DOCTOR OF PHILOSOPHY IN MANAGEMENT

ON ORCHESTRAT*ING* ECOSYSTEMS

By

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Dedicated to all my teachers.

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List of Acronyms

AePS	Aadhaar-enabled Payment System
AIM	Atal Innovation Mission
AIM PRIME	AIM Program for Researchers in Innovation, Market Readiness and Entrepreneurship
APB	Aadhaar Payment bridge
API	Application programming interface
BHIM	Bharat Interface for Mobile (app)
BIRAC	Biotechnology Industry Research Assistance Council
BIRAC BIG	BIRAC Biotechnology Ignition Grant
BMBF	Federal Ministry of Education and Research, Germany
COE	Center of excellence
CSIR	Council of Scientific & Industrial Research
CSR	Corporate social responsibility
dhip	Digital Health Innovation Platform
DMAC	Digital Health Application Center
DPG	Digital public good
DPI	Digital public infrastructure
DST	Department of Science & Technology, Government of India
EIT	European Institute of Innovation and Technology
eKYC	Electronic KYC (know your customer)
EU	European Union
FAU	Friedrich-Alexander-Universität Erlangen-Nürnberg
HDFC	Housing Development Finance Corporation (bank)
HDTV	High-definition television
ICICI	Industrial Credit and Investment Corporation of India (bank)
IISER	Indian Institutes of Science Education and Research
IMPS	Immediate Payment Service
IPFACE	Intellectual Property Facilitation Center @ Venture Center, Pune
ISO	International Organization for Standardization
iSPIRT	Indian Software Products Industry Round Table
MV	Medical Valley
MVC	Medical Valley Center
MVEMN	Medical Valley European Metropolitan Region of Nuremberg
NCL	National Chemical Laboratory
NEFT	National Electronics Funds Transfer
NIDHI	National Initiative for Developing and Harnessing Innovations
NPCI	National Payments Corporation of India
NSTEDB	National Science and Technology Entrepreneurship Development Board
OEM	Original equipment manufacturer
PSP	Payment service provider
QR code	Quick Response code
R&D	Research & development
RBI	Reserve Bank of India
SBV	Science-based venture
TBI	Technology business incubation/incubator
UPI	Unified Payment Interface
VC	Venture Center, Pune

Dissertation Abstract

Ecosystems are an organizing form involving a collective of organizations that, by leveraging unique complementarities, attempt to co-create an integrated value proposition. Given that some of the highly successful organizations (e.g., Microsoft, Amazon, Walmart, Apple) have actively engaged in ecosystem play, ecosystem research has garnered immense attention over the past decade. Scholars, however, have observed that while extant research has illuminated the structural perspective of ecosystems – concerning the 'what' and 'why' of ecosystems – the processual perspective – i.e., the 'how' of it – remains relatively under-researched. Since ecosystems are non-hierarchical collectives embodying forces of collaboration and competition simultaneously, creating, growing, and managing ecosystems must be complex. Hence, researching the process perspective becomes imperative to gain deeper insights into ecosystem organizing.

This dissertation attempts to provide an overarching view of ecosystem organizing by taking an orchestration perspective. It attempts to investigate the nature and process of ecosystem orchestration. Specifically, it investigates two research questions: (1) *what constitutes ecosystem orchestration*, and (2) *what are the underlying dynamics involved in orchestrating ecosystems?* First, the literature on ecosystems is reviewed to construct an integrative definition that helps to identify study samples. Then, to gain a deeper understanding of the *dynamics* of how ecosystems work, an orchestration perspective is adopted. Orchestration implies those ecosystem activities that are generally broad-based and impact the nature or scope of the ecosystem's combined offering. Reviewing the literature on orchestration, this dissertation underscores the necessity of orchestrating collective action. In doing so, it emphasizes deliberate strategizing and counters the observation by some scholars that ecosystems can emerge and sustain spontaneously.

The research design involved a multi-case study-based theory building approach. The use of multiple, theoretically replicated cases enabled analytical generalizability. Three ecosystems – two from India and one from Germany – were chosen as they embodied representative samples. Their orchestration activities – both historic and ongoing – were captured using longitudinal data involving several sources – interviews, documents, and participant observation. Two-pronged data analysis was performed. First, thematic analysis (as suggested by Braun & Clarke, 2006) was performed to identify patterns in ecosystem orchestration. Four categories of orchestration were observed: consolidative, performative, discursive, and cognitive. Then, inductive coding (as suggested by Miles & Huberman, 1984) was undertaken to identify (and label) orchestration activities. The activities were organized into three case reports (one for each sample) that were validated with an expert from the field. Using the orchestration categories as a backdrop, process maps were drawn that demonstrated how the three ecosystem cases were orchestrated *over time*. Abstracting from the process maps, a (generalized) process model for ecosystem orchestration is proposed that details the subprocesses characterizing ecosystem orchestration through its emergence and post-emergence stages.

This dissertation advances the understanding of orchestration at an inter-industry level of analysis. Specifically, this dissertation contributes several insights towards ecosystem orchestration: (1) it demonstrates the role played by enabling (environmental) conditions in ecosystem emergence, (2) it emphasizes the importance of identity work, (3) it shows that the founding identity of an ecosystem may transform to one or more realized identities over time, and (4) it deepens understanding of multiparty orchestration. Implications to practice and policy are also discussed. Finally, this dissertation concludes by discussing the limitations and presenting some scope for future research.

Keywords: ecosystems; ecosystem orchestration; orchestration processes; multiple case-study; process model; Venture Center; Medical Valley; Unified Payment Interface (UPI)

CHAPTER 1

Introduction

> The ecosystem provides a large tent that can encompass creators who value autonomy and want to exercise control over their ideas. Indeed, the delicacy of creativity – the fact that it withers quickly in the wrong environment – makes diverse business ecosystems not only desirable but increasingly necessary.
>
> – (Baldwin, 2012: 21)

Scholars have long emphasized the importance of collective strategizing (Astley & Fombrun, 1983; Bresser & Harl, 1986), given that there is an "increasing emergence of structures of collective action, ranging from informal arrangements and discussions to formal devices such as interlocking directorates, joint ventures, and mergers." (Astley & Fombrun, 1983: 577). While one strand of research has looked at the interdependence perspective (Pfeffer & Salancik, 1978) and, hence, emphasized the need for collaborative strategizing as the avenue to compete and survive in the ecological environment (Hannan & Freeman, 1977); another strand has alluded to increasing dynamism in organizational environments (Emery & Trist, 1965), and, hence, suggested collective strategies as the means to deliver robust value propositions (Adner, 2012; Iansiti & Levien, 2004a; Moore, 1996). Seen either way, collective strategizing has become imperative to competitive advantage. The concept of the business ecosystem – a collective strategizing device encompassing both demand- and supply-side approaches – has served to integrate both these strands.

The ecosystem conception involves both supply and demand side aspects, such as the nature of interdependencies (Adner, 2012), types of complementarities (Jacobides, Cennamo, & Gawer, 2018), modularity-driven approach (Baldwin, 2012), and co-creation of an integrated value propositions (Baldwin, 2012; Furr & Shipilov, 2018;

Moore, 1993). Ecosystem research has burgeoned over the past decade (Jacobides et al., 2018; Shipilov & Gawer, 2020). Consequently, many reviews on ecosystem literature have been published in recent years (e.g., Aarikka-Stenroos & Ritala, 2017; Autio & Thomas, 2014; Granstrand & Holgersson, 2020; Hou & Shi, 2021; Scaringella & Radziwon, 2018; Valkokari, 2015). Scholars, however, have observed that the proliferation in ecosystem literature has lacked meaningful consensus (Baiyere, 2018) and, hence, has not served to build a consistent theoretical understanding (Oh, Phillips, Park, & Lee, 2016). As a result, the ecosystem concept remains under-theorized (Wurth, Stam, & Spigel, 2021).

Understandably, several scholars have called for research that unbundles the dynamics underlying ecosystems. For instance, Jacobides et al. (2018) called for a better understanding of ecosystem governance and regulation, focusing on *how* partners coordinate and collaborate for value creation and capture. Kapoor (2018) has called for a deeper investigation of interdependencies that enmeshes actors and activities towards the architecture that enables the pursuit of integrated value propositions. Several scholars (e.g., Vasudeva, Leiponen, & Jones, 2020; Wurth et al., 2021) have called for unbundling the (paradoxical) dynamics underlying the co-optative interaction within ecosystems. In sum, there has been a clarion call for undertaking processual research of business ecosystems.

This dissertation heeds the calls (of scholars above) by embarking upon a processual investigation of business ecosystems. Compared to variance research that was concerned with drawing covariant inferences between antecedent and consequent variables, process research attempts to understand “how and why things emerge, develop, grow, or terminate over time” (Langley, Smallman, Tsoukas, & Van De Ven, 2013). Process scholarship considers a phenomenon as unfolding over time (Chia, 2002; Langley, 1999). Hence, rather than establishing causal connections between dependent and independent constructs, process research focuses on activities and their trajectories, attempting to understand how entities interrelate and contingently interact (Cloutier & Langley, 2020; Fachin & Langley, 2017). Hence, taking a process approach to understanding the underlying dynamics of ecosystems, this dissertation pursues two research questions: (1) *what constitutes ecosystem orchestration*, and (2) *what are the underlying dynamics involved in orchestrating ecosystems over time?*

While the above research question provided a broad sensitizing concept (Blumer, 1954),[1] empirically, this dissertation attempted to investigate the intricacies of ecosystem orchestration, which involved questions such as what constitutes ecosystem orchestration? What kinds of actions are taken by the focal actors that orchestrate the ecosystem? How do the activities of the ecosystem orchestrators impact their combined offering(s)? And how does ecosystem orchestration evolve over time, especially as the ecosystem evolves from emergence to post-emergence stages?

Having set the above context, this introductory chapter will do the following. First, the state of ecosystem strategy research is discussed to establish the relevance of this dissertation. Then, an overview of the structure of this dissertation, in terms of the chapters that follow, is provided.

1.1. The relevance of this dissertation

Reviews of ecosystem literature have provided significant insights into the state of ecosystem research. They have shown how the ecosystem conception has steadily attained distinctive status over other interdependence constructs such as networks, clusters, value nets, supply chains, and the like (Aarikka-Stenroos & Ritala, 2017; Adner, 2017). Also, the understanding of ecosystems has been distilled into

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[1] According to Blumer (1954: 7), "definitive concept refers precisely to what is common to a class of objects, by the aid of a clear definition in terms of attributes or fixed bench marks... A sensitizing concept lacks such specification of attributes or bench marks and consequently it does not enable the user to move directly to the instance and its relevant content. Instead, it gives the user a general sense of reference and guidance in approaching empirical instances. Whereas definitive concepts provide prescriptions of what to see, sensitizing concepts merely suggest directions along which to look."

archetypes – or variants (Autio & Thomas, 2014) – such as business ecosystems, innovation ecosystems, entrepreneurial ecosystems, and knowledge ecosystems (Scaringella & Radziwon, 2018; Valkokari, 2015). Nevertheless, some critics have argued that the ecosystem conception within management literature lacks a *coherent* theoretical foundation (Oh et al., 2016).

In their critique, Oh et al., (2016: 3) argued that "the literature shows a lack of consistency in authors' use of the ecosystem phrase." Observing that ecosystem research has duly emphasized the systemic aspect, the authors called for studies illuminating ecological aspects. Some scholars attempted to do that by focusing on aspects such as the nature of interdependencies and types of complementarities that drive ecosystem play (see for e.g., Adner, 2017; Jacobides et al., 2018; Kapoor, 2018). In doing so, ecosystem literature has witnessed the crystallization of two dominant perspectives (Hou & Shi, 2021):

1. The structural view that emphasized an alignment perspective and focused on network aspects underlying ecosystem strategy (e.g., Adner, 2017; Shipilov & Gawer, 2020). This view stressed the multilateral nature of interdependence and was concerned with how complementarity drove alignment towards the combined value offering (e.g., Jacobides et al., 2018).

2. The coevolution view that emphasized a community and affiliation perspective and focused on power-dynamics underlying ecosystem strategy (e.g., Dattee, Alexy, & Autio, 2018; Moore, 1993). This view was concerned with how the capabilities of actors facilitated co-creation and co-evolution (e.g., Moore, 1996, 2006; Phillips & Ritala, 2019).

There is, hence, a need to undertake research that bridges between the two views. In this respect, several scholars have recently called for processual research of ecosystems (e.g., Snihur, Thomas, & Burgelman, 2018; Spigel & Harrison, 2018;

Thomas & Ritala, 2022). This dissertation has attempted a processual approach by pursuing the broad question, *how ecosystems are orchestrated*. The orchestration perspective, specifically, serves to bridge the two theoretical views. Figure 1.1 shows how focal aspects of the two views map onto the orchestration perspective.

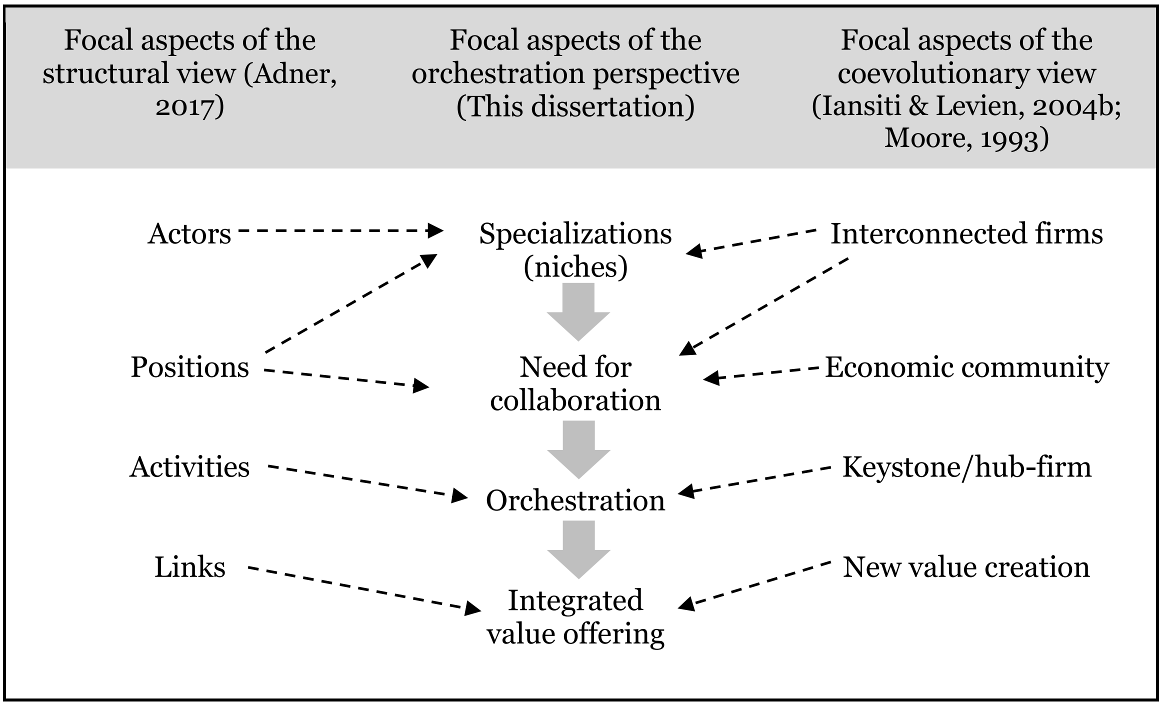

Figure 1.1: *Bridging the two views of ecosystem research.*

Further, on the under-theorization of ecosystems, scholars have observed that the usage of the term ecosystem had long been somewhat metaphorical and, hence, has lacked a clear definition (Autio & Thomas, 2014). Several scholars (e.g., Adner, 2006; Iansiti & Levien, 2004b; Moore, 1993) have attempted to lay down a definition for the ecosystem conception but, as Granstrand and Holgersson (2020) have observed, there is a lack of consensus on the defining aspects. The authors (Granstrand & Holgersson, 2020) propose a synthesized definition but limit it to one particular ecosystem variant – the innovation ecosystem – thus leaving unaddressed the need for a broad definition encompassing ecosystems in general.

An important issue with the lack of a clear definition is the inability to arrive at boundary conditions. While extant definitions provide a framework to understand how and why firms commingle into ecosystems, they do not clearly emphasize its boundary conceptions.[2] The conception of a boundary is vital to concretize the conceptualization of ecosystems and the scope and validity of their underlying dynamics (Post, Doyle, Sabo, & Finlay, 2007). Also, research has emphasized the need to identify boundaries from a systemic perspective, i.e., to identify where the ecosystem ends and its environment begins (Phillips & Ritala, 2019). Orchestration activities by architecting the nature and scope of the value offering shape the ecosystem boundary. Hence, a better understanding of orchestration has important implications for ecosystem boundary conceptions.

Finally, research has observed that ecosystems are characterized by loosely coupled entities (Brusoni & Prencipe, 2013), often involving a *tertius iungens*[3] approach (Furr & Shipilov, 2018). Thus, there is an inherent need for active and deliberate orchestration to unite diverse actors (Iansiti & Levien, 2004b; Oh et al., 2016). In metaphorical terms, orchestration provides "the glue that gives the ecosystem its infrastructure and holds it in place." (Furr & Shipilov, 2018: 63). Orchestrators do that by facilitating various underlying mechanisms, such as enhancing members' sensing capabilities (Giudici, Reinmoeller, & Ravasi, 2018), supporting knowledge mobility (Dhanaraj & Parkhe, 2006), and driving coherence (Nambisan & Sawhney, 2011). However, orchestration can be a complex affair given that it has to bring together a diverse set of actors (Williamson & De Meyer, 2012), balance collaboration for value creation with competition for value capture (Nalebuff & Brandenburger, 1996), and foster coevolution in response to environmental dynamism (Moore, 1993). This dissertation is a pursuit to understand the dynamics of ecosystem organizing from an orchestration perspective.

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[2] Santos and Eisenhardt (2005) provide a detailed treatise on boundary conceptions. According to them, there exist four distinct boundary conceptions – efficiency, power, competence, and identity. Extant literature on ecosystems does not seem to consensually draw upon any of the aforesaid boundary conceptions.

[3] Contrary to the *tertius gaudens* approach where an intermediary (or broker) acts as the conduit of information between brokered entities, in the *tertius iungens* approach the intermediary facilitates a direct exchange between the brokered parties (Quintane & Carnabuci, 2016).

The ProQuest dissertation database was searched for dissertations undertaking ecosystem research from 2000 through 2022. No doctoral studies have attempted a processual understanding of ecosystems from an orchestration perspective. Appendix 1 details the search exercise, listing some dissertations that have undertaken related research.

1.2. The structure of this dissertation

This dissertation is a monograph. Following this introductory chapter are two literature review chapters. The dual literature review was necessitated owing to the two critical aspects of the research question: a phenomenon of interest (i.e., business ecosystems) and a focal concept (i.e., orchestration). Chapter 2 reviews the ecosystem literature, while chapter 3 reviews the literature on orchestration. Then, the research design (i.e., methodology) is elaborated in chapter 4, which also details the empirical context of this dissertation. Chapter 5 discusses critical findings and synthesizes the findings into a proposed model. Chapter 6 discusses the theoretical contributions, and chapter 7 concludes the dissertation. Below, an abstract of each of the following chapters is presented.

Chapter 2 reviews the literature on ecosystems. Given the traction that ecosystems have gained in management literature, several review articles have appeared over the years (e.g., Autio & Thomas, 2014; Daymond, Knight, Rumyantseva, & Maguire, 2022; Scaringella & Radziwon, 2018). However, scholars have observed that the term ecosystem has often been employed loosely (or metaphorically), impeding coherent theorization. One roadblock hampering theorization is the lack of an integrative definition (Granstrand & Holgersson, 2020). Several ecosystem definitions suggested by scholars are reviewed to identify the essential aspects using which an integrative definition is constructed. The working of this definition is demonstrated using illustrative examples. This definition shall serve as the criterion for identifying empirical samples for this dissertation.

Chapter 3 reviews the literature on orchestration. It is observed that the concept of orchestration has hitherto been discussed predominantly in networks literature (e.g., Dhanaraj & Parkhe, 2006; Nambisan & Sawhney, 2011), and discussion of orchestration in ecosystems is only a recent occurrence (Autio, 2021; Foss, Schmidt, & Teece, 2023). Four dimensions are identified by reviewing the research on orchestration: specialization, standardization, systemic perspective, and strategic adaptation. A working definition of ecosystem orchestration is arrived at using these aspects, combined with crucial characteristics suggested by some scholars (e.g., Lingens, Huber, & Gassmann, 2021). This definition would enable the identification of orchestration activities from the data. Then, the literature on ecosystem orchestration is reviewed with a focus on process studies. Several recent studies have taken a process perspective but a comprehensive investigation of ecosystem orchestration over time (especially the post-emergence stage) is found lacking.

Chapter 4 presents the research design and methodology. This dissertation involves a process study of ecosystem orchestration. Specifically, it investigates two research questions: (1) *what constitutes ecosystem orchestration*, and (2) *what are the underlying dynamics involved in orchestrating ecosystems?* A multiple case-based methodology with exploratory intent and an inductive approach was chosen. Though in-depth single-case studies provide deep insights, multiple case approach was chosen to attempt analytic generalizability (Yin, 1994). Three representative case samples were chosen based on informal and extraordinary access to the field (Eisenhardt, 1989a). Data were gathered through semi-structured interviews, participant observations, and archival sources. First, data were analysed using thematic analysis (as proposed by Braun & Clarke, 2006), which resulted in four activity aggregates: consolidative, performative, discursive, and cognitive orchestration. Then, inductive coding was done (as proposed by Miles & Huberman, 1984) to identify orchestration activities within each case. The inductive coding exercise uncovered several first-order codes, which were they aggregated into six aggregate categories that represent subprocesses of ecosystem orchestration. Case reports were developed for each of the three samples. These case reports were member-checked for validation.

Chapter 5 presents the findings of this dissertation research. First, the four activity aggregates – consolidative, discursive, cognitive, and performative – are presented as categories of ecosystem orchestration. Then, process maps (as proposed by Langley, 1999) are drawn that describe the orchestration *flow* of each ecosystem sample in terms of how patterns of orchestration activities flowed between (and amongst) the four activity aggregates over time. Then, abstracting from the process maps, a generalized process model of ecosystem orchestration is proposed. The process model depicts how orchestration progresses through time. The process model suggests that orchestrating ecosystems involves four subprocesses – constructing identity, crystallizing architecture, broadening participation, and evolving/transforming – interlinked in myriad ways. Novel insights emerging from the process model are discussed.

Chapter 6 discusses the theoretical contribution of this dissertation. As a concept, orchestration has been treated in management literature at different levels of analysis. The conception of orchestration at various analytical levels – firm, interfirm, industry, and inter-industry – is discussed. Since ecosystems typically involve multiple industries, the contribution of this dissertation lies at the inter-industry level. Having set that stage, four contributions of this dissertation to management literature are discussed: (1) a demonstration of how enabling conditions influence ecosystem emergence, with the implication that successful ecosystems can emerge from different environments, (2) the imperative of identity work across ecosystem stages, from emergence to post-emergence, (3) a demonstration of how ecosystem identity can evolve over time, resulting in the founding identity transforming into one or more realized identities, (4) insights into multiparty orchestration, an aspect that has not been duly represented in literature. Implications of this dissertation's findings for practice and policy are briefly discussed.

Chapter 7 concludes the dissertation by summarizing the dissertation journey and reiterating key findings. Since this dissertation involved inductive methodology using three representative cases, this chapter discusses the limitations in the generalizability of the findings. Notably, though this dissertation involved diversity in its sample regarding technological domains, bundling of offerings, and modes of orchestration (i.e., centralized vs. distributed), all three cases were driven by non-profit entities and enjoyed significant state support in their formative years. The limitations to generalizability owing to the above aspects are discussed. The chapter ends with three suggestions for further research: (1) the scope to gain additional insights by replicating this study with ecosystems driven by for-profit actors and startups, (2) the scope to extend this dissertation's findings by investigating how the orchestration processes are influenced when an established ecosystem faces disruptive competition from other ecosystems, and (3) the scope to research ecosystem rigidity and its role in the demise of the ecosystem.

1.3. Chapter conclusion

This dissertation is a monograph. This introductory chapter sets the context for this dissertation. Building upon research that emphasized interdependency between firms and the need to constantly adapt in a dynamic market environment, the imperative of the ecosystem organizing form is suggested. Then, the core research question of this dissertation is laid down, which heeds calls from several scholars to undertake processual research that investigates ecosystem dynamics. Then, three arguments are presented to underscore the relevance of studying ecosystem orchestration. Having established the thrust of this dissertation research project, a comprehensive view of the dissertation structure is presented, including an abstract of each of the subsequent chapters.

Chapter 2

Literature Review: Constructing an Integrative Definition of Ecosystems

> "Do ecosystems have legs? Do notions of ecosystem add insight beyond existing constructs of broadly similar content, such as value chains and supply networks, or are we dealing simply with yet another convenient catchphrase that allows management consultants to substitute impression for substance?"
>
> – (Autio & Thomas, 2014: 204)

> "There is a need for rigorous social science inquiry both into the basic definition of ecosystems, to validate the importance of individual attributes, and into factors identified by existing research as being crucial components of ecosystems."
>
> – (Spigel & Harrison, 2018: 165)

The phenomenon of interest for this dissertation is business ecosystems. The ecosystem form of organizing has gained wide import in practice. Research has shown that companies like Amazon, Microsoft, Google, Apple, Uber, and Walmart have employed ecosystem strategies to build immensely successful businesses (Iyer, Lee, & Venkatraman, 2006). Effected through a mix of integration strategies (Furr & Shipilov, 2018; Yoffie & Kwak, 2006) while managing the risks that come with it (Adner, 2006), these companies put together an intricate web of partners (Iyer et al., 2006) and delivered complex value propositions (Jacobides, 2019). These value propositions – like, for instance, Google's Nest, Amazon's Prime Video, and Uber's Eats – have often integrated actors across different industries (Moore, 1993, 1996).

Though academic research has viewed this metaorganizational business model (Gulati, Puranam, & Tushman, 2012) variously as value networks (Christensen & Rosenbloom, 1995; Nalebuff & Brandenburger, 1996) or value constellations

(Normann & Ramirez, 1993), the ecosystem conception has been gaining theoretical ground (Daymond et al., 2022; Shipilov & Gawer, 2020). Research, especially in recent years (e.g., Adner, 2017; Dattee et al., 2018; Jacobides et al., 2018; Kapoor, 2018), has established the distinctiveness of the ecosystem conception and vehemently argued for its theorization. There are, however, concerns that the theorization of ecosystems has lacked coherence (Oh et al., 2016), owing mainly to a lack of consensus on the definition of ecosystems (Granstrand & Holgersson, 2020; Hou & Shi, 2021).

This chapter reviews the literature on ecosystems with the aim of constructing an integrative definition for business ecosystems. Identifying such a definition would be crucial to recognize and select representative empirical samples for this dissertation. I used the narrative method[4] to review the literature (Hoon & Baluch, 2020). This chapter is organized as follows: I start with recognizing the imperative of the meta-organizational form of organizing, which emphasises the relevance of the ecosystem form. Then, I argue that the ecosystem conception has moved beyond merely being a metaphor in management literature. Doing so provides a sense of construct validity to the ecosystem conception. Then, reviewing the literature on ecosystem definitions, I glean essential characteristics and construct an integrative ecosystem definition. I briefly illustrate the workings of the definition using two real-life examples.

2.1. Ecosystem as meta-organization

As environments become more complex and dynamic, the need for organizing frameworks beyond the vertically integrated model has become increasingly relevant

[4] The narrative method of literature review, in contrast to a systematic review, does not employ the process of searching repositories or databases using fixed time periods. The literature on ecosystems has grown by leaps and bounds in past two decades (Daymond et al., 2022) but there have been claims that much of research has used the term ecosystem metaphorically (Autio & Thomas, 2014). A preliminary search of the term 'ecosystem' on ProQuest journal database revealed innumerable metaphorical usages, hence, a narrative review method was deemed appropriate. I first read through various review articles that were published. That provided a general sense of the ecosystem research landscape. Then, I picked those works that were highly cited (and, hence, foundational) and used forward citation (and backward citation) to narratively trace the evolution of ecosystem literature.

(Ahrne & Brunsson, 2005). This heightened need has driven the increasing frequency with which firms enter into collaborative arrangements (Gulati et al., 2012). For instance, organizational innovation has shifted from (traditionally) producer-driven innovation towards increasingly collaborative innovation involving external partners (Baldwin & Hippel, 2011). Another instance has been the rise in strategic outsourcing models such as business process outsourcing (Srikanth & Puranam, 2010). Also, large-scale digital transformation has enabled "new ways of organizing firms' value chains and interfirm relationships, which now increasingly occur not in isolation but in so-called digital ecosystems and digital marketplaces." (Cennamo, Dagnino, Di Minin, & Lanzolla, 2020: 6). All these have led to an increase in collective organizational forms, or a rise in meta-organizations (Ahrne & Brunsson, 2005; Gulati et al., 2012).

According to Gulati et al. (2012), a meta-organization is characterized by a network of legally independent actors collaborating and coevolving via a complex set of symbiotic and reciprocal relationships in pursuit of a system-level goal. The system-level goal plays an important role. As members of the meta-organization are bound by non-contractual arrangements, it is "more common that the members' inducements, and consequently their decision to participate at all, are directly linked to the [meta]organization's main purpose and activities." (Ahrne & Brunsson, 2005: 433). Based on an overarching goal, meta-organizations organize collective action that, through leveraging a broader setting of pooled resources, can co-create value and realize joint benefits for all its members (Ahrne & Brunsson, 2005). However, to materialize the shared goal efficiently, scholars have suggested that collective action must be guided by principles and protocols orchestrated through formal and informal mechanisms (Williamson & De Meyer, 2012).

Meta-organizations have become prevalent today. Depending on the level of openness in their membership and the extent of diffusion of decision-making control, meta-organizations take different forms, such as communities, associations, franchisee networks, and ecosystems (Gulati et al., 2012). Architecturally, the meta-organization may be centred around a focal firm or may take the form of a decentralized collective. Nevertheless, given the centrality of a shared objective, they ought to be governed by membership norms. Norms that "provide a basis for members' identification with the collective and the collective's differentiation from others." (Gulati et al., 2012: 575). The membership norms must be orchestrated by a keystone entity or through a collective effort (Furr & Shipilov, 2018). Hence, though meta-organizations do not bind their members into hierarchical fiat, they employ a 'translucent' mode of governance by enforcing membership norms (Altman, Nagle, & Tushman, 2022).

Ecosystems are meta-organizations with open membership (Gulati et al., 2012). Ecosystem participants self-select themselves; however, acceptance into the meta-organization is typically governed through approval processes of a central entity (or group of entities) or adherence to a commonly accepted standard (or terms of agreement) (Kretschmer, Leiponen, Schilling, & Vasudeva, 2020). However, though ecosystems tend to have a clearly defined structure of authority – i.e., stratified decision-making (Gulati et al., 2012) – they cannot curtail the autonomy of its participants. Hence, ecosystems tend to be orchestrated using 'persuasive' strategies such as framing a compelling vision (Furr & Shipilov, 2018), using a mix of hard and soft bargaining power (Yoffie & Kwak, 2006), creating and leveraging specialized niches (Iansiti & Levien, 2004a), and engineering value capture mechanisms (Williamson & De Meyer, 2012).

2.2. Ecosystem is more than a metaphor

Though the ecosystem form has gained empirical significance, it remains relatively under-theorized in academic literature (Oh et al., 2016). Specifically, Wurth et al. (2021) have observed that a substantial part of the ecosystem literature applies the concept in a metaphorical sense, i.e., "in name only without acknowledging its key characteristics of interdependence." (2021: 7). Though mere metaphorical usage does not attenuate the theoretical power of a concept, when the plethora of metaphorical references starts inching towards looseness in usage, the legitimacy of the theoretical ground that the concept rests upon begins to erode. Questions arise, such as: “do ecosystems have legs? Do notions of ecosystem add insight beyond existing constructs of broadly similar content, such as value chains and supply networks, or are we dealing simply with yet another convenient catchphrase that allows management consultants to substitute impression for substance?” (Autio & Thomas, 2014: 205). Hence, it becomes crucial to establish that ecosystem conception has matured beyond loose metaphorical usage. More so for this dissertation, which attempts to extend the theorization of ecosystems.

The role of metaphors is to evoke vivid imagery (Oswick, Keenoy, & Grant, 2002) that can facilitate symbolic understanding (Morgan, 1980) – i.e., understanding one object in terms of another (Lakoff & Johnson, 1980) – and thereby enable better identification of a new phenomenon (Kapoor, 2018). The point to note here is “identification,” which metaphors mainly serve, whereas analogies, when employed, bear explanatory power and can help to build a theoretical basis (Ketokivi, Mantere, & Cornelissen, 2017). An analogical approach enables a simplified and structured method to comparative understanding via similarities and differences between a relatively new phenomenon and an established, well-understood phenomenon in the same or a different discipline, thus rendering the novel phenomenon graspable and comprehensible (Chase, 1985; Oswick et al., 2002).

Extant research on ecosystems seems to have detached from its metaphorical bearings and has, over the years, moved in the direction of an analogical understanding. For instance, the early usage of ecosystems may have emphasized a metaphorical approach involving interfirm interdependencies modelled after interdependencies of survival in the natural world, thus, focusing on illuminating practice (Shipilov & Gawer, 2020). Indeed, the early trajectory of the ecosystem concept within management literature has been through practitioner journals (e.g., Adner, 2006; Furr & Shipilov, 2018; Iansiti & Levien, 2004a). Subsequently, however, ecosystems have found broad interest in scholarly and academic publications (Jacobides et al., 2018). A deeper look at the similarities and differences between the conception of ecosystems in biological sciences and management studies implies an analogical basis to academic understand of ecosystems.

The ecosystem is an (acronym for) 'ecological system' essentially characterized by interrelatedness from within (i.e., the ecological aspect) and wholeness from without (i.e., the systemic aspect) in such a way that it forms a functional unit (Odum, 1971). An ecosystem embodies a complex web of interrelationships (Phillips & Ritala, 2019) that cannot be reduced to a set of dyadic relationships (Davis, 2016; Hou & Shi, 2021), thus encompassing a Gestalt where the whole (i.e., the system) offers greater value than the sum of its parts (Simon, 1969). The phenomenology of ecosystems emphasizes untraded aspects such as actor-resource complementarities, and information flows that follow channels separate from the flow of commodities (Wurth et al., 2021). Further, as an ecosystem is not reducible to an aggregate of bilateral interactions (Adner, 2017), "relationships between two parties are themselves dependent on all other relationships within the ecosystem." (Shipilov & Gawer, 2020: 102)

Similar to their conception in the biological sciences, the conception of ecosystems in management is a systemic phenomenon that embodies a complex and multilateral web of interrelationships. Also, as a collective, the ecosystem constantly adapts to the environment through the continual coevolution of its constituents. Thus, the ecosystem conception bears structural and functional agreement between the two disciplines. However, the conception of business ecosystems starkly differs from the biological conception in four significant aspects:

1. The strategic aspect: business ecosystems are, to a great extent, deliberately designed and typically governed through the 'visible hand' of a focal entity

(Moore, 2006). Most business ecosystems have been found to centre around a keystone entity (Pushpananthan, 2019). Thus, business ecosystems are consciously governed (Altman et al., 2022) compared to biological ecosystems that arise and subsist on an autopoietic basis (Odum, 1969)

2. The environmental aspect: biological ecosystems encompass both the organism-complex and the ensemble of environmental and geological factors that house the organisms (Post et al., 2007). On the contrary, the environment is external to the ecosystem conception in the case of business ecosystems. The concern of business ecosystems is how the organism/entity complex materializes the integrated value proposition (Adner, 2012; Radziwon, Bogers, Chesbrough, & Minssen, 2021). This follows the previous point where business ecosystems are conceived as deliberately constructed units rather than naturally occurring entities. Hence, while biological ecosystems sustain through organisms coevolving with the innate (ecological) environment, business ecosystems adapt to changes in the external (business) environment through coevolution between partners (Moore, 1996; Phillips & Ritala, 2019)

3. The teleological aspect: business ecosystems exist for a purpose beyond their sustenance – i.e., to deliver a competitive value proposition to the market (Adner, 2017) – whereas biological ecosystems are self-existent. For instance, Iansiti and Levien (2004b) discuss sea otters as keystone species in coastal ecosystems. However, unlike business ecosystem keystones – e.g., Microsoft, Apple, and IBM – sea otters do not deliberately attempt to position themselves in that pivotal position nor consciously endorse the ecosystem perspective. The sea otter's keystone position is not engineered but merely an artefact of the structure of the coastal ecosystem food chain.

4. The non-localized aspect: business ecosystems need not be necessarily centred around *localized* material resources (Wurth et al., 2021), whereas biological

ecosystems are necessarily centred around a geographical area whose extent may vary following the scale of habitat – whether micro- or macro-habitat – of the community under consideration (Morris, 1987).

Thus, while biological and business ecosystems share several similarities, there are essential differences between the two conceptions. As can be inferred from the four differences discussed above, business ecosystems implicate strategic considerations beyond the mere subsistence of the collective. It was in this context that Mars, Bronstein, & Lusch (2012) observed, "[o]rganizational ecosystems are expected to develop over time, through foresight and purposeful planning, in ways that contribute to the betterment of those organizations and of society as a whole. Those organizational ecosystems that do not evolve in a manner that promotes the greater good are put in jeopardy of being eliminated or becoming obsolete" (2012: 279).

By virtue of similarities and differences between business and biological ecosystems, I argue that the conception of an ecosystem in management has attained an analogical relationship with the biological counterpart, thus carving a path for its theoretical progression (Ketokivi et al., 2017)[5]. The differences, in particular, highlight the theoretical distinction that the ecosystem conception has established in management research. However, while the above arguments serve to disentangle the ecosystem concept from its metaphorical encumbrances, it still does not redress the observation by some scholars (e.g., Aarikka-Stenroos & Ritala, 2017; Ritala & Almpanopoulou, 2017) that the ecosystem conception has lacked consensus across research literature. This is mainly due to the absence of a comprehensive, all-encompassing definition for ecosystems in literature, a lacuna I seek to mitigate in the next section.

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[5] Oh et al. (2016) have argued that the ecosystem conception is based on a flawed analogy. Upon closer reading of their treatise, it seems their usage of the word 'analogy' starkly differs from Ketokivi et al.'s (2017) usage of analogy as a reasoning and argumentation tool. Oh et al. (2016) seem to have used analogy as a synonym to metaphor, i.e., merely as a comparative and not as a reasoning tool. Hence, their argument of 'flawed analogy' refers to instances of metaphorical misrepresentation.

2.3. Constructing an integrated definition of ecosystems

Scholars have observed that the ecosystem conception in literature has precipitated into two views: one supporting a structural view and the other holding a coevolutionary view (Hou & Shi, 2021). The structural view adopts a network-based approach focusing on how the ecosystem blueprint links key activities and, thus, aligns actors into network positions (Adner, 2017; Lingens, Miehé, & Gassmann, 2021). The coevolution view is a role-based perspective at heart but emphasizes affiliation and coevolution dynamics (Hou & Shi, 2021), thus focusing predominantly on the nature of interactions. The ecosystem perspective has also differed between the views. While the structuralists (e.g., Adner, 2017; Adner & Kapoor, 2010; Jacobides et al., 2018) took an ecological perspective focusing on the nature of interdependencies, the co-evolutionists (e.g., Moore, 1993, 1996) emphasized the systemic perspective and were concerned with how collectives managed to adapt to market dynamics. In other words, while structuralists took an inside-out view of ecosystems, co-evolutionary research took an outside-in approach.

An integrative perspective of ecosystems would need to account for both the above views. Intending to build an integrative perspective, I reviewed the ecosystem literature to identify the vital aspects of management ecosystems from both views. I found the following as essential characteristics of ecosystems: (1) they are structures of, and relationships between, interacting actors (Granstrand & Holgersson, 2020; Weber & Hine, 2015); (2) they pursue integrated value proposition as the outcome (Adner, 2006, 2017; Ritala & Almpanopoulou, 2017); (3) they encompass a dual-sided perspective involving both supply and demand-side interactions and interconnections (Autio & Thomas, 2014; Kapoor, 2018); (4) they are characterized by multilateral interdependencies (Adner, 2017; Kapoor, 2018), that are based upon nongeneric complementarities (Jacobides et al., 2018); (5) they embody coevolution as a strategic imperative (Moore, 1993, 2006), that necessitates co-specialization between participant entities (Shipilov & Gawer, 2020); and, (6) they embrace coopetition as the strategy to balance value creation with value capture (Kapoor & Lee, 2013). Any attempt at defining ecosystems should directly or indirectly account for the above aspects.

Recently, four studies have reviewed ecosystem literature and attempted to arrive at an integrated definition:

- Granstrand and Holgersson (2020) reviewed 21 ecosystem definitions and, having identified some vital components, proposed a new ecosystem definition as: "evolving set of actors, activities, and artifacts, and the institutions and relations, including complementary and substitute relations, that are important for the innovative performance of an actor or a population of actors" (2020: 3). Their definition portrays collective offering in terms of joint innovation outcomes but stops short of generalizing to a coherent value proposition. Hence, their definition seems to address a particular strategic aspect of ecosystems – i.e., innovativeness – which underspecifies the extent of strategizing needed to drive and sustain ecosystems (Williamson & De Meyer, 2012).

- Hou and Shi (2021) focused on comparing and contrasting two perspectives of ecosystems – the structural view and the coevolution view. While their study integrated the structural and coevolutionary views to emphasize ecosystem dynamics – i.e., towards answering how and where value proposition comes from – they stopped short of proposing a definition. Instead, they proposed a multilevel framework that suggested that integrated value creation demands constant realignment of affiliation dynamics based on (continually shifting) multilateral interdependencies. Their framework sheds light on the adaptive nature of ecosystems (Furr & Shipilov, 2018).

- Tsujimoto et al. (2018) identified four ecosystem perspectives: industrial ecology perspective, business ecosystem perspective, platform management perspective, and multi-actor (or entrepreneurial) perspective. Observing that agency, path-dependence, and behavioural aspects are significant characteristics, they proposed the following definition: "To provide a product/service system, an historically self-organized or managerially designed multilayer social network consists of actors that have different attributes, decision principles, and beliefs" (2018: 55). Their definition incorporated aspects of ecosystem emergence; however, it failed to account for crucial aspects such as complementarities and interdependencies that determine ecosystem structure (Jacobides, 2019).

- Bogers et al. (2019) suggested a succinct conception of the ecosystem as an interdependent network of self-interested actors jointly creating value. While their definition accounted for core constructs such as actors, interdependency, and value co-creation, it did not readily help to distinguish an ecosystem from other related constructs such as value networks or alliance portfolios. Furthermore, the nature of interdependency, which crucially involves complementarities, was left unaddressed in their definition.

Building on the essential aspects I gleaned from the literature, as well as borrowing from the attempts of the four scholarly works discussed above, I propose a new definition for ecosystems that is integrative and generalizable. To be integrative, it has to account for all vital aspects of ecosystems, and to be generalizable, it has to apply to different ecosystem contexts. I define an ecosystem as "*an interconnected web of functionally distinct roles, inhabited by one or more specialized actors, that interrelate predominantly through horizontal interdependencies arising out of the shared objective of realizing a combined value proposition.*" As research (e.g., Furr & Shipilov, 2018; Giudici et al., 2018) has observed that ecosystems can take either centralized or decentralized forms, I deliberately do not include any predetermined governance modes in the definition.

The idea of a "web" implicates the multilateral nature of interrelationships (Adner, 2017). The above definition accounts for both the structural and functional (viz., web of functionally distinct roles) aspects of ecosystems (Kapoor, 2018). It addresses both the ecological (viz., interrelated through interdependencies) and systemic (viz., shared objective of realizing a combined value proposition) perspectives (Ritala & Almpanopoulou, 2017). It accounts for both the production-side (viz., specialized actors) and demand-side (viz. combined value proposition) perspectives (Autio & Thomas, 2014). The underlying complementarities are captured by focusing on complementor relationships (viz., predominantly horizontal interdependencies). However, while scholars have emphasized the nongeneric nature of complementarities involved (Jacobides et al., 2018), I relax the requirement from a definitional perspective and defer it to the orchestration level, i.e., the choice of the complementarities involved are the subject matter of orchestration (Dutt et al., 2015; Giudici et al., 2018). Finally, the definition also accounts for other critical aspects that scholars have emphasized as characterizing ecosystems: (1) the scope for co-specialization (Moore, 2006) and (2) the presence of shared fate (Iansiti & Levien, 2004b)[6].

The above definition can potentially mitigate the lack of an integrative ecosystem definition. Oh et al. (2016) noted that the literature had not reached a consensus on ecosystem definition. This may be because scholars have tended to focus on specific characteristics important to the context of their study. For example, while Adner's (2017) definition concerned establishing a structural perspective, Moore (2006) intended to emphasize coevolution and adaptability. Similarly, Iansiti and Levien (2004b) focused on the nature of interconnection, Jacobides et al. (2018) emphasized the complementarities underlying actors' interdependencies, Kapoor (2018) was preoccupied with establishing the focal offer as the starting point, while Shipilov and Gawer (2020) argued for coherence in the value proposition.

[6] Members of an ecosystem share a common fate to the extent that "performance of the individual members is coupled with the performance of the ecosystem." (Shipilov & Gawer, 2020: 100)

The above definition has attempted to integrate the perspectives of all these scholars. Also, some extant definitions were deliberately narrow as the authors intended only to define variants[7] such as innovation ecosystems (e.g., Autio & Thomas, 2014) or platform ecosystems (e.g., Kretschmer et al., 2020). The definition suggested above has attempted to define an ecosystem as such (without any prefix involved) that would be applicable irrespective of the kind of value proposition at hand.

2.4. Illustrating the working of the proposed definition

The proposed definition has been shown to be theoretically all-encompassing. Now, I illustrate its applicability by looking at two studies that claim to have analysed real-world ecosystems.[8] I whet their claims using the proposed definition. First is the Chez Panisse ecosystem case taken from Chesbrough, Kim, and Agogino (2014); second is the U.S. residential solar ecosystem case taken from Hannah and Eisenhardt (2018). In the following, I demonstrate how the new definition validates the ecosystem in both of the above cases:

Alice Waters started Chez Panisse in Berkeley, California, in 1971.[9] Over the five decades of its history, Chez Panisse grew from running a local restaurant with limited menu options to a global philosophy encompassing fine-dining experiences, organic food cultivation programs, healthy eating-based educational curriculums, and an ideation network of alumni chefs from around the world. Alice Waters, today, helms two complementary initiatives, both inspired by her love for food that is made from sustainably sourced, organic, and seasonal ingredients: (1) the Chez Panisse facility, consisting of a (downstairs) restaurant that serves a daily-changing menu based on available ingredients and a café (upstairs) that provides à la carte options, and, (2)

[7] Scholars have identified several "variants" (Autio & Thomas, 2014; Scaringella & Radziwon, 2018) of ecosystems in management, such as: business ecosystems (Moore, 1993), innovation ecosystems (Iansiti & Levien, 2004b), entrepreneurial ecosystems (Zahra & Nambisan, 2012), platform ecosystems (Gawer & Cusumano, 2002), and service ecosystems (Vargo & Lusch, 2010). Variants are instances of ecosystem where the prefix broadly implicates the ecosystem strategy pursued.
[8] Like Adner (2017), I deliberately chose examples that were *not* from the high-tech industry.
[9] Entire evaluation of the Chez Panisse case is based only on details presented by Chesbrough et al. (2014).

the Edible Schoolyard Project, a non-profit entity that has partnered with schools around the world to build gardens where students learn about harvesting and cooking food that is organically grown. Waters' initiatives seem to offer two integrated value propositions: (1) providing a fine-dining experience to a highly loyal customer base and (2) transforming the garden into a classroom where young students learn (by doing) about the benefits of nutritious and organic food. The former value proposition has created a loyal base of customers through complementarities such as Chez Panisse's dynamic menu, long-standing relationships with farmers that adhere to organic farming practices, a diverse and well-connected network of specialist alumni chefs and staff, and the growing influence of food writers and awareness of sustainable farming. The latter leverages the alumni network to design food-based curricula and executes the program with the help of culinary schools, corporate partners, and food journalists. Moreover, the Chez Panisse ecosystem was dynamic and constantly coevolved (Moore, 1996) in response to the availability of produce, new recipe ideas, customer feedback, culinary innovations, and food journalism.

The U.S. residential solar 'industry' is a case of solar power generation from housetop solar installations that feed into the primary grid.[10] The industry, which was fragmented and minuscule at the turn of the century, witnessed a surge in growth following the Energy Policy Act of 2005, duly assisted by plummeting component prices and growing awareness around renewables. The growth was further fuelled by financial innovations such as investment tax credits and power purchase agreements. Installing a residential solar setup involved coordination between several providers: solar panel makers, racking makers, sales agents, installation agents, and financiers. Each provider embodied a distinct capability, e.g., panel makers specialized in researching and innovating photovoltaic cells and manufacturing panels at low cost. Some providers followed a system-level strategy of integrating many functions, but

[10] Entire evaluation of the US residential solar case is based only on details presented by Hannah and Eisenhardt (2018).

most providers focused on one specialization at a time. As the industry grew, regulators and utility providers continued to enact favourable renewable portfolio standards and net metering policies. Boosted by rapidly falling material costs, the industry touched half a million cumulative installations by 2013.

Table 2.1 shows the above two cases mapped with key aspects of the new ecosystem definition. The analysis establishes that both are indeed cases of business ecosystems. In the Chez Panisse case, Waters transformed traditionally vertical relationships – farmers and chefs – into horizontal partnerships using strategies such as co-branding, ingredient-based menus, joint hosting of Sunday markets, giving chefs a break to look for new ideas and bringing it back to her kitchen, and inviting alumni chefs from around the world to design theme-based menus and dining experiences. The Chez Panisse value proposition is materialized by an ecosystem centred around its core philosophy. In contrast, the U.S. residential solar installation is materialized by a relatively decentralized ecosystem (or adaptive ecosystem, as Furr and Shipilov (2018) have suggested), with multiple players vying to capture value through adopting component and bottleneck strategies.

Analysing using the new definition, as shown in Table 2.1, provides a way to differentiate legitimate ecosystems from cases of improper usage or incorrect labelling. For instance, Li (2009) referred to Cisco's acquisition strategy to build diverse technological knowledge in the networking domain as involving the creation of an ecosystem. The author found that from 1993 to 2005, Cisco acquired 106 companies as part of its product diversification strategy, suggesting that through M&A effort, Cisco managed to create a "business ecology around its own technology standards" (Li, 2009: 382). The ecology, however, was entirely within Cisco, which fails to satisfy the (new) ecosystem definition as Cisco's M&A strategy did not create horizontal relationships with the acquired firms. Therefore, the Cisco case discussed by Li (2009) is an incorrect application of the ecosystem conception.

Table 2.1: *Illustrating the working of the new ecosystem definition.*

Key aspects of ecosystems (based on the new definition)	**Chez Panisse case** (Chesbrough et al., 2014)	**US residential solar case** (Hannah & Eisenhardt, 2018)
The collective offers an **integrated value proposition** to the user(s)	1. Sustainable and seasonal fine-dining experience 2. Edible schoolyard program	Installation of residential solar systems
The collective is an integration of **distinct functional roles**	1. Organic farmers, specialist chefs, food writers 2. Social venture capitalists, farmers, curriculum developers, chefs	1. Photovoltaic panels, Racking and other mounting hardware, finance, sales, installation 2. Regulators, banks
Each role involves **one or more specialized actors**	1. Several specialist farmers, extensive network of alumni chefs, expert food writers 2. Host of individuals playing each role (and growing)	Panels market mostly had large incumbents with some small entrants, racking had several commodity players, sales and installation was done by several thousand local contractors
The roles are **predominantly horizontally interrelated,** i.e., dominated by complementary and not vertical relationships	1. Ingredient-based menus and co-branding with suppliers, permitting spin-out and spin-in by the chefs and staff, alumni guest chef system 2. Partner schools, food educators, food journalism	Each component directly interfaced with the customer; by 2013 when installations were widely done, customers could choose between competing bids
EVALUATION	Yes, **Chez Panisse runs an ecosystem**, perhaps at two levels. The first level consisting of the restaurant that offers a unique fine-dining experience, and a second level that leverages the restaurant's ecosystem to design and execute food-based curricula for school students round the world	Yes, the **US residential solar installation is an ecosystem**. The sales team does most of the customer interfacing, however, the final installation involves complementary products from various providers. Regulators and banks pitch in with favourable terms that boost the market of the ecosystem.

On the contrary, Burgelman, Snihur, and Thomas (2021) present the case of HP's divestiture, where a large, diversified firm split into independent entities, which then were advanced into ecosystems specialized around their offerings. The latter case qualifies as a legitimate ecosystem perspective per the suggested definition. Thus demonstrating that the (integrative) ecosystem definition proposed in the previous section provides the means to identify (and validate) ecosystem implementations in practice.

In this section, the applicability of the proposed ecosystem definition has been demonstrated. That serves to establish the exhaustiveness of the proposed definition. That said, there is still a need to prove exclusivity, i.e., to demonstrate how the new definition of ecosystems disambiguates it from other interdependence constructs, as Adner (2017) did for the definition he had proposed. However, to avoid deviating from the ecosystem focus of this dissertation, the exercise of disambiguating ecosystems from other allied constructs (using the new definition) has been deferred to the supplementary part at the end of this dissertation. See Appendix 2 for a detailed presentation of how the ecosystem definition helps to disentangle ecosystem conception from related constructs in literature.

2.5. Chapter conclusion

Ecosystems are the phenomenon of interest in this dissertation. The ecosystem form of organizing has enabled the offering of complex and integrated value propositions to the market (Adner, 2006; Baldwin, 2012; Iansiti & Levien, 2004a; Kapoor, 2018). Though the literature on ecosystems has gained significant traction over the past two decades (Shipilov & Gawer, 2020), scholars have observed that ecosystem research has, thus far, not achieved a consistent theoretical conception (Autio & Thomas, 2014). This has led to doubts about the construct validity of ecosystems (Oh et al., 2016), leading some scholars to question its empirical usefulness (Aarikka-Stenroos & Ritala, 2017).

