ECOSYSTEM SYNERGIES, CHANGE AND ORCHESTRATION

Zhe (Selina) Cao

Submitted to Imperial College London in fulfilment
of the requirements for the degree of Doctor of Philosophy

Management & Entrepreneurship Department
Imperial College Business School
South Kensington London SW7 2AZ United Kingdom

March 2023

DEDICATION

For my beloved family.

STATEMENT OF ORIGINALITY

I herewith declare that this thesis is my own work. All material and sources that do not constitute my own work have been explicitly acknowledged and referenced.

Zhe (Selina) Cao

31 March 2023

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ACKNOWLEDGEMENTS

I would like to express my deepest gratitude to my family for their continued support and encouragement. I would never have gotten this far without all of you.

To my two supervisors, Christopher Tucci and Dmitry Sharapov, I am very grateful for your guidance, encouragement, and commitment to helping me get to the finishing line.

I am deeply indebted to Jizhen Li and others from Tsinghua University and all the people I met from Alibaba and other organisations during my fieldwork for providing me with important resources and support for this thesis.

I am thankful for Imperial for providing my PhD funding and training. I would also like to thank all the people from the Imperial community that helped me throughout this process. Thank you all for everything.

Thanks should also go to the Academy of Management community for providing the platform, workshops, and various supports for me to learn and grow as an early-career scholar.

Special thanks to the people at the University of Queensland for warmly supporting, welcoming and encouraging me.

I acknowledge the contribution of Erkko Autio and Llewellyn Thomas by noting their influences on specific areas in the footnotes.

Zhe (Selina) Cao

31 March 2023

ABSTRACT

This thesis investigates ecosystem synergies, change, and orchestration. The research topics are motivated by my curiosity, a fragmented research landscape, theoretical gaps, and new phenomena that challenge extant theories. To address these motivators, I conduct literature reviews to organise existing studies and identify their limited assumptions in light of new phenomena. Empirically, I adopt a case study method with abductive reasoning for a longitudinal analysis of the Alibaba ecosystem from 1999 to 2020. My findings provide an integrated and updated conceptualisation of ecosystem synergies that comprises three distinctive but interrelated components: 1) stack and integrate generic resources for efficiency and optimisation, 2) empower generative changes for variety and evolvability, and 3) govern tensions for sustainable growth. Theoretically grounded and empirically refined, this new conceptualisation helps us better understand the unique synergies of ecosystems that differ from those of alternative collective organisations and explain the forces that drive voluntary participation for value co-creation. Regarding ecosystem change, I find a duality relationship between intentionality and emergence and develop a phasic model of ecosystem sustainable growth with internal and external drivers. This new understanding challenges and extends prior discussions on their dominant dualism view, focus on partial drivers, and taken-for-granted lifecycle model. I propose that ecosystem orchestration involves systematic coordination of technological, adoption, internal, and institutional activities and is driven by long-term visions and adjusted by re-visioning. My analysis reveals internal orchestration's important role (re-envisioning, piloting, and organisation architectural reconfiguring), the synergy and system principles in designing adoption activities, and the expanding arena of institutional activities. Finally, building on the above findings, I reconceptualise ecosystems and ecosystem sustainable growth to highlight multi-stakeholder value creation, inclusivity, long-term orientation and interpretative approach. The thesis ends with discussing the implications for practice, policy, and future research.

Keywords: Ecosystems; ecosystem synergies; ecosystem change; ecosystem orchestration; ecosystem sustainable growth; Industrial Internet of Things

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1 INTRODUCTION

"I have no special talents. I am only passionately curious."

- Albert Einstein

"The various sciences, taken together, are not colonies subject to the governance of logic, methodology, philosophy of science, or any other disciplines whatever, but are, and of right ought to be, free and independent. Following John Dewey, I shall refer to this declaration of scientific independence as the principle of autonomy of inquiry. It is the principle that the pursuit of truth is accountable to nothing and to no one not a part of that pursuit itself."

- Abraham Kaplan, The Conduct of Inquiry (1964: 3, original italics)

Fascinated by the unprecedented performance of technology companies at the beginning of the 2010s, such as Apple, Amazon, Facebook, and Google, I embarked on an academic journey to explore their magic. I was curious and in awe about their scalability and the breadth of their industry coverage. In my 2016 PhD application statement, I expressed my intrigue at the difference between these big tech players and classic monopolies in the 90s. Specifically, I could not stop wondering what synergies these new boundary-spanning organisations provide, how they evolve, and how they orchestrate other organisations to co-create value and sustain leadership positions. This genuine curiosity led me to pursue a PhD and write this thesis.

