foreign companies, corporates, universities, and startups." In our discussions of inflow openness, purchasing knowledge and licensing-like arrangements were common. For example, the CEO of a pharmaceutical company said:

We are innovating customer relationships, solutions, and ways to go to the market. This requires openness to licensing agreement or

IP procurement ... I would actually be able to take my IP and multiply it fivefold by bringing in someone else's IP.

Notably, most participants believed that openness is not only about acquiring but also about contributing, that is, how much knowledge resources a focal firm delivers to others. A senior director from the local government echoed this point by characterizing inflow openness as a mere business, whereas outflow openness is a precursor of enhancing trust. The manager said:

I think importing knowledge is called business. The level of knowledge brought into an organization does not tell us about its willingness to be open. The desire to open is reflected through what a firm transmits externally.

Outflow openness refers to outbound activities (allowing external exploitation of internal ideas). Participants described this in terms of "selling data," "out-licensing IP," "offering royalty agreements," "divesting some parts of projects," and "spinning off innovation projects to new firms" through "contracts," "cooperation," and "alliances." A central point in these interviews was the necessity of allowing the outflow of resources. As the innovation head from a large pharmaceutical firm articulated:

If it [firm] cannot or does not want to exploit its IP, then it is better to sell it or get into a contract with others who can use it .... Let's say you have a project that focuses on small applications initially but might turn out to have bigger applications later. Consider letting a partner do the work. You get paid for the IP anyway. On top of it, you get novel ideas and can direct your efforts toward the future [larger] application. So, the real opportunity is not there; the real opportunity is over here.

##### 4.4.1 | Transition into two-way openness phase

The most challenging point in our data was a firm's transition into two-way openness because this is where firms put openness into practice. As was expected, respondents had mixed feelings. Firms tended to rely heavily on inflow but were concerned about the strategic benefits of outflow openness. We found attitudinal discrepancies, the fault lines of which were most evident



regarding a firm's outflow openness. The interviewees believed they were much better off by allowing outflows than was initially thought, but this was the most challenging decision. When asked about the barriers, interviewees revealed ambivalences, such as the risk of "imitation," "creating undifferentiated products," "knowledge leakage," "fear of vulnerability to competitors," and the "erosion of competitive advantage." We categorized these into three main inhibitors: (a) competitiveness, (b) spillover, and (c) vulnerability.

Interestingly, outflow openness may diminish when competition is emphasized. Interviewees attributed this to the fact that "the imitation of open resource [product] erodes competitiveness." For example, a director from the telecommunication company suggested, "By allowing inflow, you can efficiently innovate products, and by protecting the outflow, you stay competitive. Also, you get less vulnerable to opportunistic behavior." Likewise, knowledge leakage (spillover) was another concern (as shown in Figures 3 and 4). For example, the CEO of a start-up made it clear that "two-way openness opens the door to knowledge leakage and convergence." An IP manager from a healthcare firm summarized the inhibitors in a quote:

... the original developer will have to allow access to partners that typically work with several others. This means you [firms] are vulnerable; you provide a way for knowledge to leak out. Thus, it compromises the distinctiveness of the firm's IP.

In contrast, many participants described the benefits of resource outflow that trigger transition into the two-way openness phase, including "reciprocal inflow of more productive resources," "enhanced innovativeness," "the creation of an ecosystem," "enhanced trust, which allows preferential access to unique resources in the ecosystem," "distribution channels," "learning vicariously," "opportunity recognition," "co-marketing," "increasing the business size," "grow the pie," and "long-term economic benefits." Three triggers, however, were most salient across interviews: (a) trust relationship, (b) reciprocity, and (c) innovation advantage. Notably, all interviewees highlighted the probity of inter-firm trust relationships. According to the CEO of a technology firm, "Being independent and most competitive is not good enough, and neither was being financially sound ... what counts is how well are you linked in your network that has needed resources that delivers sustainable value." Trust was the most common stimulus of inter-firm relationship discussed by interviewees. As one senior manager from a commercial

bank said, "Trust builds confidence that partners will not be opportunistic; they will not exploit our [partners'] vulnerabilities." These arguments appear to mirror the trust-based perspective discussed earlier (Connelly et al., 2018; Gulati, 1995; Luo, 2002; Uzzi, 1997; Villena et al., 2019; Zaheer et al., 1998; Zhong et al., 2017). Similar thoughts were echoed by another participant (CEO of a digital marketing firm):

By human nature, we [firms] will share resources and allocate time, money, or infrastructure to those we trust—the firm or the project that we trust more ... During our interactions, we further developed trust, which enabled us to take the risk of sharing more resources and rely on each other.