Though recent work has provided significant clarity on the ecosystem conception (Adner, 2017; Kapoor, 2018) and served to strengthen its theoretical basis (Jacobides et al., 2018; Lingens, Miehé, et al., 2021), there is still work to be done towards converging the diversity in ecosystem perspectives (Hou & Shi, 2021). In this chapter, I have attempted to propose an integrative definition for ecosystems and advance a convergence in the theoretical conception of ecosystems. I built upon extant work in several ways. First, I reinforced the meta-organizational conception of ecosystems based on interfirm interdependencies. Then, I argued that ecosystems are more than mere metaphors and can carry the weight of being a theoretical concept. In doing so, I aim to reinforce the theoretical power of the ecosystem conception. Then, I reviewed the literature on ecosystems to identify several vital aspects and went on to propose a new definition for ecosystems – *an interconnected web of functionally distinct roles inhabited by one or more specialized actors that interrelate predominantly through horizontal interdependencies arising out of the shared objective of realizing a combined value proposition*. Finally, I demonstrated the working of the new definition using case examples. I showed how it clarifies distinguishing legitimate uses of the ecosystem concept from its incorrect or improper usage. The new integrative definition of ecosystem will serve as the foundation for identifying the samples of this dissertation (see Chapter 4).

Understanding ecosystems is vital to strategy research as it provides insights into how firms identify and translate synergies from unique interdependencies into a unified value proposition such that the combined productive opportunities of the ecological collective can exceed the sum of individual productive opportunities of the partners (Pitelis, 2007). Hence, this dissertation attempts to dive deeper into the black box of ecosystem strategy. Doing so can provide an important direction to extend the theorization on ecosystems – an understanding of how diverse partners align and co-create value.

CHAPTER 3

Literature Review: Emphasizing the Necessity of Orchestration in Ecosystems

> "Collectives that rely entirely on self-selected membership may find it more difficult to fill competence gaps and ensure coordination or task completion".
>
> – (Gulati et al., 2012: 576)

> "[In] many settings today, the requirements are fluid and objectives less defined. What's needed, therefore, isn't a broker or intermediary to link the various partners but an *orchestrator* who can find connections among different partners and encourage them to work directly with one another to identify new or nascent opportunities".
>
> – (Furr & Shipilov, 2018: 59, emphasis added)

Increasingly heterogenous (and differentiated) customer demand has necessitated integrated (and complex) value offerings (Kapoor & Lee, 2013; Lanzolla et al., 2020; Moore, 1993; Nambisan & Baron, 2013), which has made it imperative for firms with different specializations (Jacobides, 2019), often spanning industry boundaries (Lingens, Böger, & Gassmann, 2021), to collaborate.[11] The ecosystem form, with its emphasis on aligning partners with complementary interdependencies (Adner, 2017; Jacobides et al., 2018), has served this need. Hence, firms have increasingly looked to ecosystem organizing as an avenue to broaden innovative pursuits and deliver

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An earlier draft of this chapter was presented (as a standalone paper) at the European Academy of Management (EURAM) conference held in Winterthur, Switzerland, from 15 to 17 August 2022.

[11] Research has also suggested the imperative of the ecosystem form from a multi-market perspective. For instance, Guillen (2021) observed that offerings tend to become complex value propositions in multi-market scenarios as different markets normally view offerings in ways contingent upon the location-based characteristics (or idiosyncrasies) of its users, hence, necessitating a tailored offering for each market. This scenario, I believe, adds to the complexity of integrated value offerings.

complex value propositions (Burgelman et al., 2022; Kapoor, 2018).

However, research suggests that ecosystem organizing is an inherently complex affair involving collective identity work (Helfat & Raubitschek, 2018; Thomas & Ritala, 2022) and balancing co-optative tensions (Dattee et al., 2018; Vasudeva et al., 2020). Hence, scholars suggest that materializing the ecosystem outcome, namely the coherent value proposition, would require oversight in the form of an orchestrating role (Altman et al., 2022; Autio, 2021). Irrespective of whether an ecosystem is centralized or decentralized, orchestration acts as the "glue" that aligns the collective into a functional unit (Furr & Shipilov, 2018: 63). However, there has not been a consistent emphasis on the *need* for orchestration in ecosystem literature, with scholars (e.g., Adner, 2017; Jacobides et al., 2018; Kapoor, 2018) mostly taking a structural or architectural perspective and sidestepping the centrality of deliberate orchestration (Autio, 2021). Understandably, some scholars (e.g., Linde, Sjödin, Parida, & Wincent, 2021; Nambisan & Sawhney, 2011) have observed that ecosystem orchestration is poorly understood and, hence, have called for deeper research.

This chapter attempts to establish the centrality (and necessity) of orchestration in ecosystems. Doing so would provide a firm ground for the research questions pursued by this dissertation. This chapter is organized as follows: First, I review ecosystem literature to unearth the nuances of managing ecosystems. Next, I present four arguments – specialization, standardization, strategic, and systemic – that will highlight various facets of how orchestrating supports the actualization of the ecosystem. The four arguments, taken together, implicate the centrality of orchestration in ecosystems. Then, I discuss how orchestration concretises the ecosystem's boundaries. To the extent that boundary is essential for charting an ecosystem's identity, orchestration becomes necessary for ecosystems. The chapter concludes with a call to undertake process studies of ecosystem orchestration.

3.1. The nuances of ecosystem orchestration

Research has shown that choosing a particular form of organizing depends on the nature of (task-level) interdependencies (Baldwin, 2008; Williamson, 1975). In this respect, scholars have argued that the strength of interdependency forms a continuum along which the different organizational forms are distributed. For instance, Van den Steen (2010) suggested that strong interdependencies (like input-output sequential flow interdependency) drive the emergence of integrated hierarchies, whereas weak interdependencies are associated with market-based forms.[12] It is at the intermediate level of interdependency – enabled by modularity and interaction across standardized interfaces – that the ecosystem form becomes relevant (Kretschmer et al., 2020). In other words, the interdependencies that characterize ecosystems differ from those that characterize the supplier-buyer type – i.e., they involve nonunique complementarities (Shy, 2001). Indeed, the nature of ecosystem interdependencies is of the pooled type (Thompson, 1967), where each actor contributes to the overall value proposition and, hence, is responsible for ensuring the ecosystem's success.

Insofar as they are based on complementary interdependencies, ecosystems are characterized by collaborative relationships that involve (formal and informal) cooperative arrangements negotiated through ongoing communicative processes (Hardy, Phillips, & Lawrence, 2003). Hence, as Jacobides (2019) suggested, participating in the ecosystem form would require a cultural outlook that espouses the ability to manage relationships with various complementors.[13] This means that

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[12] As Van den Steen's (2010) argument of interdependencies was in the context of authority in interpersonal decisions, we cautiously extrapolate his findings in the broader interdependency sense of our ecosystem discussion. Insofar as decision rights are a significant aspect of ecosystem interdependencies, we believe this extrapolation is plausible.

[13] The need for a cultural outlook is reinforced by the fact that participation in ecosystems may involve switching costs. Research has discussed various kinds of switching costs: (1) contracts, where the party that breaks that contracts usually has to pay damages; (2) training and learning costs, associated with having to work with new interfaces and/or standards; (3) data conversion costs, if the underlying repositories are stored in a certain format that may have to be migrated to a new system; (4) search costs, associated having to locate new partners; and, (5) loyalty costs wherein certain benefits accrued from continued association (i.e., loyalty benefits) could be lost (Shapiro & Varian, 1999; Shy, 2001). Several of these costs can apply in the context of switching from one ecosystem to another.

an effective ecosystem strategy necessitates firms to take a stance that straddles the tight control of vertical integration and the detached affiliation of arm's length relationships (Jacobides et al., 2018). A typical mode of affiliation within an ecosystem is that of loose coupling, where partners are distinct (i.e., autonomous in decision-making) yet responsive (i.e., accountable towards delivering their part in the co-created value) (Brusoni & Prencipe, 2013).

Ecosystems typically involve diverse actors – corporations, individuals, and communities – that operate relatively autonomously but are interconnected through an underlying, evolving technical system (Baldwin, 2012). Further, the ecosystem conception embodies consideration of both the supply side (the 'eco' aspect) and the demand side (the 'system' aspect) (Ritala & Almpanopoulou, 2017). Hence, orchestrating ecosystems would involve a plethora of managerial dimensions such as, but not limited to, managing dyadic relationships, relationship portfolios, value nets and networks (Aarikka-Stenroos & Ritala, 2017). Further, as observed by Nambisan and Sawhney (2011), managing also involves various tenets related to value creation and appropriation, such as capabilities leverage, knowledge flows, network membership, and network stability.

Research in network-based organizing has already established the need for orchestration (e.g., Dhanaraj & Parkhe, 2006). Ecosystems are undergirded by a networked structure, but the interdependencies go well beyond merely looking at the strength of ties (Adner, 2017; Shipilov & Gawer, 2020). Hence, some scholars have suggested that conscious and deliberate management of ecosystems is not just desirable but outright necessary (Altman et al., 2022; Autio, 2021; Nambisan & Sawhney, 2011; Zahra & Nambisan, 2012). Orchestrators "ensure stability of the ecosystem and the coherence of the ecosystem offering. [They] set system-level goals, define the members' role, and establish both standards, and often interfaces through which these members can coalesce." (Shipilov & Gawer, 2020: 101).

3.2. The need for orchestrating ecosystems

Ecosystems emerge when diverse entities collaborate in pursuit of a combined value proposition (Adner, 2006; Shipilov & Gawer, 2020). To realize a coherent outcome, the diverse specializations ought to be integrated in a complementary manner (Helfat & Raubitschek, 2018). The integration should be stable, typically driven through an underlying architecture involving standardized norms of collaboration, for the ecosystem to endure over time (Lingens, Seeholzer, & Gassmann, 2022). However, mere alignment does not drive outcomes, as the partners ought to be persuaded to make ecosystem-specific investments and act coherently towards co-creating the combined offering (Jacobides et al., 2018). Furthermore, the collective has to be prepared to reconfigure its architecture, either in pursuit of growth or in response to environmental changes, which demand that partners co-evolve or co-specialize (Moore, 1996, 2006). Figure 3.1 shows the aforesaid essential aspects and illustrates how they are interrelated, emphasizing the roles that drive the interrelation.

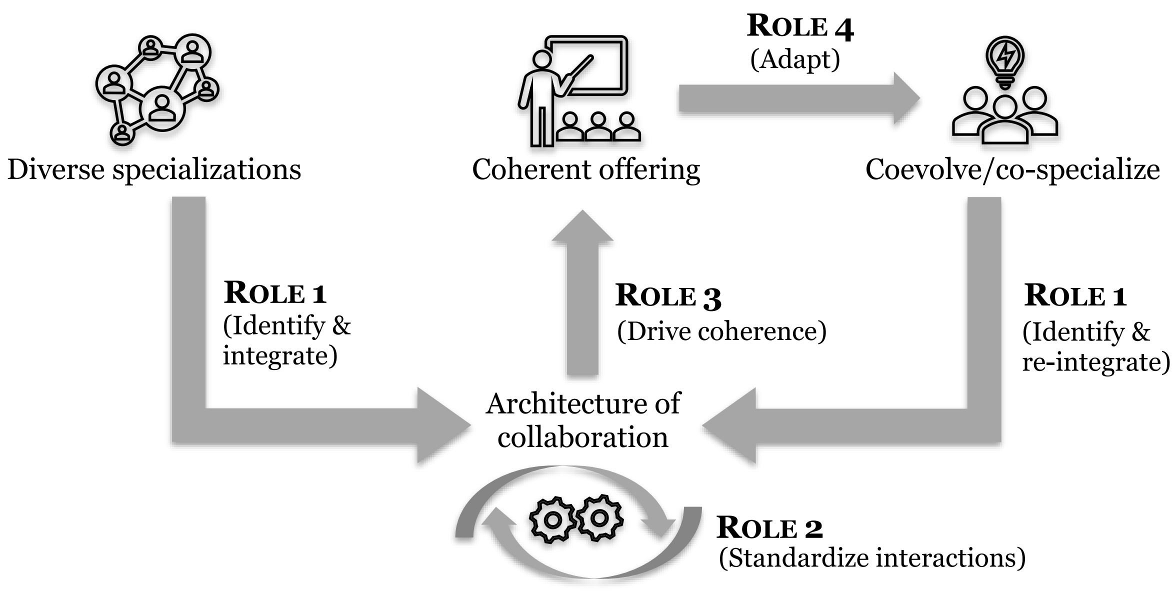


Figure 3.1*: The essential roles from an orchestration perspective*

The arrows in Figure 3.1 represent activities, but to the extent that they involve organized patterns and manifest through functional actors, they become roles (Shaw & Allen, 2018). The figure suggests that four orchestrating roles are necessary to be undertaken: (Role 1) the role of finding and integrating actors with diverse specializations, (Role 2) the role of standardizing interfirm interactions through an underlying architecture, (Role 3) the role of driving coherence towards a collective (systemic) agenda, and (Role 4) the role of enabling collective adaptation through coevolution or co-specialization. To the extent that these roles account for all orchestration-related aspects in ecosystems discussed in literature (e.g., Lingens, Böger, et al., 2021; Lingens, Miehé, et al., 2021), I argue that Figure 3.1 represents a comprehensive and exhaustive view of orchestration.

The roles, however, manifest at different levels – role 1 at the firm level, role 2 at the interfirm level, and roles 3 & 4 predominantly at the ecosystem level. The roles mutually constitute each other towards operationalizing the ecosystem. For instance, undertaking a directed search to find and integrate specialists is conditional upon the existence of a system-level strategy. Similarly, designing interfaces depends on the types of specialists that come on board and their task-level interdependencies. Figure 3.2 details the four roles. The roles listed from top to bottom in Figure 3.2 are in the order of the four roles – Roles 1 through 4 – of Figure 3.1. The arc underlying the roles signifies their mutually constitutive nature.

As elucidated in Figure 3.2, the first two roles are structural in nature – first one concerned with the content of ecosystem structure and the second one, its form – while the other two are strategic in nature. In totality, they can be said to encompass the structure, process, and strategy of the ecosystem form of organizing (Miles & Snow, 1978). The four roles characterize the multi-level nature of ecosystem strategy (Nambisan & Baron, 2013) and, hence, represent various aspects of how orchestration can serve to act as the glue that binds the ecosystem into a functional unit (Thomas & Autio, 2014; Zahra & Nambisan, 2012). Thus, the four roles, and their attendant responsibilities, can be critical arguments for the need for (ongoing) ecosystem orchestration. Alternately, an effective ecosystem *needs* orchestration involving the four roles. I now proceed to elaborate on each of the four arguments.

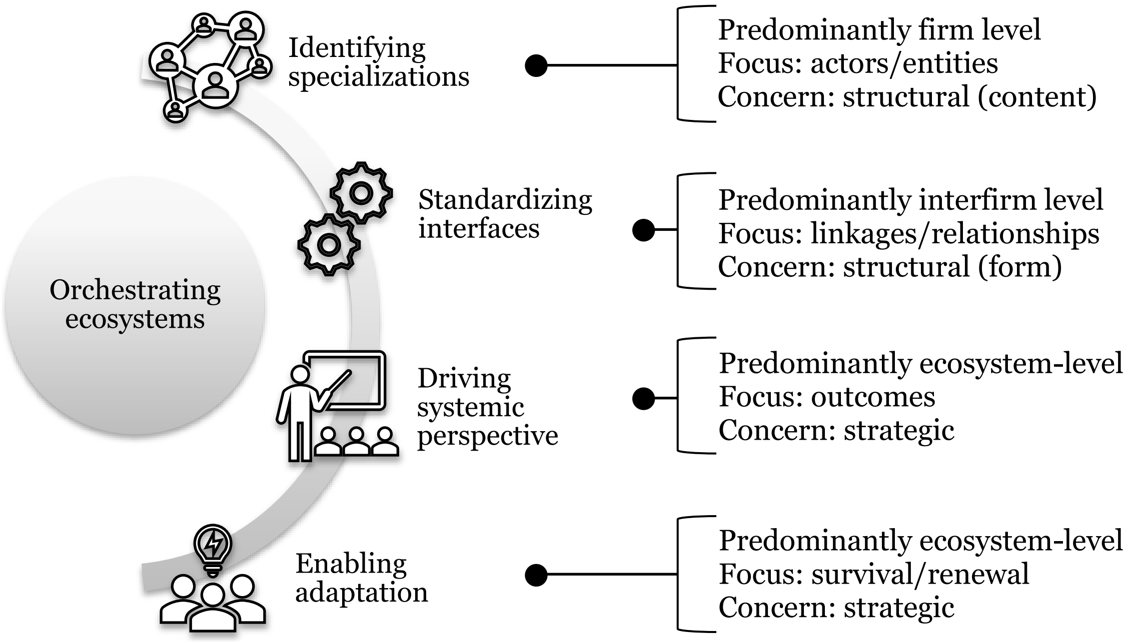


***Figure 3.2**: The four critical roles of ecosystem orchestration*

3.2.1. Argument 1: The need to integrate specialization

Scholars have observed that collectives that "rely entirely on self-selected membership may find it more difficult to fill competence gaps and ensure coordination or task completion" (Gulati et al., 2012: 576), hence suggesting the need for a directed search for specialists. Further, open membership of collectives "can result in unsolicited and unwanted contributions as well as contestation of collective goals and agreements." (Gulati et al., 2012: 576). Thus, the effective creation and management of ecosystems necessitates not just a conscious selection of capable actors but also a set of protocols and processes that facilitate effective inter-actor collaboration (Fjeldstad, Snow, Miles, & Lettl, 2012).

The specialists inhabiting an ecosystem collaborate based on task-level interdependencies. Hence, effectively integrating specialists will need a task-level view of the ecosystem. In other words, the orchestrator(s) should view the ecosystem as an activity system. Research suggests that activity systems are characterized by a large number of activities that interact in nontrivial ways (Albert, Kreutzer, &

Lechner, 2015). Interdependencies within such activity systems are composed of two dimensions: interdependence patterns and interdependence rules. The former denotes the distribution of interdependencies among the activities, and the latter prescribes how information and resource flows occur within the interdependent activities (Albert et al., 2015). While the former is a static view germane to modularity design, the latter is dynamic and evolves in accordance with the value architecture of the system. Thus, precisely capturing the multidimensional nature of interdependencies while simultaneously embodying a systemic perspective can only be possible through a role that is both central to the ecosystem and overarching in its perspective. This, I argue, implies the need for orchestration within ecosystems.

The first row in Table 3.1 summarizes the aspects of this argument: the specialization argument. The need to integrate specializations is primarily concerned with the activity-level of analysis where the focus is on finding answers to the question "Who does what best?" Some of the imperatives of this role are optimizing the search for specialists and deciding on the nature of membership (whether open or closed).

3.2.2. Argument 2: The need for standardized interfaces

Research has provided ample evidence that ecosystem value creation involves multilateral interconnections between actor-partners (Jacobides et al., 2018; Mann, Karanasios, & Breidbach, 2022). For instance, Adner (2012) discussed how the electric vehicle ecosystem involves a multiplicity of relationships between battery makers, car manufacturers, utility providers, charging infrastructure builders, gas station owners and regulators. Hence, operationalizing ecosystems would require not just knowledge of the capabilities of its constituent partners but also knowledge of how those partners interrelate with each other (Wurth et al., 2021). Knowledge of the mutual interdependencies, which some scholars have referred to as architectural knowledge (Henderson & Clark, 1990), is epistemically different from knowing the capabilities of the partners (i.e., component knowledge)

Table 3.1:*The four arguments for ecosystem orchestration.*

Arguments for orchestration	Level of Analysis	Analytic Focus	Outcomes
The specialization argument	Activity or task	WHO (does what best)?	Optimum contribution
The standardization argument	Transaction [between activities]	WHAT (are the interdependencies for the specialist to deliver) & HOW (can they work together to deliver it)?	Synergistic coordination
The systemic argument	System [as a set of activities]	WHY (should they be aligned)?	Coherent value proposition
The strategic argument	System [as a functional unit]	WHERE (next to go to stay relevant)?	Adaptation/ Renewal

Seen from the architectural perspective, each specialized participant in the ecosystem is a task module[14] linked to other modules through task-level interdependencies. Modularity theory suggests that architectural knowledge enables the separation of tasks coupled with interaction across standardized interfaces (Baldwin & Clark, 2000; Baldwin, 2012). Thus, modularity design involves activity-level configuration, i.e., decisions regarding which activities each specialist can perform, how they engage with them, and whether they can be permitted complete control of the activity (Amit & Zott, 2001).

A modular system can be viewed as a network of subsystems or subproducts that offers flexibility on the supply and demand sides (Pil & Cohen, 2006; Sanchez & Mahoney, 1996). On the supply side, modularity enables autonomous innovation, thereby enhancing the capacity for coevolution that can facilitate adaptability in

[14] A task module can be defined as a group of tasks where there is high interdependency within the group, and low or minimal dependence on tasks outside the group (Baldwin, 2008). In complexity systems' terminology, modules have the characteristics of near decomposability (Simon, 1962), which entails the possibility of loose coupling (Orton & Weick, 1990) that is an essential characteristic of ecosystem participants' relationships.

periods of high uncertainty. On the demand side, modularity can provide users with variety in terms of mix-and-match complementarities without unduly compromising economies of scale (Langlois & Robertson, 1992). The above benefits of dual flexibility would apply mainly in the context of specialist producers and users (Von Hippel, 2005). In that respect, modularity design can facilitate further specialization of ecosystem participants (Baldwin, 2008; Jacobides, 2005; Langlois, 2003).

While modular design facilitates adaptation in ecosystems, it brings in the complexity of managing the interfaces across which the task modules interact. The interfaces can also be subject to change over time. For instance, users could discover opportunities for improving offer quality by expanding affordances or exposing glitches (Hilbolling, Berends, Deken, & Tuertscher, 2021). To some extent, this case of incremental quality control can be autonomously managed without ongoing centralized guidance. However, changing interfaces will need centralized intervention owing to two reasons: (1) modularity theory suggests that the architectural design of ecosystems will need systemic knowledge (von Hippel, 1990), which implies a centralized authority with a high-level perspective, and (2) scholars have argued that control over interfaces provides significant control over the system and its overall evolution (Baldwin & Woodard, 2009). Such significant control naturally ought to rest with a central authority.

Even from a task design perspective, scholars have suggested that the modularization of tasks is most efficient when done in such a way that cross-module problem-solving interdependencies are minimized (von Hippel, 1990). In other words, when the 'thin crossing points' within task interdependencies are well and clearly identified, and tasks are segregated on their basis (Baldwin, 2008). Thus, making important choices about task partitioning and laying down the modularized task design has to be a carefully managed process that will, more often than not, require a systemic perspective. For instance, the design and manufacturing of various components in an automobile shall not be deemed to be modularized merely by the nature of their tasks. It is possible that a particular component – like, for instance, a cooling duct that runs through the entire body of the vehicle – would have strong interconnections with several other components and, hence, would need to consider the design aspects of those other components in the course of its own design and manufacturing (von Hippel, 1990).

Thus, designing standardized interfaces that are driven by precise architectural knowledge of the system and which are optimized for loose coupling that facilitates coevolution can only be possible through a role akin to a systems architect. This, I argue, implies the need for orchestration within ecosystems. The second row in Table 3.1 summarizes the aspects of this argument: the standardization argument. The need to standardize interfaces is primarily concerned with the transaction-level of analysis, where the focus is on understanding the nature of interdependencies and designing transactions based on those interdependencies. Hence, one of the imperatives of this role lies in identifying the thin crossing points within the activity system of the ecosystem.

3.2.3. Argument 3: The need for a systemic perspective

The ecosystem form is premised on the need to offer an integrated value proposition to the market (Adner, 2017). Delivering that integrated value necessitates coherence and alignment within the collective of participants inhabiting the ecosystem. However, though the system-level goal need not be (coherently) shared by all participants of the collective, it has to correspond with the goals set by its architects (Gulati et al., 2012). In order words, there has to be an *ex-ante* system-level goal that closely corresponds with the structure of the integrated value proposition and which would guide partner alignment. Scholars have argued that such a system-level anchoring role is necessary both in the nascent (Wurth et al., 2021) and steady-state (Gulati et al., 2012) stages of the ecosystems' evolution.

One core tenet of the anchoring role is to drive consensus within the collective. Wareham, Fox, & Cano Giner (2014) observed that “a governance infrastructure must be developed that embraces entrepreneurial, self-interested motivations; fragmented knowledge; diverse expertise; and market contexts and yet simultaneously directs disparate contributions to the greater collective benefits of the ecosystem.” (2014: 1198). However, consensus towards who would play the anchor role may not be straightforward. Indeed, as Adner (2017) observed,

> “leadership is contestable – even when firms agree on structure, they can still disagree on roles (e.g., Google and Visa in mobile payments; Cisco and Philips in smart-city lighting, where each of the partners has credible claim for leadership, and has shown a reluctance to embrace a follower role). Note that leadership need not be the purview of a single firm, and examples of collaborative consortiums (e.g., SEMATECH in the context of semiconductor manufacturing)… demonstrate the potential of shared leadership.” (2017: 48)

The need for an anchor to champion a system-level goal is necessary, though selecting the anchor could be an intensely contested process. The anchor, which may be a single entity or a collection of entities – and which may evolve over time – has to drive the ecosystem-level strategy. Research has shown that ecosystem strategy need not be crystallized *ex-ante* and may evolve over time as the collective pursues a range of potential value propositions (Dattee et al., 2018). This suggests that ecosystem strategy may undergo continual change during ecosystem evolution.

Other than changes in the value proposition, changes in ecosystem strategy may also be demanded by coevolutionary processes. Over time, the ecosystem can end up getting locked into a particular architecture, which may cause some entities within particular task modules to feel delimited by the interface design and restricted in the heterogeneity of possibilities they could explore (Pil & Cohen, 2006). Such situations would demand changes to the module design and impact system architecture. However, changing or updating architectures can be costly exercises needing extensive coordination and may not gain easy acceptance (Ethiraj & Levinthal, 2004). In such situations, it rests with the ecosystem-level anchor to drive the evolution of interfaces with time.

From a membership perspective, research has indicated that ecosystem participation is not binary (Kretschmer et al., 2020); instead, participants in an ecosystem vary the intensity of their involvement based on design and governance considerations, i.e., access to key resources and ambiguity in platform leadership. For instance, in their study of a technology development platform consisting of a central development environment that offers modular interfaces to complementary developers, O'Mahony & Karp (2020) found that developers' intensity of participation varied as the central platform transitioned in terms of control and access. Specifically, the authors found that as the platform "transitioned from proprietary to collective governance, most participants increased their participation intensity, but pulled back when control over platform leadership became unclear." (2020: 13). Thereby, "participation was found to decrease if platform leadership was ambiguous, highlighting the need for the allocation of decision rights as a coordinating mechanism." (Kretschmer et al., 2020: 11). Thus, the allocation of decision rights to an anchor role could potentially remove leadership ambiguity and, thus, enhance ecosystem participation.

In summary, driving a system-level goal that transforms in accordance with the evolution of the value proposition while also providing pertinent opportunities to modify the overall architecture can only be possible through a role that anchors the ecosystem-level perspective at all times. This, I argue, implies the need for orchestration within ecosystems. The third row in Table 3.1 summarizes the aspects of this argument: the systemic argument. The need for a systemic perspective is primarily concerned with the ecosystem level of analysis, where the focus is on how everything fits together to achieve the intended value outcome.

3.2.4. Argument 4: The need for strategic change

Business environments are constantly in flux, which can have a disruptive impact on ecosystems. Researchers have long emphasized that markets are characterized by inherent uncertainties (Dattee et al., 2018; Eisenhardt, 1989b), often involving shifting customer demands (Wareham et al., 2014). In this respect, owing to their value proposition focus, ecosystems would have to keep pace with changes on the demand side constantly. Further, changes in underlying technologies can impact ecosystems in multiple ways: while on the one hand, change of the competence destroying kind (Tushman & Anderson, 1986) engenders supply-side impact, technological changes can foster new sociotechnical configurations (Geels, 2002) that can engender large-scale shifts on the demand side. Hence, ecosystems ought to espouse a strategy to adapt to changes either on the supply or demand side.

Building a strategy for ecosystem adaptation can be complicated due to various reasons. Firstly, ecosystems involve an ensemble of loosely coupled actors that will have to embrace the change in a coherent manner. This will necessitate not just knowledge of how change impacts the actors but also the linkages between them (Ganco, Kapoor, & Lee, 2020; Henderson & Clark, 1990). Secondly, different actors need to perceive the change in the same way and, hence, may endeavour to respond in different ways. The change strategy must ensure adherence to the ecosystem alignment structure (Adner, 2017) and present a coherent adaptive response. Thirdly, as Hurst & Zimmerman (1994) suggested, over time, ecosystems tend to precipitate a conservative mode wherein structures get crystallized, and the focus shifts from resilience to efficiency. This phase of the ecosystem, characterized by low levels of entropy, is not germane to renewal unless mobilized by a crisis.

Implementing a change-based ecosystem strategy will necessitate the coevolution of the ecosystem participants. As already emphasized earlier, coevolution may involve changes to interfaces of interaction (i.e., the linkages between components) and, hence, may demand coordinated participation in the form of galvanized and concerted action (Moore, 1996). Moore (2006) has defined coevolution as “reciprocal cycles of adaptation among one or more elements of an economic system” (2006: 32). Adner (2012) observed that coevolving demands new ways of analysing risks and prioritizing opportunities. He suggested using a wider lens that evaluates risks throughout the adoption chain (i.e., having a multilevel perspective). Members of an ecosystem have a shared fate. Hence, sustenance "is a function of the health of the whole ecosystem, not just of individual firm's capabilities." (Iansiti & Levien, 2004b: 222).

Thus, evolution for adaptation may need changes at several levels that can have ecosystem-wide impact. Scholars have typically suggested the need for a keystone entity (Iansiti & Levien, 2004b) that can foresee, plan, and drive necessary changes at the core as well as in the complementors that interface with it (Gawer & Cusumano, 2002). This, I argue, implies the need for orchestration within ecosystems. Orchestrating adaptation may be an ongoing process (like in the case of standard-setting exercises) or implemented in a punctuated manner (in cases such as responding to technological change). The third row in Table 3.1 summarizes the aspects of this argument: the strategic argument. The strategic perspective is primarily concerned with the ecosystem level of analysis, where the focus is on answering the question of where next to position the ecosystem. The imperative is to ensure ecosystem sustenance and can involve varying levels of strategic renewal.

Thus, through laying down the above four arguments, it is emphasized that orchestration is imperative for ecosystem emergence and sustenance. In fact, the four arguments implicate four dimensions of orchestrating ecosystems. To illustrate, the four arguments are translated into four processes (i.e., verbs ending with *-ing*) in Figure 3.3, a reframed version of Figure 3.2. The specialization argument involves processes of searching and integrating; the standardizing argument involves the standards-creating processes; the systemic argument implies processes related to anchoring the value proposition and driving coherence; and the strategic argument represents processes of orchestrating strategic change and renewal. As is evident from Figure 3.3, ecosystem orchestration is a multidimensional concept involving several underlying processes manifesting at different levels of analysis (Autio, 2021; Thomas, Autio, & Gann, 2022).

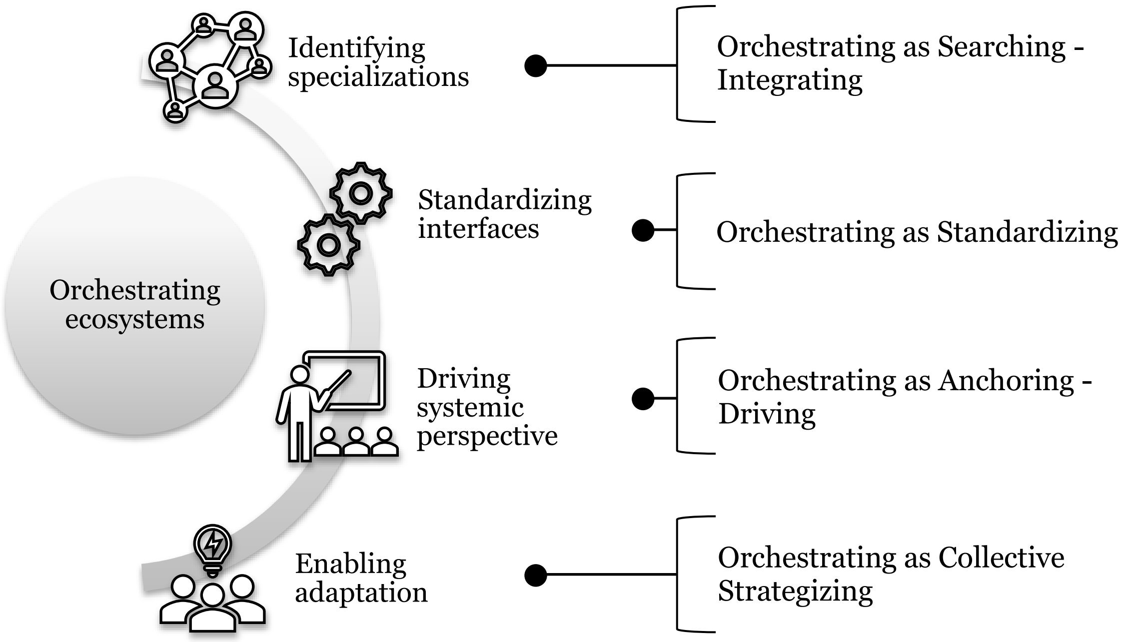
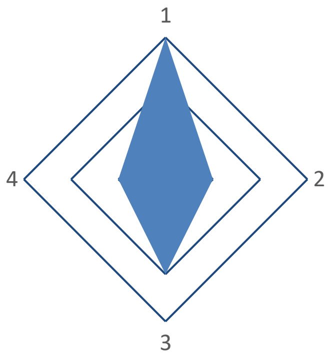
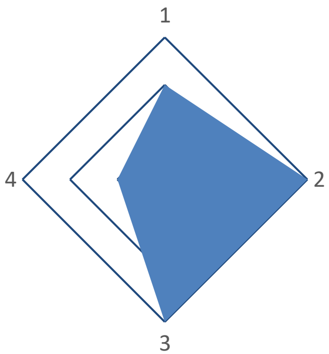
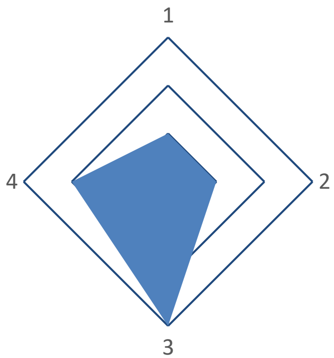
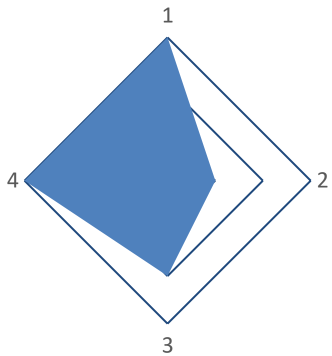


***Figure 3.3**: The four dimensions of ecosystem orchestration*

To explain the dynamic nature of the dimensions, Table 3.2 provides a perspective on how the four dimensions may play out across the four stages of ecosystem evolution (as suggested by Moore, 1996).

The pioneering stage is characterized by scanning the landscape for opportunities, arriving at a feasible value proposition, and finding relevant specializations. This stage typically involves a breakthrough idea or solution that guides the value proposition and is dominated by processes of searching and integrating the specializations needed to realize that proposed value. It is expected that searching-integrating processes dominate orchestration at this stage. Once a nascent ecosystem is in place, the next stage focuses on creating standardized interfaces to enable the creation of a go-to-market strategy. At this point, the focus shifts to concretizing the ecosystem bounds by incorporating allies such as complementors and suppliers. While the standardizing aspect dominates this stage, the systemic perspective is also expected to play a crucial role in drawing ecosystem boundaries.

***Table 3.2**: Orchestration dimensions and ecosystem evolution.*

Stages of ecosystem evolution[a]	**Pioneering**	**Expansion**	**Authority**	**Renewal**
Explanation	Establishing a system and sequence of symbiotic relationships that result in value creation	Achieving critical mass across available customers, markets, allies, and suppliers	Establishing a steady state value blueprint that guides all participants to continue to work together	Ensuring survival of the ecosystem through adaptation in the face of environmental change
Key focus area	Value Proposition	Growth	Performance	Sustenance
Mapping[b] **the four dimensions of orchestrating**				

[a] Based on (Moore, 1996).
[b] Mapping is shown using a radar chart, where the four numbered nodes represent the dimensions: 1 – searching-integrating; 2 – standardizing; 3 – anchoring-driving; 4 – strategizing. The extent of the grey area in the direction of each node symbolizes the hypothesized relevance of that node for that particular stage of ecosystem evolution. The extent is measured on a three-point scale (for each node) representing low, medium, and high levels of relevance.

Once established in the marketplace, the next stage is that of leading the ecosystem by putting in place a value architecture that can guide steady-state value delivery while also accommodating incremental changes in pursuit of realizing efficiency gains. At this point, owing to the centrality of the value blueprint, the systemic perspective is expected to stay predominant with medium levels of strategic orchestration. Finally, over a period of time, changes in the environment can render the extant blueprint obsolete and necessitate radical shifts in value created. At this point, the adaptive perspective becomes critical and strategic orchestration will necessitate large-scale transformation demanding the coevolution of existing partners as well as a search for new specializations.

3.3. Extant research on ecosystem orchestration

The concept of orchestration found initial ground in the research on networked innovation (e.g., Dhanaraj & Parkhe, 2006; Nambisan & Sawhney, 2011) and resource orchestration within a firm and its subsidiaries (e.g., Schriber & Löwstedt, 2018; Sirmon, Hitt, Ireland, & Gilbert, 2011). It was observed that orchestration was imperative to drive collective action – whether to convince network partners to make network-specific investments (in the case of the networked innovation stream) or for managers within the firm to integrate resources that they do not wholly own (in the case of asset/resource orchestration stream). Since ecosystems are driven and sustained through collective effort, orchestrating becomes a critical process in ecosystem organizing (Furr & Shipilov, 2018; Iansiti & Levien, 2004b). Researchers have argued for orchestration as central to ecosystem organizing *and* strategizing (Autio, 2021; Thomas et al., 2022; Thomas & Ritala, 2022).

This dissertation proceeds on the basis that ecosystems *need* orchestration. In other words, contrary to the observation by some scholars that ecosystems can emerge through the self-organization of constituents without the need for centralized coordination (e.g., Giudici et al., 2018), this dissertation has argued that orchestration is necessary for ecosystems to materialize *and* sustain (see Chapter 3 for the detailed argument). For instance, Leong, Pan, Newell, & Cui (2016) have shown how the emergence of ITC-enabled e-commerce in remote villages of China involved significant self-organization yet needed orchestration by institutional support and grassroots workers' activity that motivated the participants to coalesce *and* co-evolve.

A literature review exercise was undertaken to grasp the extant understanding of ecosystem orchestration. The Web of Science (owned by Clarivate™) database was searched for articles with the keywords orchestrat* *and* ecosystem* in the entire text for a 20-year duration from 2003 through 2023. The starting date of 01-01-2003 was deemed appropriate as one of the pioneering works on orchestration (Dhanaraj & Parkhe, 2006) appeared only in 2006. The search was restricted to business and management categories. The results were filtered to include only journals, book chapters, and conference publications.

The search resulted in 134 articles. When the abstracts of the 134 articles were read, 34 were found to be inappropriate. Analysis of the rest 100 articles (i.e., reading through the abstracts initially and looking at the entire paper only where necessary) revealed patterns in the ecosystem orchestration landscape. While a few studies have investigated ecosystem orchestration from an actual process perspective (n=10), most of the literature has taken either a variance perspective or a prescriptive approach. Figure 3.4 shows the themes that were observed in the literature. At the outset, it seemed that ecosystem orchestration research had gained some ground, suggesting that this dissertation should take a theory elaboration approach. As can be seen in Figure 3.4, research has looked into several domains, with grand challenges receiving significant attention. This is not surprising as grand challenges typically involve high levels of collaboration from diverse actors and are germane to the ecosystem perspective.

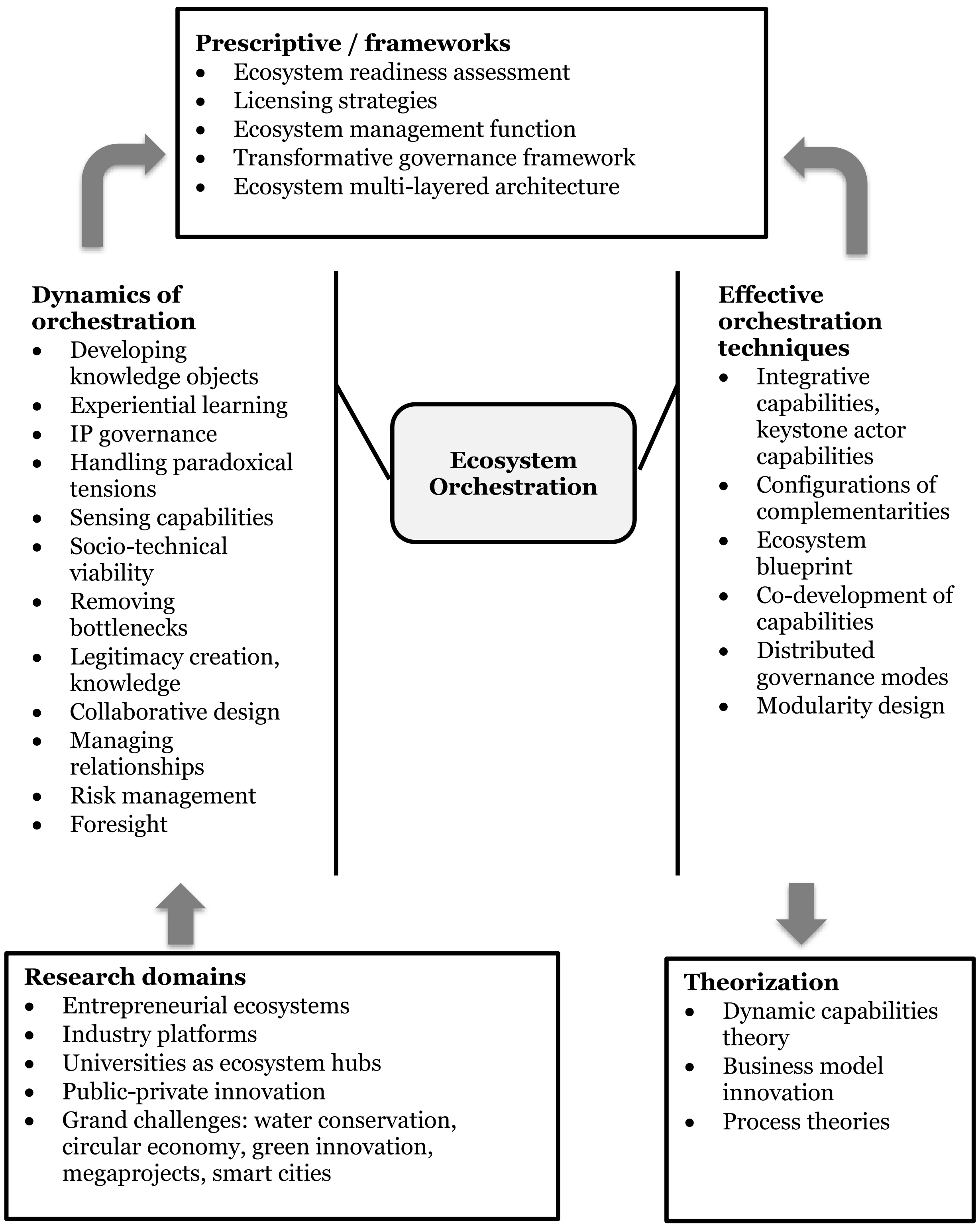


***Figure 3.4**: Illustrative mapping of the themes that emerged from reviewing the ecosystem orchestration literature.*

The bulk of ecosystem orchestration research so far has either investigated factors – such as keystone actor capabilities (Poblete, Kadefors, Radberg, & Gluch, 2022), modularity (Kapoor, Bigdeli, Schroeder, & Baines, 2022), and ecosystem blueprint (Lingens, Miehé, et al., 2021) – that contribute to successful orchestration, or focused on understanding *specific* aspects of orchestration – such as sensing capabilities (Giudici et al., 2018), experiential learning (Gomes et al., 2022), and foresight (Spaniol & Rowland, 2022). By doing so, scholars have contributed to enriching the understanding of orchestration, but an overarching view of *how ecosystems are orchestrated* remains relatively under-researched.

Some scholars have attempted process research of ecosystem orchestration. Table 3.3 lists studies that were identified as process studies, i.e., they (1) involved empirical research using longitudinal data, and (2) employed some level of qualitative analysis, and (3) attempted to suggest a process model or theory in its findings. At the outset, it can be noted that processual research of ecosystem orchestration has only recently gained scholarly attention.

Table 3.3*:Process studies of orchestration, ordered by year descending, first author ascending (table continues to next page).*

Research study	Summary of research
(Wikhamn & Styhre, 2023)	Using longitudinal data, the study elaborates a process model of ecosystem organizing. It finds that the ecosystem followed guided principles and evolved through three stages: build-up, expansion, and integration.
(Blackburn, Ritala, & Keranen, 2022)	Using a multiple-case approach, the study elaborates on orchestration processes that enable value creation in digital platforms for the circular economy.
(Cennamo, Oliveira, & Zejnilovic, 2022)	The study uses a longitudinal case study of the Patient Innovation platform to analyse the orchestration of value shaping, a process that involves mitigating bottlenecks and facilitating innovation by participants.

Research study	Summary of research
(Lingens et al., 2022)	Using a multiple-case approach, the study attempts to elaborate on how focal actors can leverage configurations of complementarities to orchestrate specific structures of ecosystems in specific environments.
(Lu & Zhang, 2022)	Through a single case study, the authors illustrate how actors in an entrepreneurial ecosystem orchestrate resources and capabilities to facilitate new venture creation.
(Mann et al., 2022)	Through a longitudinal case study, the authors demonstrate how an ecosystem's digital transformation is orchestrated. Their findings illuminate digital transformation processes in ecosystems.
(Thomas et al., 2022)	The study uses secondary data from five exemplar platform ecosystems (Amazon, eBay, Facebook, Google, and Salesforce) to investigate the processes of ecosystem emergence. In doing so, the study can provide insights into how overall ecosystem governance trickles down into micro-processes.
(Dattee et al., 2018)	The study uses longitudinal data from multiple case studies to draw a process model that shows the dynamics of orchestrating nascent ecosystems with unclear objectives.
(Giudici et al., 2018)	The study uses a longitudinal single case study to investigate the orchestration of open ecosystems and illustrate how relational dynamics enable experiential learning.
(Snihur et al., 2018)	Using a longitudinal single case study of the Sales Force's evolution, the study demonstrates how (business model) framing can orchestrate ecosystem emergence (through disruption).

Though Table 3.3 shows that research has taken a processual perspective of ecosystem orchestration, there remains a gap insofar as comprehensive understanding is concerned:

- Wikhamn & Styhre (2023) studied the process of (open) innovation ecosystem formation by AstraZeneca. Their study provided a limited process view as it pertains to the (often discussed) case of a large firm-driven centrally controlled ecosystem whose strategy, by definition, involved centralized implementation. Hence, strategy processes gleaned by the study were distinctive to the focal firm and not generalizable to decentralized orchestration contexts. Also, generalization was further compromised by the single case study design.

- Blackburn et al. (2022) studied the processes of orchestrating platform-based ecosystems for the circular economy. While their focus was on the limited process view of ecosystem emergence, their choice of cases pertained to orchestration within the particular context of digital platforms. Platforms, by definition, are restricted to a centralized architecture often controlled by the platform owner, hence, lack the generic case of multilateral orchestration.

- Cennamo et al.'s (2022) study, similar to the previous one, also dealt with the specific context of digital platforms (albeit in the healthcare domain). The unilateral nature of orchestration was evident in this study as the authors found three orchestrator roles – community organizer, market matchmaker, and innovation manager – which were all undertaken by the platform owner.

- Lingens et al. (2022) studied how orchestrators matched complementarities in creating ecosystems and, subsequently, coevolved as the ecosystem evolved. While their study provided a comprehensive view of the dynamics of partner matching, other dimensions of orchestration (like, for instance, identity creation) remain unaddressed.

- Lu & Zhang's (2022) study provided a comprehensive view of the orchestration process in an entrepreneurial ecosystem. Entrepreneurial ecosystems can have dynamics peculiar to their context, given their specific relational organizations (see Spigel, 2017). Furthermore, the study looked at "hub-based" systems in which orchestration, by definition, is centralized.

- Mann et al. (2022) studied the digital transformation of a focal firm assisted by an ecosystem of partners, where eventually, several ecosystem partners also underwent digitalization. Their ecosystem perspective, hence, was not concerned with a market-focused offering. Also, the orchestration process ended with digital transformation and did not account for other ecosystem stages, such as growth and renewal (see Moore, 1996).

- Two of the studies (Dattee et al., 2018; Thomas et al., 2022) undertook comprehensive investigation of orchestrating processes. Both involved multiple cases –Thomas et al. (2022) studied five ecosystems, and Dattee et al. (2018) looked at four embedded cases within a single firm – which precipitated generalizable findings. However, their studies only focused on ecosystem emergence and, hence, do not address the dynamics of orchestration in subsequent lifecycle stages (see Moore, 1996).

- Giudici et al. (2018) studied processes of community orchestration by a venture association and inferred that certain orchestration aspects enhance the sensing (and, hence, innovative) capabilities of the participants. While their study took an ecosystem-level perspective and uncovered foundational processes, the totality of orchestration with respect to materializing (and sustaining) the value proposition was not fully addressed.

- Snihur et al. (2018) looked at inter-ecosystem competition and focused on how orchestration can disrupt an incumbent ecosystem and lead to the emergence of a new one in its place. Their study was focused on cognitive aspects such as framing and meaning-making that can render salience for one business model over another. In doing so, their study elided integrative and discursive aspects of ecosystem orchestration.

All these suggest that while processual perspective of ecosystem orchestration has begun to gain scholarly attention, there is a still a dearth of comprehensive understanding both in terms of the nature of orchestration (i.e., multilateral understanding) and its evolution over time (i.e., understanding of orchestrating beyond ecosystem emergence stage). This dissertation study is an attempt to fill that gap. The next chapter (i.e., Chapter 4) explains the design of this study.

3.4. Chapter conclusion

This chapter delves into the conception of ecosystem orchestration. The focus on orchestration emphasizes a fundamental premise underlying the ecosystem conception in business – that business ecosystems are invariably “managed systems” (Altman et al., 2022) that need constant supervision and ongoing strategic anchoring. If left unmonitored, uncontrolled growth of complements can affect outcome quality and, ultimately, lead to the demise of the ecosystem (Boudreau, 2012; Wareham et al., 2014). Hence, orchestration is deemed necessary for ecosystems to emerge and sustain over time.

This chapter attempts to assert the necessity of orchestrating ecosystems. Four arguments are put forth in support: (1) First argument takes the specialization perspective. Drawing upon the phenomenon of vertical disintegration and niche-based specialization, I argue for the need to find and integrate specialized actors to materialize the integrated value propositions that markets demand. (2) Second argument deals with interfirm transactions that characterize ecosystem functioning and takes a standardization perspective. Drawing upon the activity-based view and theory of modularity design, I argue for the need to build standardized interfaces that espouse loose coupling. Further, I contend that the orchestration of the interfaces ought to incorporate the need for coevolution through regular and timely interface updates. (3) Third argument takes a systemic perspective that enables the coherent delivery of the combined value proposition. This argument is premised on the need for an anchoring role that drives consensus and enacts resonance. (4) Fourth argument takes a strategic perspective to orchestrating and focuses on ecosystem sustenance in the face of environmental change. I draw upon the need for ecosystem partners to coevolve as transformations evoke adaptive changes.

Having argued for the necessity of orchestration, the chapter then presents the findings from a literature review exercise where published works on ecosystem orchestration were reviewed. The exercise showed that the bulk of orchestration research has taken a structural perspective and process studies are only beginning to gain attention in recent years. The review exercise showed that there is a gap in comprehensive processual understanding of ecosystem orchestration. That lays the ground for this dissertation's study which broadly seeks to understand how are ecosystems orchestrated? Having set the ground for a process-focused research of ecosystems, the next chapter will delve into designing of the research study and its related methodology.

CHAPTER 4

Research Design & Methodology

> "From the structural point of view, there are already a host of studies focusing on how ecosystems are structured, often using network analysis methods to do so… empirical studies rarely track the actual interdependencies across actors and their activities over time. Such investigation, again, is extremely challenging. However, scholars might consider developing methodologies that could document activities within and beyond the ecosystem, and how these activities contribute in facilitating and constraining other activities over time."
>
> – (Phillips & Ritala, 2019: 11719)

This dissertation responds to calls by several scholars to pursue a processual understanding of ecosystems (e.g., Jacobides et al., 2018; Snihur et al., 2018; Thomas & Ritala, 2022). Unlike variance research, which intends to establish relationships between antecedents and consequents of a phenomenon, process research aims to unpack the dynamics *within* a phenomenon (Cloutier & Langley, 2020; Fachin & Langley, 2017; Langley, 1999). This dissertation takes a process perspective on ecosystems with a focus on ecosystem orchestration. It investigates two research questions: (1) *what constitutes ecosystem orchestration*, and (2) *what are the underlying dynamics involved in orchestrating ecosystems over time?*

As has already been established in the preceding review chapters (i.e., Chapters 2 and 3), ecosystems need orchestration. Though collectives of organizations driven by shared interests can spontaneously emerge on the basis of interdependencies (realized over the long term), orchestration as a strategic imperative is necessary to manifest the ecosystem form. Orchestration implies a broad set of activities that, working at an ecosystem level of analysis, facilitate materializing the combined focal offer (Adner, 2017; Dhanaraj & Parkhe, 2006; Giudici et al., 2018). Understanding the *dynamics* of ecosystem orchestration can provide a crucial processual view into the nuances related to ecosystem strategizing (Autio, 2021; Thomas et al., 2022).

4.1. Researching ecosystem orchestration

The research on ecosystems has grown by leaps and bounds since Moore (1993) introduced the concept in management literature. Figure 4.1 shows the growth in ecosystem research publications in the past two decades (2003 – 2023).