In organisational studies, scholars from various disciplines have explored organisational behaviours through different theoretical frameworks and constructs (Koontz, 1980; Mayer & Sparrowe, 2013; Okhuysen & Bonardi, 2011). Each lens comes with its unique analytical focus, makes its assumptions about organisations, and picks its unit and level of analysis (Aldrich, 1999; March & Simon, 1958; Weick, 1995). To explain why and how organisations exist and evolve, scholars have provided various answers, such as classical economic theory, behavioural economics, evolutionary theory, old and new institutional theory, resource-based view and dynamic capabilities, competitive dynamics, upper echelons, organisational ecology, and sensemaking (Koontz, 1961; March & Simon, 1958; Tsoukas & Knudsen, 2003). Each is valuable, possesses

unique limitations, and contributes to an increasingly comprehensive understanding of organisations (Gioia & Pitre, 1990).

As big technology companies became progressively influential, ecosystem theory emerged as a popular explanation for such collective organisational behaviours (reviews, e.g., Cobben, Ooms, Roijakkers, & Radziwon, 2022; Gomes, Facin, Salerno, & Ikenami, 2018; Oh, Phillips, Park, & Lee, 2016; Scaringella & Radziwon, 2018; Tsujimoto, Kajikawa, Tomita, & Matsumoto, 2017). Following worldwide business successes in the last three decades, the notion of ecosystems has gained greater currency in practice and academic discourse to the extent that almost everything can be viewed as an ecosystem (Scaringella & Radziwon, 2018). Early ecosystem elaborations focused on the dynamics of co-evolution (Iansiti & Levien, 2004b; Moore, 1993) and gradually populated to become an alternative theoretical framework (Jacobides, Cennamo, & Gawer, 2018; Kretschmer, Leiponen, Schilling, & Vasudeva, 2022). Driven by the advancement of digital technologies, ecosystems display disruptive features by orchestrating a wide range of non-hierarchical and symbiotic participants across industries to collectively create a system-level output larger than any single participant could achieve (Adner, 2017). Such ecosystems tend to reside upon a layered digital infrastructure, with the lower layer providing infrastructural support to enable the upper layer to generate user-facing solutions (Yoo, Boland, Lyytinen, & Majchrzak, 2012). Network effects are highlighted as central and salient drivers of platform competition (Gawer & Cusumano, 2014), which "*trigger a self-reinforcing feedback loop that magnifies incumbents' early advantages*" (Gawer, 2014: 1241). Although in its infancy, ecosystem theory has started to show powerful explanations (John & Ross, 2021; McIntyre & Srinivasan, 2017; Stonig, Schmid, & Muller-Stewens, 2022).

In this thesis, I adopt an ecosystem perspective to research these big technology companies, specifically their synergies, change, and orchestration strategies. I present my research motivation, questions, central arguments, research method, and thesis structure in the following.

1.1 Research Motivation and Research Questions

It is my intention in this thesis to explore ecosystem behaviours. Ecosystems in this thesis refer to business-related organisational forms, excluding those used in regional or national policy contexts, e.g., entrepreneurial ecosystems, regional innovation systems, and knowledge ecosystems (Cao & Shi, 2020; Clarysse, Wright, Bruneel, & Mahajan, 2014; Spigel, 2017). Specifically, this thesis explores 1) what synergies ecosystems offer, 2) how ecosystems change,

and 3) how ecosystems are orchestrated for sustainable growth. Besides my curiosity, these research questions were motivated by the following two aspects.

A fragmented landscape and theoretical gaps. Understanding the unique synergies ecosystem organisational forms offer is a critical first step to grasping the essence of ecosystem magic. This is because ecosystem synergies 1) convey ecosystems' distinct advantages over alternative collective organisational forms, such as supply chains, business groups and strategic alliances, and 2) explain why and how ecosystem orchestrators can attract external organisations to co-create value with limited hierarchical controls. Reviewing the studies on ecosystem synergies, I found that, although insightful, the existing literature is rather fragmented. Such fragmentation manifests in different and sometimes overlapping concepts proposed by scholars from various disciplines without a coherent synthesis. For example, scholars have used network effects (Katz & Shapiro, 1994), multi-sided markets (Boudreau & Hagiu, 2009), supermodular complementarity (Jacobides et al., 2018), and generativity (Zittrain, 2007) to explore the constellation benefits of ecosystems. This compartmentalised landscape where siloed groups talk in different languages prevents scholars from reaping the benefits of cross-fertilisation and reaching the core of ecosystem advantages. While comprehending ecosystem synergies, I also realised the critical role time plays for ecosystem synergies to materialise. Therefore, as the second step to grasping the essence of ecosystem magic, I decided to investigate ecosystem change and ecosystem sustainable growth. The literature review unveiled that insights remain limited by fundamental debates about the drivers and nature of ecosystem change (Ritala & Almpanopoulou, 2017; Wareham, Fox, & Cano Giner, 2014). Questions such as "What drives ecosystem change? How do ecosystems change? Are changes intentionally designed by ecosystem orchestrators or emergent without predictability?" remain unsatisfactorily answered. Without explicitly addressing and concretely understanding the dynamics of ecosystem change, we risk lacking effective vehicles to orchestrate ecosystems for synergies, success and sustainable growth.