Outflow obliges the recipient(s) to reciprocate. An innovation manager from a software firm elaborated this; "The more open a firm's strategy becomes, the more inclusive ecosystem it creates, and the higher is the value that migrates from the ecosystem to the firm." Some even recommended offering resources at a "preferential lower price" and "helpful terms" to partners. The logic was that a benevolent price shows a firm's intention for a long-term, co-operative relationship that fosters trust and induces reciprocity. As one CEO of a local technology firm said, "I believe that doing so at a favorable price obligates partners to reciprocate in future ... one should consider the multiplicative effects of sharing." The most potent message was that two-way openness enables a firm to create an innovation advantage. Participants generally believed that an open innovation advantage emanates from a densely connected network of trusted alliance partners. Having a strong network creates more opportunities for efficient learning and mobilization of unique resources. As a middle manager from City of Ryde local government said, "An advantage is because you [firm] get inputs from many partners and diverse actors. So, you're better positioned to innovate and compete than isolated firms or firms with less open ecosystems." Another advantage of outflow discussed by interviewees was sustained interdependence. For instance, the CEO of a digital marketing firm put it thus:

By sharing your resources [outflow openness], you not only want to impress on partner firms your belief in a cooperative, future-oriented outlook, but you keep them dependent on you for a longer time. This is a great advantage.

## 5 | DISCUSSION

One of the important themes in innovation management literature is the idea of inter-firm openness. While a growing body of innovation research on this topic has enhanced our knowledge, we still know little about “how” firms systematically adopt openness. The main contribution of this study is a comprehensive process model of inter-firm openness comprising four transitory phases in chronological order: realization, socialization, strategic alignment, and two-way openness. Our data show that openness starts with a *realization*. When firms operating within an ego-system context realize that innovation success depends on external knowledge resources and capabilities, they are motivated to connect with others. Collaboration with those in possession of such resources can help them save costs, bridge a knowledge gap, overcome obsolescence, address scarcity of resources, and innovate superior products to create sustainable competitive advantage. This realization of dependence and complementarity stimulates *socialization*, the next phase of openness underpinned by two critical dimensions: familiarity and integration. Rather than working alone to tackle uncertainty, interdependent firms engage with competent and dependable partners. Repeated interactions create familiarity among firms; they identify areas of mutual interest and develop synergy by integrating with partners at multiple levels. Eventually, firms develop positive mutual expectations in the shape of trust, enabling them to rely on partners and take greater risks to scale up collaborations.

Socialization propels firms to the next phase, strategic alignment—firms align their goals, activities, and resources. First, the inflow of heterogeneous knowledge resources from strategic alignment enhances firms’ absorptive capacity to identify new opportunities and use them to their benefit. Second, it expands firms’ dynamic capability to bootstrap internal and external resources and reconfigure them to respond to changing environments. Finally, strategic alignment coaxes firms to adopt two-way openness. Firms reciprocate by allowing resource outflow to partners, not just a compulsion to maintain trust and stability but also a strategy to gain relational rents and preferential access to unique resources, thus creating an open innovation ecosystem.

### 5.1 | Key findings

Our data allow us to argue that open innovation is not an end state but a journey in which innovating firms orchestrate the crystallization of an ecosystem, and openness is a lever with which managers might act to go “in” and “out” of open innovation. Furthermore, adopting openness is a