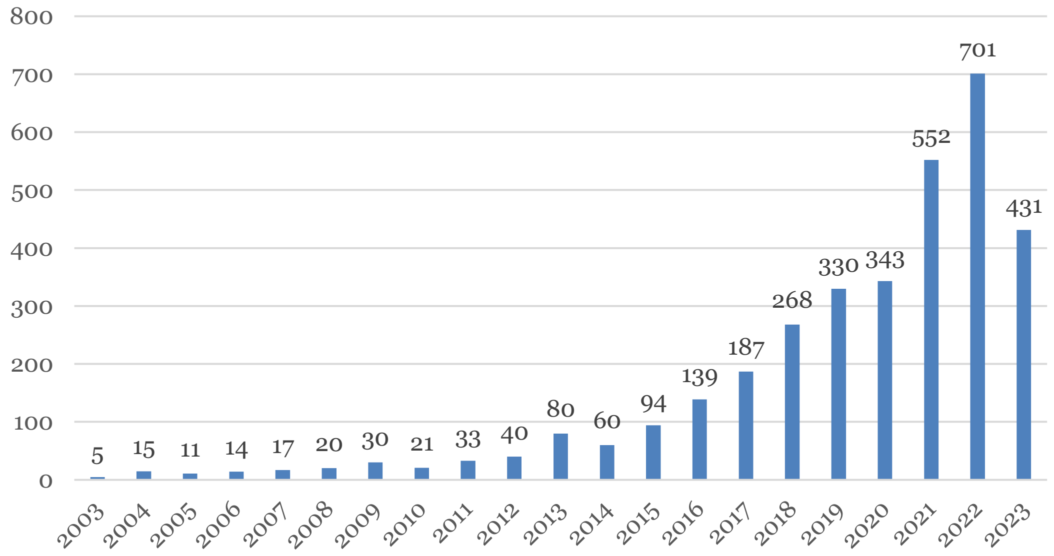


Figure 4.1: *Extract from the Web of Science database for all articles with the term (ecosystem*) anywhere in full text, published from January 2003 through June 2023. Each column represents the number of articles (journal articles + book chapters + conference proceedings) published that year. Only business and management categories were selected.*

Responding to the surge in ecosystem research, several reviews of ecosystem literature have been published in recent years (e.g., Altman et al., 2022; Daymond et al., 2022; Scaringella & Radziwon, 2018; Shipilov & Gawer, 2020). The journal Technological Forecasting and Social Change has also published a special issue consisting of several ecosystem reviews in 2018 (see Volume 136, November 2018 issue). These reviews have significantly advanced our understanding of ecosystems in aspects such as construct validity, empirical perspectives, value creation logics, and governance frameworks.

Taken together, extant reviews have evolved a theoretical basis for the ecosystem organizing form, justifying how the ecosystem conception is "a useful tool for understanding and predicting the conditions that shape and influence organizational systems" (Mars et al., 2012: 279) and, hence, can "stand on its own legs" (Autio & Thomas, 2014: 205). However, although extant reviews have significantly advanced ecosystem theorization, they have taken a predominantly structural perspective and focused on clarifying the "what" and "why" of ecosystems. There is, hence, some gap in understanding the "how" of ecosystems.

As was highlighted in the previous chapter, the process perspective of ecosystems has gained significant traction only in recent years (e.g., Snihur et al., 2018; Thomas et al., 2022; Wikhamn & Styhre, 2023). Process scholarship has looked at understanding ecosystem *organizing* – i.e., from the "what/why" to the "how" of ecosystems. Scholars researching the organiz*ing* aspect of ecosystems have provided significant insights into *how* ecosystems emerge (e.g., Dattee et al., 2018; Snihur et al., 2018), grow (e.g., Burgelman et al., 2022), and are effectively sustained (e.g., Giudici et al., 2018). Further, this stream has also provided a bridge to understanding the role played by underlying capabilities and resources in effectively *organizing* ecosystems (e.g., Foss et al., 2023; Helfat & Raubitschek, 2018).

While process research into ecosystem organizing has provided a view into "how" ecosystems are "configured" towards value delivery, the research has often taken a structural perspective and, hence, has provided a static view. In other words, organizing has viewed ecosystem as an "alignment structure" in which "actors are satisfied with their positions… [and there is] a consistent construal of the *configuration* of activities." (Adner, 2017: 42, emphasis added). Evidently, such research has attempted to suggest that governing ecosystems involves "designing" a "blueprint" (e.g., Lingens, Miehé, et al., 2021).

This dissertation attempts to go beyond ecosystem *organizing* by taking the perspective of ecosystem *orchestrating*. Orchestration involves a broad set of activities affecting the entire collective (Giudici et al., 2018). It is concerned not just with how actors are positioned, and resources are interconnected, but the *totality* of actions and interactions that are undertaken to realize the combined value offering (Dhanaraj & Parkhe, 2006; Giudici et al., 2018; Nambisan & Sawhney, 2011). Orchestrat*ing* involves the vantage point of overall ecosystem perspective and implicates the *dynamics* of value creation and capture (Autio, 2021; Dattee et al., 2018; John & Ross, 2022). Hence, while organizing is concerned with 'putting everything together', orchestrating involves making 'it all work together'[15]. Orchestrating, thus, is a dynamic and overarching perspective that transcends mere ecosystem organizing.

Thus, while current process studies of ecosystem orchestration have managed to unpack the black box of orchestration, they lacked an overarching perspective as they focused either on specific (or distinctive) contexts (such as digitalization) or specific ecosystem stages (like emergence). Thus, there is a dearth of research studies that have taken a comprehensive look at *how ecosystems are orchestrated over time*, especially post their emergence stage. This dissertation intends to fill that gap by comprehensively investigating orchestration in ecosystems over time (i.e., including both emergence and post-emergence stages).

4.2. Research design & methodology

As discussed in the previous sections, the literature on ecosystem orchestration is not nascent, yet the question of *how ecosystems are orchestrated* has not been addressed in an overarching sense. Hence, given the intermediate state of literature and the theoretical elaboration intended by this dissertation, an exploratory approach was chosen which involved iterating between findings induced from the

[15] To illustrate with an analogy of a musical event, organizing the event would involve choosing instruments, procuring them, contracting musicians, and arranging the seating positions. Orchestrating would involve all of those, plus the processes that ensure a harmonious *performance* is delivered.

data and prior understandings in literature (Edmondson & McManus, 2007).

Case-based methodology suited the exploratory nature of this dissertation (Eisenhardt, 1989a; Yin, 1994). When “little is known about a phenomenon” (Eisenhardt, 1989a: 548) – i.e., comprehensive understanding of orchestration is lacking – the case study approach, through rich contextual insights, enables theoretical elaboration (Yin, 1994). However, since orchestration research has developed over time, an iterative method of drawing sensitizing concepts from literature (Blumer, 1954; Bowen, 2008) coupled with inductively generated insights from empirical context (Corbin & Strauss, 1990) was employed. Further, multiple case study logic was chosen to compare emerging findings across contexts and develop a holistic and (analytically) generalizable understanding of ecosystem orchestration (Eisenhardt & Graebner, 2007; Stake, 2006).

The level of analysis was the ecosystem, in line with the definition of orchestration as playing out at the level of the combined value offering. To investigate orchestration *processes*, the activities within the ecosystem were chosen for analysis (as proposed by Fachin & Langley, 2017). Hence, the unit of analysis was activities undertaken by various (focal) ecosystem actors. Figure 4.2 provides an overview of the methodology of this dissertation. As can be seen in Figure 4.2, this dissertation followed a stage-wise study design. The entire study was conducted roughly over a four-year period (2020 – 2023). First, the groundwork of reviewing literature was done to identify and refine the research question of interest. The literature review involved two phases: (1) reviewing the research on ecosystems to gain conceptual understanding and, thence, constructing an integrated definition of ecosystems (see Chapter 2), and (2) understanding how and why ecosystems need orchestration and glean essential aspects of orchestration from extant research (see Chapter 3). The groundwork enabled the designing of a case-based, exploratory study with an inductive approach and guided sample selection and identification of orchestration activities. The subsequent stages are explained in the following subsections.

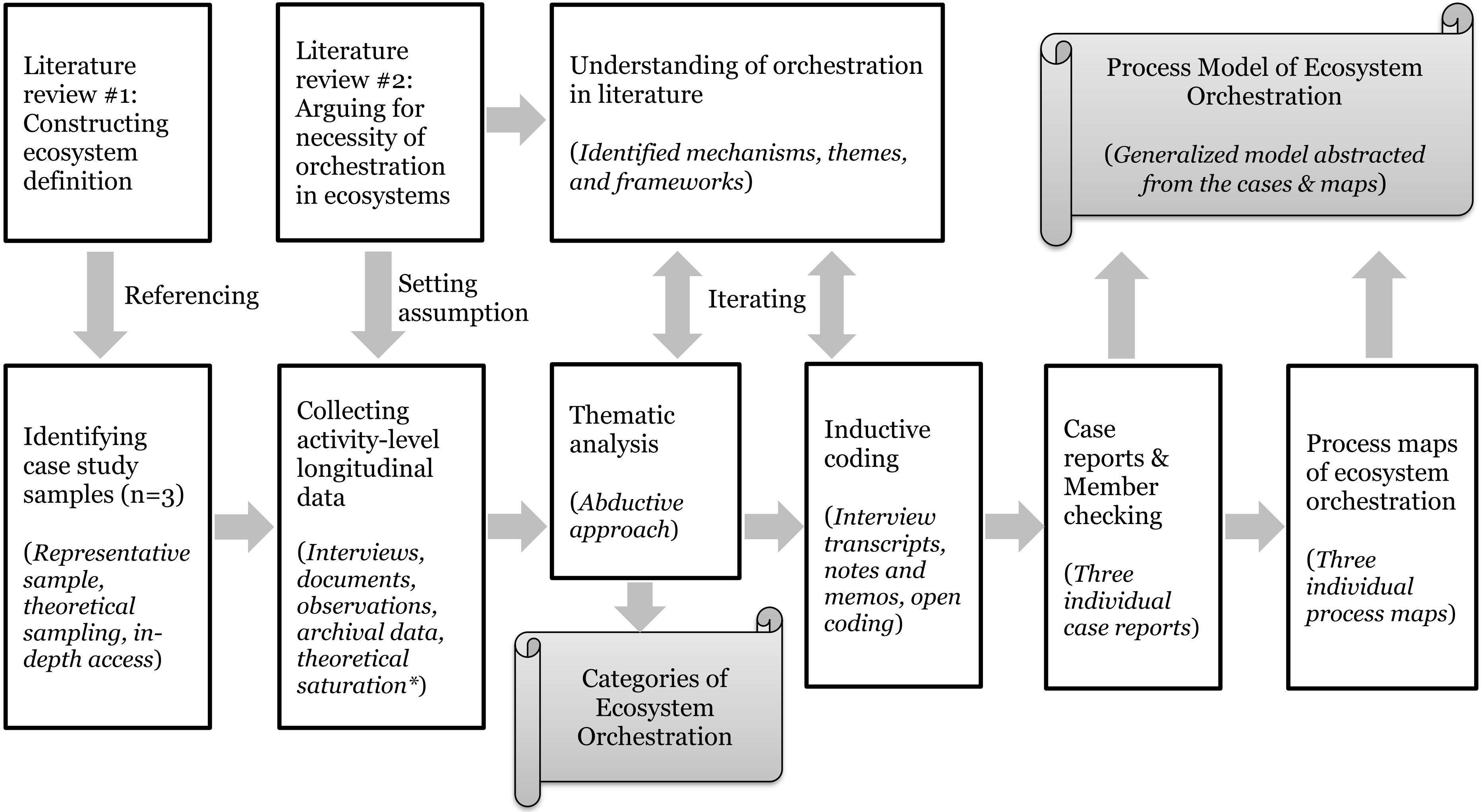


***Figure 4.2**: Methodology of this dissertation [* identifying theoretical saturation involved iterating between coding and data collection until no more radically new codes were emerging (as proposed by Miles & Huberman, 1984)]*

4.2.1. Identifying case study samples

This dissertation followed a multiple-case design. The advantage of involving multiple cases is that they can "create more robust theory because the propositions are more deeply grounded in varied empirical evidence... Multiple cases also enable broader exploration of research questions and theoretical elaboration." (Eisenhardt & Graebner, 2007: 27). This dissertation followed a theoretical sampling approach (as proposed by Eisenhardt, 1989a) to identify representative cases. Representative cases incorporate a typical manifestation of the phenomenon being studied (Eisenhardt, 1989a). Also, to aid an in-depth investigation, the cases ought to provide high access levels to the researcher (Yin, 1994).

Also, this dissertation aimed at investigating ecosystem orchestration across time (involving both emergence and post-emergence stags). Hence, the focus was on pursuing ecosystems that have attained operational maturity beyond the emergence stage. Nevertheless, though mature, ecosystems were expected to be in a constant state of flux given the complex nature of their value propositions, dynamism in the environment, and diversity in participation. Furthermore, since process research demanded longitudinal data (as suggested by Langley, 1999), the ecosystems ought to have existed over a period of several years to enable reasonably long period of data collected. However, the period of existence ought not to be too long so as to be able to find participants that were involved in the founding stages and that they would have clear recall of the ecosystem's history.

Three ecosystem cases were identified that satisfied the above requirements. The cases were accessed through formal and informal connections that permitted extraordinary access to key players – mainly anchor firms and individuals – and enabled fine-grained qualitative data collection (Yin, 1994). The three samples studied for this research are as follows:

Sample 1 was a non-profit entity-led technology business incubation ecosystem in Pune, India. Over its 15-year history, the ecosystem has nurtured and supported the commercialization journey of science-based ventures[16]. They executed a broad range of programs (including both onsite and remote mentoring) targeted at ventures at different stages. The ventures came from diverse technological domains such as healthcare, medical devices, agriculture, and material science. The focal organization, called Venture Center (VC), whose physical location was the site of the incubation activities, consisted of an inhouse team of more than 50 individuals that undertook different activities to identify, select, mentor, and support new ventures. VC was the focal organization in the ecosystem that consisted of mentors, investors, and legal advisors who partnered with VC to provide a wide range of services. The ecosystem had successfully mentored more than 600 ventures, with about 85% still active and running. This sample shall be referred to as the VC ecosystem in subsequent discussions.

Sample 2 was a consortium-led innovation ecosystem in European Metropolitan Region Nuremberg (EMN), Germany. The ecosystem specialized in medical device innovation and had a geographic focus. While the ecosystem has a wide range of critical stakeholders, it specifically nucleated around three prominent actors: the Erlangen city administration[17], the Friedrich-Alexander-Universität Erlangen-Nürnberg (FAU), and Siemens Healthineers (Healthineers). FAU is one of the largest universities in Germany and has been consistently voted as one of the most innovative research universities in the European region. Healthineers is one of the world’s leading healthcare firms, researching and manufacturing advanced medical imaging technology, laboratory diagnostics, and designing relevant IT solutions. The focal firm of this ecosystem is called Medical Valley EMN (MVEMN), a non-profit

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[16] Science-based ventures are firms, typically startups, that attempt to create value from newly established (sometimes, unproven) lab-based inventions and pursue financial returns through commercializing that value (Lubik & Garnsey, 2016).

[17] Erlangen is a prominent city in the state of Bavaria (‘Free state of Bavaria’) in Germany. The Erlangen city administration actively participated in seeding the emergence of the ecosystem initially with a focus on Erlangen alone, but later expanding to the EMN.

association with headquarters in Erlangen city of EMN. It has more than 210 members (including FAU and Healthineers) from various domains of the region. Over its 15-year history, the ecosystem has churned out pioneering innovations with a focus on digital health. This sample shall be referred to as the MV ecosystem in subsequent discussions.

Sample 3 was a government body-led mobile payment ecosystem located in India. The ecosystem, legally founded in 2016, was called Unified Payment Interface (UPI). It centred around a payment bridge owned by the National Payments Corporation of India (NPCI). Through governance of the bridge, NPCI nucleated an ecosystem – consisting of banks, financial service providers, and app developers – that enabled real-time funds transfer from users' mobile devices. Over its 7-year history, the ecosystem has grown to account for more than half of digital payments in the country. Banks were a crucial partner in ensuring the ecosystem's success, and as of December 2021, 281 banks (including all the major banks of India) had joined the ecosystem. This sample shall be referred to as the UPI ecosystem in subsequent discussions.

All three dissertation samples were appropriate instances of successful ecosystem functioning, having seen consistent organic growth and high-impact outcomes over several years up until the end of the study period. Further, each study sample was an ecosystem in a mature state, i.e., they embodied a clear structure, incorporated a standardized set of activities, and realized a stable and ongoing revenue stream. Table 4.1 demonstrates how the three samples adhered to the reference ecosystem definition (see Chapter 2 for the definition), thus, underscoring their relevance to the requirements of this dissertation. To further reinforce, the three cases justified selection as they satisfied the three conditions posed by Stake (2006: 23): (1) each case was relevant to the interest of the study, (2) the three cases provided diversity across contexts, and (3) the cases provided an excellent opportunity as well as in-depth access necessary to grasp the phenomenon in all its complexity and context.

Table 4.1: *Matching sample characteristics with the integrative ecosystem definition as suggested in Chapter 2*

Ecosystem definition	*Interconnected web…*	*Functionally distinct roles (inhabited by one or more specialized actors)…*	*Predominantly horizontal interdependencies…*	*Offering combined value proposition*
VC ecosystem	Collective brought together by an incubator	Office space provider, validation services (9), mentors (200), advisors, investors (165)	Partners provide complementary services, are not hierarchically related	Facilitating the commercialization journey of science-based ventures
MV ecosystem	Collective governed through a consortium	Research institutions, universities (80), hospitals (65), regulators, business companies (500)	Partners provide complementary services, are not hierarchically related	Development and commercialization of healthcare-based solutions
UPI ecosystem	Collective sharing a common payment bridge	Banks (282), regulators, payment service providers (20), merchants (1.7 lakh)	Partners provide complementary services, are not hierarchically related	Peer-to-peer digital payment service

Further, as Yin (1994) recommended, the three samples can be integrated into a multiple-case study framework only if they are literally or theoretically replicated, i.e., the three cases should be either essentially similar or contrasting. It was seen that the three cases chosen for this dissertation adhered to replication logic embodying a mix of literal and theoretical replication. This provided unique benefits. While literal replication strengthened the results' validity, theoretical replication expanded the potential for generalizability. Table 4.2 illustrates how the three samples compared and contrasted on essential aspects.

***Table 4.2**: Comparing sample characteristics to show literal and theoretical replication.*

<table>
<tr><th>Criteria</th><th>VC ecosystem</th><th>MV ecosystem</th><th>UPI ecosystem</th></tr>
<tr><td colspan="4">Similarities between the samples (literal replication)</td></tr>
<tr><td colspan="4">• Ecosystems founded using government support
• Ecosystems are centred around a focal firm that drives its ongoing maintenance
• The focal firm is a non-profit entity
• The focal firm has no competitive orientation and prioritizes the overall health of the ecosystem (instead of focusing on its gains/benefits)
• Ecosystems have clear boundaries drawn through focal firm-driven policies</td></tr>
<tr><td colspan="4">Contrast between the samples (theoretical replication)</td></tr>
<tr><td>Core expertise of the focal firm</td><td>Technology specialist</td><td>Regional champion</td><td>Protocol owner</td></tr>
<tr><td>Condition for membership</td><td>Should pertain to science-based venturing</td><td>Should be located in a particular geographical region</td><td>Should abide by the standards of the protocol</td></tr>
<tr><td>Bundling of value offered (i.e., aggregation within or outside the ecosystem)</td><td>Fully aggregated offering (i.e., offerings are fully bundled by the focal firm)</td><td>Both aggregated and disaggregated value are offered (i.e., focal firm offers bundles, but users are also free to mix and match)</td><td>Fully disaggregated offering (i.e., focal firm offers no bundling, users construct value based on their preferences)</td></tr>
</table>

4.2.2. Collecting data

Process research demands in-depth qualitative data covering an extended duration to gain insights into underlying mechanisms over time (Langley, 1999; Van De Ven, 1992). An activity-based approach was adopted (as proposed by Fachin & Langley, 2017) to investigate ecosystem orchestration processes. The snowball method was used to obtain in-depth access to each case sample, and data were collected from various sources, as shown in Tables 4.3, 4.4, and 4.5. The tables detail the nature, timeline, and data collected for each sample (one table per case).

Table 4.3: *VC ecosystem data sources*

Data sources	Details	Use in Analysis
Semi-structured interviews of ecosystem users (July 2021 – Sep 2021, 842 minutes, 172 pages verbatim, 12 pt. font, single-spaced)	15 science-based ventures with a mix of technologies (6 – early stage; 6 – building/testing prototype; 3 – market ready)	Capture activity-level needs of start-ups as they commercialize through the ecosystem. This helped in corroborating the coverage of activity-level data from VC sources
Semi-structured interviews of key VC individuals (Oct 2021 – Jan 2022, 311 minutes, 54 pages verbatim, 12 pt. font, single-spaced)	Participants' position and experience: • Founder director (15 years) • CEO (14 years) • Program manager (7 years) • CSR anchor (5 years) • Senior associate (1 year)	Comprehensive view of the evolution of the ecosystem, founding values, ongoing day-to-day activities, aspects of management, and coordination needs
Participant observation[a] (Sep 2021 – Feb 2022, 1852 minutes)	First-hand observation of events conducted by VC • 118 pages of notes taken	In-depth view of coordination between entrepreneurs, VC staff, and ecosystem partners
Documents (Jun 2021 – Jan 2022)	Internal • Screening procedures • Mentoring logbook Public domain • Readiness level assessments • About start ups	Understanding the structural and operational aspects of key programs conducted by VC, triangulating the operational details captured in the interviews
Archival data and other secondary sources (Jun 2021 – Apr 2022)	• Online webpages • Video recordings • Social media updates, media reports • Event notifications and handouts	Triangulating facts captured from primary sources, expanding the activity-level details (where possible), and getting historical understanding of ecosystem

[a] To corroborate the dynamics observed in VC's events, I attended training/outreach events by two other incubators that also focused on science-based ventures. The effort spent on that was negligible compared to the primary data gathering and, hence, is not counted in the above list. I found that events across incubators were broadly similar in nature and dynamics.

***Table 4.4**: MV ecosystem data sources*

Data sources	Details	Use in Analysis
Semi-structured interviews of actors in the MV ecosystem (Jun 2022 – Aug 2022, 1535 minutes, 210 pages verbatim, 12 pt. font, single-spaced)	Participants' profile: • MVEMN (6 participants) • Medical Valley initiatives (2 participants) • FAU (4 participants) • Siemens Healthineers (4 participants) • Other regional actors (7 participants)	Comprehensive view of evolution of the ecosystem, founding values, ongoing day-to-day activities, aspects of management, and coordination needs
Field observations[a] (Jun 2022, 10 days)	• Informal discussions with research scholars and business individuals • Visit to the Med Museum in Erlangen • Attending an annual community event (*Schlossgartenfest*) held on 25th July 2022 at the FAU Erlangen campus, where several important dignitaries of the region were in attendance	In-depth view of informal coordination and collaboration aspects between various actors in the region, understanding of the historical evolution of medical innovation in the region
Virtual events (Oct 2021, 5 hours)	Online events by Siemens and FAU showcasing their collaborations, including sample pitches.	View into regional collaborative activity between two of the region's dominant players and upcoming research streams.
Documents (Since inception)	Internal • Accounting spreadsheet • Bootcamp structure and plan • Research theses Public domain • Press releases • Handouts, flyers • Transcript of lectures/ interviews	Understanding the structural and operational aspects of key programs conducted by MVEMN, triangulating the operational details captured in the interviews
Archival data and other secondary sources (Oct 2021 – Oct 2022)	• Online webpages • Video recordings • Social media updates, media reports • Event notifications and handouts	Triangulating facts captured from primary sources, expanding the activity-level understanding of ecosystem

[a] Time spent on this activity was not precisely tracked, no formal recordings were done, but notes or photographs were taken when possible.

***Table 4.5**: UPI ecosystem data sources*

Data sources	Details	Use in Analysis
Semi-structured interviews of actors in the India Stack ecosystem (Oct 2022 – Jan 2023, 452 minutes, 74 pages verbatim, 12 pt. font, single-spaced)	Participants' profile: • NPCI board member (1 participant) • Ex-iSPIRT member (1 participant) • Initiative anchors (4 participants)	Comprehensive view of evolution of the ecosystem, founding values, ongoing day-to-day activities, aspects of management, and coordination needs
Industry-events (Dec 2022 – Mar 2023, in-person events, 1050 minutes)	Ecosystem awareness events by anchors of initiatives within the India Stack framework	• In-depth view of informal coordination and collaboration aspects between various actors in the ecosystem • Understanding how use cases are discussed and debated • Insights into how the plans (and joint vision) are articulated
Virtual events (Dec 2021 – Dec 2022, 1100 minutes)	Online events included panel discussions, seminars, and virtual conferences, where initiative anchors did presentations.	Deeper understanding of the ecosystem structure and processes
Archival data and other secondary sources[a] (Jan 2022 – Dec 2022)	• Online webpages • Video recordings • Social media updates, media reports • Event notifications and handouts • Podcasts • News reports (both video and text)	Triangulating facts captured from primary sources, expanding the activity-level understanding of ecosystem
Documents (Jan 2009 – Jan 2023)	Available in the public domain • Press releases by government departments/subsidiaries • Minutes of the meeting from the RBI	Triangulating facts captured from primary sources, expanding the activity-level understanding of ecosystem

[a] Gathering the data involved watching a wide range of online sources where members of the developer community – notably, individuals like Nilekani, Varma, and Jain, that led the Aadhaar initiative, and members of iSPIRT like Sharma, Chandra, and Kumar – spoke about the UPI ecosystem and the larger India Stack context. The talks included interviews, panel discussions, and podcasts, where information about the genesis and evolution of the UPI ecosystem was obtained. Over 100 hours were spent on this activity.

The interviews were semi-structured (as proposed by Miles & Huberman, 1984), where each participant was engaged through an informed consent process. Participants were informed about the broad context of the study with a brief about the current academic understanding of ecosystem orchestration. Then, they were invited first to describe their ecosystem from their perspective and then describe in whatever possible detail the nature of activities in their ecosystem, focusing not only on the activities they were involved in but also on the activities of others in relation to their activities. Some of the indicative interview questions were as follows:

- Can you talk about your role in this ecosystem? (*Both your role as an individual and the role of your organization*)
- What responsibilities does your ecosystem involvement entail?
- Can you talk about your activities as part of this ecosystem?
- Who are your ecosystem partners? How do you manage coordination with them?
- What kind of accountabilities exist between the ecosystem participants?
- What kinds of investment have you and your partners committed to the ecosystem? How did you manage to convince your partners to make their investments?

The interview methodology was reviewed and approved by the Institutional Review Board of the Indian Institute of Management Bangalore (Study IDs: IIMB-IRB#33 and IIMB-IRB#41). Extensive notetaking was done to capture thoughts soon after each data collection episode (as proposed by Miles & Huberman, 1984). At each site, data collection was deemed complete when theoretical saturation was reached, i.e., no new pattern of activities was emerging from additional sources (as proposed by Glaser & Strauss, 1967).

4.2.3. Data analysis

The focus of data analysis was to gain a detailed understanding on *how ecosystems* *are orchestrated*. Two-pronged data analysis was performed owing to the two research questions that were pursued by this dissertation study, namely, (1) *what constitutes ecosystem orchestration?* and (2) *what are the underlying dynamics involved in orchestrating ecosystems over time?* To answer the first research question – *what constitutes ecosystem orchestration?* – thematic analysis (as suggested by Braun & Clarke, 2012) was undertaken. This helped to identify thematic patterns that led to uncovering four categories of ecosystem orchestration. Then, to answer the second research question – *what are the underlying dynamics involved in orchestrating ecosystems over time?* – fine-grained inductive coding (as suggested by Miles & Huberman, 1984) was undertaken. This helped to identify the underlying processes of orchestrating ecosystems over time.

4.2.3.1. Thematic analysis

Data, including interview transcripts, documents, handwritten notes, and memos, were analysed to identify activities pertained to ecosystem orchestration. Every occurrence of a verb in the text was analysed to identify activities. Once identified, the activity was assessed to determine whether it pertained to orchestration. Activities that affected the nature or scope of the ecosystem's value proposition were deemed as *orchestrating* and attached to a descriptive label. Table 4.6 shows some excerpts from data which involved orchestrating activity.

Table 4.6*: Excerpts from interview data showing orchestration activity. Similar scanning and labelling of orchestration activities was done on all data sources (table continues to next page).*

Sample	Excerpt from interview data	Activity
VC ecosystem	"*We realize that the advice and mentoring activities also become important, so we had to create a network of more than 300 advisors and mentors... We are in ongoing contact with them, they are reviewing some of the startup ideas, they are monitoring the progress of our startups...*" [VC CEO, interview data]	Integrating members

Sample	Excerpt from interview data	Activity
VC ecosystem	"*We have a committee meeting where there are few people from the corporate and a few people from the Venture Center end and then we shortlist candidates, they come and present in front of the committee, and then the committee selects the final grantees*" [VC CSR anchor, interview data]	Gatekeeping (screening users)
VC ecosystem	"*We have campaigns as per the calls which are coming; we try to do campaigns around those thematic areas because generally each campaign we try to marry it with some funding opportunity. Just doing a campaign doesn't make sense unless there's some funding available.*" [VC initiative anchor, interview data]	Evangelizing (campaigning)
MV ecosystem	"*What we're focusing on are really source angel investors that are coming from the branch, they know about the risks of MedTech and are investing not just money but also their experience. That, for our team is more or less a winner. That's what we're focusing on*" [MV CEO, interview data]	Partner onboarding
MV ecosystem	"*We asked them as well who would be the top markets you would be interested? I think they did the survey at 2012/13, three or four years before I moved into my possession. At that time this BRIC states was very important*" [MV anchor for internationalization, interview data]	Creating affordances (in new markets)
MV ecosystem	"*We have consolidated everything under the brand of Medical Valley. From there on, it was only Medical Valley Centres, the other network organizations, we just, kind of, merged with them or acquired them, not in an economical way, but we said OKAY, this is now merged in the Medical Valley Association. Everything was branded under the overall brand of Medical Valley, European metropolitan region of Nürnberg – every activity. This was really also a major step because then you heard Medical Valley everywhere.*" [Past CEO of MV, interview data]	Consolidating (bringing under one umbrella)
UPI ecosystem	"*We went from state to state, meeting chief ministers and chief secretaries, convincing them about this model.*" [Nilekani, online interview on YouTube]	Evangelizing (the value proposition)
UPI ecosystem	"*And NPCI, as an entity, is accountable to both the reserve bank and to private bank owners, because the banks are all shareholders in NPCI*" [ISPIRT volunteer, interview data]	Legitimacy building

Thematic analysis (as suggested by Braun & Clarke, 2006, 2012) involves identifying meaningful patterns in the data that unravel the constitutive nature of the phenomenon being studied. Extant literature had shown that orchestration can involve patterns of activities (see Figure 3.3 in Chapter 3 for the four dimensions of orchestrating as suggested by literature). Hence, thematic analysis was undertaken to find patterns among the orchestration activities captured in the data.

The steps suggested by Braun and Clarke (2006, 2012) were employed for thematic analysis. First, a detailed reading of the data was done to gain in-depth familiarity. Then, orchestration activities were identified and labelled according to the purpose the activity served in materializing the combined value offering. Once the entire data corpus was labelled, the activities and their labels were collated and reviewed for potential aggregation. The collating (and aggregating) activity was repeated until clear themes emerged, and the entire data set was accounted for. When the exercise was deemed complete, the emergent themes were checked for correlation with extant literature and also validated with an experienced researcher in the domain.

The thematic analysis exercise showed that the corpus of orchestrating activities aggregated into four themes: consolidative activities, discursive activities, cognitive activities, and performative activities. Table 4.7 provides an excerpt of the orchestrating activities from each case that aggregated into the four categories. As was inductively derived, each thematic aggregation has a distinct ecosystem-level impact: (1) consolidative activities define the collective and facilitate emergence of novel affordances, (2) discursive activities build a narrative around the ecosystem's value proposition and help to position the ecosystem in the marketplace, (3) cognitive activities build the image of the ecosystem in the minds of its users, while also strengthening its identity amongst the participants, and, (4) performative activities establish the viability of the ecosystem's offering(s). Given that these themes represented distinctive ecosystem-level impact, they can be said to represent a category of ecosystem orchestration. The next chapter defines and explains the themes (see Section 5.1 in Chapter 5).

Table 4.7: *Excerpt of orchestrating activities in each case that aggregated under the four thematic categories.*

	Consolidative orchestration	**Discursive orchestration**	**Cognitive orchestration**	**Performative orchestration**
Orchestrating activities in the VC ecosystem	• Program designing (e.g., Lab2Mkt) • Partner onboarding (e.g., new CSR partners)	• Campaigning & outreach (e.g., awareness sessions) • Awards & recognition (e.g., AABI award)	• Legitimacy building (e.g., expert speaker sessions) • Accreditations (e.g., Credibility Alliance)	• Field works (e.g., SIIP immersion) • Tool automating (e.g., Google doc tracking)
Orchestrating activities in the MV ecosystem	• Integrated strategizing (e.g., driving consensus) • Creating affordances (e.g., nucleating initiatives)	• Articulating (e.g., campaigning) • Educating (e.g., advertising)	• Outreach (e.g., brand building) • Recruiting key individuals (e.g., Reinhardt as chairman)	• Enabling (e.g., executing new initiatives) • Performing (e.g., winning cluster of excellence)
Orchestrating activities in the UPI ecosystem	• Co-creating (e.g., Nilekani as NPCI advisor) • Integrating new use-cases (e.g., cross border remittances)	• Publishing metrics (e.g., dashboards on the NPCI portal) • Evangelizing (e.g., CEO at panel discussions)	• Committing to open source (e.g., opening BHIM source code) • Strengthening dispute resolution (e.g., ODR processes)	• Governing the central switch (e.g., maintenance and upgrade of switch) • Gatekeeping (e.g., adherence to APIs)
Ecosystem-level impact	• Formulate (or redefine) the overarching vision for the collective. • Facilitate the emergence of new affordances (that can crystallize into novel know-how)	• Build a relatable storyline around the ecosystem value proposition. • Position the ecosystem in the market landscape.	• Strengthen ecosystem's image in the context of the broader environment. • Strengthen the ecosystem's collective identity amongst the stakeholders	• Establish (and enhance) the viability of the ecosystem's offering(s) • Foster the emergence of novel know-how

4.2.3.2. Inductive coding

Another stream of data coding was undertaken to answer the second research question: *what are the underlying dynamics involved in orchestrating ecosystems over time?* The purpose of this stream of analysis was to sift through the data in a fine-grained manner and uncover activities that manifest the *processual* dynamics of ecosystem orchestration (Fachin & Langley, 2017). As process scholars (e.g., Langley, 1999; Langley et al., 2013) have suggested, the collected data were qualitative and longitudinal in nature. The bulk of the data comprised interview transcripts (48 interviews in total, averaging 64 mins) and consisted of information about ecosystem activities, both ongoing and historical (dating back to before founding of their respective ecosystems). Hence, the collected data were germane for processual analysis (Abdallah, Lusiani, & Langley, 2019).

Data were coded inductively using an interpretive lens (Corbin & Strauss, 1990; Gioia, Corley, & Hamilton, 2013; Miles & Huberman, 1984). The informants were seen as knowledgeable agents that "know what they are trying to do and can explain their thoughts, intentions, and actions" (Gioia et al., 2013: 17). Hence, open coding process (as suggested by Corbin & Strauss, 1990) was employed where meaningful chunks of data were identified and coded while data collection was still in progress. By doing so in an ongoing manner, the researcher's perspective was constantly shaped and enabled better informed subsequent data collection (Miles & Huberman, 1984).

Codes are "tags or labels for assigning units of meaning to the descriptive or inferential information compiled during a study." (Miles & Huberman, 1984: 56). Codes were inductively assigned to textual chunks that represented orchestrating activities. As open coding was followed, the initial set of codes comprised of labels that were much closer to the data. Also, in the open coding process, focus was purely inductive, i.e., there was no concern towards adhering to already existing concepts in the literature on orchestration. Data collection was deemed completed when almost all of newly emerging codes began appearing similar to the corpus of existing codes (Gioia et al., 2013).

Data were hand coded. All materials, including interview transcripts, field notes, observation memos, documentary and archival records were analysed in great detail (often through multiple iterations) to identify orchestration activities. The open coding exercise led to an excess of 100 codes. This is because descriptive codes were used that were close in meaning to the coded segments. While the thematic analysis exercise aimed at identifying broad chunks of data linked to a particular characteristic of orchestration, inductive coding exercise served to dig deeper and identify activity-level instances. Thus, the inductive coding exercise involved a fine grained approach where one segment of text that may have been viewed as a single chunk thematically involved more than one activity-level codes. For instance, figure 4.3 shows a segment of text (from an interview of an MV anchor) that was labelled as one single chunk thematically but was deemed to involve three different activity codes when inductively coded.

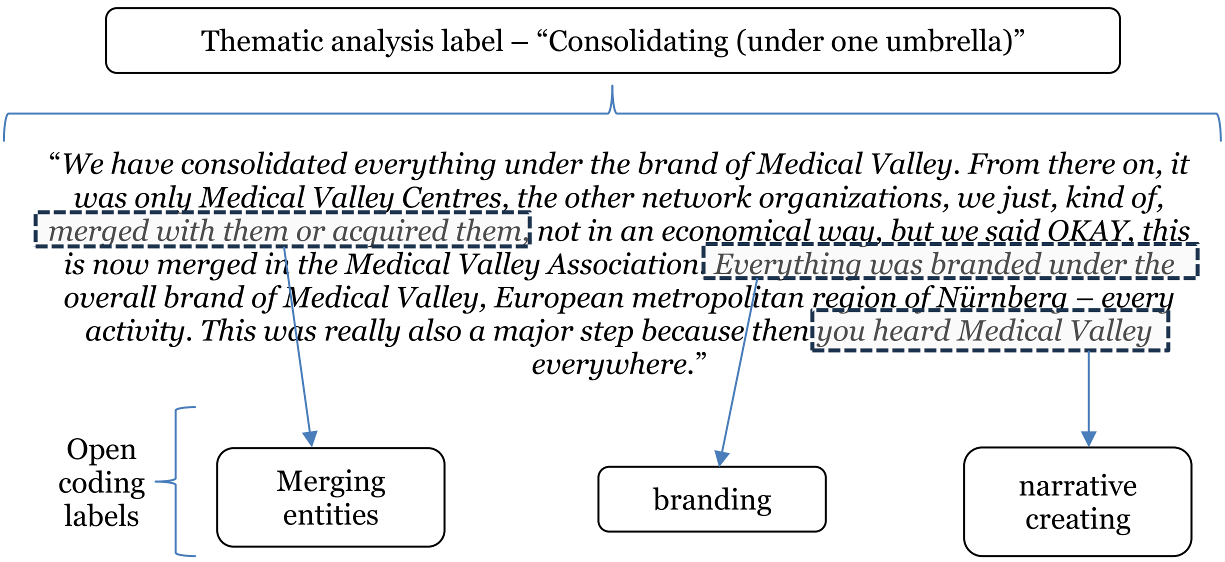

Figure 4.3: *Sample text segment (from an interview of MV anchor) comparing the outcomes from thematic labelling and inductive coding exercises.*

Once the corpus of descriptive codes was compiled, constant comparison technique (as suggested by Corbin & Strauss, 1990) was employed to organize the descriptive codes into sets. Through this exercise, closely related codes were grouped together to arrive at a limited set of first-level codes (as suggested by Gioia et al., 2013). During the process of assigning first-level codes, the extant research on ecosystem orchestration was referred to correlate the codes with existing (or related) concepts in literature. For instance, Dattee et al.'s (2018) research had shown that ecosystem orchestration involves road-mapping activities where focal actors attempt to steer the collection in the direction of the intended value capture. Several descriptive codes were observed that seemed related to the conception of road-mapping in literature. Some descriptive codes that were mapped to first-level code 'road-mapping' were:

- "*Each of these maybe will take you five to 10 years as a scientist to do... So, the simpler way is, you will gravitate towards your usual route of publishing and surviving, right? (laughs) And you'll never try technology because it is too risky, I mean it doesn't give you enough reward as an academic. So, it is in this context I was thinking of how to convert more ideas into market, and we started thinking about how to build an ecosystem to support all of this.*" [Excerpt from interview with VC founder, open coded as *envisioning ecosystem as support system for risky ventures*.]

- "*It was really a huge credit to the NPCI team because they, like Dilip Asbe who was at the time number two was super hands on and checking issues as they came up... last week they put out a revised dispute resolution framework so that your transactions disputes are improved.*" [Excerpt from interview with ex-ISPIRT volunteer, open coded as *establishing frameworks to ease disputes*.]

- "*First you need an overarching sectoral regulation, which typically is called the master direction. That is the Bible that sets the framework for how behaviours in that new system have to be supervised and held accountable to.*" [Excerpt from interview with UPI ecosystem player, open coded as *laying down overarching framework to guide behaviours*.]

- "*So, we identified a wonderful strength, of course, for the city. And I proposed and said, 'Well, you have to get rid of weaknesses, but you should strengthen the strength'. And so, we said, we will focus on this field.*" [Excerpt from interview with MV founding member, open coded as *identifying strengths and setting strategic course*.]

- "*One example is last year they created a new department. It's AI in Biomedical Engineering, in order to push it forward... So, a lot of new professorships for medical robotics and so on, were allocated to FAU and, with that to Medical Valley ecosystem, and this is really important.*" [Excerpt from interview with ex-CEO of MV, open coded as *investing ahead in new technologies*.]

- "*At the beginning, we had our contacts in Erlangen and a little bit around. Over the last year, we enlarged our networks, and we are started to define where are the strengths... For example, in Forchheim there is many productions of MedTech, and so we were able to install this Medical Valley Center there in the city of Forchheim.*" [Excerpt from interview with CEO of MV, open coded as *charting expansion plans*.]

The emerging first-level codes were finalized in continual consultation with an expert researcher in the domain who, in this case, was the PhD supervisor. Discussion with the expert led to iterating constantly between the data and literature (and sometimes also guided subsequent data collection). Several process studies of orchestration (e.g., Dattee et al., 2018; Giudici et al., 2018; Snihur et al., 2018; Thomas et al., 2022; Thomas & Ritala, 2022) served as guides for identifying the labels for the codes. Owing to the processual nature of the study, verbs were chosen for the code names to emphasize the activity focus. On the whole, twelve first-level codes emerged after the (iterative) exercise of grouping descriptive codes into first-level codes (or concepts).

The twelve first-level codes, once established, were reviewed for interrelationships. Axial coding (as suggested by Corbin & Strauss, 1990) was undertaken where further categorization was developed (aided by discussion with the expert). This led to development of second-level codes which grouped together related first-level codes. Figure 4.4 shows the 'data structure' that illustrates the relationship between (few selected) descriptive codes, the twelve first-level codes, and the six higher-order categories. Also, process maps were drawn (as suggested by Langley, 1999) for each case that illustrated temporal sequencing of key orchestration activities over time. The process maps aided in uncovering sequentiality amongst the identified codes and enabled the creation of a generalized process model of orchestration. The next chapter (section 5.3) explains the codes and details the process model.

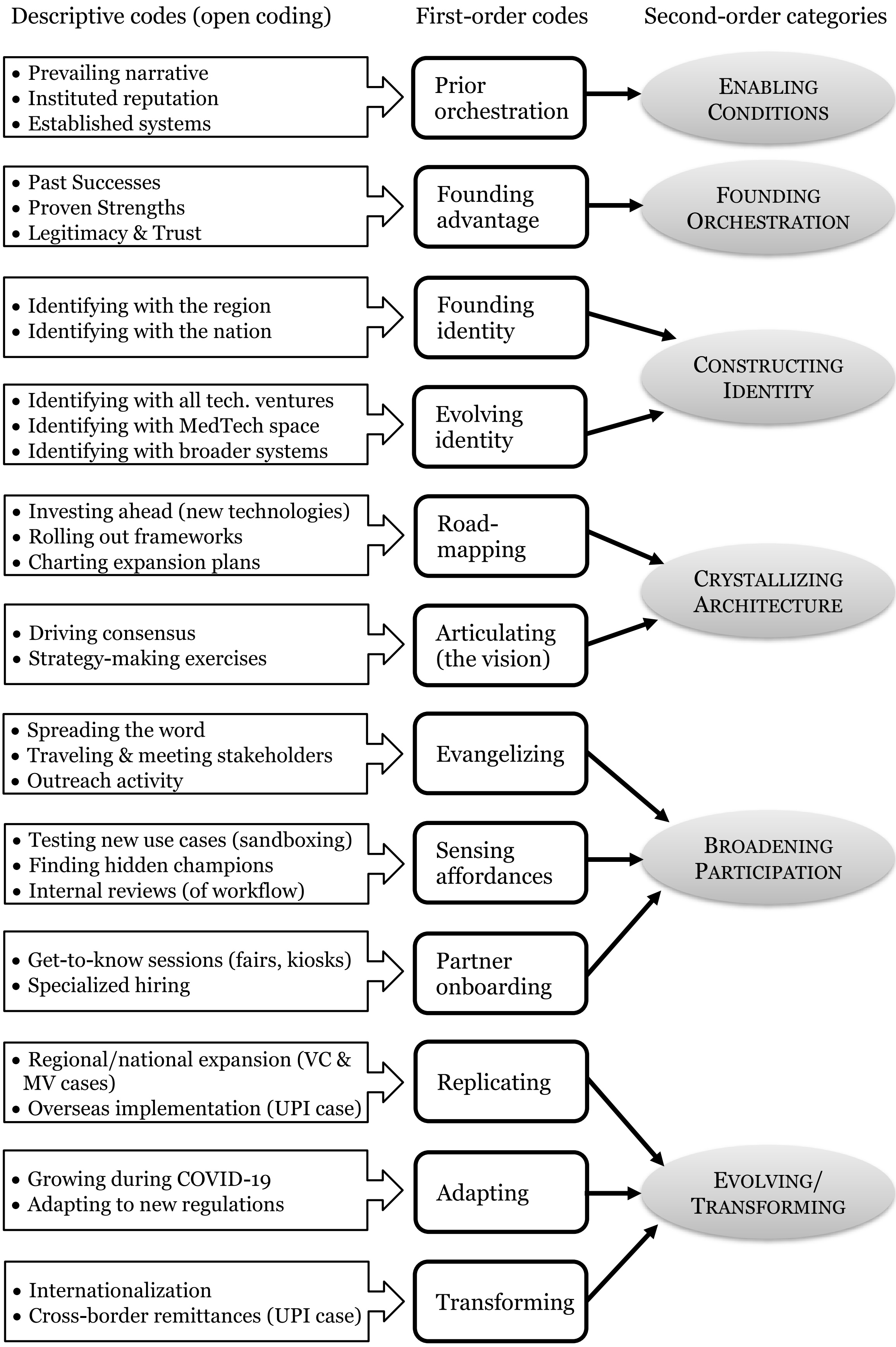

***Figure 4.4**: Data structure showing the hierarchy of codes that emerged from the inductive coding exercise. Owing to lack of space, only a small subset of actual descriptive codes is shown.*

4.2.4. Report writing and validation

After the orchestration activities were identified, individual case reports on ecosystem orchestration in each case were drafted (the case reports are presented in detail in the next section). The reports were reviewed with the thesis supervisors for structural coherence and preliminary content validation. Then, member checking was done by presenting the report to an identified expert in the field. As Stake (2006: 37) has suggested, member checking is vital in qualitative field research to achieve data accuracy and remove possible misinterpretations.

The VC ecosystem's case report was reviewed and validated by an experienced staff member of VC who had more than five years of experience at the organization and has been anchoring one of VC's key initiatives. The MV ecosystem's case report was reviewed and validated by one of MV's CEOs. The reviewer had extensive working experience (of nearly twenty years) in the region, having been involved in the region before the founding of MV, has worked at MV in various capacities since its founding, and was elected as the CEO of MV in 2022. The UPI case report was reviewed and validated by a sitting board member of NPCI. The reviewer has also been a member of iSPIRT, a volunteer-based non-profit entity that was instrumental in materializing the UPI ecosystem.

Finalizing the case reports enabled the creation of detailed process maps of ecosystem orchestration in each sample. As proposed by Langley (1999), the process maps followed a process ontology, i.e., they focused on verbs rather than nouns, emphasized flows rather than substantive states, and were concerned with showing linkages between activities rather than explaining causation. Drawing the process maps enabled abstraction into a generalized process model of ecosystem orchestration, which is the subject matter of the subsequent chapter (Chapter 5).

4.3. Case descriptions

Based on the activity patterns identified from thematic analysis, thick descriptions of ecosystem orchestration were written in three case reports, one for each sample (as proposed by Miles & Huberman, 1984). The case reports provide an in-depth view of ecosystem orchestration for each case through the perspective of the activity aggregates. This section provides a view into the case reports.[18]

4.3.1. VC ecosystem case

The VC ecosystem was centred around VC, the (non-profit) organization, as a focal firm. VC was constituted in January 2007 by its host organization, National Chemical Laboratory (NCL), as a Section 8 non-profit organization having an independent governing council.[19] The founding vision of VC was "to nucleate and nurture technology and knowledge-based enterprises for India by leveraging the scientific and engineering competencies of the institutions in the region."

The VC ecosystem's value proposition was to create a conducive environment facilitating science-based ventures' (SBVs') journey from the lab to the market. To achieve this goal, VC coordinated and brought together several partners – such as policy advisors, funders, faculty experts, other incubators, senior entrepreneurs, intellectual property experts, and business consultants – in a non-hierarchical fashion. The partners complemented each other in ways that facilitated the delivery of the collective value offering – providing services that facilitated SBV commercialization. Figure 4.5 illustrates how various ecosystem participants were positioned and contributed toward the combined value proposition.

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[18] The case reports were written as standalone documents, complete with introduction, body, and conclusion, along with a glimpse of the process model. Each report was in the range of 7000 – 10000 words. To keep this chapter within reasonable page limits, a minimalistic approach was followed and only those descriptions from the case reports that are necessary to showcase the orchestration detail have been included.

[19] Section 8 company is a form of non-profit organization that is guided by terms under Section 8 of the Indian Companies Act, 2013.

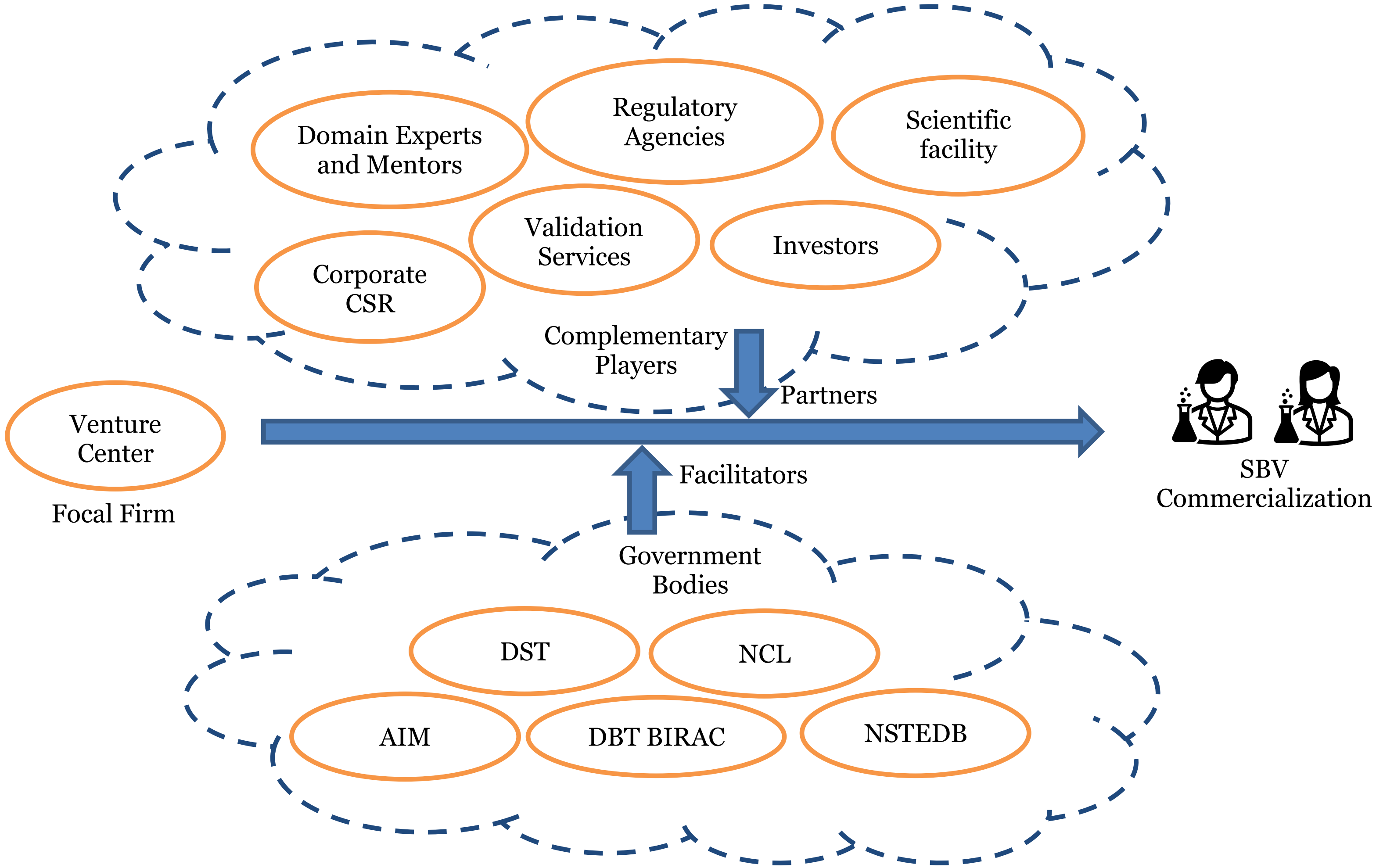

***Figure 4.5**: Simplified schematic of the VC Ecosystem, showing various partners that complement VC in enabling the commercialization of SBVs.*

4.3.1.1. Evolution of the VC ecosystem

VC was governed by a board of directors with extensive experience heading various scientific and technological initiatives nationwide. For instance, board member Ashish Lele was the director of NCL (VC's parent organization) and had previously headed the advanced materials and alternate energy group at Reliance Industries Ltd., a large for-profit conglomerate. Board member K. N. Ganesh was the director at the Indian Institute of Science Education and Research, Tirupati, having previously held the director post at the Indian Institute of Science Education and Research, Pune. Board member Satya Dash had helmed the strategy partnerships and entrepreneurship development at the Biotechnology Industry Research Assistance Council (BIRAC), a nodal biotechnology innovation agency setup by the Department of Biotechnology (DBT), Government of India.