Limited understanding of new phenomena. While reviewing ecosystem literature and observing new phenomena throughout my PhD, I discovered some new phenomena that existing ecosystem theories could not fully explain or predict. For example, the Industrial Internet of Things (IIoT) ecosystems (e.g., Siemens Mindsphere) have become a significant impetus for next-generation innovation and productivity (Khan et al., 2020; Leminen, Rajahonka, Wendelin, & Westerlund, 2020). According to the Ccidwise Thinktank, the economic potentials released by

opening up the upstream value chains are estimated to be 100 times more than those downstream. Alibaba, a leading transaction intermediary and innovation ecosystem, has entered IIoT ecosystems since 2016 through initiatives such as New Manufacturing Digital Factory and supET industrial ecosystems. Also, organisations in the public sector started to join the ecosystem community by exploring the benefits of smart government ecosystems and smart city ecosystems using IoT and AI (Kankanhalli, Charalabidis, & Mellouli, 2019; Mellouli, Luna-Reyes, & Zhang, 2014). Alibaba has also become an important collaborator with public-sector organisations such as governments and universities to enhance their operational efficiency through programs such as e-government and training platforms. I realised that ecosystems were in the process of entering into a new era. The first era focuses on coordinating collective activities from the provision side to serve the consumption side, hosting in computers and later mobile devices (Tiwana, 2014). Examples of such ecosystem cases are the Big Five: Apple, Facebook, Google, Amazon, and Microsoft. As digital technologies advanced, e.g., the decreasing price for sensors and high penetration of Wi-Fi connectivity, ecosystems started to enter a second era of application by becoming increasingly capable of facilitating provision-side operational coordination (Hein et al., 2019; Shree, Kumar Singh, Paul, Hao, & Xu, 2021). In this new era, ecosystems went beyond ensuring compatibility among ecosystem outputs to co-produce value for consumers to include collective efforts among organisations (private and public) in shared platforms to enhance operational efficiency (Arnold, Kiel, & Voigt, 2016). Although the importance of these new ecosystem phenomena is well recognised in practice, research about them is still sparse, especially in non-western contexts. Without incorporating these new phenomena, ecosystem theories face the challenges of being obsolete and losing explanatory and predictive power.

Against this backdrop, in this thesis, I choose to adopt an ecosystem perspective to explore the following questions that could expand the influence and significance of ecosystem research:

- *What are ecosystem synergies?*
- *How do ecosystems change and specifically grow sustainably?*
- *How are ecosystems orchestrated?*

1.2 Central Arguments

My analysis of ecosystems in this thesis suggests the following contributions to the ecosystem theory. The ***first*** is an integral and updated conceptualisation of ***ecosystem synergies***. This new understanding helps scholars better understand my first research question – *What*

synergies do ecosystems provide? It is theoretically grounded and empirically refined. The insights from existing ecosystem theories were classified into five themes using purpose as the main distinguishing criterion, and interrelations and assumptions were specified for synthesis. Empirically, unexpected anomalies, such as IIoT and smart government, unveiled nuances of ecosystem synergies and led to theory extensions. By synthesising the old and incorporating the new, this new ecosystem synergies framework suggests that ecosystem synergies at the core comprise three distinctive but interrelated components: 1) stack and integrate generic resources for efficiency and optimisation, 2) empower generative changes for variety and evolvability, and 3) govern tensions for sustainable growth. Together, these three components convey the unique synergies of ecosystems that differ from those of alternative collective organisations and explain the value co-creation mechanisms that attract external participation. Understanding ecosystem synergies in this way is advantageous because it liberates ecosystems from consumer-provider analytical focus to incorporate multi-stakeholders for ever-expanding and accumulative potentials of collective value co-creation in ecosystems.

The ***second*** contribution addresses my research question of "*How do* ***ecosystems change*** *and specifically grow sustainably*?" My analysis provided herein offers new insights about ecosystem change by 1) ordering extant literature through a typology framework that facilitates scholars to self-identify and leverage combinations to develop novel ideas, 2) reconceptualising ecosystem change through a duality view of intentionality and emergence, and 3) developing a phasic model of ecosystem sustainable growth. This new understanding challenges and extends prior discussions on their dominant dualism view, focus on partial drivers, and taken-for-granted lifecycle model. By focusing on longitudinal analysis, my study of ecosystem changes complements existing research that overly focuses on variance analysis and highlights ecosystems' evolving and dynamic characteristics.