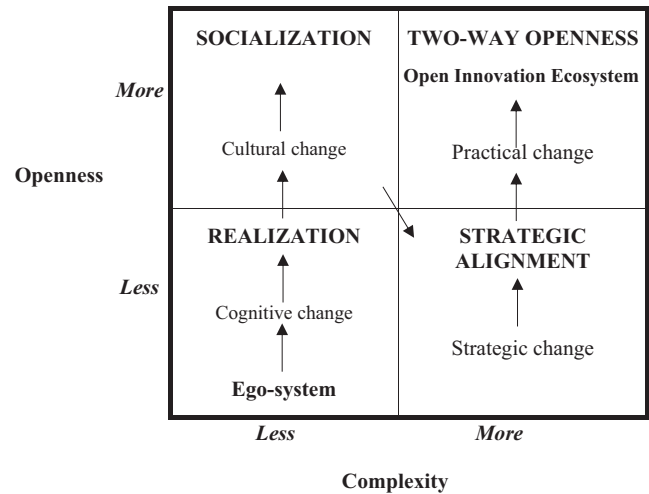


FIGURE 5 Phase transition

directed process, and along this process, several variables trigger or inhibit phase transition. The significance of our findings for the open innovation literature is that transition starts somewhat spontaneously but becomes more complex as firms proceed from ego-system to an ecosystem. The transition for the firm moves from cognitive to practical change as the degree of openness increases in each subsequent phase. Consequently, our data present a more complex and less linear picture of phase transition. A 2X2 matrix (Figure 5) summarizes these phase transitions based on the degree of openness and complexity.

First, transition into the realization phase involves a cognitive change, which is relatively smooth and swift, being driven by scarcity of resources and obsolescence. Previous research also noted that “the transition from closed to more open innovation requires a shift in mindset and cognitive frames” (Zobel & Hagedoorn, 2020, p. 407). Still, since a change challenges the *status quo* and invites uncertainty (Laughlin, 1991; Miller & Friesen, 1980), it is inhibited by a primal need for stability and skepticism about different roles firms will be expected to play. Second, the degree of correlation in firms’ products, capacity building, and management support propels the transition from realization into the socialization phase of openness (i.e., familiarity and integration). However, social constraints come into play, coordination costs arise, and firms start fearing loss of freedom that creates inertia. Our data support that this transitioning involves a cultural change, which takes time, involves more participants, and is subject to a moderate level of complexity. Our study corroborates previous studies that psychosocial factors inhibit organizational change (Jaques, 1955; Laughlin, 1991; Menzies, 1970). However, senior managers act as change agents. They are motivated by the triggers (discussed earlier) and respond to process breakdowns by taking corrective actions to adjust processes and people to conform to

their model of change. These findings provide a mandate for future research to explore moderating and mediating variables and, more importantly, enhance understanding of the micro-social processes.

Third, the transition from socialization to strategic alignment (i.e., aligning goals, activities, and resources) involves strategic change, driven by the need to obtain greater leverage and synergy. As discussed earlier, the likelihood of social lock-ins and opportunism decelerates this phase transition, and as our data show, it is a complex task to overcome these inhibitors. We noted that firms adopting strategic openness show some willingness to share (outflow) upfront but keep vital resources concealed. Firms maintain a cautious level of openness by granting partners access to resources insofar as is (psychologically) tolerable. The main aim is to align the goals, activities, and resources for product innovation, rather than just being open for its own sake. Another impetus for strategic orientation is opportunity recognition, identifying unique resources, looking for network effects, relational rents, and heterogeneity. Moreover, in accordance with existing literature, firms look for innovation, cost reduction, and increasing the demand for their still-proprietary resources (Alexy et al., 2018; Boudreau, 2010; Dobusch et al., 2017; Dyer et al., 2018; Parker & Van Alstyne, 2018).

Finally, a transition from strategic alignment into the two-way openness phase (i.e., allowing the inflow and outflow of resources) involves a practical change, which is the most challenging and complex. Most notably, our data show that firms need trust and a strong focus on collaboration to overcome the hurdles. Therefore, an important issue for firms steeped in competition is the development of trust that holds firms together in a dense web of interdependent yet autonomous activities. Although previous evidence of a direct linkage between inter-firm trust and openness exists (Chesbrough et al., 2018; Knockaert et al., 2019; Xie & Wang, 2020), our study suggests a more significant relationship by also including a practice embedded aspect, providing empirical grounds for expanding understanding of how trust enables firms to adopt two-way openness. By forfeiting control of some productive resources, firms improve the absorptive capacity and dynamic capability of their innovation ecosystem. Two-way openness eventually translates into innovation advantages due to network effects, heterogeneity, preferential access, and the ability to pick from a wider range of unique resources for capacity building through bootstrapping internal and external resources to innovate.