VC's founder director Premnath has been an academic with considerable experience in technology commercialization processes. Premnath held leadership positions in various initiatives under the NCL umbrella, such as (but not limited to) head of NCLI, and head of the Intellectual Property Group under NCL, along with being a chief scientist in polymer science and engineering. The extensive experience and broad scientific leadership of its governing council lent VC the authority (and legitimacy) to become a focal ecosystem entity.

VC greatly benefited from the support of governmental bodies such as CSIR and the Department of Science and Technology (DST), who provided infrastructure and funds for its formation. Using the initial grant from DST, VC managed to set up basic workhorse facilities for technology business incubation (TBI). VC operated out of a 10,000-square-foot built-up space at NCL Innovation Park in Pune, an infrastructure NCL granted. In its formative years, VC banked upon informal connections of its leadership team to engage with experts in different aspects of TBI, facilitating the jumpstarting of several TBI services. Building on its initial successes, VC constructed its reputation as an effective TBI service provider. Gradually, using various grants it received and leveraging income from its facilities, VC continued to procure specialized scientific facilities and embarked on various partnerships.

At the time of this dissertation, the VC ecosystem can be said to have attained maturity as the structure and operations of the ecosystem seemed to have reached a reasonably stable state. While participants continued to move in and out of the ecosystem constantly, and new niches (Pierce, 2009) were occasionally formed through additions to the existing service portfolio, the overall structure of the ecosystem (Adner, 2017), its governing logic (Jacobides et al., 2018), and the underlying processes of interaction remained stable throughout the study.

4.3.1.2. Orchestrating the VC ecosystem

The VC ecosystem delivered its value proposition of SBV incubation through a wide range of activities that influence (or impinge upon) the commercialization process in different ways. Table 4.8 shows a subset of the ecosystem's offerings. As seen, services catered to different stages of the startups' journeys. While some services (like NIDHI-PRAYAS) are specialized for ventures at certain stages, others (like Lab2Mkt) are designed to support a broader part of their journey. Some generalized services (like HR Helpdesk services) catered to ventures irrespective of their commercialization stage.

The VC ecosystem's focus was on bundling services as programs. Mentorship programs were typical of this kind, where several services were offered as a package under the label of a program. An instance of a program was the Social Innovations Immersion Program (SIIP) which involved deep-touch mentoring combining guidance from a mix of VC's inhouse mentors and external experts, field immersion activities, with funding aspects covered by specific CSR and governmental partners.

Table 4.8: *Sample of programs/services offered by the VC ecosystem to ventures at different stages.*

Stage of Commercialization	***Offered by VC inhouse***	***Offered by VC in partnership with others***
Early stage *(Ideation, Conception, Seed funding)*	• Pre-incubation services (Ignition, Kickstart) • BIRAC BIG application guidance • NCL Research Foundation internship	• NCLTEC Club (led by students of NCL) • NSTEDB & TDB seed support schemes • Mentorpool.org • Pune Inventors Network (hosted by IPFACE) • ACTIV workshops (organized with AcceleratorIndia) • CII Biotech Research Centre
Mid-stage *(Proof of concept, Prototype)*	• IP Facilitation Center (IPFACE) • Prayashala (for NIDHI-PRAYAS grantees)	• NIDHI-PRAYAS (supported by DST & SINE, IIT Bombay) • Biobank services (association with Linqlabs) • CAMS (with support from DBT-BIRAC) • Access to NCL's analytical services
Late stage *(Viable product, Manufacturing, Revenue generation)*	• Website development and maintenance • Facilitation and regulatory approvals	• Trial manufacturing (Medtech Cleanroom) • Investor mock pitches • Investor Readiness program
Covering all stages	• Lab2Mkt Program • Associate Incubatee Program (AIP) • Soft Landing Program • HR Helpdesk services	• Bioincubator (supported by BIRAC) • NIDHI-EIR (supported by DST) • NIDHI-COE (supported by NSTEDB)

Underlying the wide range of services (or programs) offered by the VC ecosystem was a broad spectrum of activities. Though the VC ecosystem offered TBI as a combined value proposition, unbundling the services indicated a combination of activities performed by both VC and its partners. Seen that way, orchestrating the VC ecosystem involved a mix of all four thematic activities: consolidative, discursive, cognitive, and performative.

Consolidative activities of ecosystem orchestration

The VC ecosystem has undertaken several consolidative efforts, such as expanding its service portfolio by adding services in the form of new programs (like the Investor Readiness Program), implementing incubation services in response to being chosen as the preferred implementation partner (for funding programs such as the BIRAC BIG grant), coordinating with ecosystem partners in leveraging their expertise (such as workshops conducted by faculty members). In undertaking the above activities, VC has, over the years, added to its in-house resources or facilities and brought new partners onboard.

Program designing work is an essential consolidative activity that orchestrates the VC ecosystem. By being the anchor firm in the ecosystem, VC was responsible for bundling services into program offerings. Programs were integrated offerings consisting of a well-defined set of TBI services involving VC in-house facilities and external partners. Programs provided a clear and objective understanding of workflows, enhanced predictability in outcomes, and drove alignment between expectations and outcomes. Four notable programs designed and implemented by VC are explained below:

- The Lab2Mkt Program nurtured ventures from idea to conception. The program is conceived as involving three stages of activities: (a) business model stage, involving technology and market research, preliminary business planning, and risk identification; (b) proof of concept stage, involving seed funding, market due diligence, proof of concept execution, and engaging with beta customers; and (c) operational stage, involving laying down detailed business plan, setting up executive and operational teams, and raising Series A funding. This program engaged ecosystem partners such as angels, venture capitalists, technology domain experts, IP professionals, and government funding agencies.

- The Bioincubator program was an incubation program targeted at ventures in the biotechnology area. This program, supported by DBT BIRAC, offered a wide range of services – such as lab space, office space, analytical services, advisory services, IP-related services, access to seminar series, and technical workshops – that assist biotechnology ventures in their commercialization journey. The program was overseen by a rotating council that consisted of resident as well as invited experts from the biotechnology industry.
- The Associate Incubatee Program (AIP) was an initiative to support and nurture ventures that do not reside at VC premises. The program involved various mentoring aspects – packaged as Ekalvya services – such as advice, referrals, access to resources, networking, and visibility involving both VC's inhouse and other ecosystem resources.
- The SIIP program targeted ventures that focused on solving socially critial problems. The program mentors were a mix of VC's in-house and external mentors. The program was supported through DBT BIRAC.

While program design had the apparent integrative perspective that orchestrated the ecosystem's value offering, VC also specialized in implementing its incubation services through deep-touch mentoring. Deep touch mentoring involved deep engagement of a VC in-house mentor with the SBV, which typically involved high levels of interaction and extensive guidance. This was illustrated by an interviewee, "we have deep touch mentoring, where we can go fairly deep, but we will not spoon feed. That means people do their own thing, but we give them all the tools, we will show them, illustrate to them, what they can think about all of those things." Deep touch mentoring is of the nature of orchestration as it consolidates several aspects of TBI into a single and coherent workflow and continually engages with different partners to realize the ecosystem value proposition of effective incubation.

Discursive activities of ecosystem orchestration

VC has a roster of awareness events that it rolls out annually, amounting to over 300 events in a calendar year. VC has an internal registry of individuals or organizations that have subscribed to their mailing service. They contacted the subscribed audience with flyers and announcements on their awareness events. For instance, as VC was an implementation partner in specialized funding programs such as NIDHI-PRAYAS and BIRAC's Biotech Ignition Grant (BIG), VC's in-house team of mentors ran awareness events when the application window for those programs opened. The events would typically start with an introduction to the VC ecosystem and its relevant services.[20] In doing so, VC was spreading the word about its ecosystem being a chosen partner and weaving the narrative around its incubation services, which are the ecosystem's core value offering.

Another instance of discursive orchestration was related to the end-to-end handling of Corporate Social Responsibility (CSR) activity. VC employed dedicated resource person(s) to leverage its capability of using CSR grants as funds for TBI support. The resource person scouted for companies with an inclination for CSR sponsoring and reached out to them with an offer for engagement. In doing so, a narrative of VC as a channel for consuming CSR grants was created, orchestrating the inclusion of new (CSR) partners within the collective. However, VC closely monitored CSR grant-funded TBI activities with regular audits. The audit reports were shared with the CSR granting organization which, in the words of an interviewee who anchored the CSR

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[20] Some awareness events (like the event by VC AnalytiX on Gas Chromatography) also include hands on exercises, which serves to deepen the force of the narrative and can almost take it to a cognitive level.

grants group at VC, created an image of transparency and trust that enhanced the likelihood of further collaborations.

A third instance of discursive orchestration was the narrative created around awards and recognition that VC has been endowed with over the years. Notable among them were the awards (such as the National and AABI awards) that established VC's excellence in TBI execution. While VC was a non-profit entity with a stated commitment to contribute to social/national benefit, advancing an image of being a well-recognized TBI ecosystem created a strong reputation that attracted more funds and other complementary partners. Having more partners enhanced the range of services offered and, hence, orchestrated an improved value proposition.

Cognitive activities of ecosystem orchestration

As seen already, VC indulged in narrative activity with very high intensity. In other words, VC consistently reinforced the message of its effectiveness as a TBI ecosystem on several occasions and through different channels. Such strong messaging would have a cognitive impact. However, the relevance factor ensured that VC's persistence did not become spam. VC ecosystem events were organized in response to an upcoming funding call or an open grant application. Hence, VC's intense narrative-creating activity took on cognitive dimensions. To further reinforce legitimacy, VC invited entrepreneurs who had graduated from VC's TBI program to share their experiences. Some of VC's events were exclusively expert-speaker driven (e.g., M-clinic, R-clinic), to which either an experienced industry practitioner or a senior faculty member from a reputed academic institution was invited. By endowing helpful knowledge to the participants, such events went beyond mere narrative setting.

Similar to how awards orchestrated discursively, accreditations orchestrated cognitively. This is because accreditations provide legitimacy to an entity in the mind of an observer. Credibility Alliance has accredited VC under its highest category – Desirable Norms. Credibility Alliance is a national consortium of voluntary organizations committed to good governance and accountability principles. Whereas being a non-profit entity endowed VC with the neutrality and integrity necessary to be a focal player, accreditations deepened the sense of integrity. They created confidence in the minds of potential partners and participants towards being a part of the VC ecosystem. In that respect, accreditations became acts of orchestration.

Strategic partnerships drove cognitive orchestration further. While accreditations established the legitimacy of VC in-house capabilities, strategic partnerships established the legitimacy of the collective. The VC ecosystem had several strategic funding partners – like BIRAC, TDB, and NSTEDB – that provided seed funds and early-stage grants. These partnerships endowed immense legitimacy for the ecosystem as a viable ground for SBVs to incubate. Thus, strategic partnerships of the VC ecosystem with seed funding agencies orchestrated confidence in the ecosystem's value proposition.

Performative activities of ecosystem orchestration

The journey of SBVs is fraught with unpredictability and often guided by serendipitous findings. In this respect, some VC staff believed that the cafeteria and corridors of VC were as germane to inventive work as the meeting rooms or laboratories. Thus, spaces facilitating informal discussions were seen as beneficial to the (primarily resident) incubatees. Thus, establishing resource centres such as the library and facilitating the formation of clubs (such as the NCLTEC club) that provided platforms for informal exchanges became acts of orchestration that enhanced the value proposition of successful incubation.

VC ecosystem included fieldwork as an essential part of many of its programs. Fieldwork was that activity where a mentor accompanied the entrepreneur team(s) as they immersed themselves in an actual market situation. An excellent example of fieldwork execution was seen in the SIIP, where the mentor and (wannabe) entrepreneurs engaged deeply with a field setting. As described by the (in-house) SIIP anchor, the field immersions not only facilitated the generation of a wide range of ideas from the participants but also provided an opportunity for building a relationship with field members. Over time, the field members became a part of VC's ecosystem as stakeholders. Hence, field immersion became performative orchestration that enhanced the scope of the ecosystem's value proposition.

Another instance of performative orchestration was activities undertaken by VC as part of catalysing its TBI process, and which precipitated ecosystem-wide impact. Two examples of such activity were lead user testing and tool automation. Both these activities were not necessitated in the ordinary course of incubation but were undertaken as additional measures to enhance effectiveness. Both activities were, in a way, occasioned by the COVID-19 pandemic. The lead user testing activity involved VC becoming an early adopter of one of its incubatees product(s). One instance was a product that involved spot testing of individuals for COVID-19 symptoms. VC installed the product at the entry point of its campus and used it to test its staff daily. By demonstrating the effectiveness of its incubatees products, VC was indeed demonstrating the viability of its own TBI. On the other hand, an instance of tool automation was the usage of Google Docs to track TBI progress. This was undertaken during the pandemic when incubatees could not physically visit the VC campus. VC innovated by creating online mentoring logbooks where every aspect of progress was tracked. The logbook became an excellent audit trail to analyse the incubatees' journeys and evaluate the effectiveness of the TBI program design. Thus, some activities undertaken to catalyse effective TBI implementation went on to orchestrate the ecosystem by demonstrating the viability of the overall TBI program design.

Thus, as described in the case report above, an ensemble of orchestration activities was found in the VC ecosystem. Analysing the activities through the four thematic aggregates provided a systematic approach and enabled the visibility of higher-order linkages. Also, the systematic approach enabled the drawing of process maps, which will be discussed in the next chapter (Chapter 5).

4.3.2. MV ecosystem case

Upon his elevation as Mayor of Erlangen in 1996, Siegfried Balleis heralded several initiatives to nucleate and nurture medical technology innovation in the region. It took about a decade for Balleis' efforts to crystallize into a consolidated organizational form, a *Verein* (association) that took an ecosystem perspective to the region and embarked upon a cohesive strategy to shape and develop it as such. That organization was called Medical Valley (MV), with a stated goal "to pursue a commonly defined innovation strategy, [and] create solutions for the healthcare challenges of today and tomorrow… aimed at strengthening the innovative power of our partners to make a lasting contribution to improving regional economic strength and competitiveness." Medical Valley aspired to become, in the long term, a model region for healthcare research, services, and innovation.

The ecosystem's value proposition was facilitating MedTech innovations that delivered novel and holistic healthcare solutions. To do that, the leaders of the region envisaged leveraging the ensemble of functionally specialized partners – such as large businesses, hospitals, research universities, non-university research centres, start-ups, regulatory agencies, insurance companies, and SMEs – in a non-hierarchical fashion using a mix of formal contractual obligations and informal collaborative mechanisms. The partners complemented each other in ways that facilitated the delivery of several collective value offerings. Figure 4.6 illustrates how various ecosystem participants were positioned and contributed toward the combined value proposition, focusing on the focal role played by MVEMN.

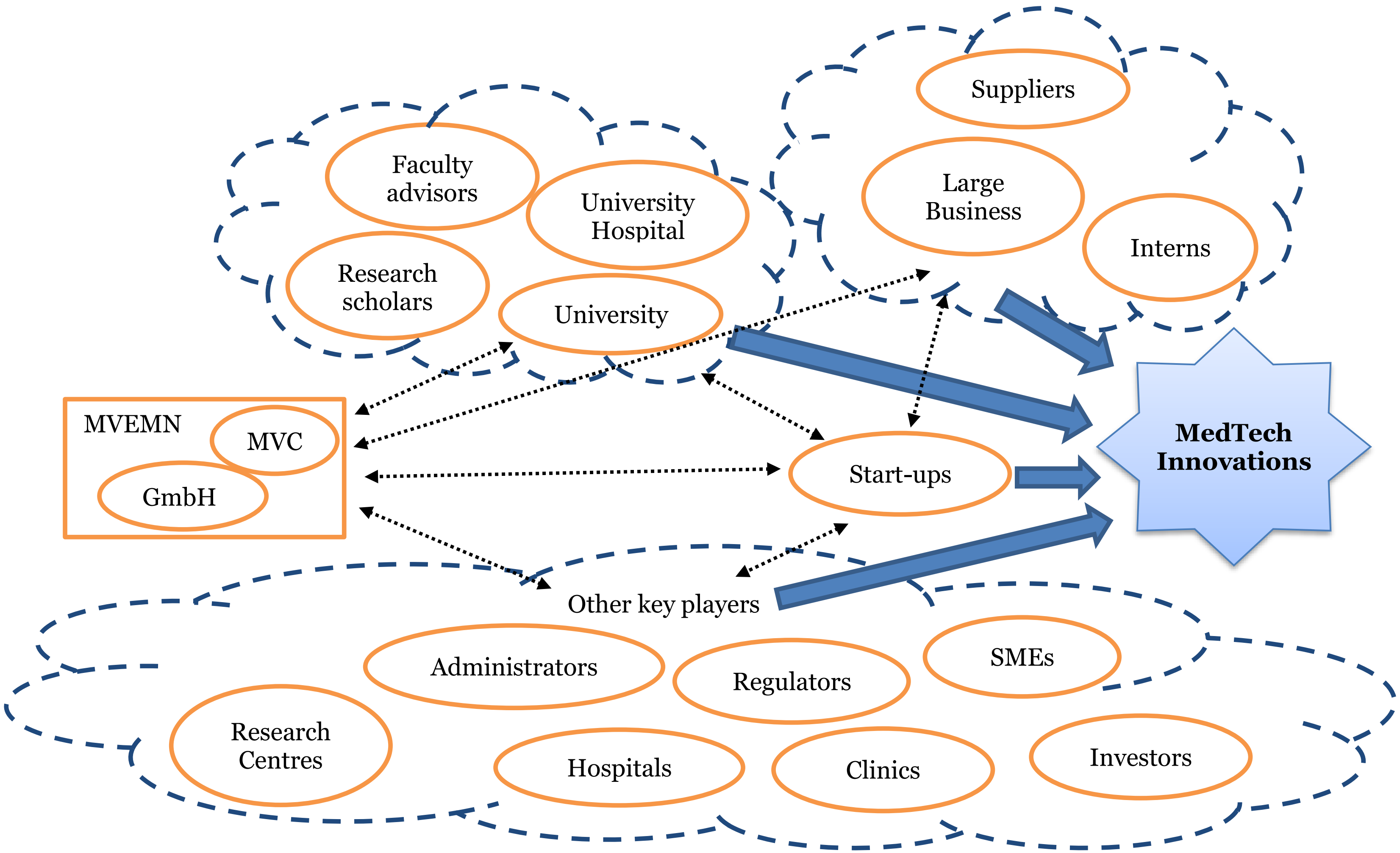

Figure 4.6: *Stylized schematic of the MV ecosystem. Thick arrows denote outcomes. Dotted arrows denote collaborations.*

4.3.2.1. Evolution of the MV ecosystem

The roots of the MV ecosystem's integrative mission lay in the visionary leadership of its founding members. As part of their administrative responsibilities, they were concerned with nurturing and enhancing the overall economic condition of the region. One of Balleis's initial attempts was to evoke networking from the people in the region. To this end, in 1999, the city of Erlangen organized around 150 events on medical and health topics while dedicating the year to the theme "Medicine-Technology-Health."[21] Further, Balleis leveraged his close connections with Edmund Stoiber, then prime minister of the Free State of Bavaria, and Heinrich von Pierer, then CEO of Siemens AG, to co-construct credibility for the region's innovative potential.[22] Balleis also found a strategic partner in the region's *Industrie- und Handelskammer* (Chamber of Industry and Commerce), which, in its lead-up to designing a start-up competition in 2000, had developed a model for a business incubation centre. That model became the blueprint Balleis used to bring together funds from the *Sparkasse* (local savings bank) and further assistance from the Bavarian government. Medical Valley Center was established in May 2003 as a business incubation centre.

The business incubator (MVC) gained such quick traction that it had to be doubled in capacity within two years of its founding. Finally, on 18 January 2007, Medical Valley European Metropolitan Region Nuremberg (MVEMN) was formally set up as an *eingetragener Verein* (registered association), with prominent actors of the region

[21] The precursor to this event was the competence initiative (in medicine and pharma) which had already been rolled out in 1996. The competence initiative invited scientists, entrepreneurs, and public sector officials to congregate, hosted by different companies in the region, where ideas would be presented and discussed.
[22] Balleis narrates of a fortunate incident that gave flight to his vision. In 1997, Siemens AG announced plans to build a new medical technology factory on the Röthelheimpark campus in Erlangen. That would be Siemens largest project after the German reunification. That investment by Siemens entailed two significant benefits for Balleis' vision. On the one hand, it enhanced the strategic cooperation with the Bavarian government as it created a positive impression of the region's capabilities in medical technology; on the other hand, it greatly enhanced the reputation of Erich Reinhardt who was the medical technology division's head at the time.

constituting its board. However, MVEMN was still a networking organization at this time. In 2008, Erich Reinhardt moved out of Siemens and took up the chairmanship of the MVEMN. This was the time when the German federal government was running a contest – *Spitzencluster-Wettbewerb* – to identify clusters of excellence. Jürgen Schüttler, dean of the medical faculty at FAU, had made an application to the contest representing Erlangen, which failed. Finally, when a revised application was made by MVEMN's board, in collaboration with Schüttler, with an expanded representation from the EMN, the application was successful. MVEMN became a focal player in the region, earning a national-level prominence of excellence. Indeed, the MV ecosystem has been attracting interest from various actors distributed in the region. The membership of the ecosystem has seen steady growth over the years. Figure 4.7 shows the trend in membership growth in recent years.

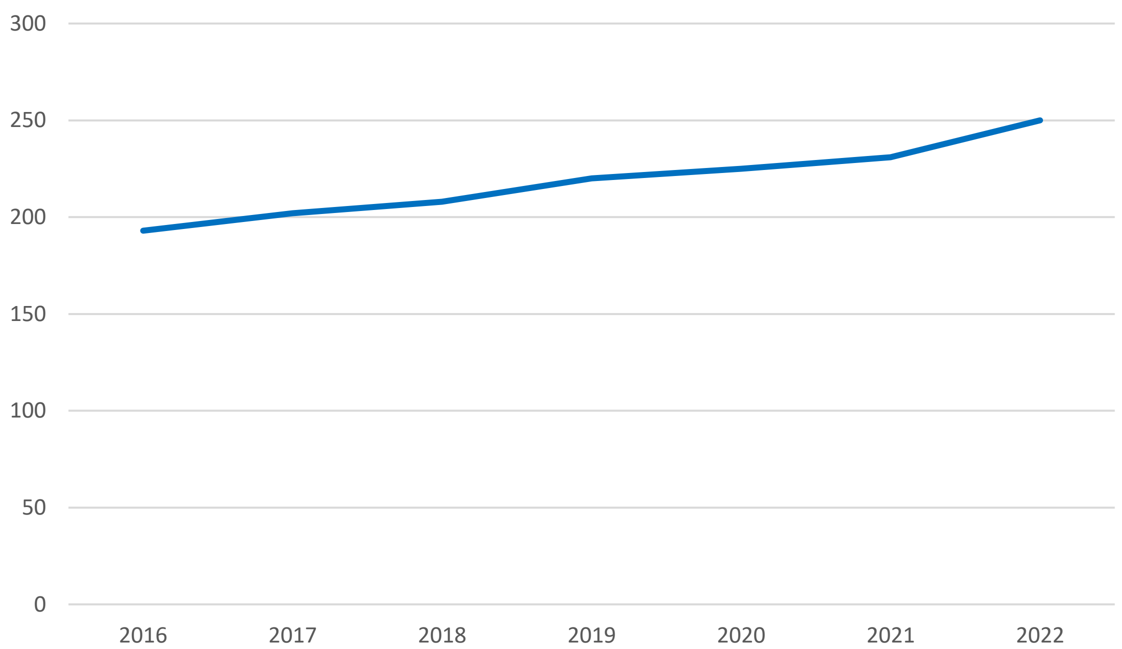

Figure 4.7*: MV ecosystem members count by year (including paying and non-paying members). Source: MVEMN internal documents.*

Over the 16 years of its existence, the MV ecosystem grew in the size of its membership and significantly diversified (and deepened) its service portfolio. MVEMN started as a networking organization focused on arranging interaction events. Gradually, it began arranging innovation-focused events such as hackathons and bar camps. Then, it pursued connections with funding sources, such as public grants and investments in the region, to provide better guidance and assist its clients with market access. Then, it started consulting activities aimed at incoming or outgoing internationalization, i.e., either companies from abroad that seek to enter the regional MedTech ecosystem or local companies that aspire for the markets outside Germany. MVEMN spawned initiatives such as the Digital Health Innovation Platform (dhip)[23] and the Digital Health Applications Center (DMAC)[24] that specialized in providing focused assistance such as clinical studies and consulting-related services.

MVEMN leveraged the extensive network of personal connections that characterized the region to grow its service portfolio. For instance, the dhip initiative was led by Tobias Zobel, who has worked extensively with regional start-ups and led the ZIMT for several years. Similarly, the head of strategy at the DMAC initiative was Matthias Rass, who has been a part of FAU's chair for innovation and value creation for several years. By incorporating individuals deeply embedded in the region, MVEMN continued to build deeper roots and reinforce its position as a focal player in the ecosystem (Granovetter, 1985; Uzzi, 1997).

At the time of this dissertation, the MV ecosystem can be said to have attained maturity as the structure and operations of the ecosystem seemed to have reached a reasonably stable state. While participants continued to move in and out of the ecosystem constantly, and new niches (Pierce, 2009) were occasionally formed, the overall structure of the ecosystem (Adner, 2017), its governing logic (Jacobides et al.,

[23] Dhip, founded in 2018, was a joint initiative between MVEMN, FAU, Healthineers, and University Hospital Erlangen aimed at advancing research and innovation in the area of digital health, especially through leveraging curated clinical data. Dhip was envisioned as a platform that can offer services to foster innovation in collaboration with external partners.
[24] DMAC was founded by MVEMN in 2018 to advance research in patient-centered digital health solutions. To this end, DMAC undertook research projects and offered consultation services in the field of digital health, with a focus on digital health providers that sought to enter the German healthcare market.

2018), and the underlying processes of interaction (Spigel & Harrison, 2018) remained stable throughout the study.

4.3.2.2. Orchestrating the MV ecosystem

In order to manage the deepening service portfolio, MVEMN's organizational structure also underwent significant changes. For instance, by its statutes, the MVEMN association was prohibited from seeking profits or doing investments. Hence, Medical Valley Solutions GmbH was founded in 2013 as a for-profit entity. The staff at MVEMN freely circulate between the two entities. The GmbH entity provided, amongst various consultation activities, accelerator services for helping in commercializing healthcare innovations. Also, MVEMN has been steadily broadening its footprint in the EMN by establishing centres at Bamberg, Forchheim, and Amberg-Weiden. In sum, MVEMN has sustained a consistent growth trajectory in pursuit of its strategy of enabling the region to be seen as a model for MedTech innovation. Orchestrating the MV ecosystem involved a mix of all four thematic activities: consolidative, discursive, cognitive, and performative.

Consolidative activities of ecosystem orchestration

MVEMN followed a three-pronged integrative strategy that was cohesive, coherent, and consensual. Cohesiveness came from the fact that MVEMN did not bring many research capabilities to the table; most of the specialized services come from its ecosystem members. Hence, whenever a new topic came up for discussion, MVEMN has always looked to get together the right people to discuss and evaluate the topic. One of the MVEMN's CEOs pointed out that a mutual understanding between them and their members formed the basis of their ecosystem. MVEMN's integrative approach was complemented by the growth in its membership that brought deeper network connections and, hence, put MVEMN in the driver's position to pursue a cohesive strategy for ecosystem development.

Next, MVEMN's ecosystem strategy aimed at coherence insofar as bringing together complementary partners is concerned. An instance of coherent strategy enacted by MVEMN was the successful pursuit of Gaia-X funding from the German Ministry of Economics. Eleven partners from MVEMN's network were brought together in a complementary fashion and created a winning proposal in just about 2-3 weeks.

Finally, MVEMN followed a consensus-based methodology for designing and implementing its strategy. For instance, when MVEMN had to implement a new strategy to sustain their organization beyond the initial public funding from the excellence cluster award, they ran a member survey to understand the needs and expectations of their members from their organization. Also, MVEMN has periodically organized combined strategy exercises with its members. Thus, MVEMN's strategic activity was a consolidative activity undertaken at the ecosystem level, often leading to new directions, and uncovering novel affordances.

Another consolidative activity was finding gaps that, manifesting as holes in the ecosystem fabric (e.g., Ahuja, 2000), can render the ecosystem's value offering suboptimal. Uncovering these holes can provide opportunities to incorporate new services to enhance the overall value offering. For instance, MVEMN facilitated an open innovation initiative involving regional actors to discover new business opportunities. Borrowing from Autio, Nambisan, Thomas, & Wright (2018), I label these opportunities as affordances in the ecosystem's setup. Uncovering these affordances provided strategic direction to improve the value offering. Typical instances of consolidative processes based on affordances uncovered in the ecosystem were networking events such as Innovation Night, Franken Finance Festival, and the Competence Pool gatherings, which occasioned the coming together of interested parties in specialized settings intending to shape and enable new ideas or initiatives.

Discursive activities of ecosystem orchestration

Members of MVEMN – whether erstwhile or current – seemed to employ a nurturing perspective when referring to their partners, members, or other ecosystem participants. For instance, a core member of the dhip initiative who was part of the MVEMN team in the past observed that "Medical Valley is a network plus an administrative group which has the *pure intention* of making the members more successful. It's really an administrative group that *takes care of the needs* of its members" (interview data, emphasis added). Core members of MVEMN echoed this perspective. The effort, it seems, has been to articulate a narrative of the ecosystem as a collective where the strong help the weak, and of MVEMN as a benevolent caretaker of the collective.

Another discursive process involved the creation of a broad narrative of the ecosystem being a leading-edge arena for MedTech innovation. In doing so, MVEMN has attempted to position its ecosystem within the market's competitive landscape. Instances of this discourse were seen in persistent mention of various awards won by the MV ecosystem – notably, the "cluster of excellence" award from the German federal government and the "digital health hub" award from the Federal Ministry for Economic Affairs and Energy – in outreach initiatives, through handouts, brochures, and banners at various events coordinated by MVEMN.

Another instance of a discursive activity was benchmarking. One of the MVEMN's CEOs mentioned the benchmarking activity: "we are working together with the Bavarian ministry of commerce on this regional Bavarian-base level. There we have to do some benchmarking. And benchmarking is always nice because there you have to provide the figures to certain parameters that ministry wants" (interview data). By agreeing to participate in benchmarking at a state level, MVEMN has attempted to showcase the quality of the ecosystem's outcomes. In doing so, it has materialized the narrative of quality-based discourse.

Cognitive activities of ecosystem orchestration

A typical instance of cognitive orchestration is legitimizing activity. MVEMN sought to legitimize the MV ecosystem's identity in several ways: (1) by constituting a board of members consisting of "the who's who of the region" (excerpt from an interview with an MVEMN core member); (2) pursuing the proposal for being a part of EIT Health initiative of the European Commission so that MV ecosystem can build connections with various excellence centres across Europe; (3) partnering with the incubator Zollhof in its successful application for the national digital health hub. All of these activities qualify to be orchestration on the part of MVEMN as they enhance the 'brand value', so to say, of the MV ecosystem as the 'Go-To' region for MedTech innovation.

MVEMN has attempted to gain legitimacy (as an orchestrator) by recruiting critical actors in the ecosystem. In its initial days, MVEMN founders were keen on getting Erich Reinhardt to helm the collective. Through his tenure in leadership positions at Healthineers, Reinhardt gained a strong reputation for effective leadership in the region. As a founding member of MVEMN articulated, "Professor Reinhardt is a unique person that is not only a scientist but also a professor and entrepreneur. I think, all over Europe, there would not be another man or woman with this competence he has… [recruiting Reinhardt] was, I think, the breakthrough for this association because I have then a wonderful scientist in the field of medical technology and a wonderful entrepreneur in one person."

Though Reinhardt's presence built trust and eminence for the MVEMN and enabled their successful pursuit of the excellence cluster award, there was more to be done. Brand building is essential to cognitive orchestrating processes, as the brand is symbolic to internal and external audiences (Schultz, Hatch, & Ciccolella, 2006). MVEMN, in its discursive activity of outreach, was targeting visibility and brand building by constantly projecting its status as a cluster of excellence, showcasing the prominent members that were part of its organization, and the quality of service it adhered to. Thus, while external actors were attracted by the brand and sought to become part of the ecosystem, internal partners trusted the ecosystem to deliver quality partnerships.

Performative activities of ecosystem orchestration

MVEMN demonstrated various performative processes of orchestration that shaped the MV ecosystem's value proposition in different ways. One of the early acts that shaped the regional ecosystem was including the entire EMN in the excellence cluster application rather than focusing only on the city of Erlangen. This brought several actors into the mix and incorporated new competencies into the integrated offering. As one of the CEOs of MVEMN observed, "at the beginning, we had more or less our contacts in Erlangen and a little bit around. Over the last year, we enlarged our networks, and we are started to define where the strengths are, or the focus points of MedTech in the region. For example, in Forchheim there are many productions of MedTech, and so we were able to install this Medical Valley Center there in the city of Forchheim. In Bamberg, there is not so much start-up competence but there are competencies in hygiene technology, for example, there is competence in digital health topics in a few and there's competence in education of medical staff. We said okay, let's make a kind of application centre where companies can go and get consultancy in different topics." Winning the excellence cluster award from the German Federal Ministry of Education and Research underscored the viability of the expanded ecosystem.

Another significant performative activity was initiatives undertaken by MVEMN toward operational sustainability. The initial R&D pot of Euro 100M that was available from the excellence award lasted for roughly five years; hence, MVEMN leadership needed to enact a long-term strategy to make the ecosystem economically sustainable without having to depend on recurrent state funding. While MVEMN continued its close collaboration with the Bavarian government, a deliberate strategy was implemented to deepen its service portfolio. As shown in Table 4.9, MVEMN has continually expanded its service offerings over time – adding facilities, embarking on new partnerships, and establishing new initiatives. Creating a profit-oriented offshoot from MVEMN – the Medical Valley Solutions GmbH – was also an act of performative orchestration that demonstrated the viability of the revenue-generating model and economic self-sufficiency.

Table 4.9: *Expanding portfolio of MVEMN.*

Year	Facility added / initiative started / partnership initiated
2003	Medical Valley Center (MVC) was established in Erlangen. MVC was the incubator component responsible for startup support. The founding name for MVC was *Innovationszentrum Medizintechnik und Pharma*.
2007	Medical Valley European Metropolitan Region Nuremberg e. V. (MVEMN) was founded to coordinate with all stakeholders. MVEMN is the orchestrating entity of the MV ecosystem.
2010	• Winner of the Federal Ministry of Education and Research national excellence competition. Received $40M in funding. • Branded as Leading-Edge Cluster in medical technology.
2013	Medical Valley Solutions GmbH was founded.
2016	Extended MVC to Forchheim, focusing on the intersection of medicine and IT.
2017	Recognition of MVEMN (along with Zollhof Tech Incubator and Health Hackers) as Digital Health Hub by the Federal Ministry of Economic Affairs and Climate Action
2018	Establishment of the Digital Health Innovation Platform (d.hip) in Henkestraβe 127, Erlangen
2019	The Digital Health Application Center (DMAC) was founded in Bamberg
2021	The Institute for Healthcare Robotics and Automation (IFOHRA) was founded as a Medical Valley Center Bamberg component.
2021	Partnership between MVEMN and MEDTEQ+ (Canadian Consortium for Industrial Research and Innovation in Medical Technology) to advance medical technology research into the domain of AI
2022	Medical Valley Academy was established as an initiative to offer online learning and training content regarding accessing the healthcare market.

While, on the one hand, MVEMN leadership has pursued a strategy of deepening its service portfolio, they have also been looking out for new topics to embark upon. For instance, the integrated care concept has been a topic that has been consensually approved for strategic pursuit. If proven viable, the topics can percolate and add to MVEMN's service portfolio downstream.

An important performative activity has been creating new initiatives or platforms in collaboration with ecosystem members. Two such initiatives were the DMAC and dhip. These initiatives emerged as responses to filling gaps in the ecosystem. For instance, with the rise in digital health applications – especially after the Digital Healthcare Act of 2019 in Germany – there has been a significant rise in patient-centered health applications. MV ecosystem had traditionally focused on hospital- or doctor-centered applications; hence, there was a need to create an integrated platform to offer consulting on patient-centered applications, especially in regulatory and reimbursement matters. DMAC was created to fill this need. Similarly, the dhip was created as a platform for provisioning clinical data. MedTech innovation almost always needs clinical data for validation; however, obtaining clinical data has been a serious challenge, especially for SMEs and start-ups. Dhip emerged through a dedicated MVEMN, Healthineers, FAU, and Erlangen University Hospital alliance. While dhip has begun to prove its viability through developing the Digital Twin project with Healthineers, the platform was open to providing annotated multimodal clinical data to external requestors that would need its services.

Thus, as seen in the case report above, an ensemble of orchestration activities was found in the MV ecosystem. Importantly, MVEMN acted as a focal integrating actor that, through creating an association of important stakeholders of the region, orchestrated the strengthening and sustenance of the MV ecosystem. Analysing the activities through the four thematic aggregates provided a systematic approach and enabled the visibility of higher-order linkages. Also, the systematic approach enabled the drawing of process maps, which will be discussed in the next chapter (Chapter 5).

4.3.3. UPI ecosystem case

The demonetization initiative of November 2016 created a cash shortage and propelled the adoption of digital payment solutions in India. While proprietary payments platforms (like PayTM) were gaining rapid adoption by 2017, an open network-based digital payment stack called the Unified Payments Interface (UPI) anchored by the National Payments Corporation of India (NPCI) – a non-profit entity established by the Reserve Bank of India (RBI) in 2008 – had 'silently' gone live in the months *preceding* demonetization.

Intending to boost the adoption of UPI, a committed group of volunteers came together to undertake the rapid building of a reference implementation[25]. While building the reference implementation was helmed by the Indian Software Product Industry Roundtable (ISPIRT), a non-profit think tank based out of Bengaluru, India. The implementation team comprised several volunteers from the open community and technical experts from for-profit organizations such as JusPay. The team built and launched the Bharat Interface for Mobile (BHIM) payments application in December 2016. Post-BHIM launch, UPI began gaining adoption going from 1.99M in December 2016 to 4.46M transactions in January 2017. In the following months, the UPI ecosystem grew on several fronts – increased member banks coming on board, and several payment apps going live, accompanied by a surge in transactions (from 4.46M in January 2017 to over 145M by the end of the year). In November 2017, PayTM unbundled its proprietary platform and joined the UPI ecosystem.

The actors within the UPI ecosystem coordinated in a layered fashion. Figure 4.8 illustrates how various ecosystem participants were positioned and contributed toward the combined value proposition. NPCI acted as the base layer. At the core of

[25] In software parlance, reference implementation is a software application created to demonstrate the working of a platform or product's use cases, thus, materializing how users interact with the platform and its services.

the ecosystem was the NPCI-controlled switch that routed the flow of payment data using standardized open-access APIs. NPCI's switch housed the API specifications that were the foundational infrastructure of the ecosystem and enabled ecosystem participants to interface with each other. The banks and other regulated financial entities leveraged NPCI's infrastructure to effect real-time funds transfer. The users initiated their transfer requests through software apps on their mobile devices. The software apps could be provided by third-party developers or developed by the banks themselves. The apps communicated with the banks through the NPCI central switch using standardized APIs or communication protocols.

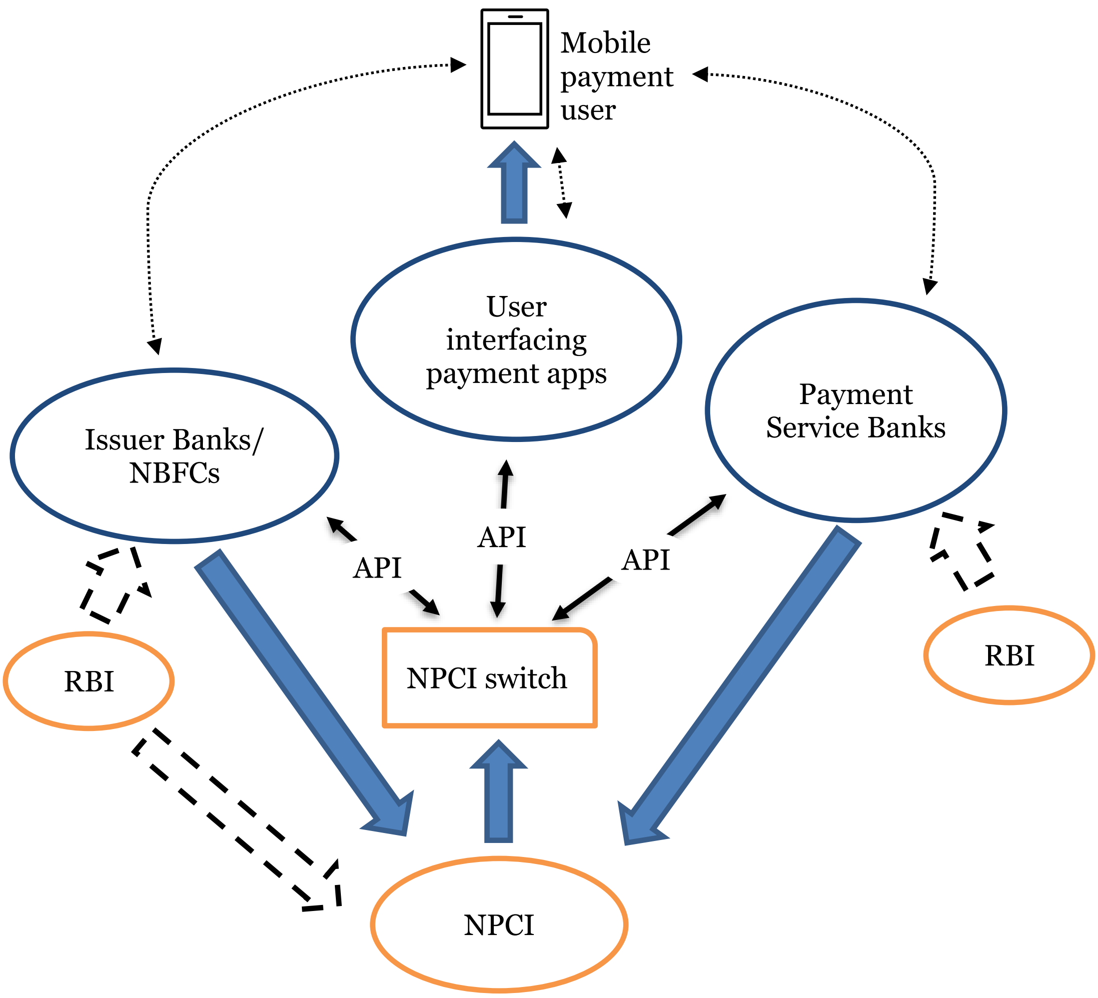

Figure 4.8: *Schematic of the structure of the UPI ecosystem. The dotted block arrow from RBI implies regulatory control. The block arrows denote governance. Line arrows denote interfaces, and dotted arrows denote dependency.*

4.3.3.1. Evolution of the UPI ecosystem

The UPI ecosystem's value proposition was to enable and facilitate peer-to-peer (P2P) and peer-to-merchant (P2M) mobile payments. To achieve this goal, several entities from the Indian techno-legal and socio-economic landscape – such as (but not limited to) regulators, the central bank, non-profit thinktanks, fintech startups, banks, nonbanking financial companies (NBFCs), and volunteers from the tech developer community – came together in a non-hierarchical arrangement, in ways that enabled the delivery of the envisioned value offering at population scale.

Several actors facilitated the emergence of the UPI ecosystem. The RBI was instrumental in providing regulatory support. In March 2005, the RBI created the Department of Payment and Settlement Systems responsible for formulating digital payment policy. The NPCI played the focal role of building the central switch and developing (and governing) its interfaces. NPCI had several pioneering financial initiatives to its credit, providing legitimacy for its focal position. NPCI built the Immediate Payment System (IMPS) in 2010, which enabled real-time inter-bank electronics fund transfer. Also, IMPS was built on top of the national financial switch (NFS) architecture which facilitated interoperability between different banks or banking systems. UPI was built on the IMPS rails, leveraging its real-time transfer mechanism. The developer community – represented by the think tank iSPIRT and several prominent actors like Nandan Nilekani, Pramod Varma, and Sanjay Jain, who had worked earlier on the Aadhaar project – played an instrumental role in coalescing volunteers for designing and building the open protocol architecture.

Buoyed by its early successes, the UPI ecosystem has continued to grow by deepening its service portfolio. As shown in Table 4.10, the UPI ecosystem has added several new services since it gained wide adoption. New services have the potential to bring new participants into the system. For instance, the launch of the UPI 123Pay service enabled non-smartphone users to join the ecosystem. Similarly, when the UPI Autopay feature was launched, it created a niche for specialized bill aggregators such as Razorpay and Billdesk. However, though new stakeholders began to engage with the ecosystem, the founding partners – i.e., volunteers of ISPIRT and technologists from the Aadhaar project – that helped to build the system continued to engage. By doing so, on the one hand, they continued to reinforce the foundational open-access principles of UPI. On the other hand, they called for increased integration of the UPI ecosystem with the broader India Stack framework. Thus, NPCI and the founding entities continued to orchestrate the evolution of the UPI ecosystem.

Table 4.10 *Key milestones in UPI ecosystem evolution.*

YEAR	MILESTONE
Dec 2007	Payment and Settlement Systems Act, which empowered the RBI and IBA to create a secure electronic payment and settlement system in the country
Dec 2008	NPCI founded
Nov 2010	IMPS launched
Jan 2014	Nachiket Mor Committee report was released, which recommended broader financial inclusion in the country.
Feb - Mar 2016	UPI Hackathon was organized as part of doing a 'soft launch.' Notably, Google and PhonePe developers participated in this hackathon, indicating their intention to be early adopters. Both Google and PhonePe went on to gain significant market share in the UPI ecosystem.
Apr 2016	UPI platform officially launched through an RBI directive
Dec 2016	BHIM app launched by prime minister Narendra Modi
Aug 2018	UPI 2.0 launched, which provided new features such as setting up payment mandates, invoice view and pay capability, and the ability to link overdraft accounts
Jul 2020	UPI Autopay launched, which allowed users to set up preauthorized mandates for recurring transactions
Mar 2022	UPI 123Pay launched, which enabled non-smartphone (or feature phone) users to join the UPI ecosystem
Sep 2022	UPI Lite launched, which introduced the facility to create an on-device wallet (that could hold a limited balance and be used to pay low-value transactions)
Dec 2022	Rupay credit card integration was permitted, which enabled users to link their credit card (Rupay only) to their UPI application. The payment facility, however, was enabled for merchant payments only.

At the time of this dissertation, the UPI ecosystem can be said to have attained maturity as the structure and operations of the ecosystem seemed to have reached a reasonably stable state. While participants continued to move in and out of the ecosystem constantly, and new niches (Pierce, 2009) were occasionally formed, the overall structure of the ecosystem (Adner, 2017), its governing logic (Jacobides et al., 2018), and the underlying processes of interaction (Spigel & Harrison, 2018) remained stable throughout the study.

4.3.3.2. Orchestrating the UPI ecosystem

The UPI ecosystem's emergence has been a case of multiparty orchestration, with regulators enabling governmental support, NPCI leveraging its past successes in building real-time transfer technology, and the coming together of the developer community under the aegis of several prominent individuals. In the words of an iSPIRT volunteer, "*it was very rare alignment of an NPCI-level CEO, somebody at the RBI level, plus major banks, plus major fintechs, plus some sort of ninjas that are working with everyone to coordinate and to pull them together*." Orchestrating the UPI ecosystem involved a mix of all four thematic activities: consolidative, discursive, cognitive, and performative.

Consolidative activities of ecosystem orchestration

In the case of UPI, a combination of regulatory thrust (RBI and NPCI) and advocacy by prominent technologists in the country stimulated consolidated processes that envisioned a 'digital-first' approach to solve societal challenges of inequality and exclusion. As observed by Gopalakrishnan, Dayasindhu, & Narayanan (2022), the growth of IT prowess in India has been a long and arduous journey (over several decades) shaped by the persevering efforts of several enterprising individuals, pioneering institutions, and forward-looking regulatory actors. This precipitated a richly interconnected tech community in the country, with specific industry bodies such as NASSCOM representing their combined voice and maintaining significant influence with the regulators. As Indian IT came of age following the turn of the millennium, some prominent technologists began envisioning the usage of technology for creating public goods (see for e.g., Nilekani, 2009). Launching the Aadhaar project in 2009 advanced the DPI philosophy and energized the tech community to envision the broader framework of India Stack. Materializing the overarching India Stack blueprint and heralding several initiatives (such as UPI, ONDC, OCEN, AA, etc.) under its umbrella may be seen as a consolidative orchestration process that was effected through an 'all-hands-on-board' approach that involved regulators (e.g., Ministry of Finance, RBI, NPCI), technologists (e.g., Nilekani, Varma, Jain), thinktanks (e.g., ISPIRT), and several organizations working together[26].

While all hands worked in coordination to effect the emergence of the UPI ecosystem, its core actors continued to enact consolidative processes (even after ecosystem maturity) by enhancing or diversifying the service portfolio. While adding new services orchestrated the inclusion of new stakeholders, refining or improving existing services had the potential to precipitate new niches. For instance, NPCI continued improving dispute resolution mechanisms to redress transaction failures better. Improving dispute resolution can become consolidative orchestration in two ways: (1) it strengthens the confidence of the ecosystem's value proposition in the minds of the users, and (2) it could precipitate new niches – like, for instance, commissioning dispute resolution provider apps – which could bring new participants into the ecosystem. In the early days of UPI, NPCI also orchestrated consolidative processes that involved changes to the APIs, such as transforming the quick response (QR) code standard and removing the facility to make payments to the Aadhaar number. NPCI's position as platform owner endowed this power to enact several consolidative orchestration processes.

[26] Amongst the organizations were also profit-seeking companies such as JusPay, Sarvatra Technologies, and Mindgate Solutions, who provided tech staff free of cost to help in implementations.

Another instance of a consolidative process was the advocacy actions undertaken by anchor individuals in the ecosystem. These individuals proclaimed themselves as ‘evangelists’ and travelled extensively around the country, participating in public events (both online and offline) and spreading awareness. While their actions were naturally helping to build narratives, their use case-based approach was readily relatable to their audience, consisting of individuals or groups interested in being part of the ecosystem. Such engagements invoked various queries and clarifications ranging from broad service offerings to finer technical details. By undertaking such initiatives, the anchor individuals sought to collaborate with potential ecosystem participants and co-create new offerings or refine technological aspects. Insofar as the evangelists brought new partners on board, their activities took the form of consolidative orchestration.

Discursive activities of ecosystem orchestration

NPCI and prominent actors from the developer community undertook narrative-creating activities such as awareness sessions, exhibitions, and exposition sprints. These events were typically attended by individuals or firms interested in being part of the ecosystem. Such narratives tended to take the form of orchestration as they targeted both breadth and depth – i.e., they were open forums that spread the message of the ecosystem to a broad audience while also targeting specific parties interested in partnering with the ecosystem. Also, in such events, potential partners often sought improvements that necessitated enhancement in the value proposition of the ecosystem. While public events created narratives that get diffused into the marketplace, Nilekani and his team of prominent technologists undertook several targeted drives where they engaged with potential ecosystem stakeholders – like, for instance, PayTM and Amazon on the app development side and leaders of banks on the banking sector side – to convince them of the benefits of adopting UPI.

Another instance of discursive orchestration was floating technical specifications in open platforms (like Github) and discussion fora (like Discord) to engage with the developer community. While, on the one hand, this discursive process helped to diffuse the DPI philosophy into the community at large, it also provided the benefit of achieving deeper reviews of the specifications, which enhanced the likelihood of delivering a robust architecture.

Cognitive activities of ecosystem orchestration

UPI ecosystem presentations typically displayed the average citizen at the centre. For instance, a fictitious character named Rajni, who symbolizes the average citizen running her micro-business, is shown as the beneficiary of various services – like instant payments, cashflow-based lending, and eKYC – delivered through the ecosystem. Further, the focus is placed on small ticket sizes that correspond with the bulk of transactions in the country. The ecosystem 'became known' as a veritable public good by constantly building a narrative around Rajni. This achieved the cognitive effect of establishing UPI as a revolution that heralded inclusion and democratization.

NPCI's sharing of daily metrics can be said to have a cognitive impact on the ecosystem as a whole. NPCI shared daily updates on transaction volume and value on their social media handles. In addition, the NPCI website provided a detailed dashboard where visitors could view UPI system performance metrics on several parameters. While on the one hand, it underscored transparency that can build trust, on the other hand, the rising volumes (and value) of transactions emphasized the growth and increasing prevalence of UPI in the market for digital payments. For instance, when NPCI's metric sharing highlighted the achievement of a milestone, it generated a 'lot of talk' that seemed to reinforce the increasing scale of UPI adoption.

Further, NPCI maintained an active presence on social media. For instance, NPCI's Twitter handle constantly interacted with individuals who raised questions, doubts, or grievances with the system and attempted to provide resolution in real time. Thus, NPCI's constant engagement with the public could have the cognitive effect of building trust in the ecosystem and viewing NPCI as its custodian.

Performative activities of ecosystem orchestration

One of the significant performative processes was reference implementation – building and launching the BHIM app. The BHIM launch led to a surge in the adoption of UPI. BHIM materialized the value proposition of the ecosystem and demonstrated its utility. Another performative process has been running hackathons that brought together a diverse population of developers who attempt to solve problems and design solutions. One of the prominent hackathons run by the anchors (i.e., ISPIRT and NPCI) of the UPI ecosystem was executed on HackerEarth from February through March 2016. This hackathon was run a little before the official launch of UPI. It aimed to involve app developers in building UPI implementations, driving adoption from day 1. However, the focus was not merely on driving adoption but also on testing the interfaces and jointly refining any rough edges. Hackathons also provided the opportunity to engage developers in finding novel ideas that could enhance the ecosystem's value proposition.