We believe the knowledge gained from this qualitative, exploratory study has important implications for research on open innovation and strategic management. The following section recapitulates those implications and outlines avenues for future research.

## 5.2 | Implications for innovation ecosystem research

Our process model helps address important gaps in innovation ecosystem literature. For example, a concise definition of the innovation ecosystem has been the subject of controversy in recent innovation studies (e.g., Adner, 2017; Bogers, Sims, et al., 2019; Jacobides et al., 2018). This study provides a starting point for theorizing about the morphology of how firms adopt openness and evolve from ego-systems to open innovation ecosystems. It describes transitory phases and untangles critical variables (triggers and inhibitors) that propel or hinder phase transition, providing deeper understanding and an overarching image of an innovation ecology that integrates (rather than separates) related streams. Thus, our model helps consolidate the descriptions of innovation ecosystems discussed in the innovation literature under different names such as value network, multisided market, maker spaces, platform ecosystem, business ecosystem, innovation ecosystems, and entrepreneurial ecosystem (e.g., Alam et al., 2022; Bogers, Sims, et al., 2019; Böhmer et al., 2015; Chesbrough et al., 2014; Fasnacht, 2019; León, 2013; Oh et al., 2016; Rohrbeck et al., 2009; Xie & Wang, 2020).

### 5.2.1 | Integration of management theories

Innovation ecosystems are not only a macro-level construct; they are multidimensional (Bogers, Sims, et al., 2019; Jacobides et al., 2018; Oh et al., 2016). Thus, innovation ecosystems should be studied through an integrated theoretical lens. As Vanhaverbeke and Cloodt (2014) argue, management theories must be combined as none of them alone can fully explain how firms benefit from open innovation. Our study underlines the importance of this approach with a finer-grained look at theories that explain sociological and socio-psychological undercurrents of inter-firm openness. Given the expansiveness of the open innovation ecosystem construct and heterogeneity of actors and activities involved, four major theories of the firm are integral: the resource-based view, resource dependence theory, social exchange theory, and trust-based approach. The resource-based view is critical because it views firms as a portfolio of resources (Alexy et al., 2018; Arya & Lin, 2007; Boudreau, 2010). Our data show that ecosystem firms continuously make strategic choices about which resources they must develop in-house, sell, or license-out, which they should purchase or co-develop, how much is at stake, which property right is implicated, which governance freedoms and constraints exist, what resources need to be opened, and by how much. Accordingly, our decision-makers adopted “strategic openness” to allow

inflow and outflow of resources. Literature also shows that access to productive resources is the main purpose of open innovation (Chesbrough & Appleyard, 2007; Vanhaverbeke et al., 2017; Zobel & Hagedoorn, 2020), but our data demonstrate that decision-makers opt for different degrees of openness and closedness.

It is clear from our analyses that firms do not innovate complex, integrated, and customized products in splendid isolation because of the uncertainty they face. An important way to cope with uncertainty is to adopt a resource dependency position with other firms. Thus, resource dependence theory (Pfeffer & Salancik, 1978) is an important lens through which to study open innovation ecosystems. Resource dependency theory helps us understand the influence of external factors on a firm's behavior within an ecosystem and how these firms, constrained by their context, act to reduce environmental uncertainty through interdependence (Adner & Kapoor, 2010; Jacobides et al., 2018; Knockaert et al., 2019). An upshot of resource dependence is social exchange with others who possess needed resources. As Das and Teng (2002, p. 448) argue, "the need for social exchange is created by the scarcity of resources, prompting actors to engage one another to obtain valuable inputs." Therefore, social exchange theory (Blau, 1964; Das & Teng, 2002) provides an additional lens suitable to study open innovation ecosystems.

Our interview participants felt that after receiving a valuable contribution from ecosystem firms, they had an obligation to reciprocate. However, due to the sometimes fragmented nature of multiparty exchanges, some participants were concerned that a lack of knowledge about reciprocity between important intermediaries would encourage freeriding. Given the risk of freeriding and uncertain future rewards, firms should demonstrate their trustworthiness in the discharge of obligations in an exchange relationship. In this regard, a trust-based approach (Gulati, 1995; Uzzi, 1997; Zaheer et al., 1998; Zhong et al., 2017) is valuable to analyze ecosystem participation. Our findings show that trust fosters ecosystem participation by reducing firms' anxiety, promoting reciprocity, and enabling risk-taking.

## 5.2.2 | Measuring openness

Scaling openness is a perennial problem in the open innovation literature. Despite great theoretical importance and practical relevance (Bogers, Sims, et al., 2019; Chesbrough et al., 2018; Xie & Wang, 2020), less attention has been paid to developing a measurement model of openness among ecosystem players. The only existing model (Alam et al., 2022) focuses on interfirm relationships to establish

a scale for openness but does not account for non-firm participants such as customers, government, and universities. There is uncertainty about what dimensions of openness can and should be measured and at what levels to measure them. A handful of qualitative studies propose ecosystem frameworks, but they are mostly conceptual or draw on simulations (e.g., Ganco et al., 2019; Luo, 2018). Consequently, researchers argue that "the innovation ecosystem notion, taken as a whole, lacks scholarly rigor and weight" (Oh et al., 2016, p. 4; see also, Ritala & Almpantopoulou, 2017). This study clarifies the largely implicit openness construct. Our process model reflects the lived experience of innovation managers and derives themes from their words. Therefore, our model serves as a robust framework for ecosystem researchers to set the boundary conditions, operationalize, and measure openness between actors at different levels. Our findings offer more generalizable relationships across varying levels of analysis and provide insight into the contingency factors that could explain variance across actors in these relationships.

## 5.2.3 | Implementing open innovation

An overarching revelation of our study is that adopting openness is easier said than done, and maintaining it is even more difficult. Prior research has focused on actors who participate in open innovation activities while largely ignoring those who revert or choose not to participate (Alam et al., 2022; Bogers, Chesbrough, et al., 2019; Jacobides et al., 2018; Vanhaverbeke & Clood, 2014; West & Bogers, 2014; Zobel & Hagedoorn, 2020). As our data clarify, firms are change-resistant, have a strong tendency to inertia even when the environment threatens them, and often only change when pushed. Our investigated firms initially resisted open innovation projects because the benefits of ecosystem participation were smaller than their expected sacrifices. It was particularly challenging for pharmaceutical and IT firms with high opportunity costs due to unique technology, knowledge in a given domain, or exceptional skills. Our study informs ecosystem researchers that a potent trigger (meaningful incentive) of value partaking (i.e., gaining benefits related to later value-in-use) is required to make a firm's value assessment positive. A weaker incentive can spiral down the journey and create inertia. Firms can cease ecosystem participation (at any stage) and revert to ego-system if the outcome of being open is lesser. As a senior marketing manager summarized: "If the outcome of being open is positive, they [firms] will continue to collaborate and initiate a virtuous circle. However, if the outcome is not good, one or either party will opt-out."

### 5.3 | Implications for strategic management

Our study confirms that critical resources often span boundaries and rest at the level of an ecosystem in which firms exercise residual control over each other's innovation. Unlike ego-system, ecosystem firms mostly operate in social lock-in situations where competitiveness emanates from inclusions, resources sharing, and strategic alignment. Moreover, the inimitability, value, and rarity of ecosystem resources is rooted in the density of relationships. Thus, the sustainability of competitive advantage has much to do with making and maintaining quality partnerships rather than keeping rivals at bay. For policymakers, our study points to a macro-level strategic approach—an ecosystemic view that looks beyond arms-length competition between rival firms to the competitiveness of their ecosystem. In other words, inclusion (rather than exclusion) is fundamental to crafting ecosystem strategies; partnerships, complementarity, and relational rents elevate the overall competitiveness of an ecosystem. Our model directs decision-makers to consider what stage or transition phase they are at and how those points in the openness process present very different sets of contextual factors that might be used as strategic levers to promote inclusion.