Finally, NPCI, in its role as platform owner of the central switch, undertook performative orchestration responsibilities. As the central switch was core to the ecosystem and a conduit to *all* transactions, its maintenance, and upgrade was a *performance* of orchestration. NPCI has built and published the core APIs that control access to the switch. Thus, by enforcing adherence to a set of API standards, NPCI orchestrated the coming together of the collective. Also, NPCI managed the dispute resolution processes that further strengthened its performative orchestration.

Thus, as described in the case report above, an ensemble of orchestration activities was found in the UPI ecosystem. Analysing the activities through the four thematic aggregates provided a systematic approach and enabled the visibility of higher-order linkages. Also, the systematic approach enabled the drawing of process maps, which will be discussed in the next chapter (Chapter 5).

4.4. Chapter conclusion

This chapter presents a detailed discussion of the research design of this dissertation. It presents the research question, discusses the research methodology, and explains the steps undertaken to answer the research question. In doing so, it sets the stage for the subsequent chapter, which discusses this dissertation findings.

Reviews of the literature showed that ecosystem research had done well to explain the ‘why and ‘what’ of ecosystems, but the ‘how’ had been relatively under-researched. Hence, this dissertation took a processual perspective and has attempted to understand two research questions: (1) *what constitutes ecosystem orchestration*, and (2) *what are the underlying dynamics involved in orchestrating ecosystems over time?*

A case-based methodology was chosen to explore the dynamics of ecosystem orchestration. Three representative cases that provided the researcher with in-depth access were identified, and longitudinal, qualitative data was gathered from several sources. Two-pronged data analysis – involving thematic analysis and inductive coding – were employed to analyse the data and investigate the nature and dynamics of ecosystem orchestration. Four thematic aggregates were observed, namely: consolidative, discursive, cognitive, and performative activities. Inductive coding uncovered an ensemble of orchestrating sub-processes. The two-pronged analysis facilitated a systematic approach that enabled drawing process maps and, eventually, abstracting a generalized process model of ecosystem orchestration, the details of which are the subject matter of the next chapter.

Chapter 5

A Process Model of Ecosystem Orchestration

"The business ecosystem has emerged as the new referent for strategy formation".

– (Iyer et al., 2006: 42)

This dissertation set out to understand the dynamics of ecosystem orchestration. Research had already established that orchestration is central to ecosystem functioning (Giudici et al., 2018; Mann et al., 2022; Thomas & Ritala, 2022). However, though extant research has acknowledged the highly dynamic nature of ecosystem orchestration (e.g., Dattee et al., 2018), scholars have rarely taken a process perspective focusing, instead, on static characteristics such as antecedents and consequences of orchestration (see section 3.3 for the detailed discussion). Some scholars that pursued a process perspective have focused their study on the limited scope of ecosystem emergence (e.g., Dattee et al., 2018; Snihur et al., 2018). Given that orchestration is a vital process at all stages of the ecosystem's lifecycle, this dissertation intended to study ecosystem orchestration well beyond the ecosystems' emergent stages.

Pursuant to the theory building nature of this dissertation and given that much process research of ecosystem orchestration did not exist, a case-based method was chosen (Eisenhardt, 1989a; Yin, 1994). Theoretical sampling was used to select representative cases that facilitated inductive theorizing (Miles & Huberman, 1984). A set of three cases were chosen to enhance (analytical) generalizability of the findings (Yin, 1994). The three cases – namely, Venture Center (VC), Medical Valley

(MV), and Unified Payment Interface (UPI) – were ecosystems in steady-state and had succeeded in different contexts. VC was the case of a centrally orchestrated incubation ecosystem in Pune, India, that facilitated the commercialization journeys of science-based startups. MV was the case of region-focused innovation ecosystem, focused on the Nuremberg Metropolitan Region in Germany, that fostered research and innovation in medical devices. UPI was the case of a national-level population-scale ecosystem in India that enabled real time mobile payments.

Taken together, the three cases represented appropriate examples of ecosystem play. Each of the samples had shown consistent growth over the years and reached a stable state of operations (i.e., ecosystem maturity) at the time of the study. The samples, though, differed from each other in two crucial (orchestrated) aspects: (1) the centrality of orchestration: while VC was orchestrated centrally by a single focal firm (the incubator, VC), MV and UPI ecosystems involved many orchestrating entities at work, and (2) bundling of offerings: VC ecosystem's offerings were services offered in bundles (as programs) designed by the focal firm, whereas in the UPI ecosystem participants could create their own bundled offerings within the scope of the ecosystem's norms. MV ecosystem was mostly unbundled where participants picked partners of their choice. The sample set, thus, exhibited theoretical replication (Yin, 1994).

The research focused on answering two questions: (1) *what constitutes ecosystem orchestration*, and (2) *what are the underlying dynamics involved in orchestrating ecosystems over time?* Hence, two-pronged data analysis was undertaken which involved thematic analysis (as proposed by Braun & Clarke, 2006, 2012) and inductive coding (as proposed by Corbin & Strauss, 1990; Gioia et al., 2013; Miles & Huberman, 1984). Thematic analysis showed that ecosystem orchestration was characterized by four categories of activities: consolidative, discursive, cognitive, and performative. Further, detailed orchestration process maps were constructed for each sample (as proposed by Langley, 1999). Though each sample had activity flows peculiar to its evolutionary context, common patterns of process flows were observed across the three cases. The results of inductive coding showed that *orchestrating* ecosystem involves four interlinked sub-processes, namely: constructing identity, crystallizing architecture, broadening participation, and evolving/transforming the ecosystem.

5.1. The four categories of orchestration

Thematic analysis found that orchestrating ecosystems consists of four patterns of activities, namely, consolidative, discursive, cognitive, and performative. Hence, answering the question, *what constitutes ecosystem orchestration?* Each activity pattern stands on its own insofar as it relates with a distinct objective of orchestration. Table 5.1 defines the patterns with a focus upon their objectives.

Table 5.1: *Four activity patterns characterizing ecosystem orchestration.*

Activity pattern	**Definition**	**Examples**
Consolidative activities	Processes that aim at integrating partners into the ecosystem's offering(s)	Constituting a governing council, new partner onboarding, incorporating new use cases
Discursive activities	Processes that aim at creating and sustaining narratives about the ecosystem's offering(s)	Campaigning, evangelizing, publishing reports
Cognitive activities	Processes that intend to create legitimacy for the ecosystem's offering(s)	Accreditations, awards, and recognition
Performative activities	Processes that aim at demonstrating the viability of the ecosystem's offering(s)	Reference implementation, hackathons

With respect to the studied samples, the four identified themes formed an exhaustive set though not strictly mutually exclusive. The lack of mutual exclusion is owing to the nature of activity-level data that was capture. Any given orchestration activity would be characterized by a range of actor-event sequences that was intimately (and intricately) interlinked with activities that preceded and succeeded it. Hence, there would be no clearly demarcating line of where one activity ended, and another began. Nevertheless, activity patterns were grouped into themes depending on the dominant objective that was intended. Hence, to the extent that the four themes provide a conceptual tool to delineate patterns (Negro, Koçak, & Hsu, 2010) and enable the cognitive infrastructure to group and separate activities based on their material objectives (Durand & Khaire, 2017), the four patterns can be deemed as categories (of orchestration).

5.1.1. Consolidative orchestration

Consolidative orchestration consists of those orchestrating activities that serve to integrate new ecosystem partners in such a way that their unique complementarities are leveraged towards realizing or enhancing the ecosystem's value proposition. In doing so, consolidative orchestration impacts the scope of the value proposition, either in widening the offering by incorporating new aspects or deepening the provision by strengthening existing aspects. An instance of widening was seen when the bill payments facility was introduced within the UPI ecosystem. Enabling bill payments widened the scope of UPI beyond its existing domain of ad hoc fund transfers into setting up recurring payment mandates. An instance of deepening was seen in the Venture Center (VC) ecosystem when the focal firm incorporated a CSR-focused team whose responsibility was to search and bring in CSR funds to support their incubation services. Doing so deepened the ecosystem's offering as it did not add a new niche but enriched the existing niche of funding partners.

Given that an ecosystem is a coherent collective of diverse participants (Iansiti & Levien, 2004a, 2004b), integrative activities play a critical role in creating and sustaining the collective (Helfat & Raubitschek, 2018). Consolidative orchestrating, hence, becomes a vital orchestration category as it involves activities (undertaken by one or more participants) that *coherently* create and enhance the collective. For instance, in their study of a business software ecosystem governance, Wareham, Fox, and Cano Giner (2014) demonstrated consolidative orchestrating that involved inducting partners into the ecosystem at five different control levels – with higher levels necessitating more certifications. To put it in figurative expression, if the ecosystem collective is viewed as a set of individuals sitting around a table and interacting, then consolidative orchestrating would involve bringing the *right* people to the table so as to enable, and enhance, the conversation.

In the VC ecosystem, four instances of consolidative orchestration were observed: (1) periodically reviewing ecosystem metrics with the governing council consisting of independent board of directors as well as a board of advisors. While on the one hand these meeting ensured legal compliance – thus, enhancing trust and legitimacy of the ecosystem – outcomes from the meetings often led to insights on future strategic direction for the ecosystem as a whole; (2) incorporating new capabilities or infrastructure – such as the ISO 13485-certified MedTech Cleanroom facility, Re – that were either self-owned or through partnerships which led to offering of new services or repackaging of existing programs; (3) embarking on strategic collaborations that facilitated the offering of new services, and (4) scanning for new sources of funding, such as recruiting an anchor for the CSR focused funding which served to enrich the critical niche of funds to support incubation services of the ecosystem.

In the MV ecosystem, three instances of consolidative orchestration were observed: (1) undertaking of strategic partnerships that led to collaborative projects and joint consulting exercises, such as DMAC, dhip, and GAIA-X. These partnerships were of the nature of orchestration as they integrated several actors with complementary capabilities towards enhancing the innovative potential of the ecosystem; (2) constant scanning of the region to identify and integrate hidden champions. This activity was of the nature of orchestration as it involved scanning the entire breadth of the region and, often, incorporated firms with stellar performance that significantly enhanced the ecosystem's offering, and (3) undertaking internationalization-related activities – both incoming (where foreign actors sought market access into the region) and outgoing (where ecosystem actors sought access to external markets) – which created scope for integrating new actors into the ecosystem as well as created wider visibility for the ecosystem in external markets.

In the UPI ecosystem, three instances of consolidative orchestration were observed: (1) designing the technical architecture – consisting of the 4-party workflow – which crystallized the architecture of collaboration within the ecosystem while also setting standards for interaction; (2) continuing integration of new use cases, such as UPI Lite, UPI Autopay, that enhanced the range of services offered by the ecosystem while also creating scope for new partners (such as bill aggregators) to join the ecosystem, and (3) expanding the scope of the ecosystem through bridging efforts such as connecting with other India Stack initiatives, and envisioning the integration of cross-border remittances.

5.1.2. Discursive orchestration

Discursive orchestration consists of those orchestrating activities that aim at creating and sustaining narratives about the ecosystem's value proposition. In figurative terms, where consolidative orchestration attempts to bring the right people to the table, discursive orchestration attempts to initiate a conversation and keep it going. Researchers have shown how discursive processes are entangled with the trajectory of the ecosystem's evolution. For instance, Jha, Pinsonneault, and Dubé (2016) observed that evolution of a tech-enabled ecosystem for poverty alleviation benefitted from the prevalent trends in IT which created a discourse around leveraging IT tools for social benefit. Similarly, Snihur, Thomas, and Burgelman (2018) demonstrated how Salesforce created narratives around its business model which enacted the frame that disrupted an incumbent's ecosystem and orchestrated the emergence of its own ecosystem.

Given that ecosystems are a collective of loosely coupled independent actors (Brusoni & Prencipe, 2013), fostering alignment towards a shared vision – i.e., the ecosystem's value proposition – will necessitate mechanisms to orchestrate collective action. Researchers have argued that discursive processes provide the framing to articulate collective action (Hargrave & Van De Ven, 2006). Thus, when Salesforce consistently disseminated narratives through press releases that emphasized, on the one hand, distinctiveness of their business model and, on the other hand, their leadership in the new emerging enterprise software ecosystem, their discursive attempts created frames that crystallized an ecosystem around them (Snihur et al., 2018).

In the VC ecosystem, three instances of discursive orchestration were observed: (1) advocating a (Pune) region-focused vision that served to leverage established recognition of Pune as one of the emerging regions for innovative startup activity in the country[27], while also emphasizing VC as being one of its core players; (2) transparency in auditing and reporting of the focal firm's performance, coupled with clearly laid out corporate governance policy. The periodic reporting involved public disclosures as well as reviews with the independent board of directors. These activities not only served to publicise VC's performance metrics – thus, providing a competitive positioning in the market – but also helped to gain the trust of ecosystem collaborators, such as CSR partners; (3) plethora of outreach activities that involved campaigning and awareness sessions held both onsite (at VC campus) as well as locations all around the country, advertising VC's offerings at entrepreneurial events, organizing workshops targeted at potential ecosystem users. VC organized more than 300 such events in a calendar year.

In the MV ecosystem, two instances of discursive orchestration were observed: (1)

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[27] Pune, India, has been recognized as an emerging startup hub given its rising rate of venture capital funding. See https://startupsusa.org/global-startup-cities/global_cities_report.pdf (accessed 22 May 2023)

wide range of events being organized around the region, aimed at campaigning the ecosystem's offering and providing a ground for interacting with actors (especially, startups) interested in joining the ecosystem. The events often took on a campaigning nature, showcasing MV's successes and disseminated the innovative capability of the region in an integrative fashion, i.e., describing the region's strengths in terms of the collective and not just MV alone; (2) periodic benchmarking with the Federal Ministry of Education and Research (BMBF). The BMBF is a nodal agency for sponsoring scientific research across the country,[28] and maintaining adherence to its standards provides MV the leverage to integrate with the science, technology, and R&D discourse across the country (and even beyond).

In the UPI ecosystem, two instances of discursive orchestration were observed: (1) regular – daily and monthly – sharing of ecosystem performance statistics by NPCI in the public domain. While the regular sharing strengthened the discourse of UPI's claim to best-in-class performance metrics, it also served as ground for various stakeholders to advance strategic discussions in the direction of enhancing performance and effectiveness of the ecosystem; (2) campaigning and advertising activities by RBI, NPCI, Nilekani and team at various tech-events across the country showcasing UPI performance, and its ability to democratize payments. These awareness-creating narratives frequently interleaved with the broader digital public goods (i.e., various other ecosystems under the vision of India Stack) discourse, thus, orchestrating a philosophical leverage to the UPI ecosystem.

5.1.3. Cognitive orchestration

Cognitive orchestration consists of those orchestrating activities that intend to create legitimacy for the ecosystem's offering(s). Legitimacy here is viewed from a cognitive perspective. As Suchman (1995) observed, legitimacy involves orchestration

[28] See https://economix.org/a55ets/publications/Medical%20Technologies%20-%20Benchmarking%20Report.pdf (accessed 22 May 2023)

processes that render the ecosystem's offering the level of 'taken-for-grantedness' in the minds of its audience (i.e., ecosystem stakeholders and users). Orchestration proceeds with the belief that the ecosystem's offering is the most efficient solution to user's needs and, hence, "alternatives become unthinkable, challenges become impossible, and the legitimated entity becomes unassailable by *construction*." (Suchman, 1995: 583, emphasis in original). Thus, cognitive orchestration attempts to legitimize what it believes is the best possible solution.

Given that ecosystems, typically, start with an unclear goal and need concerted collective action to progress, driving legitimacy becomes necessary to progress in the direction of the intended goal (Giudici et al., 2018; Thomas & Ritala, 2022). Orchestrators need to legitimize the ecosystem's (intended) value proposition in order to persuade key constituents to make (risky) ecosystem-specific investments. Scholars have observed that legitimacy is enhanced through activities – such as, for instance, showing an explicit willingness to support or nurture stakeholders, lowering relational barriers by being open and proactive – that enhance mutual trustworthiness amongst ecosystem participants (Giudici et al., 2018). Further, orchestrators can explicitly drive collective sensemaking through framing processes – such as focusing attention on salient outcomes – in ways that enable "the emergence of a set of mutual understandings among ecosystem participants regarding the central, enduring, and distinctive characteristics of the ecosystem value proposition." (Thomas & Ritala, 2022: 6)

Several instances of cognitive orchestration were observed in the VC ecosystem: (1) leveraging the experience and reputation of Premnath as founder director of VC, (2) setting up VC as a non-profit entity, which reinforces its role as a neutral actor, (3) establishing a board of independent directors from reputed backgrounds, including the director of NCL, thus, grounding the ecosystem's identity into an image of deep scientific experience; (4) creating centres of excellence (such as BIRAC BIG, NIDHI COE, IPFACE, TechEx.in) that are representative of specialized expertise in focused areas such as funding or regulation. Further, these centres organized awareness events in their focus area which, through discursive orchestration, deepened legitimacy; (6) gaining preferring implementation partner status in high-visibility programs that enhanced legitimacy both amongst ecosystem partners as well as in the market; and (7) gaining recognition through awards, memberships, and accreditations.

The MV ecosystem had two instances of cognitive orchestration: (1) gaining wide recognition through winning awards of national significance, namely the cluster of excellence award (German federal government, 2010) and digital health hub award (federal ministry for economic affairs and energy, 2017). While MV has been the recipient of several awards, the aforesaid two awards bear prominence as they provided a nation-wide legitimacy (with competitive positioning) for the innovative capability of the MV ecosystem; (2) collaborating with EIT Health, an EU-wide initiative, provided wide visibility, access, and furthered legitimacy of the ecosystem in the context of healthcare innovation across the EU.

The UPI ecosystem benefitted from environment events such as the demonetization in 2016 and COVID-19 pandemic of 2020, both of which provided a significant fillip to digital payments. However, while these events catalysed the growth of UPI, they do not qualify as deliberate acts of orchestration. There were four instances of cognitive orchestration observed in the UPI ecosystem: (1) launch of UPI through a notification by the RBI provided legitimacy through the stamp of approval from the central bank of the country; (2) launch of the reference implementation (BHIM app) by the prime minister of India deepened the legitimacy further; (3) early adoption by some of the large banks (like ICICI, HDFC) legitimated the ecosystem's offering and enabled it to gain wider traction; (4) founding (and ongoing) commitment of NPCI to open protocols, coupled with the role of NPCI as a non-profit entity, legitimated the image of a fair and democratic ecosystem.

5.1.4. Performative orchestration

Performative orchestration consists of those orchestrating activities that aim at demonstrating the viability of the ecosystem's offering(s). While in the initial phases of ecosystem emergence, the ecosystem's value proposition may need persuasive demonstration, as the ecosystem matures the value blueprint becomes crystallized and, hence, performative orchestration shifts towards innovating and renewing the ecosystem's offering (Thomas et al., 2022). Thus, performative orchestration is an ongoing pursuit of innovation and strategic renewal of the ecosystem. Evidently, when performative orchestration uncovers novel affordances, consolidative orchestration follows to identify and integrate new specialists into the collective (Autio et al., 2018).

Given that the ecosystem organizing form is an instrument to realize complex value propositions (Dougherty & Dunne, 2011; Kapoor, 2018), scholars have noted that ecosystems initially coalesce around a nascent vision which will need deliberate orchestration to demonstrate viability (Dattee et al., 2018). Dattee et al.'s (2018) study showed how an ecosystem's viability is clarified through joint action of the ecosystem's stakeholders. Using several technology-based ecosystems as case studies, they demonstrated that ecosystems typically coalesce around a "protovision" that can materialize in different ways, in accordance with the divergent interests of the stakeholders. However, performative orchestration, through road mapping and pre-empting, ensured the collective crystallized around a single envisioned blueprint, where orchestrators managed interdependencies and control points in accordance with *that* blueprint.

In the VC ecosystem, two instances of performative orchestration were observed: (1) designing and managing the commercialization workflow[29] for SBVs. The workflow

[29] The commercialization workflow maps the customer's journey and, hence, concretizes the ecosystem's value proposition. In line with Dattee et al.'s (2018) observations on road-mapping, VC ecosystem's commercialization workflow provided a roadmap that established control points and

was inductively arrived at in the founding days through the experience of its founding team, which then served as the roadmap for providing the ecosystem's (incubation) services using a mix of self-owned and partnered resources. Over time, performative orchestration of the VC ecosystem has attempted to strengthen the workflow by provisioning more specialized facilities and increasing the number of funding sources. (2) designing and managing incubation programs (such as, for instance, AIM PRIME, BIG BIRAC) and screening applicants that participate in those programs. Programs are bundled services catering to a specific context, either of technology or funding.

In the MV ecosystem, several instances of performative orchestration were observed: (1) running several startup competitions and arranging discussion gatherings in the years preceding the establishment of the business incubation centre that eventually transformed into the MVEMN; (2) creating and managing the innovation workflow which clarifies how different stakeholders synthesize towards realizing the ecosystem's value proposition; (3) organizing customer-interfacing events, such as hackathons, bar camps, and funding competitions, that enhance visibility of the ecosystem in the marketplace; (4) ongoing strategy exercises that involve the MV governing council consisting of key players from all stakeholders in the ecosystem. While outcome of the strategy exercises may uncover new strategic directions and lead to consolidative orchestration, arranging the exercises, in itself, is performative orchestration as it is an activity at the ecosystem-level and demonstrates the ability of the ecosystem to arrive consensus in a coherent manner.

In the UPI ecosystem, four instances of performative orchestration were observed: (1) designing the reference implementation (BHIM app) to demonstrate the working of the ecosystem's offering; (2) publishing (and managing) the core application programming interfaces (APIs) that embody the protocol of coordination within the

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clarified interdependencies among ecosystem participants. In doing so, it underscored the viability (in terms of one coherent vision) of the ecosystem's offering.

ecosystem. The UPI ecosystem employs open APIs which furthers its legitimacy as a digital public good (DPG) and advances cognitive orchestration; (3) governing and maintaining (i.e., upgrading) the central UPI switch by NPCI; (4) incorporating online dispute resolution (ODR) mechanisms that enhance the viability of the ecosystem by remedying transaction failures.

Thus, as suggested by the above discussion, the four activity themes identified from data – which represent four distinct activity patterns each with its distinct objective – form an exhaustive set that (within the context of the collected data) explains the entirety of the phenomenon of ecosystem orchestration. For sake of better clarity, figure 5.1 attempts to demonstrate the primary objective of each orchestration category in practitioner terms. Given that ecosystems are a non-hierarchical collective, each of the orchestration categories represents a focused approach to inducing collective action. As can be seen in the figure, the objective of each category stands tactically apart though from an operational perspective the categories seem to overlap.

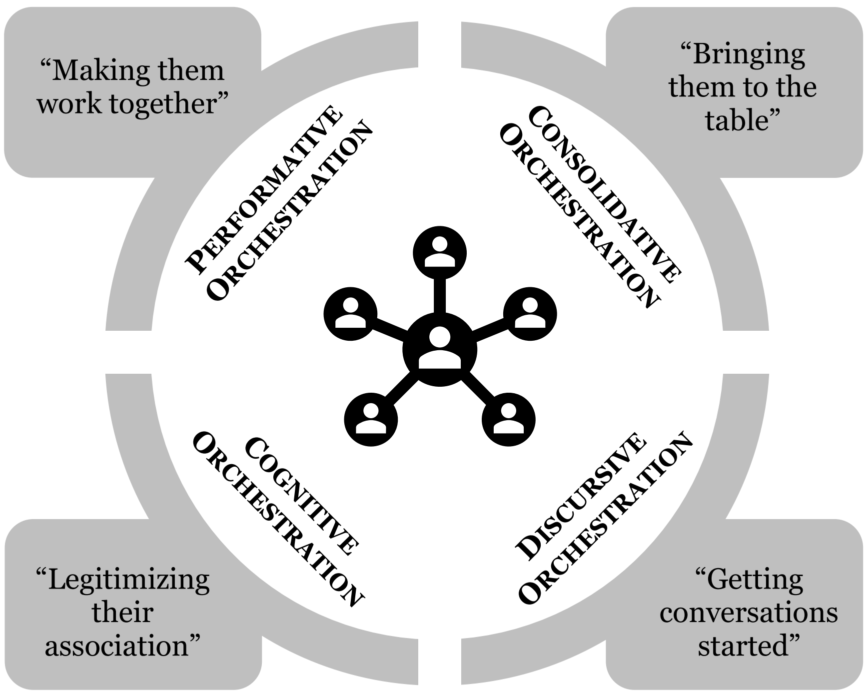

Figure 5.1*: Illustration of the distinctiveness of the objectives of the four orchestration categories*

It has to be noted that the four categories of orchestration interact in myriad ways and, hence, there is no definite sequencing between (or amongst) them. Also, though the categories may stand distinct in terms of objectives, they overlap owing to the nature of their underlying activity. Strategic outcomes are realized through a stream of decision and actions (Mintzberg & Waters, 1985) and it is impossible to clearly delineate where agent-activity sets begin and end. Hence, for instance, while discursive orchestration activities focus on shaping narratives to emphasize the combined value offering, the activities also precipitate cognitive outcomes by way of creating impressions of trust in the minds of the audience (Thomas & Ritala, 2022). Nevertheless, categories of orchestration still stand premised on the intended objective and the direct outcome. In the instance above, emphasizing the value offering is seen as the direct outcome and creating impressions is a byproduct, thus, categorizing the activity (intended for creating narratives) as discursive orchestration.

5.2. Orchestrating the three ecosystems

Identifying the categories of ecosystem orchestration enabled a systematic approach to mapping the flow of orchestrating activity for each of the three cases of this dissertation. In particular, as the four categories were observed in all three case studies, it facilitated a comparative study between the three cases. Visual mapping approach was used to trace the *flow* of orchestration in each sample (Langley, 1999). As Langley (1999) suggested, visual mapping enables simultaneous representation of various dimensions of the processes, such as precedence and simultaneity, over the passage of time.

Figures 5.2, 5.4, and 5.6 elaborate the underlying orchestration processes within the three ecosystems VC, MV, and UPI, respectively. The figures are process maps that use swim-lane diagram to illustrate the interlinked activity patterns that characterize the orchestration of each ecosystem. The figures were created using the online tool, Miro (https://miro.com/).

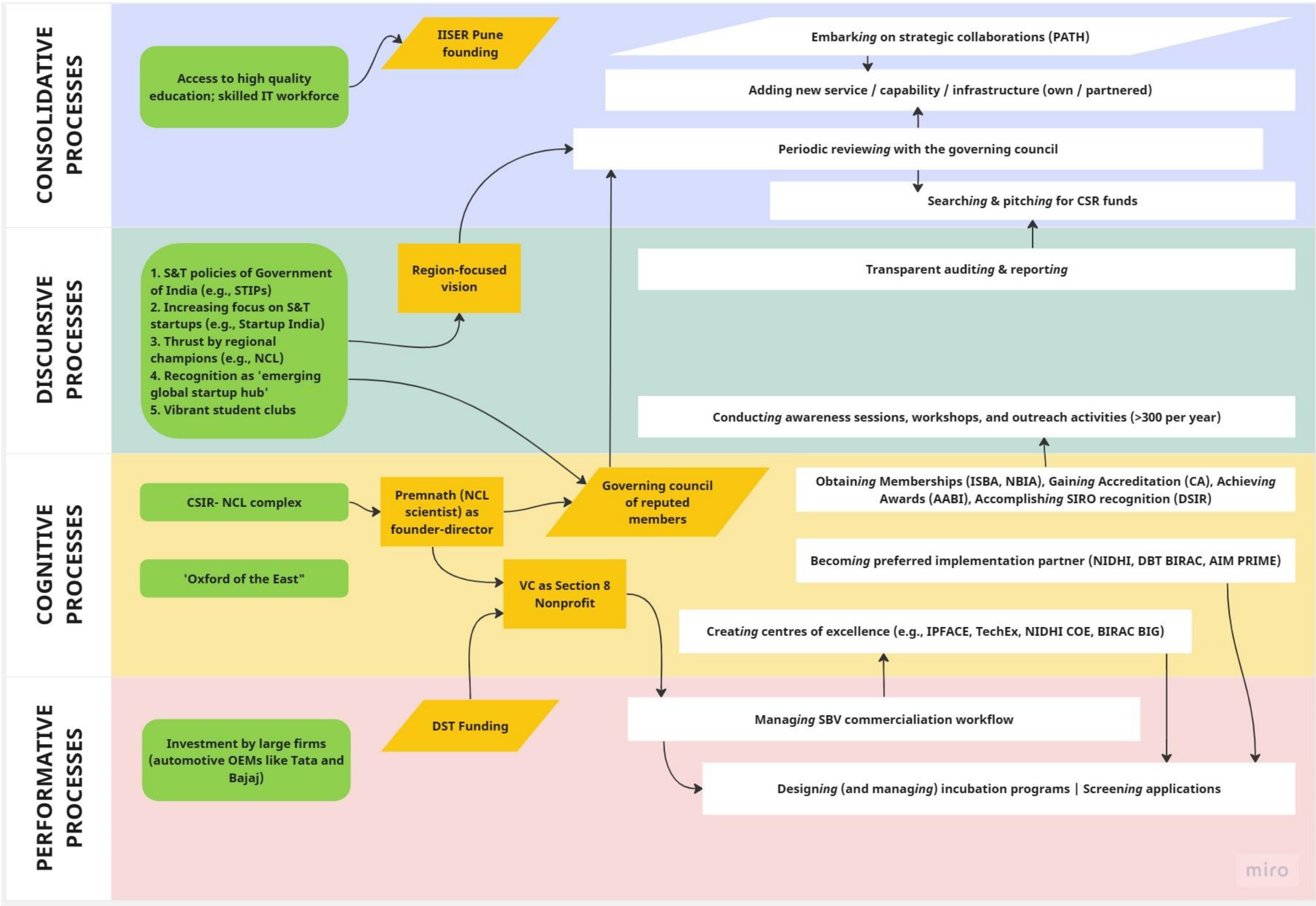

***Figure 5.2**: VC ecosystem orchestration process map*

Figure 5.2 shows the orchestration process map for VC ecosystem. The activities (which represent the descriptive codes) are listed in boxes with arrows suggesting precedence as well as linkages with other orchestration activities. The processes are depicted in a temporal sequence from left to right. Barring the set of green boxes, the horizontal axis extends from 2007 (when VC was founded) through 2022 (year when data collection ended). The vertical axis is segregated into four 'swim lanes' representing the four categories discussed in the prior section. The order of categories is chosen for mapping convenience.

The processes are color-coded to distinguish three 'temporal brackets'[30] in the evolution of the ecosystem that had a bearing on the nature of orchestration. The first bracket (rounded rectangles coloured green) represents starting conditions for the ecosystem. The processes depicted in the green 'zone' are acts of orchestration by actors prior to emergence of the studied ecosystem, but which have a bearing on the studied ecosystem's emergence. For instance, in the case of VC ecosystem (as seen in figure 5.2), the legacy of CSIR-NCL as a reputed research institution was orchestrated by NCL (and its collaborators), which provided leverage for VC when it emerged as an offshoot of NCL.

The second bracket (rectangles and parallelograms coloured Mikado yellow) represents orchestration concerned with 'founding'[31] the ecosystem. The processes depicted in the yellow zone are acts of orchestration by actors around the time the ecosystem was founded and, typically, ended when the ecosystem was formally launched. The VC ecosystem was launched when VC became formally registered as a

[30] The reference to temporal brackets is only figurative. No temporal bracketing method was used in the analysis.
[31] The reference to 'founding' is deliberate and ought to be seen as distinct from the widely researched 'emergence' phase of ecosystem. Ecosystem emergence can be a protracted process whose duration cannot be neatly defined. However, the founding phase observed in the cases of this dissertation had a short duration of 1-2 years and the founding-related orchestration processes ended once the ecosystem was established (not matured) often in the form of legal recognition.

legally recognized entity in 2007. The rectangles are orchestration processes by the focal entity (in this case, VC) while parallelograms are processes orchestrated by an ecosystem partner. For instance, funding from DST enabled VC to procure the initial infrastructure that played a vital role in its founding, hence, DST may be seen as having (performatively) orchestrated the ecosystems' founding.

The third bracket (rectangles and parallelograms coloured white) are ongoing processes that spanned across emergent and mature stages of the ecosystem. While some processes ended when maturity was attained, most continue to be ongoing through the mature stage. For instance, crystallizing the SBV commercialization workflow was critical in the emergent stage as it created a roadmap of services that ought to be offered if the VC ecosystem has to be viable in the marketplace. Once, viability was demonstrated, and some initial SBVs successfully graduated, the workflow attained legitimacy and activities that orchestrated its creation almost ceased. The rectangles are orchestration processes by the focal entity (in this case, VC) while parallelograms are processes orchestrated by an ecosystem partner.

Tracing the flow of orchestration across the four categories in figure 5.2, one can observe that while the initial conditions had orchestration across all four categories, discursive orchestration was prominent in the extant environment prior to founding the VC ecosystem. Prior discursive orchestration espoused narratives – prevalent both at the national- and regional-level – that placed impetus on SBV-based innovation and the imperative to nurture and incubate SBVs. The genesis of VC ecosystem was in such a narrative-laden environment, where its founding was orchestrated through two significant processes: (1) combining the reputation of the (Pune) region with the prevalent narrative of SBV-based innovation, while also (2) leveraging the reputation of NCL as a research institution and Premnath as one of its principal scientists. Overall, the founding orchestration seemed to have shifted from discursive initial conditions to cognitive orchestration, involving *constructing* of an identity that, through embedding personal and regional reputations within the prevalent discourse, advocated a region-focused vision.

However, once VC was established as a legally recognized entity and it kickstarted operations with basic infrastructure, post-founding orchestration shifted into a two-fold path: (1) performative orchestration of putting together the workflow, in consultation with the internal and external experts through formal and informal interactions and designing programs to implement the workflow; and (2) creating a narrative of VC ecosystem's offerings and spreading the word. Though figure 6.1 shows that ongoing orchestration involves processes across all four categories, the intensity of activity at VC was focused on performative (in designing and managing programs) and discursive (running campaigns and organizing workshops) orchestrating.

Figure 5.3 illustrates the model of VC ecosystem orchestration based on the above discussion.

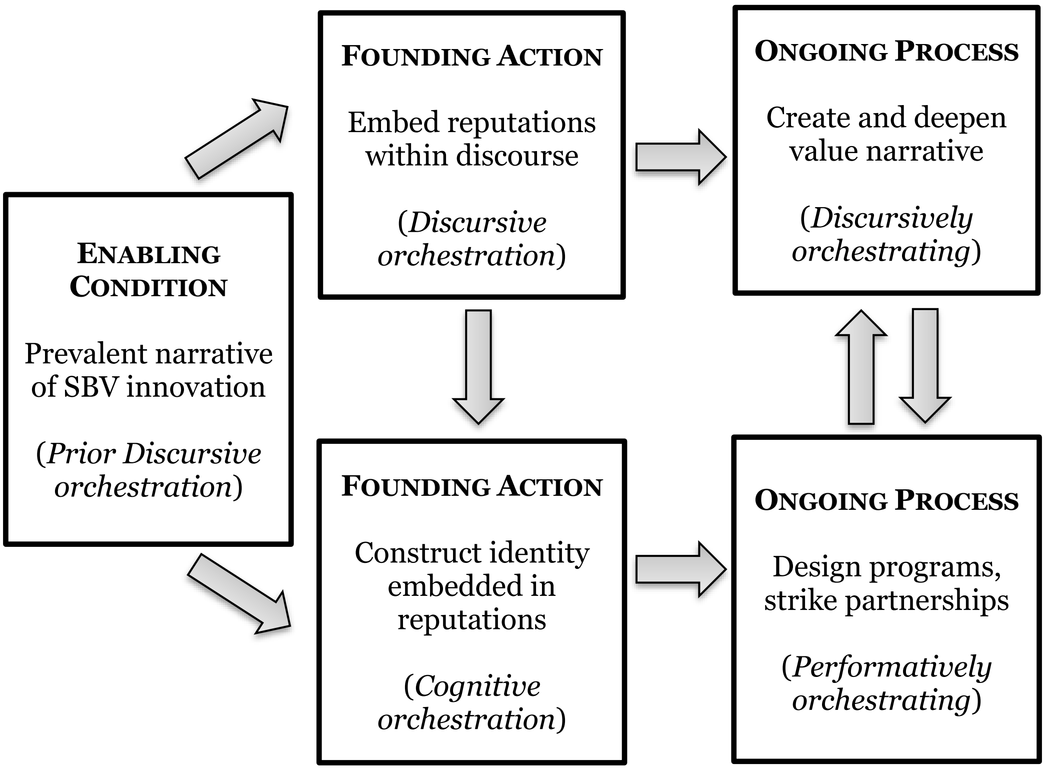

***Figure 5.3**: Abstracted process-flow model of VC ecosystem orchestration*

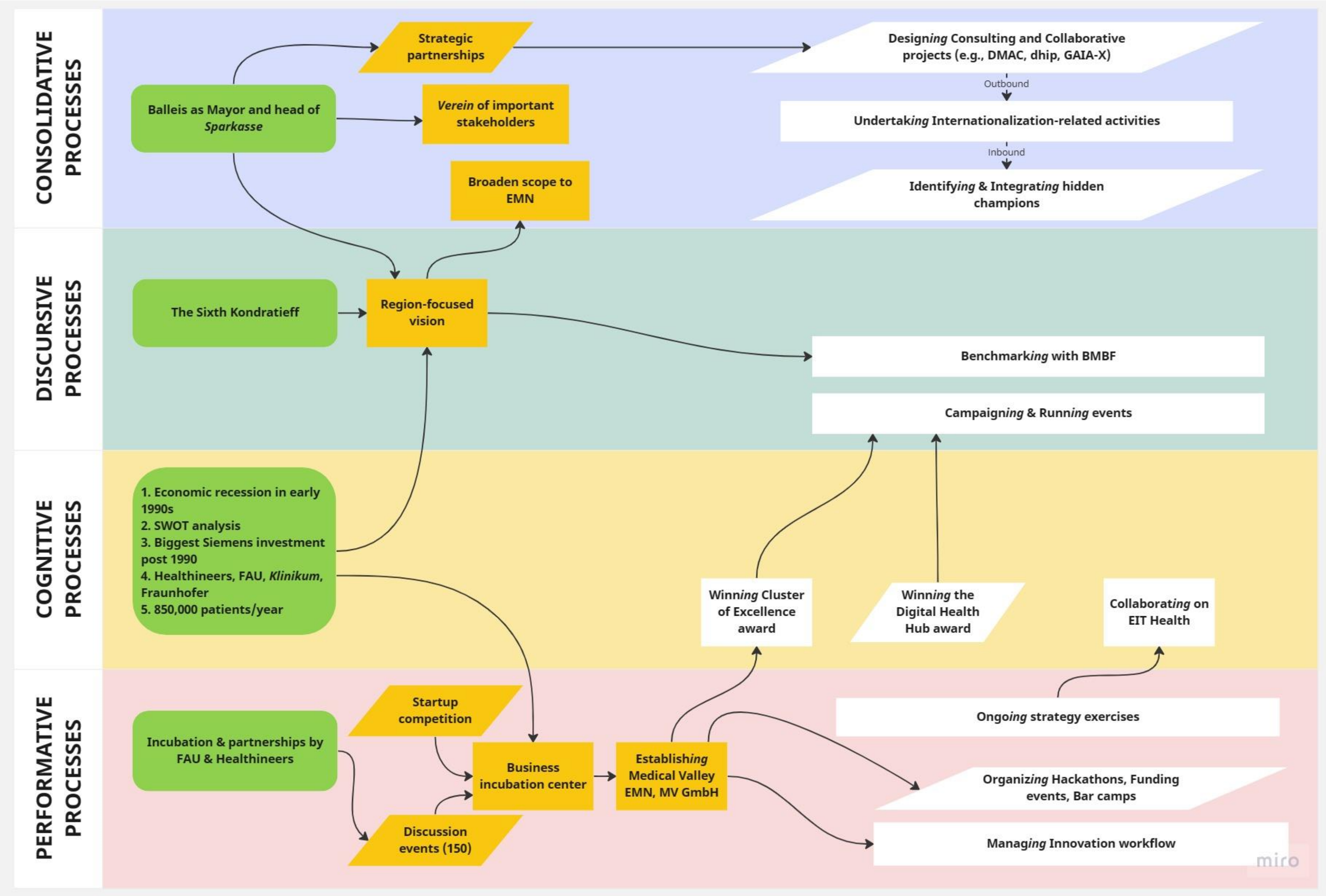

Figure 5.4*: MV ecosystem orchestration process map*

Figure 5.4 shows the orchestration process map for the MV ecosystem. The processes are depicted in a temporal sequence from left to right. Barring the set of green boxes, the horizontal axis extends from 2007 (when MV was founded) through 2022 (year when data collection ended). The vertical axis is segregated into four 'swim lanes' representing the four categories of orchestration discussed in the prior section. The listing of categories has no specific order and are chosen only for mapping convenience. The color-coding and shapes of boxes follow similar depiction as figure 5.2. The focal firm in this case (denoted by rectangles) is MVEMN.

Tracing the flow of orchestration across the four categories in figure 5.4, one can observe that while initial conditions had orchestration across the four categories, cognitive orchestration was prominent in the extant environment where the MV ecosystem emerged. The EMN had more than a century of expertise pioneering innovations in medical technology. The region's strength in research and development of healthcare goods and services was leveraged by its leadership in pursuit of economic recovery in the years following the German unification. Hence, pioneering work by Siemens Healthineers and major research universities in the region, duly supported by the local leadership, had cognitively orchestrated a reputation for the region as an epicentre for research in medical technology.

The genesis of MV ecosystem was in such a cognitively laden environment. Its founding was orchestrated through two sets of activities: (1) invoking region-wide multilateral participation towards nurturing and deepening conversations around medical technology, while also (2) coalescing collaborations, focused on the region's reputation, with an aim to advance innovation in the direction of the region's strengths. While the former process performatively orchestrated formal and informal interactions amongst the region's actors, the latter undertook consolidative orchestration and laid the foundation for MVEMN. Overall, the founding orchestration involved identity construction work (under the badge of MVEMN) that leveraged the region's reputation and undertook performative and consolidative efforts to combine existing strengths with established reputation.

Once MV was established as a legally recognized entity and kickstarted its operations, orchestration of the ecosystem proceeded in three ways: (1) performative orchestration of crystallizing an innovation workflow that served as a roadmap to integrate specialities of the ecosystem's stakeholders towards materializing innovative outcomes; (2) consolidative orchestration of continuing to scan the region for hidden champions that can be integrated into the collective, while also looking beyond the region for market access and growth prospects; and, (3) discursive orchestration of creating and sustaining narratives that spread the word about the ecosystem's pioneering efforts in medical technology R&D. Figure 5.5 illustrates the model of VC ecosystem orchestration based on the above discussion.

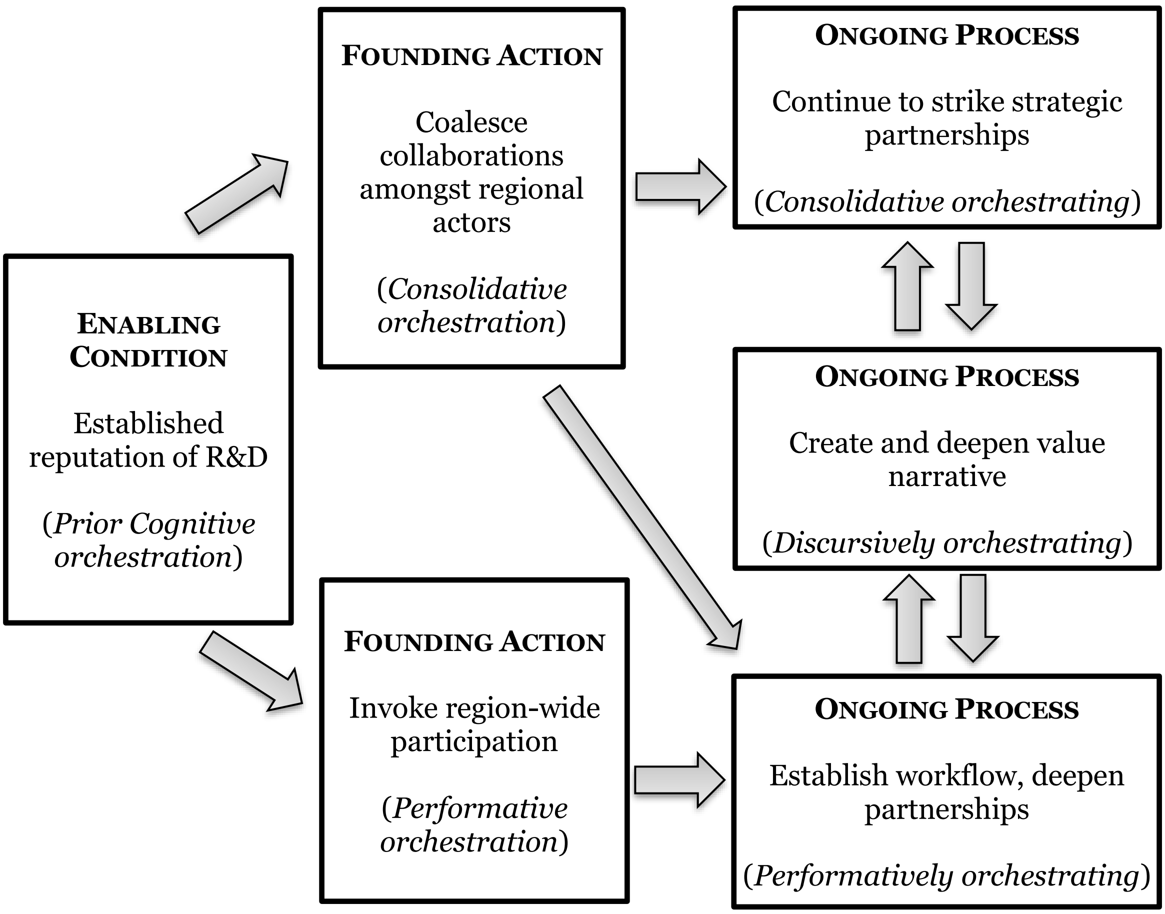

***Figure 5.5**: Abstracted process-flow model of MV ecosystem orchestration*

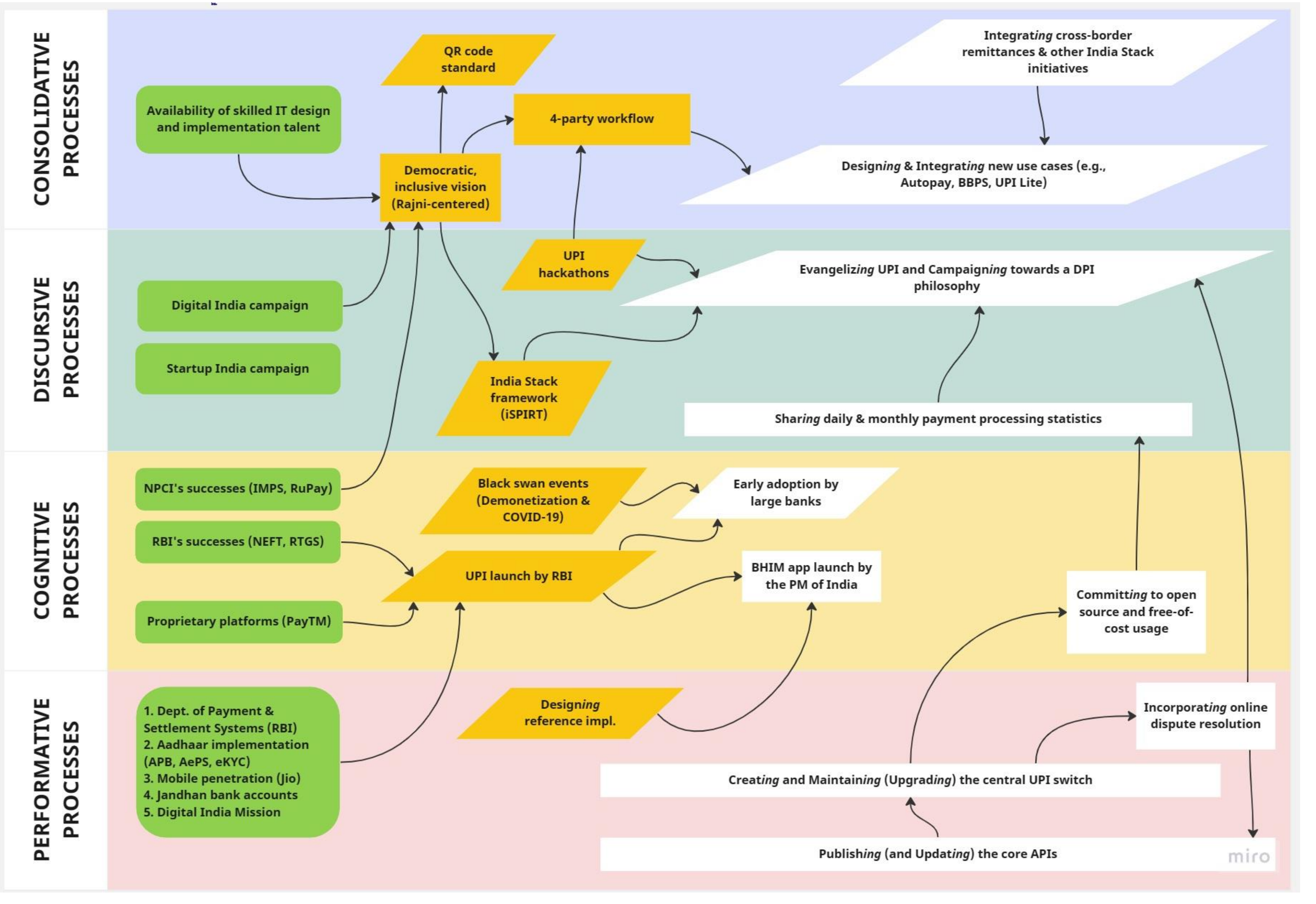

Figure 5.6: *UPI ecosystem orchestration process map*

Figure 5.6 shows the orchestration process map for the UPI ecosystem. The processes are depicted in a (rough) temporal sequence from left to right. Barring the set of green boxes, the horizontal axis extends from 2016 (when UPI was launched) through 2023 (year when data collection ended). The vertical axis is segregated into four 'swim lanes' representing the four categories discussed in the prior section. The listing of categories has no specific order and are only chosen for mapping convenience. The color-coding and shapes of boxes follow similar depiction as figure 5.2. The focal firm in this case (denoted by rectangles) is NPCI.

Tracing the flow of orchestration across the four categories in figure 5.6, one can observe that while initial conditions had orchestration across the four categories, performative orchestration was prominent in the extant environment where the UPI ecosystem emerged. The country was witness to several state-supported DPG initiatives, enabled by the Aadhaar project that provided digital identity to every citizen. Some of these DPG initiatives, such as NEFT and IMPS, had demonstrated the ability of digital technology to streamline payments and fund transfers. Thus, the RBI and NPCI (drawing from the vision of the tech specialists that developed the Aadhaar project) had performatively orchestrated platforms and processes that progressed in the direction of democratizing payments.

The genesis of UPI ecosystem was in such a performatively driven environment. Its founding was orchestrated through two sets of activities: (1) leveraging successes of systems that have demonstrated their working as well as the focal firm's capabilities in building them. It has to be noted that though RBI-NPCI held statutory advantage, building an ecosystem where banks had to undertake significant investments necessitated cognitive orchestration of building legitimacy through demonstrated systems implemented in the past; (2) coalescing stakeholders towards a unified technical architecture that conformed to the tenets of being a DPG. Overall, the founding orchestration involved constructing a collective identity that carried the legitimacy of a DPG. Doing so involved consolidative orchestration to coalesce key stakeholders towards an open protocol architecture, as well as cognitive orchestration to nurture their trust in the system. This was further enabled by NPCI being a non-profit entity governed by a consortium of banks.

Once UPI was launched by RBI and kickstarted its operations, orchestration of the ecosystem proceeded in three ways: (1) performative orchestration of managing the central switch and its core APIs; (2) consolidative orchestration of continuing to scan for new use-cases that can be integrated into the ecosystem; and (3) discursive orchestration of creating and sustaining narratives around UPI and its DPG philosophy. Figure 5.7 illustrates the model of VC ecosystem orchestration based on the above discussion.

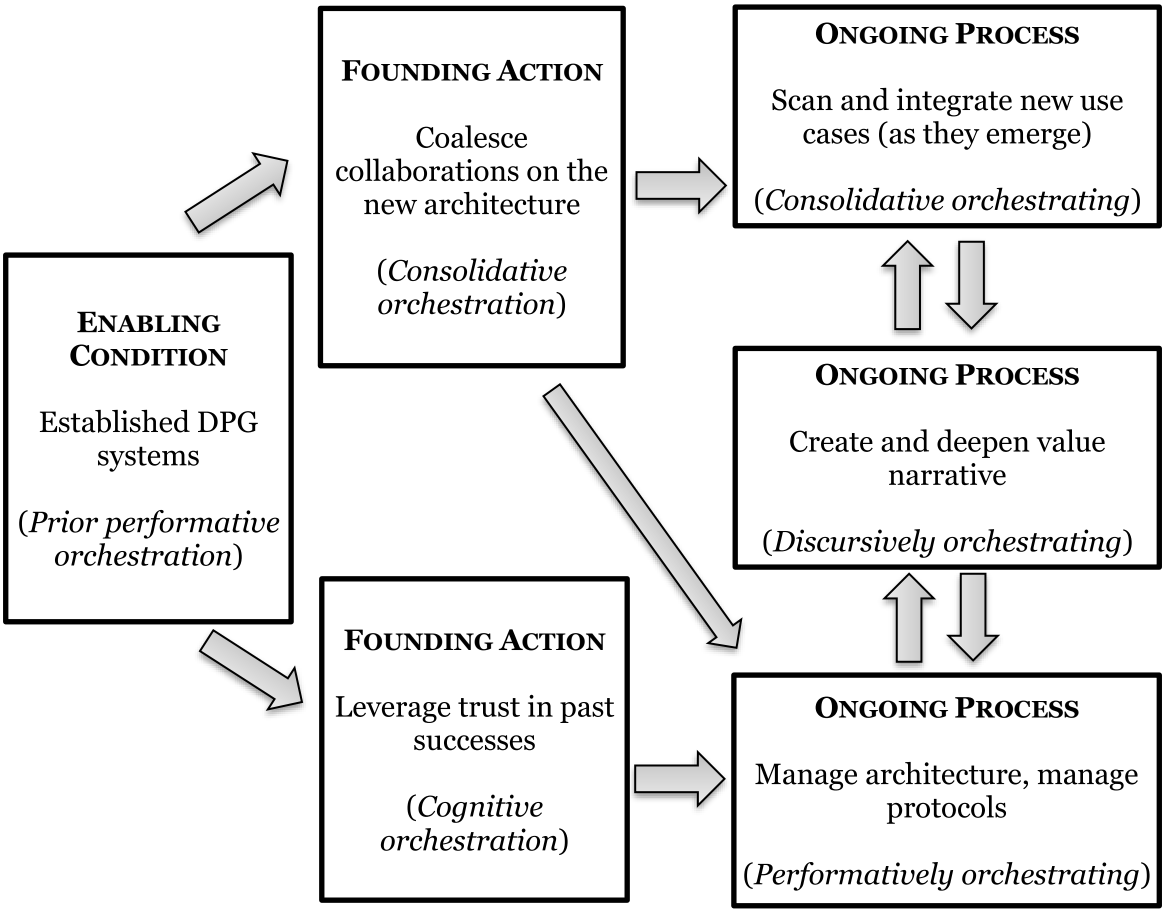

Figure 5.7*: Abstracted process-flow model of UPI ecosystem orchestration*

5.3. A process model of ecosystem orchestration

The abstracted process flows of the three ecosystems, as seen in Figures 5.3, 5.5, and 5.7, provide insights into the strategic and temporal dimensions of how ecosystems are orchestrated. From a strategic perspective, this dissertation has shown that orchestrating ecosystems is characterized by four categories that form an exhaustive but not strictly mutually exclusive set. The categories stand distinctly as each category encapsulates activities that go on to materialize specific objectives that are part of the overall ecosystem strategy of sustaining and growing the ecosystem (Adner, 2006; Furr & Shipilov, 2018; Iansiti & Levien, 2004a).