#### 5.3.1 | Ecosystem strategy

Our findings are relevant to strategy researchers who often approach open innovation by taking an inflow openness perspective, focusing on the extent to which a firm is open to obtaining from the external environment. By subsuming both inflow openness and outflow openness under the more encompassing label of “two-way openness” and by demonstrating it to be a gainful strategy for ecosystem firms, our study advances research on outbound open innovation (e.g., Cheng & Huizingh, 2014; Chesbrough et al., 2018; Greul et al., 2018; West & Bogers, 2014). Specifically, our model supports the strategic probity of outflow openness, which extends recent theoretical advances from innovation ecosystem research. Jacobides (2018, p. 128) argues, success in ecosystems “involves helping other firms innovate.” Our study further demonstrates that a firm's (dis)advantage directly links to the (dis)advantage of their ecosystem. Outflow openness is both essential to maintain trust and often necessary to continue partnerships. Due to positive spirals of prosocial behavior, the firm gains the advantage of preferential access to unique resources during perilous endeavors. These insights into the positive role of outflow openness have implications for practitioners, such as innovation managers who can use outbound openness as an initiative (rather than compulsion) to benefit from the diversity of

actors in their innovation ecosystems. By aligning multi-lateral dependencies, firms, irrespective of their size, age, or sectoral activity, benefit from outbound openness. In the experience of our participants, firms who are relatively independent in terms of ownership or facing high levels of organizational and resource interdependence benefit from outflow openness during ecosystem participation.

#### 5.3.2 | Risks of adopting openness

We also note that outflow openness is not without risk. Both micro- and macro-level deterrents to resource outflows exist in the form of imitation due to knowledge leakage (Alexy et al., 2018; Almirall & Casadesus-Masanell, 2010; Barney, 1991; Fey & Birkinshaw, 2005) and opportunism (Williamson, 1993). An important practical implication of our model is that due to social lock-ins and symbiosis, ecosystem strategies emerge from a blend of interdependent decisions. Prior research has shown that strategies in which one activity reinforces the other create a complex system whose complexity offers more protection against imitation (Ott et al., 2017; Rivkin, 2000).

Regarding opportunism, an overwhelming majority of our respondents agreed that inter-firm trust mitigates the risk of opportunistic behavior in an ecosystem. Indeed, a substantive body of literature on social embeddedness and relational attachment (Gulati, 1995; Zaheer et al., 1998; Zhong et al., 2017) and strategy (Alexy et al., 2018; Connelly et al., 2018; Luo, 2002; Uzzi, 1997; Villena et al., 2019; Zaheer et al., 1998; Zhong et al., 2017) support our position that trust can make ecosystem participation less opportunistic. Further, our findings suggest a new direction for research into the deterrent power of social pressure in preventing opportunism in lock-in and interdependent contexts. Our participants believe that opportunistic behavior not only spoils a firm's reputation and social status but also lowers its propensity for partnerships.

### 5.4 | Limitations and future research

Some important limitations not only serve as qualifiers for our process model but are also signposts for future research. First, although we studied openness at the macro-level and our sample includes large firms operating in MP, we believe that our findings are likely to hold more generally. The majority of our interviewees work for firms with the resources and market power to credibly engage in collaborative innovation. Nevertheless, these features may not always be the preconditions of openness. Moreover, owing to the nature of our cross-sectional data, we cannot claim causality. Hence, we call for future longitudinal studies that

include SMEs with fewer resources and capabilities. Second, our model provides a basis for understanding the underlying forces behind inter-firm openness. We explained how trust emerging from social exchange among interdependent ecosystem firms enables risk-taking (Zhong et al., 2017), reliance (Sitkin & Pablo, 1992), forfeiting of control (Alexy et al., 2018), and access to partner's knowledge (Kumar & Zaheer, 2019). The subjective nature of these factors provides focus for future research to develop measurement instruments and test the relationship depicted in our process model. Finally, it should be noted that most ecosystem firms are complementors that resort to multihoming tactics (Jacobides et al., 2018). This idea challenges traditional theories of the firm that focus on owned resources (Alexy et al., 2018; Barney, 1991; Peteraf, 1993). How should this perspective change when the resources exist above the firm, at the ecosystem level? Future research might find this aspect worthy of investigation.

To conclude, we have offered a process model of inter-firm openness, explaining how openness evolves and why it evolves in this way. We have shown how firm interdependence, social exchange, and trust relationship play a significant role in creating an open innovation ecosystem. We believe that in doing this, we have been able to set the stage for future research that will continue to inform innovation theory and management practice.

## ETHICS STATEMENT

The authors have read and agreed to the Committee on Publication Ethics (COPE) international standards for authors.

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