From a temporal perspective, this dissertation emphasizes that (effective) ecosystem orchestration is path-dependant. Research has already suggested that access to superior resources or capabilities significantly influence a firm's ability to orchestrate an ecosystem (e.g., Jacobides, 2019; Lingens, Böger, et al., 2021). This research adds to extant understanding by suggesting that results of past orchestration create conditions that influence how an emergent ecosystem is orchestrated (by the focal orchestrator/s). Thus, the orchestration processes in emergent ecosystems are determined by pre-existing enabling conditions.

Enabling conditions for ecosystems can materialize in several ways. In other words, different ecosystems can have very different starting points. Each of the three cases studied had distinct enabling conditions. The VC ecosystem banked upon a prevalent discourse of SBV-based innovation (i.e., prior discursive orchestration as starting point) to position its offering. The MV ecosystem leveraged legacy and reputation of a region and its resident champions (i.e., prior cognitive orchestration as starting point) to position its value proposition. The UPI ecosystem furthered the successes of other ecosystems that its key constituents had implemented in the past (i.e., prior performative orchestration as a starting point) and extended its current offering on the foundation of those established systems.

Another temporal perspective emphasized by this dissertation is that orchestration processes undertaken at the time of founding an ecosystem are likely to be significantly different from orchestration processes that have to be undertaken once the ecosystem begins to gain traction. In other words, orchestrating emergence could be significantly different from post-emergence orchestrating. The shift is conspicuous when viewed through the lens of the categories, thus, suggesting that ecosystem strategy *transforms* as the ecosystem begins to mature. Combining both temporal and strategic perspectives, this dissertation suggests that steady state ecosystem orchestrating involves a combination of the categories and is a function of enabling and founding conditions.

Figure 5.8 illustrates a generalized process model of ecosystem orchestration based on the outcomes of the inductive coding exercise (see Section 4.2 for the details) as well as patterns observed (and abstracted) from the three cases of this dissertation. As seen in the figure, emergence of ecosystems involves processes that leverage two sets of antecedents: (1) enabling conditions that can have discursive (narrative-driven), cognitive (reputation-based), or performative (extending established systems) basis, and (2) founding advantages such as established trust, proven capabilities, or past successes. Depending on an assessment of the antecedents, the orchestration begins with *founding* of the ecosystem through constructing an identity that leverages the applicable antecedents such that they are favourably aligned towards materializing the envisioned ecosystem offering.

Post-emergence orchestration shifts into *ongoing* mode involving three interlinked processes – crystallizing architecture, broadening participation, and evolving/transforming – which consist of sub-process within each of them. Further, these processes iterate as novel affordances are uncovered, necessitating architectural modifications, and the need to onboard new participants. Underlying all these processes, ecosystem’s identity construction is an ongoing process through time.

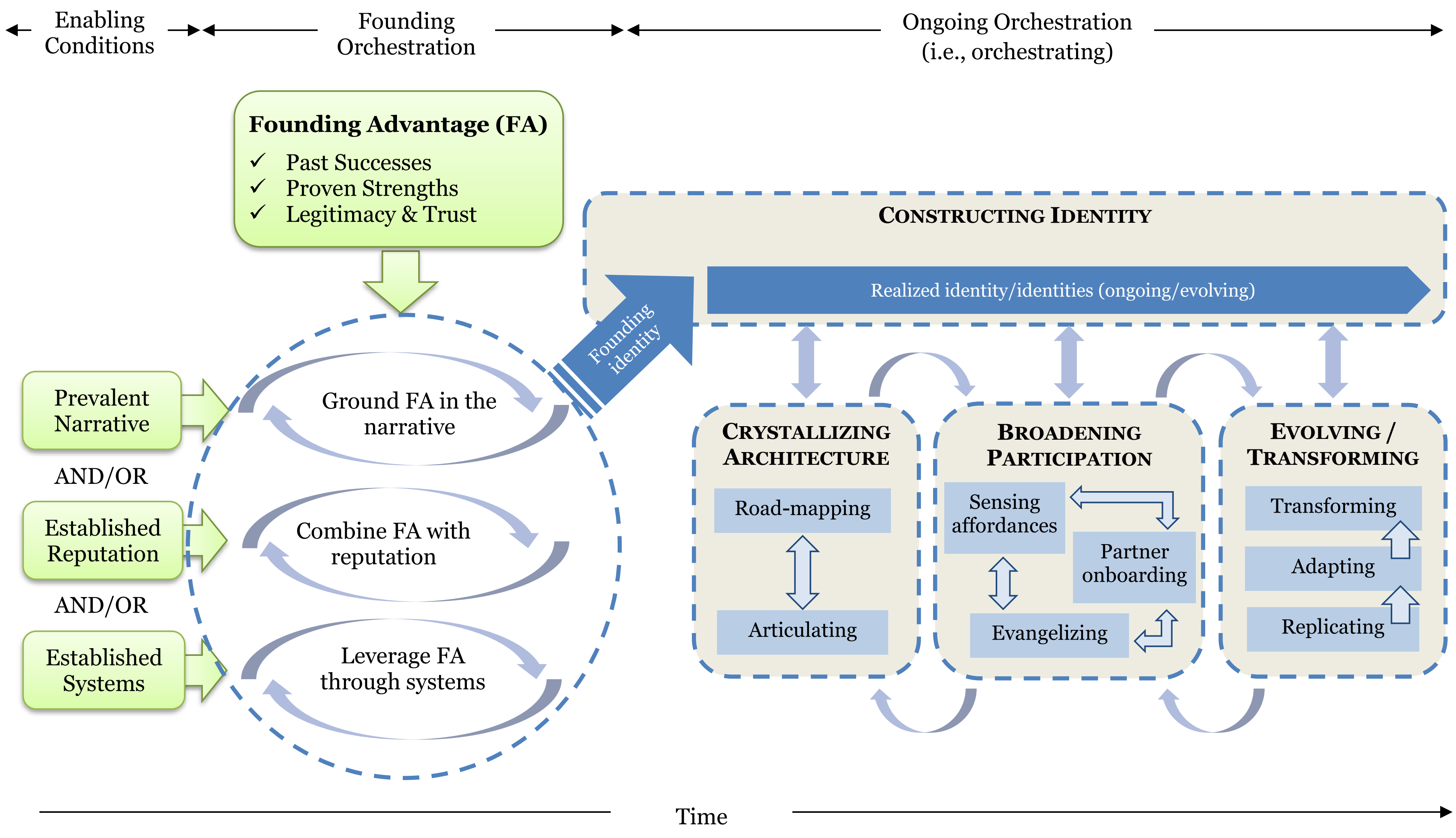

***Figure 5.8**: A process model of ecosystem orchestration*

Figure 5.8 has to be viewed from left to right as a progression of ecosystem development over time. Enabling conditions (see leftmost section Enabling Conditions) that are a result of prior orchestration become the ground that enable emergence of new ecosystems. Potential orchestrators of new ecosystems bring to bear founding advantages (see box Founding Advantage) that are key to being able to play the orchestrator role. The orchestrator embarks upon ecosystem creation by leveraging synergies between founding advantages and enabling conditions (see the three loops under section Founding Actions). The first act of orchestration is the establishment of a founding identity that becomes a 'centre of gravity' to coalesce potential ecosystem participants. Subsequently, orchestrating the nascent ecosystem progresses through interlinked sub-processes (see four blocks under section Ongoing Orchestration). Each sub-process embodies activity patterns that interact recursively with each other (see interlinked boxes within each orchestrating block).

In the following, each component of the process diagram is explained in detail. First, the enabling conditions are explained providing a view into each of the three levers – narrative, reputation, and systems – that were unearthed through this dissertation. Generalizability is not claimed here as the three levers have been inductively derived from the samples of this dissertation and more levers can be possible in practice. Then, the founding actions are explained, which involves a discussion over possible founding advantages that endow upon a certain entity the capability to orchestrate. Using the case samples, it is demonstrated how an orchestrating firm was able to synergize its founding advantage with the prevalent enabling condition to initiate ecosystem emergence. Then, orchestrating processes – starting with identity construction – that foster ecosystem emergence are discussed. As shown in Figure 5.8, constructing a 'founding identity' was seen as 'the first act of ecosystem orchestration'. However, as other orchestration subprocesses – crystallizing architecture, broadening participation, and evolving/transforming – were activated, the identity construction process evolved to materialize one or more 'realized identities' over time.

5.3.1. Enabling conditions

Research has shown that for successful emergence of a new ecosystem, the presence of enabling conditions is vital. However, scholars have looked at enablers in terms of complementary providers (e.g., Adner, 2006; Yoffie & Kwak, 2006). For instance, Adner (2012) showed how the pioneering launch of high-definition television (HDTV) by Philips in the 1980s failed to take off as the complementary technologies, such as high-definition cameras and high bandwidth transmission standards, were not present. This dissertation has shown that certain conditions – i.e., aspects of the market environment rather than complementarities – can act as key levers to enable ecosystem emergence. Based on the cases analysed, three levers are proposed: prevailing narrative, instituted reputation, and established systems.

5.3.1.1. Prevailing narrative

Narratives, through emplotment, serve to portray reality in a structured manner (Cunliffe, Luhman, & Boje, 2004), and, hence, bear the power of invoking meaning making and, thus, driving engagement (Weick, 1969). Discourses encapsulate narratives (Alvesson & Sköldberg, 2000), and become a thread that can meaningfully bind narratives into a storyline (Cunliffe et al., 2004). Scholars have suggested that discursive processes can facilitate identity construction within ecosystems (e.g., Thomas & Ritala, 2022).

All three cases in this dissertation demonstrated discursive identity-creation that led to the founding of their ecosystems. The VC ecosystem grounded its region-focused vision within the prevailing narrative of Pune as an emerging startup hub. The MV ecosystem harnessed the prevailing narrative of the EMN's legacy of pioneering medical devices' innovations. The UPI ecosystem leveraged the Digital India discourse that prevailed across the country by articulating a vision that aligned with the digitalization (of payments) narrative. Overall, this dissertation suggests that prevailing narrative can be a ground to discursively orchestrate an emergent ecosystem's identity. And by doing so, new ecosystems can benefit from exploiting established understandings in the minds of its audience.

5.3.1.2. Instituted reputation

Reputation, by definition, represents a set of characteristics that a particular entity is known for. Reputations, thus, embody historicity – i.e., a legacy built over time – as well as facilitate an assessment of favourability (Lange, Lee, & Dai, 2011). In the context of ecosystems, research has shown that reputations can provide 'soft power' to control dynamics within ecosystems (Yoffie & Kwak, 2006). Scholars have argued that reputations engender the cognitive effect of fostering trust and driving legitimacy (Suchman, 1995).

All three cases in this dissertation demonstrated cognitive identity-creation that led to the founding of their ecosystems. The VC ecosystem's vision of incubating SBVs built upon the reputation of CSIR-NCL in its lineage. The MV ecosystem was centred around an association that consisted of leaders from several reputed actors in the region. The UPI ecosystem, firstly, was driven by entities that had the reputation of implementing forward-looking systems in the past, and, secondly, was centred around a focal firm which was governed by the reputed banks of the country. Overall, this dissertation suggests that (prior) established reputation can assist in cognitively orchestrating an emergent ecosystem's identity. And by doing so, new ecosystems can benefit from preconceived trust and legitimacy of the established actors.

5.3.1.3. Established systems

Established technological systems are domains of organized action that have demonstrated stability and productivity (Thompson, 1967). Such systems form socio-technological paradigms that often materialize in the form of ecosystems (Dosi, 1982). Research has shown that knowledge and experience from involvement in an established technological system can enable actors to attempt creating new ecosystems in related (but novel) areas (Dougherty & Dunne, 2011).

All three cases in this dissertation demonstrated performative identity-creation that led to the founding of their ecosystems. The VC ecosystem's region-focused vision extended similar pursuits of other prominent actors (e.g., OEM manufacturers) that had orchestrated innovative activity in the region. The MV ecosystem's vision was an extension of the work several large actors (e.g., FAU & Healthineers) have been doing over several decades. The UPI ecosystem leveraged, and extended, several technological successes (e.g., digital identity by Aadhaar, real time fund transfer by IMPS) that had preceded it. Overall, this dissertation suggests that envisioning as an extension of established (i.e., proven-to-be-working) systems can assist in performatively orchestrating an emergent ecosystem's identity. And by doing so, new ecosystems can benefit by not having to reinvent the (technical) wheel.

5.3.2. Founding advantage and founding orchestration

Scholars have long argued that core capabilities of an actor are pivotal in determining the extent to which the actor can orchestrate (or is accepted as the orchestrator of) an ecosystem. Ecosystem orchestrators typically hold positions of advantage such as being resource-rich and influential (Iansiti & Levien, 2004b), ownership of a critical asset (Teece, 1986), pioneering ability (Moore, 1996), or network centrality (De Meyer & Williamson, 2020). This dissertation found that ecosystem orchestrating actors carried three kinds of advantages: (1) past successes, that demonstrated the ability to orchestrate successfully, (2) proven strengths, that rendered them pivotal in the emerging capability architecture, and (3) integrity and neutrality, that evoked trust and legitimacy from stakeholders.

The VC ecosystem was a case of single firm orchestration, whereas the other two cases exhibited multiple orchestrators. In the case of each orchestrator, one or more of the above three advantages were observed. Table 5.2 elucidates all the orchestrator(s) of the three ecosystems with the corresponding advantages of each. Interestingly, it may be observed that all three advantages are found in the (totality of) orchestration in the three ecosystems. That, however, was an artefact of case selection and, hence, its generalizability is not argued for. Nor does this dissertation argue for comprehensiveness of the advantages found in the three cases. Hence, towards generalizability, an umbrella term – founding advantage – is proposed which can possibly encompass several more factors given the diversity of ecosystems in the real world. The proposed model only goes as far as to argue that *founding* orchestration requires a combination of founding advantages (endogenous to the ecosystem) and enabling conditions (exogenous to the ecosystem). The following subsection on constructing identity discusses the process of how the internal and external factors were combined in the act of founding orchestration.

Table 5.2: *Founding advantages in the three cases (table continues to next page).*

Ecosystem	Orchestrator	Founding advantages
VC ecosystem	VC	• Proven strength (Premnath's experience, DST funding) • Past successes (NCL lineage) • Legitimacy (non-profit entity, independent board of directors)
MV ecosystem	MV	• Legitimacy (non-profit entity, association of prominent stakeholders)
	Large firm (e.g., Healthineers)	• Past successes (legacy of innovations) • Proven strength (manufacturing and distribution capability)
	Universities (e.g., FAU)	• Past successes (legacy of research) • Proven strength (research expertise)
UPI ecosystem	NPCI	• Past successes (IMPS, NEFT) • Legitimacy (non-profit entity, governed by consortium of banks)
	RBI	• Proven strength (regulatory control)

Ecosystem	Orchestrator	Founding advantages
	Nilekani & team	• Past successes (Aadhaar project) • Proven strength (designing population-scale architecture)
	iSPIRT	• Proven strength (coalescing developer community) • Legitimacy (no greed, no glory philosophy)

5.3.3. Constructing identity

Constructing identity was the initial act of orchestration in the ecosystems. Creating an identity can have several benefits to the nascent ecosystem: (1) it provides distinctiveness for the collective (Gulati et al., 2012), (2) it creates an anchor for coalescing collective effort (Daymond et al., 2022), (3) posits a brand image for the combined value proposition and, hence, enables positioning and disseminating in the marketplace (Cennamo, 2021), and (4) answers the question, 'who we are', that can serve as ground for collective strategizing (Wareham et al., 2014). In all the three ecosystems, identity creation became a founding act as it seeded vision creation.

Crafting an identity early facilitates coalescence of the different constituencies. As one review of literature observed, "ecosystem architects interested in promoting the emergence of an entrepreneurial ecosystem ought to focus on *creating conditions for coalescence* of diverse ecosystem actors, which refers to ecosystem participants coming together to form embryonic relationships and a shared identity, as well as initial mechanisms for and understandings of how to go about interacting" (Daymond et al., 2022: O12, emphasis in original). Also, Dattee et al.'s (2018) study showed that in a nascent ecosystem, identity helped to avoid drifting from the envisioned value proposition.

Borrowing from Thomas & Ritala (2021), ecosystem identity is defined as "a set of mutual understandings among ecosystem participants regarding the central, enduring, and distinctive characteristics of the ecosystem value proposition." (p.14). Thus, identity creation has the cognitive effect of driving common understanding among members who have self-selected to be a part of the collective, thus, rendering salient the need to make ecosystem-specific investments (Thomas & Ritala, 2022). I observed identity-making as an initial act in all the three ecosystems, albeit materializing in the form of an overarching vision that answered the questions of 'who we are' and 'what we do' (Navis & Glynn, 2010).

Constructing identity was the founding act of orchestration. Each of the three ecosystems pursued identity constructing process using a distinct combination of enabling lever and founding advantage. The VC ecosystem orchestrator had the advantage of legitimacy and trust owing to the reputation of its founder as well as its lineage from NCL. Hence, the VC ecosystem's founding was orchestrated through constructing an identity of region focused SBV incubation ecosystem that grounded its reputation within the prevalent narrative of the region (Pune) as an emerging startup hub. Founding VC as a non-profit entity further deepened the legitimacy of the orchestrated identity.

The MV ecosystem's founding advantage was the proven strength of the region as an innovator in medical technology and devices. Hence, the MV ecosystem's founding was orchestrated through constructing an identity of being a region-focused innovation ecosystem that reinforced its reputation through its strength. Naturally so, one of the founding pursuits of the MV ecosystem was to attain the 'cluster of excellence' award which legitimized its identity construction. The UPI ecosystem's founding advantage were past successes of its focal actors in designing and implementing technology ecosystems at population scale. Hence, the UPI ecosystem's founding was orchestrated through constructing an identity of digitalization that aimed at democratization and inclusion in payments, which leveraged the goals achieved by established ecosystems in areas of identity, mobile connectivity, and banking penetration.

Thus, as suggested by scholars (e.g., Daymond et al., 2022), each of the studied ecosystems orchestrated identities that provided clarity of objectives and, hence, created a 'centre of gravity' (Saxenian, 1996) that attracted interested actors to coalesce in pursuit of the envisioned ecosystem. Once actors began to coalesce, it became important to establish the norms of their interaction, so as to provide clarity on where in the alignment structure of the ecosystem does each actor stand and how do they interrelate. To do this, each of the ecosystems worked towards crystallizing the underlying architecture, which took different forms depending on the context of the ecosystem.

5.3.4. Crystallizing architecture

Constructing identity enabled an enduring and distinctive focus towards the value proposition (Lindgren, Eriksson, & Lyytinen, 2015). However, while identity "reduces cognitive distance by raising the awareness among participants that they are engaged in a common enterprise" (Thomas & Ritala, 2022: 15), an architecture of collaboration was needed to concretize how the collective should materialize the value proposition. Fjeldstad, Snow, Miles, & Lettl (2012) have suggested that an architecture of collaboration should encompass three elements: participating actors, commons where the actors accumulate and share resources, and protocols that enable collaboration. Further, since ecosystems involve unique complementarities (Jacobides et al., 2018), the architecture has to consider the structure of interdependencies and, in doing so, span the continuum from supply-side (i.e., ecological considerations) to demand-side (i.e., systemic perspective) (Ritala & Almpanopoulou, 2017). In short, an architecture[32] establishes the roadmap towards coherent and collaborative output.

Architectures can take different forms (De Meyer & Williamson, 2020). For instance,

[32] While some scholars have used the word blueprint to signify the underlying architecture (e.g., Lingens, Miehé, et al., 2021), this study takes a processual perspective and uses the word architecture.

platform-centred ecosystems, such as the UPI ecosystem, focus on crystallizing a technological architecture involving layers representing infrastructure, network, and application entities, and their protocols of interaction (Srinivasan & Krishnan, 2020). Alternately, in service-oriented (or collaborative-activity oriented) ecosystems, such as the VC and MV ecosystems, architectures take the shape of workflows involving input-output flows, handoffs, and temporal sequencing. Irrespective of the technical form of the architecture, their essential function is to map capabilities in a complementary fashion (focusing especially on unique complementarities) to ensure that interactions are seamless. This dissertation found two patterns of activities characterizing the process of crystallizing architecture: road mapping and articulating.

5.3.4.1. Road-mapping

Road mapping is the orchestrating process which aims at crystallizing an 'architecture of participation' dealing with facets such as participant roles, rules of participation, methods of handling conflicts – i.e., encapsulating aspects related to coordination and delivery of the (envisioned) value proposition (Thomas et al., 2022). While on the one hand road mapping brought clarity to the flow of resources and information among the participants, on the other hand it also laid down entry and exit criteria (Nambisan & Sawhney, 2011). In nascent ecosystems, where envisioned value proposition was not yet settled, road mapping provided a mechanism to shape development of the core value proposition while also controlling drifts (Dattee et al., 2018). However, in mature ecosystems, road mapping would involve reconfiguring the established architecture in response to adaptive and transformational changes (more on this in section 5.3.6. where scaling and transforming sub-process is discussed).

Road mapping was distinctly observed in each of the studied ecosystems. In the initial days following its founding, VC ecosystem road mapping involved gap-finding exercise by a combination of VC's inhouse experts and external mentors, that resulted in a SBV commercialization workflow. Figure 5.9 illustrates the SBV commercialization workflow that shows the sequence of stages involved in the commercialization journey of SBVs. Crystallizing the commercialization workflow enabled VC (the orchestrator) to identify the range and sequence of services necessary to materialize the ecosystem's value proposition. In its nascent stage, the VC ecosystem invited several participants to put together the set of infrastructure and services necessary to actuate the workflow. However, over time, VC (the firm) has managed to acquire infrastructure and capabilities that have enabled it to materialize a significant share of the workflow inhouse. Nevertheless, the VC ecosystem continues to engage domain experts and funding agencies to further the commercialization of SBVs.

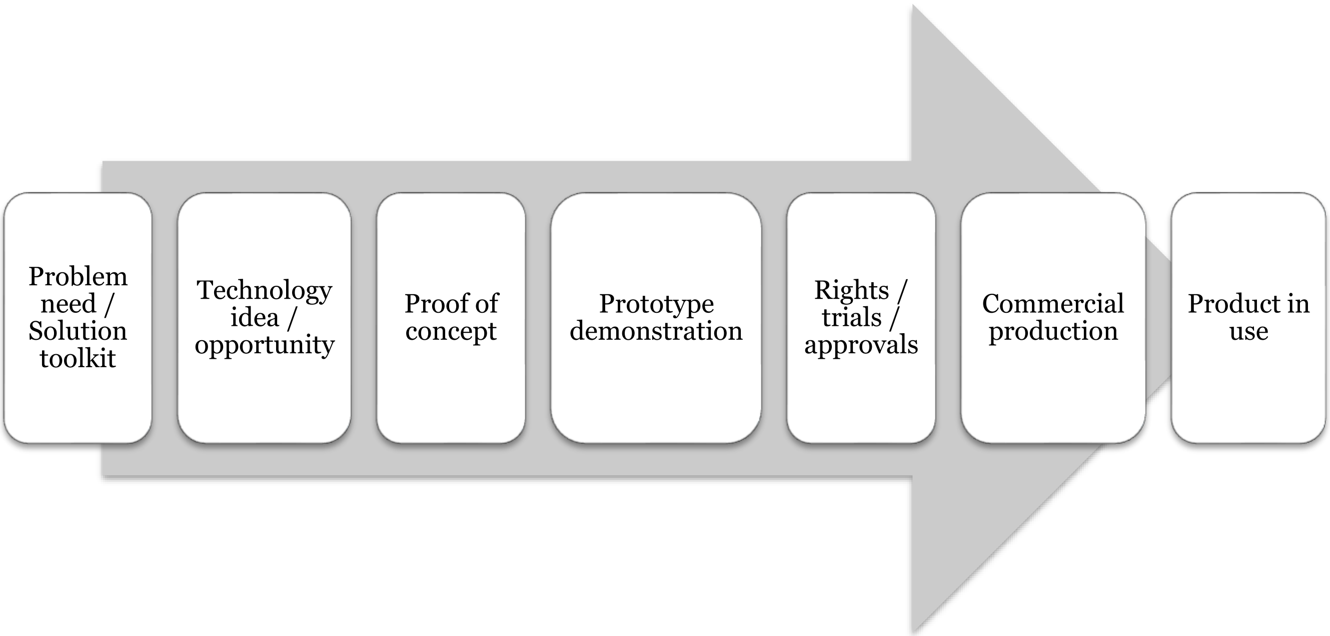

Figure 5.9: *Crystallizing architecture – VC's SBV commercialization workflow*

At the MV ecosystem, road mapping involved an integrated strategy exercise of putting together the innovation workflow that concretized the ecosystem's value proposition. To do this, MVEMN (the orchestrator) leveraged the membership of its association which involved key stakeholders of the region and put together a comprehensive understanding of the process of innovation in medical devices. Figure 5.10 shows the innovation workflow that crystallizes the stages – hence, the range and sequence of activities – involved in materializing the ecosystem's value proposition. Similar to the VC ecosystem, the value proposition of the MV ecosystem involves provisioning expertise and services.

To actuate the workflow, MVEMN established different entities – such as private wing GmbH, business incubation centres MVC in several locations of the EMN – that occasioned the provision of several services involved in the workflow. Crystallizing the workflow also enabled MVEMN to orchestrate various initiatives – such as funding events, regulatory workshops, innovation camps – that became coalescing ground for the ecosystem participants to converge and work together. Also, crystallizing work provided a clear roadmap for important stakeholders to understand their position and prominence in the ecosystem's offering.

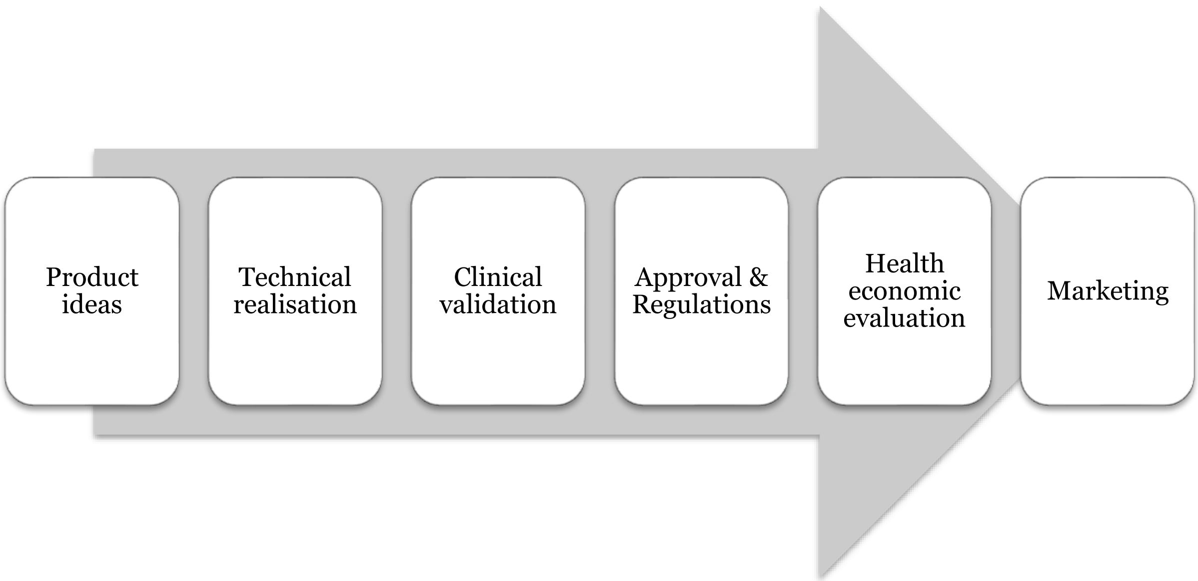

Figure 5.10: *Crystallizing architecture – MV's innovation process flow.*

In the UPI ecosystem, road mapping involved driving consensus on the technical architecture of the UPI workflow with key stakeholders while also managing RBI's regulatory oversight. Since UPI was envisioned as a digital platform-based solution, the workflow took the form of a typical platform-based technical architecture wherein a centralized platform drove services through predetermined protocols of interaction. Figure 5.11 shows the UPI transaction workflow with the NPCI platform (central payment switch) positioned at the nexus of interactions between banks and mobile users. The workflow mandated that the banks and users interact with the central platform using open APIs.

Crystallizing the workflow enabled ecosystem participants to understand their position in the ecosystem and come onboard through adherence to the API specifications. Insofar as the workflow was concerned, NPCI clearly played an orchestrating role that governed the realization of the ecosystem's value proposition.

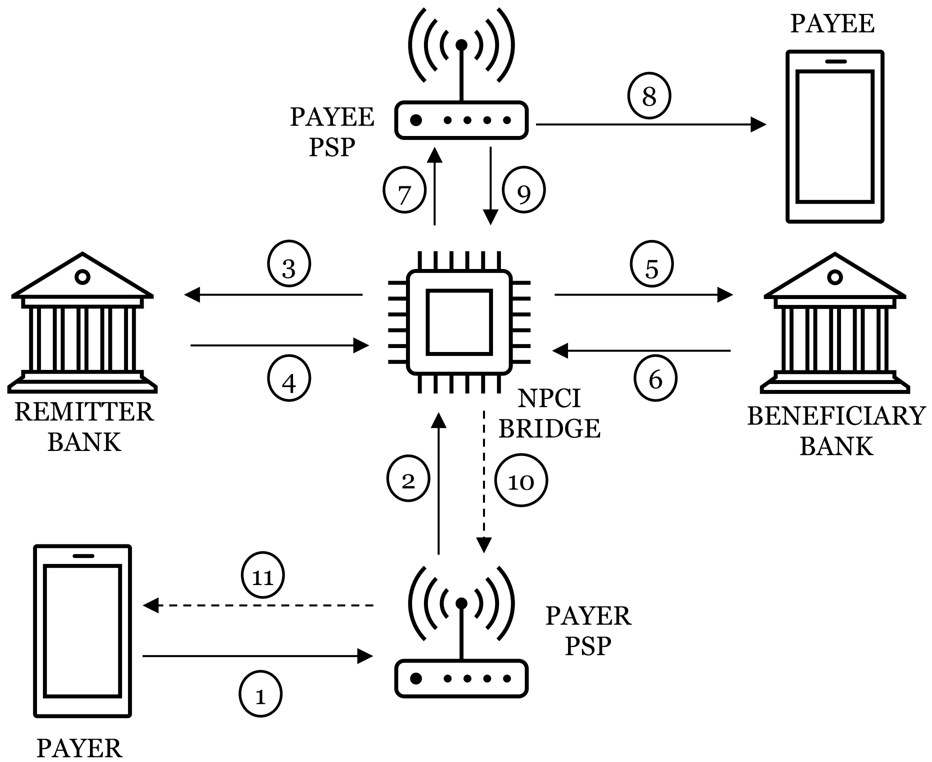

Figure 5.11: *Crystallizing architecture – UPI transaction workflow. The numbers in circles denote sequence of flow. PSP stands for Payment Service Provider.*

As seen in the above three cases, crystallizing the workflow concretized the architecture of the ecosystem, threw light on the nature the various niches, and provided clarity on their positions in the ecosystem. Also, the architecture revealed the kind of interactions that were necessary to realize the value proposition. By doing so, the crystallizing architecture sub-process effected the coming together of the ecosystem participants and furthered coherent interactions. However, as the process of crystallizing the architecture involved orchestrating consensus among key stakeholders, it necessitated high levels of coordination and collaboration, and, thus, was often associated with another activity pattern – articulating.

5.3.4.2. Articulating (the vision)

Articulating the vision becomes an important orchestrating activity as it advances the *frame* necessary for shaping the shared understanding of the ecosystem's participants (Ansari, Garud, & Kumaraswamy, 2016; Snihur et al., 2018). Articulating becomes orchestration insofar as it serves as the mechanism to negotiate the materialization of the collective outcome. Scholars have noted that orchestrators articulating a common vision will have to contend with contesting perspectives from ecosystem participants and, if need be, go back to the drawing board to reconceptualize the envisioned architecture (Dattee et al., 2018).

The VC ecosystem followed a systems integrator approach wherein the orchestrator offered bundled services to users. In the VC ecosystem case, articulating involved inviting partners to augment inhouse capabilities. VC's founding identity was constructed in the context of a thriving startup activity in the country (as well as in VC ecosystem's region), hence, VC continually articulated its SBV commercialization workflow through its region-focused identity that served to invoke interest in the VC ecosystem's value proposition and attract participants towards actualizing its envisioned workflow.

In contrast, the MV ecosystem followed a distributed governance model where articulating played a key role owing to the higher autonomy and relative independence of some of its ecosystem constituents. Unlike the VC ecosystem where one central firm pushed a preconceived workflow, the MVEMN had to consensually arrive at an architecture. MVEMN, though, was well positioned to crystallize the workflow by virtue of representing a consortium of key stakeholders of the region.

Thus, MVEMN articulated the ecosystem's architecture through a mix of combined strategy-making exercises, dialogues, and deliberations.

In the UPI ecosystem, articulating played a relatively lesser role of the three cases as platform architectures have been standardized in practice. Nevertheless, crystallizing the UPI ecosystem architecture involved driving consensus amongst the collective where some players (like banks) that carried significant bargaining power also had to make risky investments. The orchestrators involved a combination of actors (i.e., NPCI, RBI, and Nilekani & team) went to great lengths to convince the banks to join the ecosystem.

Crystallizing architecture, thus, involved a combination of road mapping and articulation. Road mapping concretized the vision into some form of architecture, and articulating disseminated the architecture amongst key ecosystem constituents and invoked deliberation to drive consensus. Orchestrators continually iterated between road mapping and articulating in the process of crystallizing the architecture. In that process, there can be instances where the founding identity undergoes changes. For instance, in the early days of establishing the MV ecosystem, it was envisioned that the ecosystem would represent only the actors in the Erlangen region of Germany. However, upon articulating the vision amongst stakeholders, the need to encompass the entire EMN was realized. This change of boundary also necessitated as revaluation of the founding identity as it had to expand to represent a larger geographical region. Hence, as shown in Figure 5.8, the subprocess of constructing identity shares an ongoing dynamic with the subprocess of crystallizing architecture.

5.3.5. Broadening participation

Ecosystems have to be dynamic entities as they must respond to both supply- and demand-side variations (Jacobides, 2019). On the supply-side, ecosystem membership is typically open involving continual flow of members in and out. Also, when members with new specializations desire to be part of the ecosystem, orchestrators must respond with more than just gatekeeping activity. On the demand-side, shift in user demand or technological change can necessitate evolution or transformation of the value proposition.

Since direct and indirect network effects are typical of ecosystem dynamics, variation in nature and extent of membership is commonplace. Hence, broadening participation, both in quantity (scale) and variety (scope) of participants, is necessary orchestrating activity. This dissertation found three patterns of activities undertaken by orchestrators to broaden participation: evangelizing the ecosystem's value proposition, sensing affordances, and partner onboarding.

5.3.5.1. Evangelizing

Evangelizing involves activities – such as advertising, campaigning, and educating – where ecosystem participants advocate the ecosystem's value proposition to actors outside the ecosystem. Evangelizing, insofar as it pertains to furthering the cause of growing the ecosystem, becomes orchestration. Evangelizing activities of orchestrating – in the form of creating and sustaining value narratives – was observed in all three ecosystems.

Several activities were undertaken by key ecosystem constituents to evangelize their respective offering(s). The VC ecosystem orchestrated evangelizing activities such as workshops, awareness sessions, setting up stalls at conferences and industry events, and funding campaigns, altogether in excess of 300 events in a calendar year. The MV ecosystem orchestrated evangelizing activities, such as hackathons, bar camps, and funding competitions, focused on creating awareness of the innovative capabilities in the region. The UPI ecosystem orchestrated evangelizing activities such as panel discussions, workshops, and hackathons to enhance participation and foster more innovative activity.

Seen from the perspective of the three cases, evangelizing produced two kinds of orchestrating effects: (1) they disseminated the ecosystem's value proposition to a wide audience that enhanced awareness about the ecosystem within the population of potential users and, hence, heightened the possibility of more users seeking to use the ecosystem's services, and (2) they showcased the viability of the ecosystem and created interest in the minds of actors that could join the ecosystem as potential partners. For instance, while evangelizing efforts by Nilekani & team brought more banks onboard the UPI ecosystem, evangelizing by NPCI served to increase adoption of UPI by mobile payment users. While evangelizing with users served to foster ecosystem adoption, evangelizing with potential partners had the ripple effect of invoking network effects (Katz & Shapiro, 1994), and brought about the possibility of uncovering novel affordances.

5.3.5.2. Sensing (novel) affordances

Much research has focused on generativity of ecosystems. To the extent that ecosystems bring together heterogenous actors, they embody greater potential to foster complementary innovation compared to vertically integrated firms (Cennamo & Santaló, 2019). However, as Murthy & Madhok (2023) have argued, though ecosystems embody greater generativity in theory, enabling value co-creation can be challenging as ex-ante visibility to the universe of co-creation possibilities is impossible. Hence, ecosystems have to resort to road mapping mechanisms and orchestrate search processes that can sense (and seize) novel affordances (Giudici et al., 2018).

In each of the three ecosystems of this dissertation, sensing affordances was an ongoing orchestration pursuit. However, the nature of interdependencies within the ecosystem influenced the breadth of their search (Ganco et al., 2020). In the VC ecosystem, searching novel affordances tended to be within the narrow scope of their operational activities. In the MV and UPI ecosystems, sensing affordances took on a broader pursuit. While on the one hand, MV ecosystem strived to find and integrate hidden champions from within the region, on the other hand, it actively sought connections with participants beyond the region. Similarly, the UPI ecosystem searched for novel affordances in terms of new use cases (both from within and beyond the scope of the architecture) that could be integrated as new services into the ecosystem.

Sensing affordances is tied to evangelizing in two ways. Firstly, evangelizing attracted new partners that could potentially introduce novel competencies, hence, new affordances, into the ecosystem mix. For instance, VC ecosystem's evangelizing with for-profit companies in pursuit of attracting their CSR funding brought onboard several CSR partnerships which facilitated offering of incubation services in new areas of environmental sustainability such as effluent treatment and soil remediation. Secondly, sensing affordances uncovered new possibilities that often transcended the ecosystem's inhouse capabilities. Hence, orchestrators had to evangelize the newly uncovered potential to bring onboard new partners. For instance, when the VC ecosystem sensed the potential to offer its services nationwide, i.e., to go beyond its traditional base of the Pune region, it felt the need to bring onboard new partners that specialized in digital marketing and social media advertising. Similarly, when new regulations for healthcare applications (e.g., DiGA) were introduced in the German market, the MV ecosystem undertook evangelical efforts to disseminate the implications of the new regulations that attracted new experts (e.g., regulatory experts/consultants) into the ecosystem mix.

5.3.5.3. Partner onboarding

Gatekeeping is a critical orchestration activity in ecosystems (Gulati et al., 2012; Zhang, Li, & Tong, 2022). Scholars have observed that the quality of complements has a significant impact on the productivity of the ecosystem (e.g., Boudreau, 2012; Zhang et al., 2022). Hence, gatekeeping to control that quality of partners joining the ecosystem becomes critical to ensure success (and sustenance) of the ecosystem. Gatekeeping process takes on the nature of orchestration as it decides who is in and who is not, hence, potentially impacting the productivity of the ecosystem (Gulati et al., 2012). Gatekeeping was explicitly observed in VC and UPI ecosystems. Whereas in the VC ecosystem the focal firm directly undertook screening of participants, in the UPI ecosystem participation was gained through adherence to NPCI's APIs. The MV ecosystem followed a relatively distributed governance, hence, there was no gatekeeping with regard to locating in the region. However, to be part of the MV ecosystem, becoming a member of the MVEMN consortium was necessary.

All three of the above orchestrating sub-processes – evangelizing, sensing affordances, and partner onboarding – are integral to broadening ecosystem participation. Broadening participation materializes through a recursive interlinking of the three sub-processes. Evangelizing can drive new sensemaking and uncover novel affordances. Sensing novel affordances occasions bringing new specialized partners onboard. New partners joining the collective could trigger renewed evangelization to showcase the enhanced collective. Further, broadening participation, especially when it brings new specializations onboard, will necessitate modifications to underlying architecture. Hence, orchestrations related to crystallizing architecture and broadening participation could continually go back and forth. For instance, when the UPI ecosystem's adoption surged due to high demand for digital payments during the COVID-19 pandemic, the broadening participation necessitated an upgraded architecture involving active load balancing and enhanced dispute resolution mechanisms.

Broadening participation can impact the ecosystem breadth (boundary of the ecosystem) as well as its depth (constitution of its niches). To the extent that integration of new affordances stimulates architectural modifications, broadening participation could also *marginally* impact the ecosystem's identity. For instance, as the UPI ecosystem's adoption began to rise, it gradually began to displace closed wallet-based payment solutions (e.g., PayTM) and emerged as a successful solution to digital payments in the country. At the same time, the identity of the UPI ecosystem as a national-level democratic platform was reaffirmed and more firmly established.

It is to be noted that only *marginal* impacts to ecosystem identity are expected through broadening participation orchestration as this orchestration is operational in its approach. Broadening participation does not involve strategic considerations such as reframing the ecosystem's vision (e.g., Snihur et al., 2018) or restructuring the entire collective (e.g., Burgelman et al., 2022). Nevertheless, ecosystems can drastically transform in response to situations such as environmental shocks (e.g., regulatory changes) or market shifts (e.g., new technology emergence) that necessitate strategic transformations. In such cases, the ecosystem identity undergoes more than just a marginal change. Strategic transformation of ecosystems is the final process of orchestration that I discuss in the next section.

5.3.6. Evolving / transforming

Scaling and growing is a strategic imperative for sustaining an ecosystem (Moore, 1996). The focus of broadening participation orchestration is to advance ecosystem growth by scaling the niches as well as, occasionally, constituting new niches. However, merely broadening participation – i.e., doing more of the same – does not monotonically improve productivity. For instance, Wareham et al. (2014), using the case of a video games ecosystem, showed that overcrowding of complementors led to a proliferation of low quality games and severe downward price pressure, which, eventually led to demise of the ecosystem. As suggested by (Iansiti & Levien, 2004b), to be productive ecosystems have to strive to maintain a 'meaningful diversity'. Hence, growing ecosystems ought to involve strategic impetus beyond incremental broadening.

Strategic growth of ecosystems could involve different levels of transformation (Mann et al., 2022; Thomas et al., 2022). The corresponding orchestrating processes involved would also differ accordingly. This dissertation suggests that strategic growth of ecosystems can proceed along three activity patterns: replicating, adapting, and transforming. The three patterns form a hierarchy insofar as they embody increasing levels of complexity and, hence, increasing range of orchestration processes involved. I suggest replicating as the pattern of activity that recreates the ecosystem in new contexts wherein orchestration would be preoccupied with reconstructing contextual embeddedness. I suggest adapting as the pattern of activity that reframes the ecosystem's offering (often in response to competition) while still more or less retaining the current identity. Adapting would often need realignment of partners and, hence, orchestrating ecosystem adapting would necessitate fostering co-evolution in line with the renewed architecture. I suggest transforming as the pattern of activities that bring about radical change in the ecosystem identity. I expect transformation to necessitate orchestration almost similar to emergence of a new ecosystem.

5.3.6.1. Replicating

Replicating, as a strategy for scaling the ecosystem to a larger context, was observed in the VC and MV ecosystem cases. For several years since its founding, the VC ecosystem had remained limited to catering to startups in Pune region. When startups from outside Pune aspired to be a part of the ecosystem, they were required to relocate to Pune (into the physical quarters of VC, the firm) in order to be a part of the ecosystem. However, during the COVID-19 pandemic when physical movement was restricted, the VC ecosystem was forced to conduct their incubatory activities in remote mode. Doing so evoked the strategy of expanding the ecosystem footprint to a national level. VC, then, orchestrated the replication of its operations at a national scale wherein much of its ecosystem constitution remained unchanged, and its discourses shifted from being region focused to a focus on assisting specific kinds of startups (i.e., SBVs).

The MV ecosystem scaled by replicating incubation centres across the region. What started as one centre at Erlangen, multiplied into centres at Bamberg, Forchheim, and Amberg/Weiden. By doing so, the MV ecosystem gradually deepened its footprint across the EMN. Orchestrating the replication needed new infrastructure at the selected locations and new staff, but not new competencies. Hence, as shown through the VC and MV ecosystem cases, replicating is an ecosystem strategy of expanding footprints across the same or different contexts, where orchestration does not concern itself with doing something new but merely doing more of the same. However, to the extent that the contexts are new or different, orchestration would correspondingly need to revise the processes of broadening participation.

5.3.6.2. Adapting

Another form of growing is adapting. In contrast to growth by replication, which essentially preserves the ecosystem structure but merely transplants it into a new context, adapting involves broadening participation to involve new specializations with the strategic intent of repositioning the value proposition. In adapting, the underlying architecture remains essentially the same, but the value proposition is repositioned in response to a changing (or changed) competitive landscape.

An excellent example of ecosystem-level adapting was observed slightly outside the scope of the VC ecosystem case. PayTM was an established wallet-based proprietary digital payments ecosystem established in 2014. By 2017, when the UPI ecosystem was launched, PayTM had garnered a user base of 270 million. However, the UPI ecosystem's fast rise prompted PayTM to undertake adapting activities wherein it unbundled its proprietary architecture and joined the open network terms of NPCI. The value proposition of PayTM as a digital payment solution remained unchanged, but its users were able to transfer funds to any app provider or bank outside of the PayTM ecosystem (but within the UPI ecosystem)[33].

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[33] This example suggests that adapting necessitates changes to underlying architecture, in which case Figure 5.8 ought to show a direct link from 'Evolving/Transforming' subprocess to 'Crystallizing Architecture' subprocess. I argue that the direct link may not be needed because the changes to the architecture are by-products of adapting orchestration and not orchestration activities in themselves.

Another instance of adapting comes from within the UPI ecosystem. At the time this dissertation concluded, the UPI ecosystem was witnessing a need to adapt as it was getting increasingly integrated within the broader India Stack framework. For instance, two of India Stack's initiatives – ONDC and OCEN – have been built over UPI as one of their infrastructural layers. Both those initiatives run on the flow-based lending methodology where the UPI ecosystem's transaction data is a critical input. Hence, when those initiatives go live, UPI ecosystem would need to adapt provide its data to a broader participatory framework than its existing ecosystem mix. This would mean that UPI would have to start 'doing something different' to cater to the needs of the new systems it integrates with.

A minor example of adapting was also seen in the VC ecosystem's case when the COVID-19 pandemic hit and 'business as usual' could not continue due to restrictions on physical movement. VC orchestrated adapting by incorporating new processes of remote work, online management of incubation activities (including moving mentor logs online) and bringing new vendors onboard to build and manage tools needed to provision the online services.

5.3.6.3. Transforming

Transforming is a radical ecosystem change that may involve such fundamental change as revising the ecosystem's value proposition. Research has shown that ecosystem transformation involves a wide range of orchestration activities (see for e.g., Mann et al., 2022). Seen from the perspective of our proposed model, transformation prompts the ecosystem orchestrator(s) to 'go back to the drawing board' and, hence, implies the need to rechristen their collective identity. There is, thus, a high likelihood the new 'realized identity' would be different from the original 'founding identity'. Armed with the new identity, the orchestrator(s) would have to

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When PayTM unbundled its proprietary architecture, it did *not* orchestrate its partners to join the new architecture. The new architecture belonged to UPI ecosystem and, hence, prior crystallizing architecture orchestration undertaken by NPCI became relevant.

revisit the underlying architecture and initiate new road mapping and attendant articulating in alignment with the rechristened ecosystem's vision. Rearchitecting may necessitate changes to ecosystem's structure with new participants joining (i.e., broadening participation) and some existing ones falling off (Mann et al., 2022).

Instances of transforming were not readily observed in the cases studied. Nevertheless, the MV and UPI ecosystems were potentially on the verge of transformative changes. The MV ecosystem has begun looking at increasing its international presence and looks to setting up bases in cities such as Shenzhen, China, which would enable it to obtain access to international talent as well as markets. However, doing so would be a transformational change to the ecosystem founded on a regional identity. Similarly, the UPI ecosystem has been looking to integrate cross-border remittances. Doing so would not dent its founding identity but would certainly transform its vision beyond the nationalistic zeal of democratizing payments *within* the country. Moreover, integrating foreign remittances would necessitate changes to underlying architecture to include international entities and currency conversion routines.

Overall, the three patterns of activities – replicating, adapting, and transforming – characterize the subprocess of evolving/transforming orchestration. As suggested already, the three form a continuum in the sequence: replicating – adapting - transforming. While replicating is concerned with the strategy of 'doing the same but in a different context', adapting is concerned with the strategy of 'doing something different', while transforming attempts to adopt the strategy of 'becoming different'. The continuum is characterized by increasing complexity, with replicating being least complex and transforming being the most complex.

The evolving/transforming subprocess impinges upon broadening participation mainly in the cases of replicating and adapting. Replicating, owing to its new context, would necessitate renewed evangelization and may, if necessary, bring new partners onboard. Adapting, owing to the need to do something new/different, would certainly need new partners or competencies coming onboard. In the case of transforming, however, a fundamental change in identity would necessitate renewed identity construction. Subsequently, orchestration would proceed in the sequence of (re)crystalling (revised) architecture and attendant broadening participation.

5.4. Implications of the proposed process model

Based on the orchestration processes observed in the three cases of this dissertation, a generalized process model consisting of interlinked subprocesses that characterize ecosystem orchestration was abstracted. As shown in Figure 5.8, the sub-processes of orchestration – namely, constructing identity, crystallizing architecture, broadening participation, and evolving/transforming – characterize *ongoing* orchestration of ecosystems. That is, the proposed model unpacks the dynamics of ecosystem orchestration post-emergence.

5.4.1. Implications towards processual understanding

Though the proposed model delineates founding and ongoing phases of ecosystem orchestration, it ought to be noted that it does not implicate delineation between emergence and post-emergence phases. Founding orchestration need not encompass the entirety of ecosystem emergence. Ecosystem emergence, as suggested by Thomas et al. (2022), involves the process of an ecosystem attaining a fully formed state and, typically, necessitates value discovery, resourcing setup, contextual embedding, and collective governance aspects to be put in place. By founding orchestration, only those activities were implicated that led to a legal recognition of the collective. In the case of VC and MV ecosystems, founding orchestration was complete when the focal organization, VC and MV respectively, were established as non-profit entities. In the case of the UPI ecosystem, founding orchestration was complete when UPI was formally launched through an RBI directive. Thus, ongoing orchestration (as shown in Figure 5.8) encompasses both emergence and post-emergence processes.

Though the process model suggests that the sub-processes of orchestration interact in myriad ways and, especially, iterate over time, certain sequence of activities was observed in all cases. This was owing to the fact that irrespective of their context all ecosystems typically begin from emergence and stabilize over time. Though each of the three cases started with distinct enabling conditions, and had correspondingly distinct founding activities, they invariably converged, in terms of the sub-processes, at two points in their evolution: (1) creating an identity that coalesced the variety of partners (each with a distinct objective) under a shared cognitive understanding, and (2) establishing an underlying architecture (including aspects such as standards of interaction and protocols of coordination) in a consensual manner. These sub-processes were accomplished typically early in the ecosystem's evolution and invoked the other subprocesses.

Figure 5.12 shows a landscape where the orchestration "journey" of the three cases is mapped along two dimensions. The horizontal dimension (i.e., x axis) consists of the subprocesses shown in Figure 5.8. The sequencing of the sub-processes is in accordance with the dominant flow of activities observed in all the three cases. Typically, each ecosystem started from founding actions that leveraged enabling conditions. Constructing identity was one of the first tasks invoked during ecosystem emergence, followed by crystallizing of workflow (i.e., architecture of collaboration). Once the norms of interaction were established, the focus shifted towards broadening participation (to attain critical mass and to grow beyond). Over time, as the ecosystems grew, orchestration gradually was preoccupied with evolution and transformation of the value proposition. The vertical dimension (i.e., y axis) in Figure 5.12 consists of the four orchestration categories ordered as per convenience of mapping. Each case was mapped on this landscape based on the understanding of how ecosystem orchestration evolved over time. Data was primarily taken from the abstracted process maps (Figures 5.3, 5.5, and 5.7). The orchestration journeys of the three ecosystems can be traced through the labels representing each ecosystem.

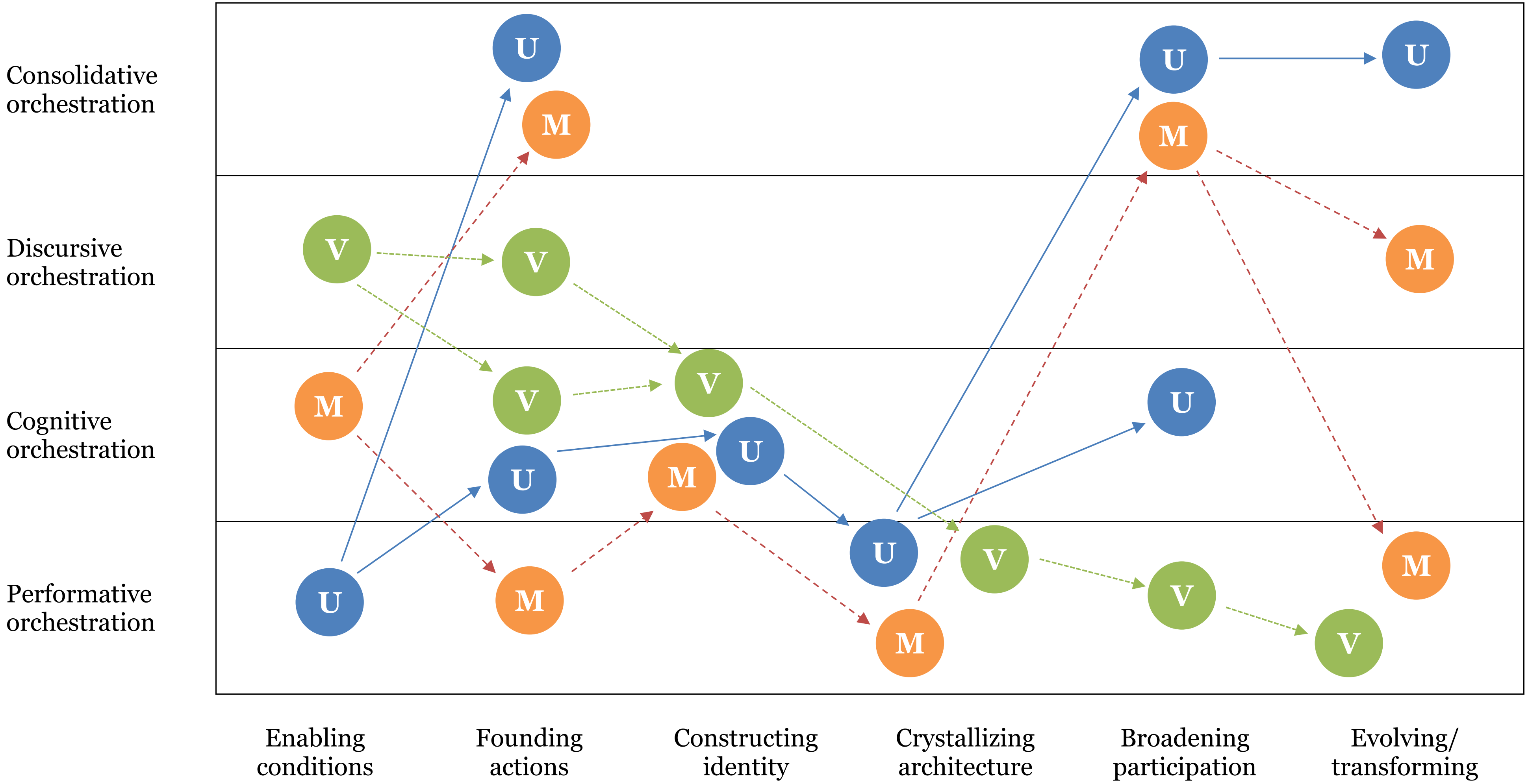

Figure 5.12: *Many paths to successful orchestration. Figure illustrates the flow of orchestration activity in the three cases from the perspective of categories and subprocesses. The circles labelled 'V' represent VC data points, those labelled 'M' represent MV data points, and those labelled 'U' represent UPI data points.*

From Figure 5.12 it can be seen that through the three cases had distinct enabling conditions and invoked disparate founding actions, emergence (and stabilization thereafter) essentially involved cognitive orchestration of identity creation and performative orchestration of mapping the norms of interaction. Thus, these sub-processes are deemed essential aspects of orchestrating ecosystem emergence and sustenance. Thereafter, the three ecosystems can be seen tracing distinct paths. While the VC ecosystem was orchestrated towards higher control and bundling by the focal firm, orchestrators of the UPI ecosystem focused on strengthening trust and expanding the user base. In contrast, the MV ecosystem undertook a wide range of activities involving consolidative (for instance, regional expansion), discursive (for instance, deepening value narrative), and performative (for instance, enhancing internationalization operations). These subsequent orchestration activities (of broadening participation and evolving/transforming) invoked, in turn, new identity creation and changes in the underlying workflow.

5.4.2. Implications towards extant research

The process model also entails several implications towards extant understanding in literature. The implications precipitate into three categories: (1) implications that confirm the findings in extant research, (2) implications that contradict current understanding of ecosystem orchestration, and (3) implications that extend current understanding through novel insights.

This dissertation confirms the findings of scholars that have undertaken similar process research. For instance, Dattee et al. (2018) presented a process model of ecosystem emergence which showed how orchestration starts with an ‘envisioned’ value proposition and gradually materializes it through a negotiated process that involves pre-empting drift of partners (trying to maximize their own value capture) and enacting resonance within the collective. Our process model has confirmed the sequence of processes by incorporating activities of road mapping and articulation that complement the envisioning and negotiating in Dattee et al.'s (2018) study. In fact, Dattee et al.'s (2018) study was only concerned with ecosystem emergence while this dissertation took a broader perspective of both emergence and steady-state processes. In doing so, this dissertation not only confirms Dattee et al.'s (2018) findings but also provides a segue into how orchestration continues with similar subprocesses post-emergence.

Also, some scholars undertook focused studies that investigated significant (but narrow) insights into ecosystem orchestration. Thomas and Ritala (2021) focused on ecosystem identity construction and emphasized cognitive and discursive processes underlying orchestration. Similarly, Snihur et al. (2018) looked at ecosystem disruption and demonstrated how framing processes orchestrate coalescing around a new value proposition. This dissertation, through its broad perspective, has not only confirmed the underlying processes suggested by these authors - i.e., discursive, and cognitive orchestrating – but also integrated those into a larger framework consisting of two additional categories – namely, consolidative, and performative orchestration – and, hence, provided an all-round view of ongoing orchestration.

Further, this dissertation through a process model has showcased that orchestration involves several underlying subprocesses with distinct analytical foci. For instance, the two subprocesses articulating and evangelizing are conceptually similar, yet they have contrasting foci. While articulating focuses on potential partners (i.e., internal focus), evangelizing focuses on the market environment (i.e., external focus). Table 5.3 lists the analytical foci of the underlying activity patterns within each subprocess. It can be seen that each orchestration subprocess has a distinct analytical focus that represents the preoccupation with accomplishing a specific orchestration outcome. The range of analytical foci (listed in Table 5.3) encompass (and, hence, validate) the work of scholars that have focused on specific aspects of orchestration.

***Table 5.3**: Analytical foci of the orchestration subprocesses.*

Orchestration subprocess		**Analytical focus (*key orchestrating question*)**	**Correlation with other works**
Synergizing FA with enabling conditions	Grounding FA in the narrative	Discourse focus (*what is the prevalent narrative?*)	Autio, 2021; Dattee et al., 2018; Thomas et al., 2022
	Combining FA with reputation	Capability focus (*which competency is necessary?*)	
	Leveraging FA through systems	Technology focus (*which technology is relevant?*)	
Constructing identity		Ecosystem identity (*who are we?*)	Thomas & Ritala, 2022
Crystallizing architecture	Road mapping	Ecosystem structure (*how can we work together?*)	Adner, 2017; Dattee et al., 2018
	Articulating	Potential partners (*how can we convince you to join us?*)	Daymond et al., 2022
Broadening participation	Evangelizing	Market environment (*this is what we do, do you know?*)	Furr & Shipilov, 2018; Giudici et al., 2018
	Sensing affordances	New opportunities (*what more can we do?*)	Autio et al., 2018
	Partner onboarding	New partners (*how can we help you join us?*)	Lingens & Huber, 2021; Lingens, Huber, & Gassmann, 2021
Evolving/ transforming	Replicating	New context (*where else can we go and do what we are doing now?*)	Adner, 2012; Jacobides, 2019; Jacobides et al., 2018; Moore, 1996
	Adapting	New opportunities (*where can do more differently?*)	
	Transforming	New identity (*how can we be different?*)	

While the above were instances of confirming or complementing extant understanding, this dissertation has also served to contradict claims by some scholars. Firstly, this dissertation has shown how multiple orchestrators can all orchestrate different facets of orchestration *at the same time*. For instance, in the UPI ecosystem, it was seen that while NPCI undertook road mapping activities, Nilekani and team complemented with articulating the vision to key stakeholders and driving consensus, while iSPIRT orchestrated the tech community to build the underlying API architecture. This contradicts research that has either assumed the presence of a single orchestrator (the keystone) (e.g., Iansiti & Levien, 2004b) or suggested that orchestration passes from one entity to other sequentially through time (e.g., Davis & Eisenhardt, 2011).

Another contradiction lies in the area of emergent conditions. Most scholars have focused on resourcefulness of orchestrators as the basis for orchestrating ecosystem emergence. For instance, Yoffie & Kwak (2006) argued that firms leverage a combination of hard and soft power to orchestrate ecosystems. Their analysis was based on observations of how 'powerful' firms such as Microsoft and IBM coerced their partners to make complementary investments. Similarly, Williamson & De Meyer (2012) showed how ARM, the market leader in processors for mobile devices, was able to attract handset manufacturers such as Nokia and Samsung into *its* ecosystem. This dissertation has contradicted such research that has suggested a titular role for firm capabilities (or resource ownership) in ecosystem orchestration (e.g., Helfat & Raubitschek, 2018), by showing that successful orchestration of ecosystem emergence necessitates a combination of founding advantage *and* environmental conditions. In that respect, this dissertation has demonstrated how ecosystems can emerge from very different originating conditions. For instance, while VC emerged by leveraging the prevalent narrative, MV focused on harnessing geographical reputation, and UPI exploited the success of existing systems.

Finally, the process model extends with the work of several scholars who have also undertaken processual studies of ecosystems. Mann et al. (2022) demonstrated that ecosystem orchestration goes well beyond mere planning or coordination of disparate actors, rather it involves an intimate management of different elements of the integrated value proposition driven by the intention of creating benefit for all actors involved. The process model of this dissertation has unbundled aspects of the 'intimate management' and showed how materializing the value proposition involves an intricate interplay of several patterns of activities.

This dissertation is one of the few studies that has investigated orchestration processes beyond ecosystem emergence. By doing so, it has shown how the processes manifested during ecosystem emergence play out in steady state. For instance, Dattee et al.'s (2018) study threw great light on road mapping as the means of crystallizing a value proposition during emergence. This dissertation suggests that road mapping is also inherent to orchestration in steady state where it recursively iterates during processes of broadening participation and identity (re)construction. On identity construction, Thomas and Ritala's (2021) argued that identity construction was a way for nascent ecosystems to overcome the 'liability of newness'. In that respect, their study laid the ground for a founding identity. This dissertation extends the perspective of identity construction as an ongoing activity that extends well beyond the nascent stage into both steady state (where sensing new affordances can invoke marginal identity changes) and ecosystem transformation stages. Thus, the process model extends current understanding by showing that ecosystems can be characterized by evolving identity over time, especially showing that the realized identity (in steady state) need not be the same as the identity constructed at ecosystem founding.

Further, the processual perspective of this dissertation has precipitated a model that complements the multilevel framework of orchestration suggested by Autio (2021). In his conceptual paper, Autio (2021) delineated ecosystem orchestration as involving activities across four layers: (1) the technological layer embodies the value architecture that is typically characterized by a set of standards, (2) the economic layer that consists of incentives to attract participation, (3) the institutional layers that involves establishing the rules of the game, and (4) the behavioural layer that embodies strategies to influence the actions of ecosystem constituents. While Autio (2021) work has laid down a structural perspective clarifying the 'what' of orchestration, this dissertation had advanced a complementary process perspective explaining the 'how'. Our process model has elaborated how, (1) value architecture is crystallized through deliberation and negotiation, (2) participation is attracted through discursive and consolidative orchestrating activities of sensing affordances, evangelizing, and partner onboarding, (3) rules of the game are finalized through a combination of identity construction, road mapping, and articulation. Thus, this dissertation has extended the multi-level (static) orchestration framework with a process-focused (dynamic) complement.

5.5. Chapter conclusion

This chapter has provided a comprehensive view of the findings of this dissertation. It started with enunciating the four categories of orchestration – consolidative, discursive, cognitive, and performative – that were observed as activities patterns grouped by distinct objectives. The activity patterns emerged from thematic analysis exercise (explained in the previous chapter). Given the nature of activity flow, the four activity patterns cannot be clearly delineated, hence, the identified themes fail to be mutually exclusive. Nevertheless, given that each activity pattern flows from a clearly intended objective, they are branded as categories. By identifying the four categories, this exercise has served to answer the research question, *what constitutes ecosystem orchestration?*

Then, process maps were presented that showcased the flow of orchestration activity in temporal sequence using the orchestration categories as an organizing backdrop. Thus, in section 5.2, the discussion of process mapping for each case culminated in an abstracted process model of orchestration, specific to that case. Precipitating the abstracted process maps enabled a view of how orchestration flowed across the orchestration categories over time.

Then, the chapter (in Section 5.3) elaborated a process model that provided a view of the sub-process underlying ecosystem orchestration. The process model encompassed both founding and steady state orchestrating, and answered the research question: *what are the underlying dynamics of orchestrating ecosystems?* The model demonstrated that ecosystems could arise from different enabling conditions and, correspondingly, undertake peculiar combinations of founding actions. Successful orchestration, it was seen, often found an optimal synergy between enabling conditions in the environment and inherent advantages of the orchestrating entity.

The process model also illustrated how orchestration panned out post-emergence. It suggested that subsequent to ecosystem launch, orchestrating involved processes of identity construction, crystallizing architecture, broadening participation, and evolving/transforming. These processes could be effected through different orchestrators (all working at the same time) and typically executed in an interlinked fashion, with identity construction being an overarching process that started from a founding identity and evolved into one or more realized identities over time.

Having analysed ecosystem orchestration from two perspectives – thematic and processual – a combined view is then attempted by mapping orchestration journeys (of the three ecosystems) in a landscape involving both thematic and processual dimensions. The analysis emphasized the criticality of cognitive and performative orchestration (especially in the initial stages of the ecosystem's lifecycle). Then, implications of this dissertation's findings are discussed under three headings: how the findings corroborate propositions by other scholars, where the findings contradict extant research, and ways the findings contribute novel insights to literature.

CHAPTER 6

Theoretical Contribution

> "Meta-organizations offer a reminder that organizations are not necessarily the victims of given environments. Rather than simply adapting to a possibly uncertain and hostile environment, organizations are sometimes able to turn part of their environments into organization: they are able to get rid of environment. Obvious cases of this are mergers and acquisitions, but meta-organizations provide another and different kind of example. Here parts of the environment are moved from an environmental order into an organizational order— not, however, by reducing the number of organizations, but by increasing it."
>
> – (Ahrne & Brunsson, 2005: 447)

This dissertation was borne out of an interest in investigating the phenomenon of business ecosystems. A review of the literature showed that the research on ecosystems has burgeoned in recent years, and scholars have been attempting to lay down a theoretical framework for ecosystems. However, the theorization of ecosystems had taken a predominantly structural perspective (e.g., Adner, 2017; Jacobides et al., 2018), and, hence, some scholars had begun to call for undertaking processual studies of ecosystems (Spigel & Harrison, 2018; Thomas et al., 2022). This dissertation embarked on a process study of ecosystems, attempting to investigate the ecosystem phenomenon, and examining the underlying dynamics of *how* ecosystems are effectively managed and successfully sustained.

An activity-based view was adopted towards taking the process perspective on ecosystems (as proposed by Fachin & Langley, 2017). The activity-based view uncovered a plethora of ecosystem activities, wherein it emerged that orchestration was a pivotal process involving a broad set of activities that affected the entire collective (Giudici et al., 2018) and governed the creating (and capturing) of value

(Dhanaraj & Parkhe, 2006; Kapoor, 2018). In short, orchestration was the process responsible for envisioning, building, and sustaining the ecosystem (Autio, 2021; Helfat & Raubitschek, 2018).

Research that has investigated the organiz*ing* aspect of ecosystems has provided significant insights into *how* ecosystems emerge (e.g., Dattee et al., 2018; Snihur et al., 2018), grow (e.g., Burgelman et al., 2022), and are effectively sustained (e.g., Giudici et al., 2018). Further, the research on orchestration has provided a bridge to understanding the role of underlying capabilities and resources in effectively *organizing* ecosystems (e.g., Foss et al., 2023; Helfat & Raubitschek, 2018). Nevertheless, a generalized model of how ecosystems are orchestrated, especially in the stages beyond emergence, remained under-researched. This dissertation has attempted to fill that gap by constructing a process model encompassing the ensemble of (sub)processes that effect ecosystem orchestration[34].

This dissertation has shown (see Figure 5.8) that ecosystem orchestration proceeds through distinct founding and post-founding stages with attendant identity construction work (Thomas & Ritala, 2022). Once the ecosystem is founded, orchestrating shifts into an ongoing mode that involves interlinked patterns of activities characterized by four subprocesses: constructing identity, crystallizing architecture, broadening participation, and evolving/transforming. In doing so, this dissertation has attempted to extend the theorization of ecosystems from a process perspective. In line with the observation by process scholars (e.g., Cloutier & Langley, 2020), the process model suggested by this dissertation embodies multiple levels (i.e., firm-, interfirm-, and ecosystem-levels). Also, since ecosystems often span across industry boundaries (Moore, 1996), the process model contributes to theorizing on orchestration across industries. To explain this contribution, let us first see how orchestration has manifested at different levels of analyses.

[34] A detailed explanation of how this study arrived at the process model is covered in Chapter 4 (Research Design & Methodology). The process model itself is elaborated in Chapter 5 (A Process Model of Ecosystem Orchestration).

6.1. Orchestration at different levels (of analysis)

The concept of orchestration has received attention from several streams of management research. One of the highly cited works on orchestration is by Dhanaraj & Parkhe (2006)[35], who used the concept to explain how a focal firm can manage the innovation network around it. The authors suggested that orchestration involves activities that facilitate value creation and capture amidst loosely coupled autonomous entities. Similarly, several scholars in different streams of research have applied the concept at different levels of analysis.

6.1.1. Orchestration at the firm level

The literature on resource orchestration has looked at orchestration predominantly within the firm, sometimes extending to the enterprise encompassing the focal firm's subsidiary network. Thus, resource orchestration research has investigated firm-level orchestration (e.g., Schriber & Löwstedt, 2018; Sirmon et al., 2011). One stream of resource orchestration literature, branded as asset orchestration, has focused on how a firm's managerial decisions leverage the firm's assets toward finding fitness in an ever-changing dynamic environment (Schriber & Löwstedt, 2018; Teece, 2007).

Resource orchestration has been concerned with how "managers make, build, acquire, deploy, and redeploy decisions with respect to assets/capabilities" (Pitelis & Teece, 2010: 1254). Resource orchestration leverages the organization's knowledge base and manifests through collective efforts (Winter, 2003). Scholars have argued that resource orchestration can encompass a firm's entire range of assets and involve the entire managerial hierarchy (Sirmon et al., 2011). While some scholars argued for the primacy of the nature of the resource base (Sirmon, Hitt, & Ireland, 2007), others focused on how managerial fiat selected and configured those resources (Helfat et al., 2007). Still, others argued that orchestration pertained to how skilfully an

[35] The work had close to 2500 citations as on 13 July 2023 (based on data from Google Scholar).

'enterprise' created unique and distinctive value by working with a portfolio of assets that the enterprise owned (Teece, 2007).

Scholars have suggested that resource orchestration involves structuring, bundling, and leveraging firm resources to secure competitive advantage (Sirmon et al., 2007). Firms structure their resource portfolio either by acquiring valuable resources from strategic factor markets or developing resources internally while divesting resources that do not contribute to value creation. Then, they bundle resources to create capabilities that either augment existing capabilities or create entirely new capabilities. Finally, the (renewed) capabilities are leveraged for value creation through mobilizing, coordinating, and deploying processes (Sirmon et al., 2007). Thus, the literature on resource orchestration has elaborated on the orchestration processes at a firm level.

6.1.2. Orchestration at the interfirm level

The research stream on (innovation) networks has extensively considered orchestration as a mechanism for interfirm coordination, especially involving firms that are outside the focal firm's value chain (e.g., Dhanaraj & Parkhe, 2006). Scholars have employed orchestration to represent how a focal firm assembles and develops an inter-organizational network involving complementary partners. For instance, Paquin & Howard-Grenville's (2013) study investigated an industrial symbiosis network in the UK and found that the lead firm actively orchestrated engagements with (and between) network participants to foster the creation of novel (and fruitful) ties that can bring value to its members. Dhanaraj & Parkhe (2006) suggested that governing innovation networks involved orchestration activities (by the hub firm) that facilitated knowledge mobility, innovation appropriability, and network stability.

The literature on supply chains has investigated how orchestration manifests across the value chain. The supply chain typically refers to the flow of goods from raw materials, through distribution, to the product's sale to the end consumer (Dedrick, Kraemer, & Linden, 2010). Increased vertical disaggregation (Jacobides, 2005; Mudambi, 2008) has dispersed firm specializations to external entities and necessitated interfirm coordination. Thus, focal firms must orchestrate tangible and intangible resource (and knowledge) flows across firms to create value for the end user. For instance, Hinterhuber (2002) has shown how firms like Monsanto and DuPont orchestrated a wide range of partners that were part of their extended supply chain, thus, enabling the focal firms to deliver several pioneering biotechnology solutions. In the process of orchestrating the supply chain, the firms employed mechanisms such as R&D collaborations, alliances, and joint ventures (Hinterhuber, 2002).

Further, in supply chain literature, one of the streams that have focused extensively on orchestration is the research on multinational enterprises (MNEs) and the ways they manage global value chains (GVCs) (e.g., Hannigan, Cano-Kollmann, & Mudambi, 2015; Pitelis & Teece, 2018). Pitelis & Teece (2018) have argued for an orchestration "theory" to explain how MNEs set up and manage different modalities in different markets. Using the example of Starbucks, which uses alliances in some countries and an FDI approach in others, they argue that the orchestration approach provides the best explanation for how Starbucks managers "manage each modality efficiently and respond appropriately as issues arise in each country-modality sub-group" (Pitelis & Teece, 2018: 530).

6.1.3. Orchestration at the industry level

The literature on dominant design and standard-setting has looked at industry-level orchestration. A new dominant design can emerge when a new technology disrupts and renders an incumbent technology obsolete. Amongst the several variants of the new technology that emerge in the marketplace, the ferment of variation and selection renders one variant the dominant design (Anderson & Tushman, 1990). Research has shown that precipitating a dominant design through the ferment is work no single firm can achieve independently (Srinivasan, Lilien, & Rangaswamy, 2006). A dominant design emerges through coalitions of partially competing and partially complementing firms that share a similar technological view (Möller & Rajala, 2007). These coalitions orchestrate processes of agenda setting, sometimes also involving regulators and financial institutions in the mix, to subtly align public opinion in favour of their design. Subsequently, they orchestrate mobilization and coordination activities that establish their design as the preferred design for future commercial applications and services (Möller & Rajala, 2007).

The phenomenon of standard setting is also an industry-wide phenomenon similar in strategic aspects to dominant design emergence. However, while establishing dominant designs is the purport of commercial organizations – like IBM's role in establishing PC design, or Microsoft-Intel partnership's role in establishing Wintel architecture – nonprofit standards associations – like the International Telecommunication Union (ITU) and Institute of Electronics and Electrical Engineers (IEEE) – typically play the focal role in setting industry standards[36]. Research has shown that orchestration processes, similar to those leading to dominant design establishment, play out in how standards were established. For instance, the adoption of GSM as a standard for the European mobile communications industry involved orchestration by Scandinavian regulators in consonance with manufacturers such as Ericsson and Nokia (Funk, 2009). Similarly, the emergence of Bluetooth[37] as an industry standard was orchestrated by the Bluetooth Special Interest Group (BSIG), which leveraged the resourcefulness of its core members – Intel, IBM, Ericsson, Nokia, and Toshiba – to bring on board a wide

[36] The focality of standards organizations, of course, pertains only to standards that are committee-based. As Keil (2002) has suggested, standards can also be established purely through market-based mechanisms where the winning standard is not predetermined by associations or committees but emerges through market forces such as user adoption.
[37] https://www.bluetooth.com/ (accessed 14 July 2023)

range of participants in the personal computing industry.[38] The BSIG included more members as newer versions of Bluetooth were released (Keil, 2002).

6.1.4. Orchestration at the inter-industry level

The research on service-dominant logic (SDL) has looked at orchestration across industries. The SDL takes the perspective that all goods are essentially services since the value that is created – though embedded in a product – is eventually realized through 'value-in-use' by the consumer (Chesbrough, Lettl, & Ritter, 2018; Vargo & Lusch, 2004). Also, goods embody predetermined and embedded value realized through discrete exchange transactions; while services are user-centred and value is realized through co-creation (with the users) involving mutuality and dynamic relationships (Vargo & Lusch, 2004). Hence, value creation in the context of services involves an intimate connection between user needs and service characteristics, focusing on enhancing user experiences (Prahalad & Ramaswamy, 2004).

According to the SDL, value creation (and innovation) relies on a tacit understanding of the subjective utility function that drives individual customer experience (Chesbrough, 2011; Gallouj & Weinstein, 1997). Correspondingly, value creation and delivery involve an extended knowledge base, including those of the producers and consumers and possibly several other stakeholders (Grönroos & Voima, 2013). Take, for instance, the service innovation of programmable motors introduced by LEGO in its kits in 1998 (Chesbrough, 2011). In due course, LEGO realized the potential of taking the innovation to kids in the schools. Hence, LEGO orchestrated partnerships with various schools in the US and developed a middle-school curriculum wherein children could learn (and experiment with) preliminary robotics technology using the new LEGO kits with motors. In doing so, LEGO had orchestrated beyond its

[38] Though Bluetooth is a standard in several other industries (for e.g., mobile communications), owing to its general-purpose functionality of enabling wireless interaction between any two compatible devices, the impact on computing industry was the greatest, hence, the focus of this standard-setting case remains as an industry-level phenomenon.

traditional gaming industry, going into the education industry.

The research on application programming interfaces (APIs) is another stream that has looked into the context of inter-industry orchestration. APIs are often discussed in the literature on platform ecosystems (e.g., McIntyre, Srinivasan, Afuah, Gawer, & Kretschmer, 2021; Srinivasan, 2021). Unlike pipeline businesses where value flows along a chain (Van Alstyne, Parker, & Choudary, 2016), platforms intermediate between several players (typically from different industries) at the same time and involve activities for leveraging the pool of resources towards generating benefits for all participants (McIntyre et al., 2021). Hence, platform business models typically involve orchestrating flows of resources through standardized protocols of interaction (i.e., APIs) (Srinivasan, 2021). For instance, Apple's iTunes platform employs APIs to intermediate between players from different industries such as music producers, hardware manufacturers, operating system software providers, and digital rights management modules with the aim of providing users access to a wide range of music. In that respect, APIs become building blocks for intermediating inter-industry collaboration (Hein et al., 2020).

Another example of orchestration across industries is in the context of business ecosystems. Ecosystems often encompass actors from multiple industries (Moore, 1993, 2006). Take, for instance, a multisided e-commerce platform (Cennamo, 2021; Gawer & Cusumano, 2002). The digital infrastructure at the centre facilitates (and regulates) interaction between several ecosystem participants such as buyers, sellers, banks and financial entities, logistics providers, and app developers, all possibly hailing from different industries. Nevertheless, the platform becomes a common meeting ground where the (platform) owner orchestrates their coalescence and coordination through protocols and norms of communication. Another non-digital example is that of the electrical vehicles' ecosystem, which consists of car manufacturers, battery technology, regulators, charging infra providers, software developers, and insurance agents, to name a few (Adner, 2012). Thus, orchestrating ecosystems can be a complex affair of negotiating diverse perspectives to deliver a coherent value offering (Kapoor, 2018; West & Olk, 2023).

While some recent work has begun to elaborate ecosystem orchestration from a processual perspective (e.g., Burgelman et al., 2022; Dattee et al., 2018; Daymond et al., 2022; Giudici et al., 2018), scholars seem to have taken an interest in researching the emergence phase (Thomas et al., 2022; Thomas & Ritala, 2022). Consequently, there has been a dearth of studies that has investigated *ongoing orchestrating* as ecosystems mature or reach a steady state. This dissertation attempted to fill that gap. The process model of ecosystem orchestration laid down in this dissertation (see Chapter 5) elaborates on a generalized process view of how ecosystems are orchestrated, primarily as they transition into the post-emergence stage. In doing so, this dissertation has contributed to enhancing the theoretical understanding of orchestration at the inter-industry level. Table 6.1 summarizes the above discussion on different levels of orchestration.

By elaborating on categories of orchestration, this dissertation showed that orchestrating partners from different industries involves a mix of consolidative, discursive, cognitive, and performative processes. From a processual perspective, orchestration involves four sets of activities: (1) activities involved in constructing an identity for the collective to coalesce efforts into alignment (Daymond et al., 2022); (2) activities aimed at crystallizing an architecture for collaboration and coordination (Dattee et al., 2018; Fjeldstad et al., 2012); (3) activities focused on broadening participation once an architecture is precipitated (Giudici et al., 2018), and (4) activities for evolving and transforming the ecosystem in response to changing internal/external conditions (Burgelman et al., 2022). This dissertation has, thus, served to extend the findings from the research on ecosystem emergence by illustrating the intricacies of how ecosystem (hence, inter-industry level) orchestration unfolds over time.

Table 6.1: *Orchestration at different levels of analysis. The orchestration categories are explained in Chapter 5.*

Orchestration level	**Focus of orchestration (example domain)**	**Relevant orchestration categories**
Firm-level	Bundle resources to enhance value creation (e.g., Resource/asset orchestration)	Consolidative
Interfirm level	• Leverage interdependent relationships (e.g., supply chain, value chain) • Enhance innovative capability (e.g., innovation networks)	Consolidative, discursive
Industry level	Creating/setting the norms (e.g., dominant design, standard setting)	Consolidative, discursive, cognitive
Inter-industry level	Co-creation (e.g., SDL, ecosystems)	Consolidative, discursive, cognitive, and performative

As shown in Table 6.1, this dissertation has elaborated on category-level dimensions of orchestration. It has shown that ecosystem (or inter-industry) orchestration involves additional dimensions compared to orchestration at the other (lower) levels. Specifically, it has found that performative orchestration – i.e., activities that demonstrate the viability of the coherent value offering – is an additional dimension that assumes significance in orchestrating inter-industry collectives such as ecosystems.

Since ecosystems are collectives of relatively autonomous actors, there is a need for mechanisms to *persuade* potential partners to make ecosystem-specific investments (Helfat & Raubitschek, 2018; Jacobides et al., 2018; Teece, 2007). Performative orchestration attends to that need. For instance, in the UPI ecosystem case, performative orchestration was undertaken by NPCI in developing the reference implementation (BHIM) with the intention of increasing adoption of the ecosystem and persuading many partners to join the ecosystem. However, though performative orchestration gains focus as a novel insight, this dissertation suggests that all four orchestration categories – consolidative, discursive, cognitive, and performative – have equal standing in ensuring effective orchestration. Indeed, as shown in Figure 6.1, the four categories are interlinked in the process of *ongoing* orchestration.

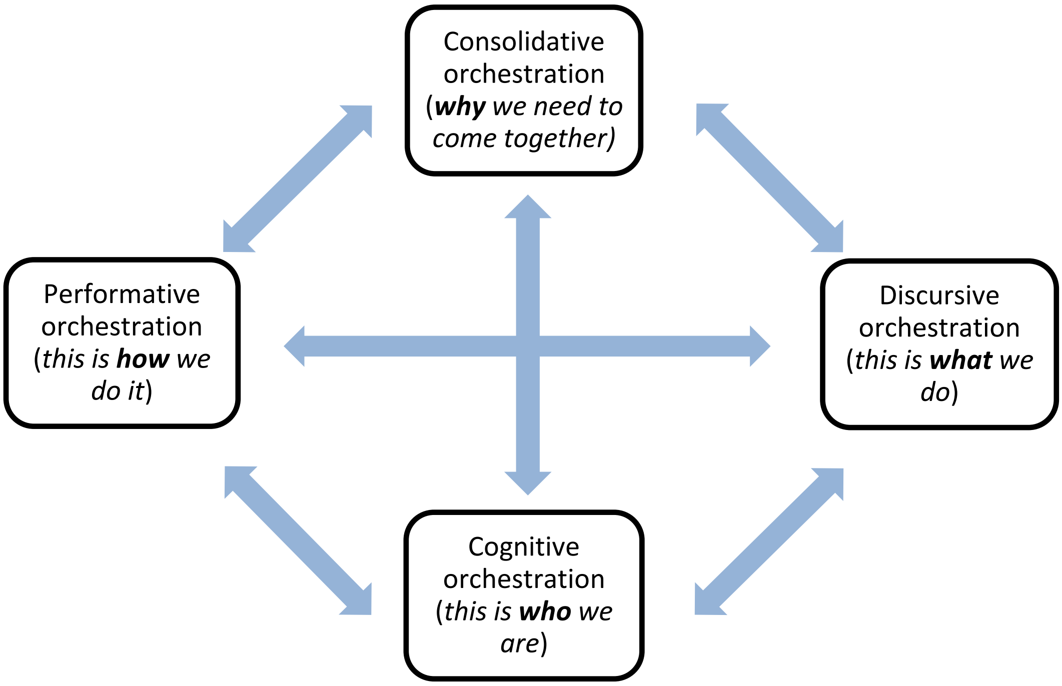

Figure 6.1*: Interlinking of ecosystem orchestration categories. There is no definite sequence, and the categories can interact in myriad ways.*

Figure 6.1, in fact, takes the form of a mosaic with value creation being intimately linked with value capture, in ways that show how successful orchestration of an ecosystem is a unique achievement and not readily replicable. Research has shown that value creation and capture are reciprocally related in an ecosystem setup – while the extent of value appropriated by an ecosystem participant is typically a function of its share in the overall value created, each participant's extent of value captured acts as a motivation in driving its contribution towards value creation (John & Ross, 2022). Thus, shown in Figure 6.1, orchestrators ought to *engineer* a value mosaic involving an intricate balance between the dynamics of value creation and value capture (Daymond et al., 2022; West & Olk, 2023).

The consolidative ("why" we need to come together) and cognitive ("who" we are) orchestration drive the dynamics of value creation. Identity (cognitive orchestration) and purpose (consolidative orchestration) act as coalescing forces (Daymond et al., 2022). While identity provides the ground for legitimacy (Thomas & Ritala, 2022), enacting a purpose drives integration and synthesizes value creating efforts (Thomas et al., 2022). Complementarily, the discursive ("what" we do) and performative ("how" we do it) orchestrations enable positioning and differentiation; hence, driving the dynamics of value capture. Narrative setting (discursive orchestration) and value demonstration (performative orchestration) facilitate value delivery and dissemination (Thomas et al., 2022). While narratives enable framing of the value proposition (Snihur et al., 2018), performative demonstration concretizes the offering and, hence, sets the stage to realize value capture (Jacobides et al., 2018).

Radziwon et al.'s (2021) case study of how AirAsia, a low cost airline firm headquartered in Malaysia, orchestrated an ecosystem to emerge from the disruptions caused by COVID-19 pandemic provides a demonstration of the value mosaic effected through the four categories of orchestration. In the years following the COVID-19 pandemic, AirAsia underwent comprehensive digital transformation by jointly innovating with several partners. The transformation involved an ecosystem approach where all four categories of orchestration were undertaken by AirAsia. Consolidative orchestration enabled identification of partners (such as ecommerce platforms, ghost kitchens, digital media agencies), and cognitive orchestration enabled refocusing and repurposing critical assets that served to "expand, monetize, and broaden AirAsia's digital footprint" (Radziwon et al., 2021: 6). As discussed above, these two categories primarily orchestrated value creation. On the other hand, discursive orchestration enabled (re)framing the scope of operations, and performative orchestration enabled leveraging synergies between the ecosystem partners, thus, facilitating value realization, and, hence, concretizing value capture. Thus, by disentangling the nature of orchestrating ecosystems, this dissertation has contributed towards examining how value mosaic manifests at the inter-industry level. The next section discusses four significant contributions by this dissertation to the research on ecosystems.

6.2. On orchestrating ecosystems

By investigating the underlying dynamics of orchestrating ecosystems over time, this dissertation has unpacked the black box of ecosystem orchestration. The findings of this dissertation have elaborated how ecosystem orchestration unfolds, and illuminated how value co-creation strategies can be effected over time. In laying down a process model, this dissertation makes four significant theoretical contributions to the research of ecosystem orchestration: (1) it has emphasized the role played by enabling condition in ecosystem emergence and, thence, shown what it takes to orchestrate ecosystems, (2) it has demonstrated that identity creation is one of the foremost processes of ecosystem orchestration, (3) it has shown that ecosystem identities undergo evolution over time, and (4) it has illuminated the process of multiparty orchestration.

6.2.1. Enabling conditions for ecosystem emergence

This dissertation has shown that effective orchestration can facilitate ecosystem emergence starting from different enabling conditions. More importantly, it has demonstrated that orchestrating ecosystem emergence necessitates a combination of firm-level advantage and environmental munificence. Extant research has looked at the two aspects separately. For instance, scholars focusing on firm-level advantages suggested that firms ought to embody high levels of bargaining power – either in terms of hard power, such as capital, or soft power, such as market influence – to be able to orchestrate ecosystems (De Meyer & Williamson, 2020; Williamson & De Meyer, 2012). Others have argued that those firms that develop integrative capabilities (Foss et al., 2023; Helfat & Raubitschek, 2018) and can envision the combined value offering (Dattee et al., 2018) will become effective orchestrators.

Another stream of research focused on the role of environmental munificence in ecosystem emergence. Adner (2012) cites several instances of pioneering innovations that failed because the market environment lacked the necessary complements to realize the full potential of the innovation. The author cites the case of HDTV, which failed to gain initial traction as it had arrived far ahead of matching innovations in video recording and broadcasting. Similarly, in another case cited by the author, the run-flat tire technology by Michelin failed to gain adoption as there was a lack of readiness on the part of car manufacturers and service mechanics. This stream of research has suggested that environmental readiness is vital to orchestrating ecosystem emergence (e.g., Yoffie & Kwak, 2006).

This dissertation has shown that *both* firm capabilities (i.e., founding advantage) *and* environmental factors (i.e., enabling conditions) are necessary for orchestrating ecosystem emergence. More importantly, for effective orchestration, the orchestrator should identify the right combination of founding advantage and enabling conditions. It was witnessed in each of the three cases in this dissertation. In the VC ecosystem's case, VC grounded its reputation in the prevalent narrative of the region as a hub of startup activity. In the MV ecosystem's case, MV, as an association of key players in the region, embodied proven strength, which it combined with the established reputation of the region in medical device innovation. In the UPI ecosystem's case, NPCI had several past successes to its credit which it leveraged through established systems that would be the infrastructure for the envisioned UPI ecosystem.

In emphasizing founding advantages, this dissertation has also emphasized facets of 'what it takes to orchestrate'. The focal players in all three ecosystems – VC in the VC ecosystem, MVEMN in the MV ecosystem, and NPCI in the UPI ecosystem – displayed characteristics that strengthened their ability to orchestrate their respective ecosystem. All three espoused a firm intent and drove the shared vision within their partner community. Also, all three envisioned clear metrics about what they wanted to achieve (which, in turn, enabled driving the shared vision): VC aspired for its ecosystem to be the go-to destination for SBVs in the region (and, later on, across the country), MVEMN aspired for its ecosystem to be a nationally recognized (and, later on, globally recognized) hub for innovation in healthcare, and NPCI aspired for its ecosystem to democratize payments (and, later on, expanding to several other financial transactions). It also helped that all three were founded as not-for-profit entities which facilitated perceptions of neutrality and integrity.

The emphasis placed on both firm and the environment in ecosystem emergence by this dissertation is an important contribution as it demonstrates that thriving ecosystems can emerge wherever the right conditions of actors and enabling conditions are present. A metaphor comes to mind here. The model of ecosystem emergence suggested by this dissertation can be seen as the lighting of the fire, where enabling conditions are like fuel, and the firm with the founding advantage is the spark. This dissertation suggests that the fire gets lit when the fuel is ready, and the spark is timely.

6.2.2. Demonstration of identity work

This dissertation emphasizes ecosystem identity construction. In all three cases, it was observed that identity creation was one of the first, if not *the* first, processes of ecosystem orchestration. Research has shown that an ecosystem's identity is the 'centre of gravity' (Saxenian, 1996), which facilitates overcoming the liability of newness (Singh, Tucker, & House, 1986), enables framing of participants' perspectives (Snihur et al., 2018), and drives coalescence (Daymond et al., 2022). Also, since ecosystems lack hierarchical control, scholars have argued that orchestration cannot proceed through the unilateral imposition of a predetermined blueprint (Thomas et al., 2022). Hence, ecosystem identity plays a crucial role in persuading potential participants to become part of the collective.

Thomas & Ritala (2022) suggested that ecosystem identity is constructed through framing and positioning strategies. Framing "consists of the construction of meaning that focuses attention on selected salient features to organize experience and guide action" (Thomas & Ritala, 2022: 9), while positioning is where "users collectively make sense of what is distinctive and valuable about the ecosystem value proposition and why" (Thomas & Ritala, 2022: 10). Thus, ecosystem identity construction "consists of the emergence of a set of mutual understandings among ecosystem participants regarding the central, enduring, and distinctive characteristics of the ecosystem value proposition" (Thomas & Ritala, 2022: 6). Further, the authors suggested that the emerging ecosystem's identity is reinforced by orchestrators through performative processes of value realization where the viability of the ecosystem's value proposition is demonstrated.

This dissertation empirically validated the abovementioned processes suggested by Thomas & Ritala (2022). In each of the studied ecosystems, identity construction was seen to be one of the earliest activities undertaken by the orchestrators. Further, the constructed identity aligned with the combination of founding advantage and enabling conditions in the backdrop of which the ecosystem was emerging. For instance, in the VC ecosystem's case, a solid regional identity was projected, which leveraged the region's status as a startup hub and VC's deep roots in the region. Hence, by incorporating a regional identity, VC was leveraging pre-existing mutual understanding amongst actors in the environment as well as emphasizing distinctive and enduring characteristics of its envisioned value proposition (which was to further the region's eminence as a startup hub). Similar processes were also observed in the MV ecosystem's founding orchestration, which followed a region-focused approach. In the UPI ecosystem's case, NPCI constructed the ecosystem's identity around the concept of democratization, which complemented its vision of implementing an open and shared ecosystem that emphasized transparency, interoperability, and would run on open protocol rails. Table 6.2 shows the elements of (founding) identity constructing work observed in the three cases studied. For each case, the constructed identity is shown as a statement which was drawn from statements by the ecosystem actors in the public press.

Table 6.2: *Elements of ecosystem identity construction work.*

Ecosystem	**Framing elements**	**Supporting elements**	**Constructed identity (who we are)**
VC ecosystem	The Pune region as a hub of startup activity	Premnath and NCL's reputation as regional champions	"We will nurture technology enterprises in the Pune region and empower and enable their objectives."
MV ecosystem	EMN's expertise in medical research, production, and services	MV as an integral and neutral association of key stakeholders in the region	"We will accelerate time to market for healthcare innovations."
UPI ecosystem	Democratizing payments, inclusive economy	Aadhaar as an enabler, JAM penetration	"We will build an open-access system for mobile payments in the country."

Three aspects about the nature of ecosystem (founding) identities can be gleaned from the above discussion: (1) identity work is necessary to drive legitimacy, (2) early formation of identity is imperative to attract adoption by potential partners, and (3) identity work espouses unifying dynamics that brings the collective together in the context of an envisioned objective (i.e., positioning in the marketplace). By being necessary, early, and unifying, identity work lays the ground for strategic decisions that follow in the other subprocesses of orchestration (see Figure 5.8).

While demonstrating identity construction as one of the foremost acts of orchestration was one part of the theoretical contribution, this dissertation goes further by showing that the envisioned identity (at founding) evolves over time, leading to one or more "realized identities." This is elaborated in the following subsection.

6.2.3. Ongoing evolution of ecosystem identity

While much research has investigated processes of ecosystem emergence (e.g., Dattee et al., 2018; Thomas et al., 2022), including the identity-constructing work involved in them, there is a dearth of research that has looked at how identity construction unfolds post-emergence. That is a gap this dissertation has attempted to fill. This dissertation could trace the evolution of identity construction work post-emergence stage by investigating processes of orchestration in three ecosystems that had reached maturity. It was found that ecosystem identities change over time, especially as ecosystems grow and transform.

The envisioning and road mapping processes that facilitate ecosystem identity construction at the time of emergence (Dattee et al., 2018) were seen to be undergirding ecosystem evolution post-emergence. As the ecosystem's context changed, new affordances materialized, and the orchestrators' need for new contextual embedding was invoked (Thomas et al., 2022). Witnessing a change in circumstances, the orchestrators sought to integrate the changing context by reframing their identity through collective action that involved discursive orchestrating – such as articulating and evangelizing – and cognitive orchestrating – such as renewed framing and revised positioning. In doing so, the new/revised identity sought to position the ecosystem in the new context without losing its established position in the older context. In other words, ongoing identity construction sought to position the ecosystem in the context of the future while remaining in the shadow of the past (Poppo, Zhou, & Ryu, 2008)[39].

Table 6.3 demonstrates the revision in ecosystem identities witnessed in the three

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[39] Poppo et al. (2008) found that experiences of past interactions between organizations created expectations in the future. Hence, they found that the shadow of the past (i.e., prior history) interacted with shadow of the future (i.e., forward-looking calculus). This dissertation suggests a similar interaction between past and future in the present moment of identity creation. While the orchestrators' forward-looking calculus aims to position the revised identity in line with expectations from the future, they would not want to let go of the established frame of past ecosystem success. Hence, *ongoing* identity construction continually navigates the shadows of the past and the future.

ecosystem cases. Table 6.3 has to be read as a continuation of Table 6.2, where the founding identities of each of the ecosystems were constructed. Over time, the contexts shifted, and as a result, the orchestrators sought to reposition their respective ecosystems in the new contexts.

Table 6.3: *Ongoing identity construction leading to an evolution in identities.*

Ecosystem	**Changed context**	**New positioning**	**Constructed identity (who we *now* are)**
VC ecosystem	National-level partnerships (e.g., AIM PRIME, DBT BIRAC)	National-level player	"We will nurture technology enterprises *of India* and empower and enable their objectives."
MV ecosystem	European-level recognition (e.g., EIT Health)	EU-level focus	"We will accelerate time to market for healthcare innovations *for Europe*."
	Internationalization (outbound)	Global focus	"We will *partner with similar regions around the world to* accelerate time to market for healthcare innovations."
UPI ecosystem	Broadening ecosystem (e.g., India Stack)	Infrastructure for the broader ecosystem	"We will *provide the basis for democratizing the Indian economy*."
	Internationalization (e.g., porting to other countries)	Ecosystem as a digital public good	"We will *provide the basis for democratizing other economies*."

By showing the evolution in ecosystem identities over time, this dissertation has (1) deepened the focus on identity construction work in the post-emergence phases and (2) provided insights into the underlying orchestrating mechanisms that support and facilitate ecosystem growth and evolution. Importantly, by showing that orchestrators actively engage in ongoing identity work, this dissertation has demonstrated how ecosystems sustain as they scale or increase in scope.

6.2.4. Multiparty orchestration

Scholars have only recently begun investigating how multiparty orchestration works in ecosystems (e.g., West & Olk, 2023). The case of multiparty orchestration that this dissertation found is relatively novel compared to the bulk of ecosystem literature that has emphasized the predominance of a single hub firm or keystone entity (e.g., Chesbrough et al., 2014; Iansiti & Levien, 2004b; Mann et al., 2022; Williamson & De Meyer, 2012). An exception is the work of West & Olk (2023), who studied the global ecosystem of actors – academics, nonprofits, governments, large and small firms – working to find a cure for Alzheimer's disease. They found that several R&D consortia orchestrated the ecosystem through regional control, sponsorships, and the formation of umbrella entities. However, while their study illuminated the case of multiple simultaneous orchestrations of an ecosystem, it focused on the governance structure and, hence, emphasized the structural perspective. This dissertation extends that understanding from a process perspective.

This dissertation has shown that multiple actors can orchestrate an ecosystem. By taking a process perspective, it has illuminated that multiparty orchestration can occur in two modes: (1) where multiple actors orchestrate at the same time, and (2) where multiple actors orchestrate at different points in time. Accordingly, borrowing from the work of Adair (1973, 1984), the two multiparty modes can be conceptualized as distributed and shared orchestration, respectively. The case of distributed orchestration is that where multiple actors orchestrate the ecosystem at the same time, and the case of shared orchestration is where the ecosystem is orchestrated by different actors at different points in time[40].

The MV ecosystem exhibited distributed multiparty orchestration. Though MVEMN played a focal role in identity construction for the ecosystem and crystallizing the

[40] Shared orchestration can be viewed as a relay race where the baton of orchestration shifts from one actor to another actor in the ecosystem.

architecture of collaboration, other powerful players in the region (i.e., FAU and Healthineers) orchestrated cognitively, *at the same time*, by joining the association and investing their resources (such as funds and expertise) into the ecosystem. Also, incubators (such as Zollhof) orchestrated by investing significant efforts to evangelize the ecosystem within (and outside) the EMN region which led to broadening the ecosystem participation.

In contrast, the UPI ecosystem exhibited an instance of shared orchestration. While NPCI orchestrated identity construction by leveraging its IMPS implementation and projecting UPI as a democratizing platform, Nilekani and team engaged in discursive orchestration by undertaking articulating and evangelizing activities, and ISPIRT undertook performative orchestration of designing and developing the reference implementation (BHIM app). All these actors predominated at different points of time in the evolution of the UPI ecosystem. While Nilekani and team's efforts facilitated ecosystem emergence, the BHIM app was launched a little after the ecosystem emerged, and NPCI assumed bulk of the UPI ecosystem orchestration in the steady state.

Thus, by taking a process perspective, this dissertation has contributed several theoretical insights to the literature on ecosystem orchestration. While on the one hand, it has demonstrated empirical validity to conceptual models of scholars (e.g., Thomas & Ritala, 2022), on the other hand, it has contributed several novel insights, such as the evolution of ecosystem identities, ongoing identity work, and multiparty orchestration. Nevertheless, the findings of this dissertation are limited insofar as it is based on three representative cases. Specifically, the three cases of this dissertation, though diverse in context and domain, were all public ecosystems founded by nonprofit entities. It is possible that orchestration processes may play out slightly differently when a private for-profit entity undertakes ecosystem creation. The concluding chapter (Chapter 7) discusses these aspects in detail.

6.3. Implications for practice

The process model suggested in this dissertation (see Figure 5.8) lends itself to advancing ecosystem orchestration strategy. In other words, it provides a processual perspective to ecosystem *strategizing*. In doing so, it contributes to practice in several ways. Firstly, it suggests that ecosystem identity construction is pivotal to strategizing ecosystem emergence. Orchestrators ought to lay down an envisioned (founding) identity – an early picture of who we are – to create coalescence conditions. Secondly, it suggests that while identity construction provides cognitive ground, orchestrators should drive collaboration by laying down a workflow. Crystallizing the workflow requires both consolidative (i.e., road mapping) and discursive (i.e., articulating) efforts on the part of the orchestrator. Thirdly, it suggests that orchestrators should view architecting and identity construction as iterative. Road mapping can undergo 'course corrections' as the ecosystem takes shape and users begin to experience and evaluate the value proposition, and the evolution in architecture can necessitate ongoing identity reconstruction. The above strategic aspects bring to bear the processes suggested by Daymond et al. (2022).

In their effort to guide managers on ecosystem strategizing, Williamson & De Meyer (2012) laid down six levers for ecosystem building. Table 6.4 lists the levers and maps each lever to the process model proposed by this dissertation. It can be seen that each of the levers is accounted for in the process model, which attests to its exhaustiveness insofar as extant practitioner understanding is concerned. However, it may be noted that current practitioner understanding regarding orchestrating ecosystem emergence primarily focuses on establishing an architecture of collaboration (Fjeldstad et al., 2012). While a robust architecture clarifies the differentiation of roles, lays down norms of collaboration and (knowledge) exchange, and provides clarity on value creation and capture mechanisms, it does *not* account for the complexity of identity creation which serves as the ground for persuading ecosystem partners to make investments in specific complementary assets in the first place. Thus, the process model suggested by this dissertation provides crucial insights to managers on the intricacies involved in ecosystem strategy, especially with reference to the significance of identity construction work. By doing so, this dissertation contributes over and above the framework suggested by Williamson & De Meyer (2012).

Table 6.4: *Mapping levers suggested by Williamson & De Meyer (2012) with the orchestration subprocesses proposed by this dissertation.*

Levers	Matched orchestration subprocess
Articulating the value proposition	Crystallizing architecture (articulating)
Drawing the structure of differentiated roles	Crystallizing architecture (road mapping)
Stimulating complementary investments	Crystallizing architecture (articulating, road mapping), Broadening participation (evangelizing)
Reducing transaction costs through trust and seamless knowledge sharing	Constructing identity, Crystallizing architecture (articulating, road mapping)
Enabling flexibility and accelerating co-learning	Crystallizing architecture (articulating, road mapping)
Engineering value capture mechanisms	Crystallizing architecture (articulating, road mapping)

While there are studies (e.g., Adner, 2006; Furr & Shipilov, 2018; Jacobides, 2019) that have provided managerial insights into strategizing for ecosystem emergence, there has been lesser focus on works that have provided managerial insights post-ecosystem emergence. This dissertation has attempted to fill that gap by providing a processual view of the ongoing orchestration of ecosystems post-emergence. It has shown that orchestrating mature (or steady state) ecosystems involves an iterative set of activities focused on broadening participation, refining/revising ecosystem identity, and recrystallizing architecture over time. Also, this dissertation has demonstrated that orchestration need not be the exclusive concern of a single actor; instead, it can involve distributed efforts of several actors working simultaneously on different aspects (or subprocesses) of orchestration.

This dissertation has demonstrated that ecosystem growth and sustenance can involve several stages of increasing complexity, with corresponding implications on the other subprocesses (see 'evolving/transforming' box in Figure 5.8). Effective strategizing for ecosystem evolution can make the difference between ecosystem renewal and death (Moore, 1996). This dissertation provides insights into how ecosystem growth strategies can involve increasing complexity levels. Table 6.5 briefly elucidates the strategic implications of the three growth trajectories demonstrated in Figure 5.8. As can be seen, the strategic implications of ecosystem growth multiply as orchestration moves from replication mode (which involves similar kind of participants) towards adapting (which involves a larger variety of participants) and transforming (which involves increased number of complementary partners) modes. Understanding the complexities involved in different modes of ecosystem growth can enable managers to prepare appropriately before embarking on that growth trajectory.

Table 6.5: *Implications of ecosystem growth strategies.*

Mode of growth	**Strategic objective**	**Implications on orchestration subprocesses**
Replicating (similar participants)	*"Doing more of the same."*	• Minor (or absent) identity reconstruction • Minor recrystallizing architecture • Major broadening participation
Adapting (varied participants)	*"Doing some things differently."*	• Minor identity reconstruction • Medium recrystallizing architecture • Major broadening participation
Transforming (complementary participants)	*"Becoming different"*	• Major identity reconstruction • Major recrystallizing architecture • Major broadening participation

Finally, with respect to the literature on ecosystem strategy, this dissertation has contributed to the domain of open and shared ecosystems. Srinivasan (2021), using the context of platform ecosystems, has suggested that the underlying architecture of ecosystems is contingent upon two dimensions: (1) restriction on participation, which decides whether ecosystems are either open (with no restrictions) or closed (with restricted participation), and (2) sponsorship control, in which case ecosystems can be either proprietary (controlled by a single sponsor and provider)[41] or shared (controlled by multiple sponsors and providers). Thus, four categories of ecosystem architectures can be witnessed: (1) closed proprietary ecosystems (e.g., Apple's iOS ecosystem), (2) closed shared ecosystems (e.g., edX online learning ecosystem), (3) open proprietary ecosystems (e.g., Android ecosystem), and (4) open shared ecosystems (e.g., Barcode ecosystem) (Srinivasan, 2021). All three cases studied in this dissertation were instances of open and shared ecosystems.

6.4. Implications for policy

This dissertation, though not undertaken from a public policy perspective, has provided some crucial policy implications owing to the nature of the study samples. All three cases involved ecosystems that benefitted from governmental backing. State participation significantly affected the trajectory of the ecosystems. In the case of the VC ecosystem, government funds supported the establishment of initial infrastructure. Later, as the ecosystem gained traction, government agencies (like DBT and AIM) actively partnered with the ecosystem by choosing it as the implementation partner for the incubation projects they funded. This enabled the ecosystem to establish and grow while also providing legitimacy.

The MV and UPI ecosystems also witnessed extensive governmental involvement. In the MV ecosystem, the mayor of Erlangen (Balleis) took the initiative to consolidate various regional actors, organize interactions, and project the region as a cluster of

[41] Ecosystem sponsors are those actors that define the rules of engagement and, hence, shape knowledge flows, whereas ecosystem providers build and enable the infrastructure for interaction between the ecosystem participants (Srinivasan, 2021).

excellence. The government's bank (Sparkasse) provided funds for setting up initial infrastructure. Similarly, in the UPI ecosystem, RBI played an enabling role in furthering the ecosystem's creation. The Indian government (and its various departments) adopted a forward-looking mindset that advanced the UPI ecosystem's emergence. Thus, the three ecosystems significantly benefitted from state support.

The three cases of this dissertation implicate a nurturing policy from the state. It is seen that the state can foster ecosystem emergence (and growth) by adopting a nurturing mindset without having to engage in orchestration by itself. Importantly, this dissertation has emphasized the central role played by associations or consortia in playing the orchestrator role. VC was a nonprofit entity governed by a board of directors, MV was an association of stakeholders of the region, and NPCI was a nonprofit governed by a consortium of banks. Other scholars have also shown similar orchestration by independent consortia (e.g., Giudici et al., 2018; West & Olk, 2023). These instances imply that a policy-friendly atmosphere for the creation of associations or consortia could go a long way in enabling the emergence of successful and impactful ecosystems.

This dissertation also found that state support can enable the emergence of open and public ecosystems. For instance, in the case of the UPI ecosystem, adoption of a 'cash-less economy' objective by the government, further reinforced by the narrative of the DPI vision, facilitated the coalescence of the developer community and evoked participation by volunteering organizations such as ISPIRT, which enabled the creation of an open protocol architecture. The open ecosystem, by virtue of its broad participation, gained rapid ground and disrupted the market of closed ecosystems (such as PayTM) in its space. Similarly, in the case of the MV ecosystem, early adoption of a region-focused vision by the government (of Erlangen) enabled the emergence of MV ecosystem as a public and open ecosystem.

Another policy implication from this dissertation is the legitimizing benefit that state supported financing can provide to ecosystems. All three ecosystems benefited from governmental grants. The VC ecosystem particularly benefitted from various grants through its emergence and steady state phases (like, for instance, the funds from DST that helped in setting up initial infrastructure). Being the recipient of (prestigious) government (financial) backing provided VC (the focal firm) the legitimacy of being a recognized expert amongst the ecosystem partners.

6.5. Chapter conclusion

This chapter discusses the theoretical contribution of this dissertation. Scholars have long argued for the need to clarify how one's study contributes to theoretical understanding (Corley & Gioia, 2011; Whetten, 1989). This dissertation contributes at the inter-industry level of analysis. Doing so distinguishes this dissertation from other research on orchestration that has focused on lower levels of analysis. By focusing on the inter-industry level of analysis, this dissertation fills a critical gap in processual understanding in the extant research.

Then, the chapter discusses four aspects in which this dissertation provides significant theoretical contributions. First, this dissertation has shown that enabling conditions for ecosystem emergence involve a combination of firm-level capabilities and environmental factors. This dissertation has integrated the research streams focused on firm and environmental aspects. Second, this dissertation has uncovered the intricacies involved in identity work. Recent research has conceptualized the processual intricacies of ecosystem identity construction, this dissertation confirms their propositions and provides empirical validity. Third, this dissertation has shown how ecosystem identity evolves over time. By doing so, distinctions are drawn between founding and realized identities. Lastly, this dissertation has provided a view into the multiparty orchestration of ecosystems. Whereas extent research had largely focused on orchestration by a single entity, this dissertation has illuminated how multiple actors can orchestrate ecosystems simultaneously.

In the concluding part, this chapter discusses implications for practice and policy. As implications for practice, it discusses strategic implications (in the backdrop of extant works) of how orchestration processes unfold over three stages of ecosystem emergence, maturity, and transformation. Finally, since the data of this dissertation involved significant governmental involvement, it draws some insights into how governmental policies can contribute to ecosystem emergence and orchestration.

Chapter 7

Conclusion

> "As the costs of global communication and information processing continue to decline, hierarchy will become a relatively more expensive way of organizing".
>
> – (Fjeldstad et al., 2012: 746)

This dissertation undertakes a research study to investigate the phenomenon of business ecosystems. The ecosystem organizing form has gained significant traction both in research and practice. However, though the ecosystem concept was introduced in management literature about two decades ago (Moore, 1993), the plethora of academic research that has investigated the ecosystem phenomenon has lacked the consistency (i.e., convergent conception) that is necessary for coherent theorization (Hou & Shi, 2021; Oh et al., 2016). While on the one hand, scholars have observed that the lack of an integrative conception of ecosystems has hindered consistent theorization (Adner, 2017); on the other hand, there is a dearth of processual studies that have comprehensively analysed the phenomenon and its underlying dynamics (especially, in the post-emergence stages) (Thomas et al., 2022). By undertaking a broad investigation of ecosystem orchestration involving both emergence and post-emergence stages, this dissertation is an attempt to fill both those gaps.

The background of this dissertation was shaped through a two-part literature review. The first review (Chapter 2), which investigated extant theorization of the ecosystem conception, found that several scholars point to the lack of a consistent definition for ecosystems as hindering its coherent theorization (e.g., Autio & Thomas, 2014). Some scholars, that have advanced theorization, attempted to propose an all-encompassing definition (e.g., Jacobides et al., 2018). However, the theorization has tended to take a structural perspective, focusing on aspects such as the nature of complementarities, modes of alignment, and conditions that drive the co-creation of value. There have been several calls for processual studies that investigate the inner dynamics of ecosystem *organizing* (e.g., Spigel & Harrison, 2018; Thomas & Ritala, 2022).

The second review (Chapter 3) delved into the processual perspective of ecosystems, taking orchestration as the focal construct. This review was concerned with establishing the necessity of orchestration in ecosystems. That is to say, contrary to what some scholars have suggested (e.g., Dutt et al., 2015; Giudici et al., 2018), ecosystems cannot emerge through the self-organization of dispersed entities, rather the ecosystem *must* be systematically orchestrated by one or more entities if it has to sustain as a collective (Autio, 2021). The review constructed four arguments that emphasize the need for orchestration.

The four arguments take the shape of four S's, namely, the specialization argument (orchestration is needed to search and integrate specialized actors to systematically inhabit various niches of the combined offering), the standardization argument (orchestration is needed to consensually formulate norms of interaction, characterized by standardized interfaces, and to facilitate seamless evolution of the interfaces over time), the systemic argument (orchestration is needed to drive coherence towards the combined offering through continually facilitating alignment of the individuals towards the collective), and the strategic argument (orchestration is needed to enable coevolution of actors whenever external forces or underlying technological changes necessitate adaptation or transformation of the collective offering). Having established a four-pronged argument, the review then proceeded to lay down extant understanding of orchestration as a multidimensional construct that serves to concretize the ecosystem's bounds. Thus, by using orchestration as the core construct for the context of ecosystems, the research question of this dissertation pursues a concrete phenomenon-based conceptual understanding.

This dissertation is designed as a qualitative process study involving case-based data (Chapter 4). Processual studies of ecosystems with an orchestration focus, especially in the post-emergence stages of the ecosystem, were hard to find. Hence, this dissertation took an exploratory approach using inductive coding (as suggested by Miles & Huberman, 1984) and thematic analysis (as suggested by Braun & Clarke, 2006) to glean an understanding of how ecosystems are orchestrated (through emergence and post-emergence stages). Three representative cases were chosen (as suggested by Eisenhardt, 1989a). The cases operated at three different levels – local level (the Venture Center case), regional level (the Medical Valley case), and national level (the Unified Payments Interface case). Two cases were from India, and one (Medical Valley) was from Germany. The three cases were theoretically replicated, which enabled cross-case comparison (as suggested by Stake, 2006) and the pursuit of analytical generalizability (Yin, 1994).

Longitudinal data was collected through several sources – interviews, internal documents, participant observation, and public domain – over three years (2020 – 2023). Two-pronged data analysis was conducted. Thematic analysis was used to identify activity patterns and group them into thematic aggregates. Four categories of orchestration were observed: consolidative orchestration (that aims at integrating partners into the ecosystem's offering), discursive orchestration (that aims at creating and sustaining narratives about the ecosystem's offering), cognitive orchestration (that intends to create legitimacy for the ecosystem's offering), and performative orchestration (that aims at demonstrating the viability of the ecosystem's offering).

Subsequently, the data were analysed using inductive coding to understand the evolution of orchestration over time. Process maps of orchestration (as suggested by Langley, 1999) were drawn for each of the three cases (Chapter 5), which showed how activities interacted over time to achieve intended outcomes. Based on the results of the inductive coding exercise, a generalized process model of ecosystem orchestration was proposed. The process model showcased how *orchestrating* (as a process) manifested through an ecosystem's emergence and post-emergence stages.

The process model showed that orchestrating ecosystems involved four subprocesses, each consisting of interlinked activity patterns. The four subprocesses were constructing identity, crystallizing architecture, broadening participation, and evolving/transforming. This dissertation found that, in the emergent phase, the potential orchestrator(s) undertook founding actions which involved a combination of firm-level advantage and enabling conditions. The three cases of this dissertation emerged from different conditions, showing that thriving ecosystems can be orchestrated (by one or more orchestrators) from different 'starting points'.

One of the foremost founding actions was constructing a founding identity. Identity became the 'centre of gravity' that coalesced interested partners (Saxenian, 1996). However, the ecosystem, though legally founded, did not take off until an underlying architecture of collaboration was established. The orchestrating subprocess of crystallizing the architecture involved the orchestrator(s) constantly iterating between road mapping and articulating, which led to an acceptable architecture crystallizing over time. This was followed by a focus on broadening participation, which sought to enhance participants' adoption of the ecosystem. Orchestrators typically undertook three interlinked activities to broaden participation: sensing affordances to find and capture new value, onboarding partners to fill new and existing niches, and evangelizing the value proposition to a broader audience. These three activities interlinked in different ways to broaden ecosystem participation.

The three subprocesses discussed above did not follow a linear sequence but rather iterated amongst themselves in different ways. For instance, broadening participation necessitated the reconstruction of identity when the new affordances were integrated, and the overall value proposition changed. Similarly, re-crystallizing of architecture could be necessitated whenever new niches were integrated, or the structure of existing niches underwent a change. Finally, orchestrators were also involved in evolving or transforming the ecosystems. The evolution/transformation typically happened through three levels: (1) replicating level, where the value proposition was transplanted into a new context, (2) adapting level, where the value proposition underwent a strategic change in the course of adapting to new external or internal changes, and (3) transforming level, where the value proposition was radically changed as the ecosystem underwent (disruption and) renewal. Any of the three levels could iterate with the other subprocesses depending on the extent of change.

By laying down a generalized process model, this dissertation adds to the theoretical understanding of ecosystems. It contributes by elaborating a processual understanding of *ongoing* ecosystem orchestration. In doing so, this dissertation adds several novel insights to the literature: (1) it shows that enabling conditions for ecosystem emergence involves a combination of firm-level capabilities and environmental factors, (2) it demonstrates the intricacies involved in identity work, (3) it shows how ecosystem identity evolves over time, specifically differentiating between founding and realized identities, and (4) it provides a view into the multiparty orchestration of ecosystems.

7.1. A process perspective to ecosystem strategy

This dissertation unbundles ecosystem strategy. By elaborating a process model consisting of interlinked sub-processes, this dissertation provides a processual view of *how* ecosystem strategy, insofar as it is the purview of the orchestrating entities, unfolds over time. Seen that way, the four subprocesses – constructing identity, crystallizing architecture, broadening participation, and evolving/transforming – become critical underpinnings to ecosystem strategy. If any of the subprocesses is not effectively performed, then that aspect of orchestration would be lacking, and the strategic outcomes expected would most likely not be achieved. Indeed, failure in any of the subprocesses may even lead to ecosystem death.

Constructing identity subprocess is an overarching subprocess initiated at the time of founding and can be invoked on an ongoing basis from any of the other sub-processes. Research has shown that identity creation is a vital step in shaping the legitimacy of the ecosystem (Thomas & Ritala, 2022). At the time of ecosystem emergence, identity can facilitate overcoming the liability of newness by symbolizing what the ecosystem is about, what it seeks to achieve, and how it aims to achieve its goals. While on the one hand, identity can galvanize the collective under a shared cognitive basis, on the other hand, it creates distinctiveness for the ecosystem in the minds of its consumers or users (Thomas & Ritala, 2022).

Identity, by including those essential and enduring characteristics, can influence perceptions and qualitatively differentiate the ecosystem from its competitors (Albert & Whetten, 1985). Identity embodies all those aspects that collectively represent "who we are." Thus, identity can serve to concretize the ecosystem boundaries, separating those who belong to the ecosystem from those who are not a part of it. Insufficient focus on this orchestration subprocess can lead to a malformed identity. For instance, PayTM, a mobile wallet-based payment ecosystem, had a thriving ecosystem in 2017. However, when an alternate ecosystem (UPI) based on open protocol architecture went live, PayTM resisted reconstructing its identity along the lines of democratization that UPI stood for. As a result, PayTM's rigidity in being an exclusive player lost a significant part of the market to competing players such as Google Pay and PhonePe. The legitimacy of being a pioneer that PayTM enjoyed as an early mover in the digital payment space was lost owing to its failure to reconstitute its identity in the payment democratization movement that UPI heralded in 2016-17.

Crystallizing architecture subprocess follows (or sometimes can run in parallel to) the identity construction. It tends to be prominent at the ecosystem emergence stage as architecture is necessary to establish the collaboration structure. Research has shown how orchestrators employ road mapping activities to envision the value offering and use articulation as the medium to drive engagement and involve partners towards concretizing the vision (Dattee et al., 2018). Crystallizing the architecture is a vital act of orchestration to prevent drifting from the envisioned roadmap (and, hence, protecting the collective identity). Crystallizing architecture need not be a one-time exercise at the time of ecosystem emergence, as changes to the ecosystem's value offering over time can necessitate re-crystallizing work.

Since ecosystems involve autonomous entities that often self-select to be part of the ecosystem, the process of crystallizing architecture ought to be consensual and, to whatever extent possible, democratic. Orchestrators that dominate the collective and tend to unilaterally impose the architecture may risk losing the trust of their partners (Yoffie & Kwak, 2006). This is because the underlying architecture not only lays down how value is co-created but also specifies how much value each actor captures. An architecture that is enforced without considering all stakeholders may not be viewed as fair by all actors, and hence, the ecosystem may lose partners as a result. For instance, when Sony's e-reader launched in the market, its architecture required users to independently purchase eBooks online and upload them to the e-reader. Compared to Amazon Kindle (a competing ecosystem), which crystallized an integrated architecture with the eBook publishers, Sony enforced an architecture the publishers did not fully trust. As a result, Sony failed to materialize a successful ecosystem and had to exit the market while the Kindle became a market leader.

The broadening participation subprocess is niche-focused. It involves activities to intensify existing niches, i.e., integrate more actors within a niche, as well as attempts to add new niches. In this orchestration subprocess, onboarding partners is a vital activity that may involve governance considerations such as gatekeeping and enforcing membership criteria. However, as shown in Figure 5.8, onboarding partners is complemented by two other activities: evangelizing and searching for novel affordances. Hence, this subprocess requires that orchestrators have the marketing capability to evangelize the value proposition as far and wide as possible to attract potential participants and also the innovativeness to sense new affordances that can constitute new niches (in which case recrystallizing architecture subprocess may be invoked, also leading to a possible reconstructing of identity).

Failure to orchestrate the broadening of participation can have two kinds of negative impacts: too little participation or too much of it. Both extremes can lead to ecosystem failure. An instance of failure due to inadequate participation was the case of the HDTV launch by Philips in the 1980s (Adner, 2012). While Philips pioneered the research and manufacture of HDTV technology, the firm failed to ensure the readiness of the ecosystem necessary for users to enjoy HDTV services. Philips did not orchestrate the broadening of the participation that was necessary to bring several complementors – such as high-definition camera manufacturers, broadcast standards regulators, and content producers – on board. As a result, HDTV technology failed to gain adoption for up to two decades after its launch, resulting in Philips having to undertake a $2.5 billion write-down. In contrast, an instance of ecosystem failure due to high levels of participation was the case of videogame ecosystem (Cennamo & Santaló, 2019; Wareham et al., 2014). Atari, a market-leading game console manufacturer in the early 1980s, permitted an uncontrolled surge in video games to cash in on the rising market for games. As a result, low-quality games began to dominate, leading to consistently downward price pressure and, ultimately, the demise of the ecosystem.

Finally, the evolving/transforming subprocess aims at orchestrating ecosystem change or adaptation. Strategic considerations here could take one of three directions: (1) replicating the ecosystem into a new context ("doing more of the same"). This strategy is relevant in cases where a new market is discovered for an ecosystem that has hitherto attained maturity in its current market. Implementing the UPI ecosystem in another country is an instance of the replicating orchestrating strategy. (2) adapting the ecosystem to (incrementally) new requirements or conditions ("doing something new"). This strategy is relevant in cases where changes in the external environment necessitate 'course correction' for the ecosystem and where the ecosystem can typically respond by revising its offering. Integrating a CSR-focused wing into the VC ecosystem in response to changes in the CSR regulations was an instance of the adapting orchestration strategy. (3) transforming the ecosystem to a (radically) new offering ("becoming something different"). This strategy is relevant in cases where the ecosystem embarks on a 'paradigm shift' and completely transforms the nature or scope of its offering. An instance of transformative orchestration strategy was seen in the MV ecosystem. In the early days of the MV ecosystem, when the focal actors realized that merely leveraging the regional identity of Erlangen was insufficient to gain the status of a cluster of excellence, they orchestrated a systemic transformation by including the entire EMN region within their boundary. Doing so drastically transformed the ecosystem's identity and enabled the successful pursuit of the cluster of excellence label.

Failure in undertaking the evolving/transforming orchestration can lead to a loss of market share for the ecosystem and, depending on the level of negative impact, even lead to obsolescence (Snihur et al., 2018). An instance of replicating failure was seen in the PayTM ecosystem case where, in response to the open protocol shift, PayTM could have responded by replicating its closed ecosystem model onto the open protocol platform. However, PayTM failed to replicate in time. As a result, competitors that joined the open protocol platform early garnered the lion's share of the digital payments market (though PayTM eventually replicated about a year late). An instance of adapting failure was seen in Nokia's persistence with its proprietary Symbian mobile operating system while Google's Android, built as open source, was gaining wide adoption. Finally, an instance of transformation failure was Kodak's persistence with film-based photography for decades, owing to which the firm failed to orchestrate transformation towards digital photography.

Failures in orchestrating evolution/transformation can potentially lead to the obsolescence of the ecosystem. Depending on the extent of change, the effects of obsolescence vary in severity, with the worst impact being the demise of the ecosystem. Replication failures are typically low in severity and often lead to a loss of market share. When PayTM failed to replicate its ecosystem in the open platform, it lost market share to its competitors. However, the PayTM ecosystem continues to survive, albeit on the open platform, for several years following the delay in replication. Adaptation failures can have a mixed impact. In Nokia's case, failure to adapt led to ecosystem demise in the form of a sell-off to Microsoft, as competitors like Samsung and Apple moved quickly to deny Nokia from recouping its loss. Transformation failures are the most severe and often lead to ecosystem demise. Kodak's failure to orchestrate the digital transformation of its photography business led to the demise of its traditional film-based ecosystem. Kodak filed for bankruptcy in 2012. Figure 7.1 illustrates how failures in each of the subprocesses of ecosystem orchestration can impact the ecosystem outcome.

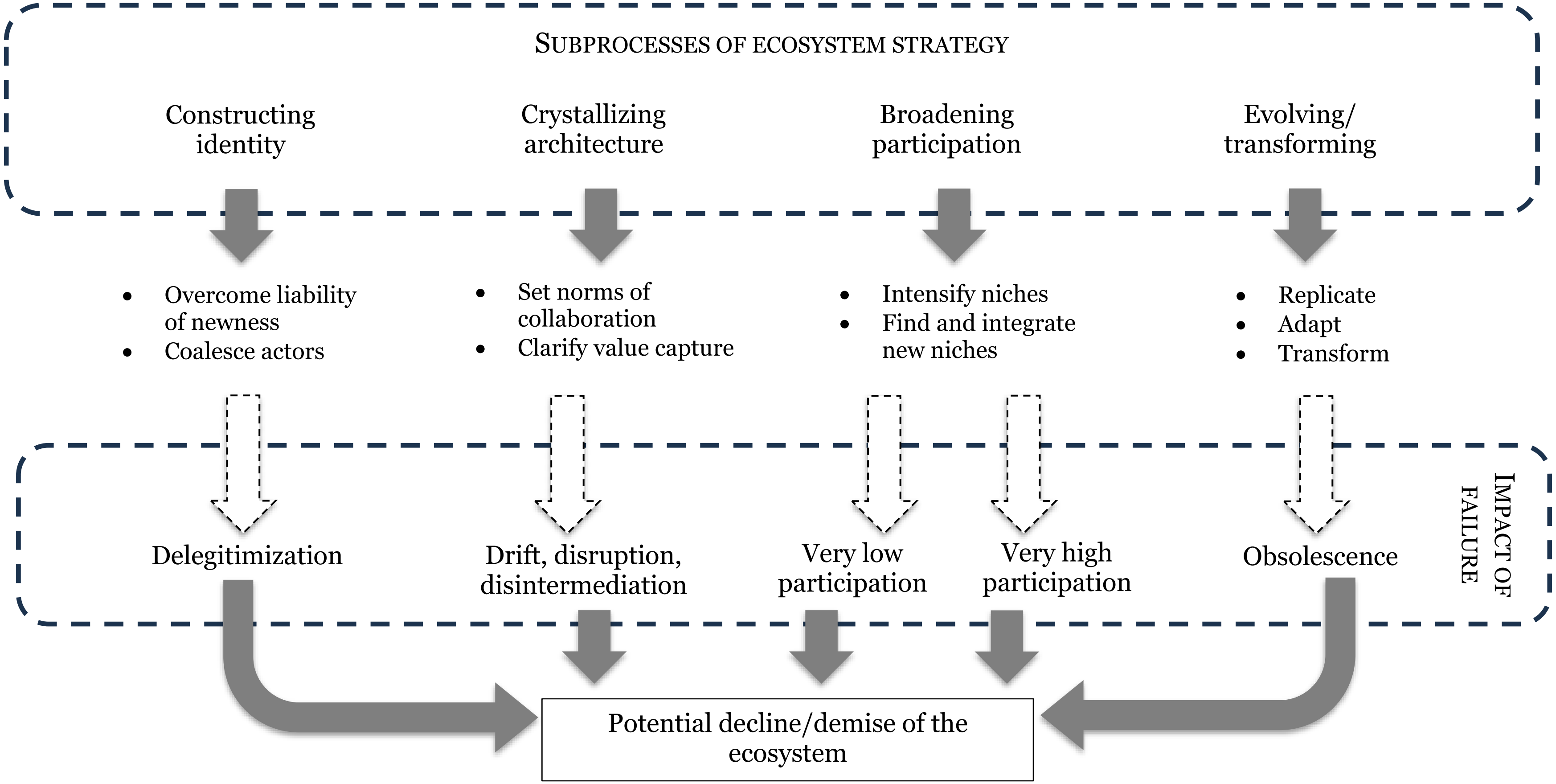

Figure 7.1*: A processual perspective to ecosystem strategy.*

7.2. Limitations of this dissertation

This dissertation has proposed a process model of ecosystem orchestration. Importantly, the process model accounts for both emergent and post-emergence stages of ecosystems. To ensure wide applicability, reasonably diverse samples were chosen. The three samples provided extraordinary access to the researcher, which enabled in-depth longitudinal data collection. Nevertheless, the choice set was limited by the extent of access availability. Hence, while a great diversity of ecosystems exists in the real world, this dissertation, owing to limitations of time and access, could only study a subset of the (diverse) population. Given the nature of this study and the limited sample set, there are limitations with regard to generalizing this dissertation's findings.

The limitations are primarily due to the choice of method (i.e., case-based study) and the purposive approach adopted in sample selection (i.e., biased toward public ecosystems). The focus of the case-based method is to pursue an in-depth understanding that embodies contextual richness (Yin, 1994). Especially as this dissertation set out to understand a complex phenomenon, more so with a view to examining multiparty, dispersed orchestration (in contrast to extant studies that had mostly studied single-party, centralized orchestration), the focus was on capturing a wide range of activities. Hence, this dissertation pursued three cases that provided unusual access to activity data at a fine-grained level of detail (as suggested by Eisenhardt, 1989a). In doing so, the findings of this dissertation could only abstract across the contexts of the three case studies. Hence, the applicability of this dissertation's findings to contexts disparate from the sample set of this dissertation will have to be treated with caution.

Also, this dissertation adopted a purposive sampling approach (as suggested by Guba & Lincoln, 1982). Owing to the need to understand ecosystem orchestration post-emergence, cases were selected based on maturity. The three cases selected were operationally stable and were regarded as thriving ecosystems in their respective domains. However, it turned out that all three cases had non-profit firms as focal players. Also, all three ecosystems enjoyed significant backing from the State in their formative years. Hence, there is a possibility that the ecosystem creation process may not have faced the kind of challenges that either for-profit firms or startups face when driving ecosystem emergence. Non-profit firms enjoy the perception of neutrality compared to for-profit entities. Also, given that all three cases were supported by the State (in different capacities), specific challenges in procuring resources (such as access to funding and regulatory hurdles) that firms such as startups face may have been mitigated for the orchestrators in the sample set. Hence, given the above aspects, the orchestration process suggested by this dissertation may not account for some of the additional challenges faced by for-profit entities and startups. In the next section, I address this limitation as a scope for future research.

Finally, although much effort was expended in collecting comprehensive data about each ecosystem, including triangulation using a mix of different sources (Jick, 1979), it is possible that some aspects of orchestration could not be captured. Two out of the three cases had completed 15 years of existence; hence, my attempts at capturing information about the formative years may have missed some finer details owing to inadequate recall. I have compensated for recall bias through triangulation; however, if some processes were entirely missed, they would remain as resident gaps in understanding. Also, compared to the information captured about successes, there was scarce mention in the interviews about failures – such as, for instance, conflicts that failed to materialize partnerships. This might have introduced a survivor bias in the findings (Denrell, 2003).

Nevertheless, while the survivor bias is a limitation insofar as a comprehensive understanding of the intricacies of orchestration is concerned, I do not view the limitation as curtailing the suggested process model. That is because this dissertation aimed to understand what constitutes "successful" orchestration. The findings have illuminated the patterns of activities that undergird both the successful emergence of ecosystems and their effective sustenance over time.

7.3. Scope for future research

Though this dissertation has strived to provide a comprehensive view of ecosystem orchestration processes, several avenues exist to enhance understanding. As stated in the previous section on this dissertation's limitations, the choice of cases has been biased towards ecosystems where non-profit firms played a focal role, especially in orchestrating ecosystem emergence. Hence, nuances related to specific challenges faced by other kinds of firms – such as large for-profit businesses and startups – attempting to orchestrate ecosystems have not been captured as part of this dissertation.

In the case of for-profits attempting to orchestrate ecosystems, scholars have observed that value appropriation bears as much, if not more, emphasis as value creation (Jacobides, 2019; Williamson & De Meyer, 2012). In the three cases of this dissertation, the nonprofit actors that were central to the ecosystem took a facilitator orchestrator perspective (Hurmelinna-Laukkanen & Nätti, 2018)[42], where the strategy behind value cocreation was to realize societal benefits such as the advancement of science and human welfare. Such a social welfare vision need not be the primary thrust for for-profit entities. For-profit firms will likely adopt a player orchestrator perspective when orchestrating ecosystems (Hurmelinna-Laukkanen & Nätti, 2018). In doing so, the dynamics of for-profit orchestration may differ in nature, scope, or intensity from currently analysed data.

[42] Hurmelinna-Laukkanen & Nätti (2018) observed that three kinds of orchestrators were found in practice: (1) player orchestrators who typically leveraged a solid resource base, actively participated in the ecosystem's value offering and espoused a competitive orientation (i.e., competed with partners in capturing value), (2) sponsor orchestrators espoused a mix of individual and collective goals, typically occupied a nodal position in the ecosystem by virtue of their relational resources, and had a relatively long-term view on benefitting from their activities, and (3) facilitator orchestrators who primarily focused on collective goals, had a predominantly non-competitive orientation, and typically occupied a strong relational position governed by neutrality and integrity.

Also, large for-profit firms often enjoy immense leverage in resource availability and market power, which can favour their occupying the orchestrating role in ecosystems (De Meyer & Williamson, 2020; Iansiti & Levien, 2004b; Yoffie & Kwak, 2006). Nevertheless, the significant bargaining power accompanying the leverage can engender trust and neutrality issues (Blomqvist, Hurmelinna, & Seppänen, 2005). Thus, large for-profit firms that enjoy immense bargaining power may have to exercise their power "smartly" to persuade ecosystem partners to make ecosystem-specific investments (Dattee et al., 2018; Yoffie & Kwak, 2006). Thus, there is immense scope to extend this dissertation's findings by replicating the research design with ecosystems orchestrated, exclusively or predominantly, by large for-profit entities.

Another instance of extension is the case of orchestration by startups. Startups do not enjoy resource leverage or bargaining power compared to large for-profits. Nevertheless, given favourable conditions, startups have been found to orchestrate ecosystems. For instance, Lingens, Böger, et al. (2021) studied nine ecosystems that were orchestrated by startups. The authors found that startups faced additional complexities in orchestrating ecosystems compared to orchestrating by large firms. The complexities were related to funding (startups had to secure funding to support their own product development, which was a crucial input to the ecosystem's combined offering), coordination (startups had to invest additional managerial effort to undertake coordination which typically involved hiring new staff), persuasion (startups had to continually demonstrate technical competence and market knowledge), and scaling (scaling was slow and painstaking). Thus, orchestration by startups is expected to have additional dynamics beyond the subprocesses proposed by this dissertation. Hence, there is scope to extend the findings of this dissertation by replicating the research design with ecosystems that are orchestrated by startups.

Another scope for further research comes from ecosystems that have faced (or are facing) instability, either due to competitive disruption or the threat of obsolescence.

As was stated in the prior section on limitations, the cases studied in this dissertation were in a stable state of operations for the period of the study. As a result, much insight was not gained into orchestrating in the face of conflict or disruption. Future studies can build on the findings of this dissertation by investigating how orchestrating plays out when an established ecosystem (1) encounters disruptive competition from outside or (2) faces obsolescence due to its inability to change.

Snihur et al.'s (2018) study took a processual perspective on ecosystem disruption. The authors found that framing processes played a vital role in advancing and legitimizing new business models and enabled the disruptor to replace an established ecosystem that had been a market leader. While Snihur et al.'s (2018) study provided important processual insights into ecosystem disruption, it did so from the disruptor's perspective. There is, hence, scope to understand how the established incumbent responded, perhaps, through orchestrating defensive framing processes. Such a process study can be incredibly insightful given that disruptions are often not single events but processes that play out over time (Wessel & Christensen, 2012). To derive valuable insights, one ought to look at ecosystem cases where the incumbent managed to fend off disruption and continued to retain their market share. How global car manufacturers (such as Toyota) are orchestrating changes to their ecosystems to respond to disruption by electric vehicle makers (such as Tesla) could be a case in point.

Another scope for future study is related to ecosystem demise owing to rigidity. Research on organizational rigidity has, thus far, investigated the dysfunctional effects of deeply embedded core capabilities within organizations (Leonard-Barton, 1992). Ecosystems are also vulnerable to rigidities. The aim of the evolving/transforming subprocess (see Figure 5.8) is to drive ecosystem adaptation and, hence, pre-empt obsolescence. However, orchestration-related rigidities, if present, can hamper the evolving-/transforming-related activities. As per my knowledge, no known study has investigated rigidities within ecosystems. The process model suggested by this dissertation can be a helpful ground based on which failures can be modelled (as shown in Figure 7.1) and rigidities better understood.

7.4. Conclusion

This chapter concludes this dissertation. It summarizes the dissertation chapters and reiterates key findings. While the main body of this dissertation managed to examine two research questions – namely, *(1) what constitutes ecosystem orchestration? (2) what are the underlying dynamics involved in orchestrating ecosystems over time?* – this chapter goes further. It discusses the implications of the proposed process model on ecosystem strategy, especially concerning how failure to undertake any of the subprocesses could lead to ecosystem demise. Limitations of this dissertation and scope for future research are then discussed.

This dissertation was undertaken with a keen interest in analysing the ecosystem phenomenon. In a world where markets are becoming increasingly dynamic, and demand is taking complex and heterogenous forms, the ecosystem form of organizing has become an avenue not only to succeed but also to realize above-normal returns. Since ecosystems involve diverse actors interacting without hierarchical control, orchestrating ecosystems is critical. This dissertation has attempted to unbundle the dynamics of ecosystem orchestration. It is hoped that the process model unearthed by this dissertation will serve as a helpful guide to ecosystem managers by delivering insights necessary to craft successful ecosystem strategy. On the other hand, as the processual nature of this study has unpacked several underlying dynamics of orchestrating ecosystems, it is hoped that this study will inspire further research on the complex phenomenon of ecosystem management and sustenance.

Appendix 1: Reviewing other dissertations (year 2000 onwards)

I tested the possibility of unpublished dissertations overlapping with my dissertation project. Hence, as part of my literature review, I searched ProQuest database for doctoral dissertations.[43] I searched for dissertations published after 1st January 2000 that contained the term 'ecosystem' either in their title or abstract. I filtered the results for the following fields: management, information technology, business administration, and entrepreneurship. That brought the list down to 271 results. I read through each abstract, selecting only those that related to the *dynamics* of business ecosystems, which pertained to my research question. I could identify only seven dissertations (Altman, 2015; Bergman, Jr., 2021; Corte, 2016; Hannah, 2016; Pushpananthan, 2019; Rinkinen, 2016; Steinberger, 2017) as related to my project. Table A1.1 has the dissertation details listed in alphabetical order of authors.

Altman's (2015) study provides three important insights that are a basis for my project: (1) reduction in information processing costs can enhance community engagement by breaking down the traditional boundaries of the firm and, hence, facilitate the emergence of ecosystems. This, in turn, initiates new interdependencies for the focal firm (Thompson, 1967); (2) when interdependencies are asymmetric, partners tend to manage relationships through either of three response strategies: compliance, influence, or innovation, which suggests that ecosystem strategy involves within-system nuances in relation to how the interdependencies play out; (3) migration from a product- to ecosystem-based business model can have profound identity implications for the focal firm.

[43] https://about.proquest.com/en/dissertations/ (accessed 26 March 2023)

Bergman, Jr.'s (2021) study provides insights into how entrepreneurial support organizations (ESOs) catalyse the creative efforts of entrepreneurs. His study, firstly, issues a call for research that looks at ESOs from dynamic and relational perspectives. In other words, his review indicates the need for dynamic studies of ecosystems. Further, it clarifies the need to consider interdependencies – insofar as they influence relationships – and account for them from the strategic perspective, specifically in terms of how divergence in expectations of the ecosystem partners can affect the strategic dynamics. Corte's (2016) study adds the dimension of institutional logics to the nuance of how divergence in expectations can arise. While Bergman, Jr.'s (2021) study looked at a particular context of ESOs, Corte (2016) studied the context of open-source software (OSS).

Hannah (2016) looks at the cooptative aspect of ecosystems, thus, building upon Corte's (2016) notion of governance tensions. The study, which has also been subsequently published (Hannah & Eisenhardt, 2018), emphasizes bottleneck strategies in guiding value appropriation amongst ecosystem participants. Hannah's (2016) study divests itself in analysing the contours of balancing collaboration and competition at both ecosystem and component levels, with the component architecture being core to ecosystem dynamics. Hannah (2016) does not study orchestration as such but only considers participant-level strategies insofar as it affects the collective.

Pushpananthan's (2019) study describes various processes undertaken by a focal firm that deliberately aimed to be the keystone of an ecosystem and, hence, effected an ecosystem to emerge around its strategic transformation. The study indicates how the orchestration process is fraught with uncertainties and demands several trade-offs along the way. This study reinforces the need for research that further investigates the dynamics of orchestration in business ecosystems.

The above dissertations provided several bases for my dissertation work, though they do not significantly overlap with my planned work. Pushpananthan's (2019) study comes closest from an orchestration perspective. Though the study dealt with the context of orchestration from the (exclusive) perspective of a focal firm aspiring to be the keystone of its ecosystem (Iansiti & Levien, 2004b), for my dissertation, I take a generalized perspective of orchestration where focal firms may be hubs of certain activities but need not necessarily be keystone entities. Furthermore, my dissertation anticipates orchestration as involving different firms (orchestrators) at different points in time – or several firms coordinating the orchestration activity. Hence, the question of a keystone entity is somewhat tangential to my dissertation project.

Two more dissertations that I identified had much less overlap. Rinkinen's (2016) study did not relate much to my dissertation project but did evoke a line of thought regarding the policy implications of ecosystem-related findings, as ecosystems can play an important role in the economic renewal of a region. Similarly, Steinberger's (2017) study did not seem to fall within the scope of ecosystems altogether and only implicated ecosystems in relation to its findings. Nevertheless, Steinberger's (2017) study provides insight into the antecedents and consequences of modular design – the former as an entailment of reduced information processing costs and the latter suggesting long-term adaptability. Modularity, insofar as it enables niche creation and ecosystem formation, is a theoretical premise of my dissertation project, and hence, Steinberger's (2017) insights significantly reinforce the basis of my work.

In summary, the seven dissertations that I found to have studied processes and strategies related to ecosystems do not overlap with my dissertation plan and actually provide essential insights that reinforce my dissertation project.

Table A1.1: *Dissertation details (table continues to next page).*

Author [Year, Institute]	Dissertation Title	Empirical Context [Ecosystem Context]	Summary of the Dissertation
Elizabeth Jane Altman [2015, Harvard Business School]	Platform and Ecosystem Transitions: Strategic and Organizational Implications	Multi-year field study of a well-known consumer technology products provider joining a powerful platform-based ecosystem. [Platforms, complementors]	The study looks at how mature incumbents make the transition to multi-sided platforms-based business model. The study identifies three kinds of dependencies – technological, information, and values-based – and three response strategies – compliance, influence, and innovation – that organizations making the transition from product to platform models face, and also suggests that platform transitions ought to be accompanied with relevant transitions in organizational identity.
Bergman, Jr., Brian J. [2021, Indiana University]	Entrepreneurial Support Organizations: Curating and Catalyzing Entrepreneurial Action	Inductive case-study of a maker space-based ESO and its resident entrepreneurs [Entrepreneurial ecosystems, supporting infrastructure]	The first essay provides a review of literature on entrepreneurial support organizations (ESOs) such as incubators, accelerators, etc., and calls for a research agenda involving dynamic, relational perspectives to ESOs. The second essay involves an inductive case-study of an ESO and its participant entrepreneurs and finds that an ESO environment can potentially help as well as hinder its entrepreneurs' developmental efforts. The third essay draws upon the earlier case study but provides an external perspective wherein ESOs are found to build legitimacy for entrepreneurial activity in a region and catalyse the formation of entrepreneurial ecosystems.
Diego Mastroianni Dela Corte [2016, McGill University]	Institutional Logics and the Governance of Open Source Software Ecosystems	Longitudinal study of an open source software system in a healthcare setting [Open source software, governance]	The dissertation investigates the evolution of open source software ecosystem governance in a healthcare setting. Through a longitudinal study, the research shows how governance negotiates considerations of control and complexity in governing the collective.

Author [Year, Institute]	Dissertation Title	Empirical Context [Ecosystem Context]	Summary of the Dissertation
Douglas Paul Hannah [2016, Stanford University]	Firm Strategy in Early-Stage Ecosystems	Multiple case-study of five firms in the nascent US residential solar ecosystem [Business ecosystem, bottleneck strategy]	The dissertation looks into a hitherto unexplored area of early-stage ecosystems where identity and relationships between ecosystems partners are not well-established. The study explains how bottleneck strategy can play a key role in governing value capture in evolving ecosystems. The study also goes on to theorize – using mathematical modelling and game theoretic concepts – how firm strategy unfolds in nascent ecosystems over time.
Gouthanan Pushpananthan [2019, Chalmers University]	The Emergence of Innovation Ecosystems: Exploring the Role of the Keystone Firm	Longitudinal case study of technology development at an automotive firm [Innovation ecosystem, keystone entity]	The study builds on literature that indicated the advantages of occupying keystone role in an ecosystem (Iansiti & Levien, 2004b). The study provides a process perspective on how innovation ecosystems emerge, and then how firms manage to take up the keystone position.
Rinkinen Satu [2016, LUT, Finland]	Clusters, Innovation Systems, and Ecosystems: Studies on Innovation Policy's Concept Evolution and Approaches for Regional Renewal	Several form of data from players within the Finnish ecosystem [Innovation ecosystem, innovation policy]	This dissertation is concerned with the macro perspective of informing innovation policy so as to influence regional renewal initiatives. It investigates innovation ecosystems from the perspective of understanding how they relate with innovation policy and its concept evolution.
Thomas Farnan Steinberger [2017, UC Irvine]	Organizing beyond Boundaries: Capabilities and Design	Production strategies of a restaurant chain [Interfirm context, not particularly ecosystem]	This dissertation is an attempt to examine the strategies employed a firm that aspires to do work with the ecosystem form of organizing. First, the author theorizes that information costs are a key determinant to a firm's choice of organizing within or beyond its boundaries. Second, using the concept of spatial representation, the author develops a framework of how routines are (re)modelled to organize beyond boundaries. Thirdly, the author looks at how modularization can enable long-run adaptation through design strategies that focus on modularization.

Appendix 2: Differentiating Ecosystems from Allied Constructs

In Chapter 2, I proposed an integrative definition for ecosystems. While on the one hand, the new definition can help to mitigate inconsistent usage of the ecosystem term (Ritala & Almpanopoulou, 2017; Weber & Hine, 2015), on the other hand, it can also help to delineate ecosystems from interdependence constructs it conceptually overlaps with (Adner, 2017). Doing so can be a helpful exercise in disambiguating the ecosystem understanding from allied constructs, a requirement the new definition has the potential to satisfy. Attempts to establish the theoretical validity of the ecosystem conception have been impeded by its overlap with other interdependence constructs, so much so that scholars have claimed the ecosystem as a redundant construct in management (e.g., Oh et al., 2016). Indeed, as Adner (2017) observed, “it is often hard to disentangle [ecosystem’s] characterizations and recommendations from those of other approaches to interdependence (e.g., networks, platforms, multisided markets).” (2017: 41), indicating that there is a need to delineate the ecosystem conception from allied interdependence constructs in literature.

According to Autio and Thomas (2014), the ecosystem concept is broader than other interdependence constructs. It involves *both* demand and supply-side perspectives and, hence, can include a wide variety of stakeholders. However, a broader concept does not imply redundancy unless it is reducible to the other (low-level) constructs. In this appendix chapter, I contrast the ecosystem conception – as laid down by the new definition – with allied constructs established in the literature and highlight essential differences between them. The constructs considered for comparison are supply chains or value chains (Porter, 1985), value nets or networks (Christensen & Rosenbloom, 1995; Nalebuff & Brandenburger, 1996), industrial clusters (Porter, 1990), strategic networks (Gulati, Nohria, & Zaheer, 2000), strategic alliances (Das & Teng, 2000), alliance portfolios (Lavie, 2007), platforms (Baldwin & Woodard, 2009), and community forms of organizing (Seidl & Stewart, 2011).

Supply chains and value chains. In contrast to supply chains, ecosystems are dominated by horizontal relationships (Adner & Kapoor, 2010; Autio & Thomas, 2014). Supply chains are characterized by sequential interdependence, whose core concern is to maximize supply-side efficiency (Kapoor, 2018), whereas ecosystems have both demand and supply-side focus and, hence, efficiency and effectiveness are more closely intertwined for ecosystems. A related construct to supply chains is that of the value chain (Porter, 1985), which, like an ecosystem, has a value co-creation focus. However, as Kapoor (2018) has indicated, "while the ecosystem perspective takes a macro view of the external actors that contribute to the focal firm's value creation, the value chain perspective takes a micro view of the firm's internal activities that underlie its performance relative to its competitors." (2018: 4). Hence, three factors – i.e., the multilateral structure of interdependence, dual-side focus, and the systemic (i.e., macro) perspective – differentiate ecosystems from supply and value chains.

Value networks. A value net (Nalebuff & Brandenburger, 1996) or value network (Christensen & Rosenbloom, 1995) shares the value co-creation emphasis with ecosystems. However, unlike the ecosystem approach, value net/networks are silent on the underlying nature of interdependencies (Adner, 2017). Further, ecosystems emphasize coevolution to new internal states compared to value net/networks that seek to optimize output potential based on a static network configuration (Autio & Thomas, 2014). Hence, two aspects – i.e., the continual coevolution of partners and the importance of the nature of interdependence – mainly serve to differentiate ecosystems from value nets and value networks.

Clusters. A cluster is a "geographically proximate group of interconnected companies and associated institutions in a particular field, linked by commonalities and complementarities." (Porter, 2000: 20). Ecosystems differ from clusters from the perspective of the underlying interdependencies. In clusters, the interdependence is of the commensalistic type (Astley & Fombrun, 1983), wherein many units of the 'same species' collaborate to drive down raw material costs through supply-side economies of scale. In contrast, ecosystems are characterized by symbiotic interdependencies involving partners with complementary competencies or capabilities that may be directly (i.e., pairwise) or indirectly (i.e., linked through interdependent chains) interrelated (Astley & Fombrun, 1983). Hence, ecosystems are conceptually different from industrial clusters with respect to the nature of interdependency and the different nature of specializations of the participants. Finally, clusters are necessarily geographically bound and provide a competitive advantage for a geographical region (Porter, 2000), whereas ecosystems need not be geographically bound. Ecosystems, in fact, frequently span political and industry boundaries (Brusoni & Prencipe, 2013).

Networks. Networks are formal and enduring inter-organizational relationships – either horizontal or vertical, or both – that may span industrial or national borders and include a host of formal ties such as alliancing, long-term buyer-supplier partnerships, etc. (Gulati et al., 2000). The core concern of network research is to investigate how cooperative ties can effect competitive advantage (Jarillo, 1988). Ecosystems are (structurally) based on the concept of networks, but their phenomenology goes well beyond networks. Ecosystems are premised on the focal offer that then drives interdependencies (Kapoor, 2018), whereas the network-based approach starts with inter-organizational relationships as given (Shipilov & Gawer, 2020).

Network research has mainly focused on firm- or dyad-level analysis (Shipilov & Gawer, 2020): firm-level research has looked into egocentric or alter-centric aspects (Podolny, 2001) involving network variables such as network position, while dyad-level research has typically looked at tie-formation aspects such as nature and strength of ties (Granovetter, 1973). In contrast, ecosystem research often involves a systemic aspect drawing upon the focal offering (Shipilov & Gawer, 2020). Nevertheless, the interest of network scholars in the nature of ties may have significant commonalities with the nature and type of interdependencies that are core to ecosystem research. However, the ecosystem lens reveals dynamic mechanisms of value transformation that represent an active value creation process in contrast to a passive network approach (Rong, Wu, Shi, & Guo, 2015; Scaringella & Radziwon, 2018).

Alliances and alliance portfolios. Strategic alliances are an "inter-firm cooperative arrangement, aimed at achieving the strategic objectives of the (Das & Teng, 1998: 491). Research on alliances, which started as a subset of the scholarship on networks, gained popularity from the trends towards internationalization in the 1990s (Shipilov & Gawer, 2020). Though cooperation is key to the success of strategic alliances, one cannot preclude opportunistic behaviour on the part of alliance partners. Insofar as ecosystems embody a shared fate (Iansiti & Levien, 2004a), there is an *ex-ante* disincentive to opportunistic behaviour. Hence, while alliances necessarily involve formal devices such as contracts, ecosystem interrelationships may be driven through informal authority (Gulati et al., 2012). In fact, as the value propositions pursued through ecosystem forms tend to be complex (Dattee et al., 2018), the nature of the interrelationship cannot often be determined *ex-ante*. Hence, ecosystems may come to be dominated by informal relationships. Alliance portfolio, another related construct, refers to a collection of a focal firm's direct alliances with different partners and is akin to an egocentric network (Lavie, 2007). Hence, alliance portfolios would differ from ecosystems along the lines discussed under alliances and networks above.

Platforms. The platform is a set of stable components that provides an architectural basis for building a family of offerings (Baldwin & Woodard, 2009). In other words, a platform encapsulates a core that remains relatively unchanged while interfacing with a heterogeneous set of complementary actors that continually strive to offer a stream of derivatives (Baldwin & Clark, 2000; Kretschmer et al., 2020). While a platform is a (generic) offering by itself, its full potential towards end-users is realized only when complemented by a diverse set of autonomous agents who collaborate to co-create value (Hein et al., 2020). Thus, platforms are not ecosystems in themselves but become ecosystems when sets of complementary actors collaborate and bring about diverse offerings (Chen, Tong, Tang, & Han, 2021).

Communities. Communities are guided by norms of membership and driven by shared objectives. Research has shown that in community-based forms, actors commingle based on unique complementarities and coevolve in pursuit of shared objectives (O'Mahony & Bechky, 2008). Communities seem to bear a close resemblance to ecosystems as they are characterized by permeable boundaries and are primarily governed through informal authority. The nature of membership, however, underscores a significant difference. Community membership tends to be highly fluid and typically involves significant incorporation of volunteers (Seidl & Stewart, 2011), whereas ecosystems cannot rely entirely on self-selected voluntary membership. As Gulati et al. (2012) observe, "[c]ollectives that rely entirely on self-selected membership may find it more difficult to fill competence gaps and ensure coordination or task completion, since exit from the collective is as easy as entry. Open membership can result in unsolicited and unwanted contributions as well as contestation of collective goals and agreements." (2012: 575)

Table A2.1 breaks down the ecosystem definition and enumerates how ecosystems compare with the allied constructs discussed above. It can be seen that communities, networks, and value nets seem to have much in common with ecosystems.

Table A2.1: *Differentiating ecosystems from allied constructs.*

	Ecosystems	Supply Chains	Value Chains	Value Net/ Networks	Clusters	Networks	Alliances (Portfolio)	Platforms	Communities
Integrated Value Proposition									
Does the collective offer a combined value proposition?	Yes	No	No	Yes	No	Maybe	Yes	NA	Yes
Can the user mix-and-match parts of the value proposition?	Yes	NA	NA	Yes	NA	Maybe	No	No	Maybe
Are memberships fluid, ad-hoc, or voluntary?	No	No	No	No	Yes	No	No	No	Yes
Distinct Functional Roles									
Can the value offered be split into distinct functional parts?	Yes	No	No	Yes	No	Yes	Maybe	Yes	Maybe
Are there different specialized actor(s) undertaking those functions?	Yes	NA	NA	Yes	NA	Yes	Yes	No	Yes
Do functional roles continually coevolve pursuing new value?	Yes	NA	NA	Yes	No	Maybe	Maybe	Maybe	Maybe
Horizontal Interrelationships									
Do the functional roles share complementary relationship?	Yes	No	Yes	Yes	No	No	Maybe	Yes	Maybe
Are all relationships based on formal contracts?	No	Yes	Yes	Yes	No	Yes	Yes	No	No
Do all participants of the collective directly share in the overall outcome?	Yes	No	No	Yes	Yes	Maybe	Yes	Yes	Maybe

Note: shaded boxes under the constructs represent features that do not match with ecosystems.

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