The ***third*** main contribution relates to my third research question – *how are* ***ecosystems orchestrated***? My case analysis in this thesis demonstrates how attention to time, width and systematisation can help advance research on mechanisms through which ecosystems are orchestrated. Ecosystem orchestration involves systematic coordination of technological, adoption, internal, and institutional activities, and it is driven by long-term visions and adjusted by the re-visioning process to steer collective behaviours towards ideal futures and ecosystem sustainable growth. My findings contribute to existing research by 1) highlighting the long-term vision-driven

and re-envisioning approach and 2) unveiling a systematic orchestration approach that maximises mutually enabling relationships of four activities, including architectural, internal, adoption, and institutional orchestration. My analysis highlights internal orchestration's important role (re-envisioning, piloting, and organisation architectural reconfiguring), the synergy and system principles in designing the adoption activities, and the expanding arena of institutional activities.

The ***fourth*** contribution lies in the conceptualisation of ***ecosystem sustainable growth***. By theorising empirical events unfolding over 21 years, the thesis provides insights into the conditions for ecosystems to grow sustainably: 1) incorporating the environmental and societal sustainability elements and value creation for multi-stakeholders in the ecosystem business model, 2) leveraging both intentional and emergent actions, and 3) rethinking the traditional concept of competitive strategy to a more inclusive and long-term understanding of rivalry dynamics.

Addressing my three research questions enabled me to rethink ***ecosystem conceptualisation***. This is the ***fifth*** contribution. Instead of the dominant view of designed collective arrangements, I propose to rethink ecosystems as empowering engines that emerge and grow sustainably with the help of participants and empower participants in their own ways. By taking multi-stakeholder synergies, the duality view of intentionality and emergence, sustainable growth, layered network instead of customer-provider logic and interpretative approach seriously, ecosystems as empowering engines can enable a wide range of users to be better selves according to their needs and, through empowering, can co-develop future direction of ecosystem development for ecosystem sustainable growth, i.e., an increasing pie with an increasing portion of participant-specific value for each. My discussion suggests scholars pay greater attention to and contribute towards emerging ecosystems literature that takes an active, inclusive, and fluid approach.

1.3 Research Method

This study adopts a case study method with abductive reasoning to investigate ecosystem synergies, change, and orchestration strategies. New phenomena like IIoT have challenged existing theories' explanatory and predicting power, calling for theory refinement. Existing literature was reviewed using the thematic review method, empirical data was gathered from primary and secondary sources, and the empirical case was analysed using process data theorisation and narrative and temporal bracketing strategies. The empirical context is the Alibaba ecosystem in China from 1999 to 2020.

1.4 Thesis Structure

The thesis consists of seven primary chapters describing the literature reviews, the research problems, methods, findings, discussions, and conclusions. Following this introductory chapter,

- Chapter 2 and Chapter 3 provide the literature reviews and lay the theoretical foundations. More particularly,
    - Chapter 2 reviews concepts related to ecosystem synergies and introduces a five-fold typology to understand ecosystem synergies.
    - Chapter 3 reviews the literature on ecosystem change and associated orchestration strategies and provides a categorisation to delineate the similarities and differences between different themes.
- Chapter 4 describes the research methodologies, empirical settings, data sources, and analysis processes.
- Chapter 5 presents the empirical findings and how the case of Alibaba challenges and complements existing research.
- Chapter 6 discusses the implications for research, practice, and policy as well as limitations and future research directions.
- Chapter 7 presents the concluding remarks.

2 ECOSYSTEM SYNERGIES[1]

"Synergies grow out of valued differences, not emphasized similarities."

Bird (2013: 504)

What synergies do ecosystems offer? In the business field, the notion of ecosystems refers to a community of interdependent actors (organisations or individuals) co-evolve for mutual and collective competitive advantages (Adner, 2017; Gawer & Cusumano, 2014; Iansiti & Levien, 2004b; Jacobides et al., 2018; Moore, 1993; Tiwana, 2014). It has gained increasing popularity since the 1990s among practitioners, academics and policymakers because of the unprecedented synergies ecosystems offer.

Ecosystem synergies are understood as the combined ecosystem-level effect that is greater than the sum of separate effects. A booming number of disciplines have explored ecosystem synergies using a wide range of concepts, such as network externalities or network effects (Farrell & Saloner, 1986; Katz & Shapiro, 1985; Rochet & Tirole, 2003), two- or multi-sided markets (Boudreau & Hagiu, 2009; Hagiu & Wright, 2015), complementarity in innovation ecosystems (Adner, 2006; Adner & Kapoor, 2010; Kapoor, 2018), supply chain and industry platforms (Gawer, 2009b; Gawer & Cusumano, 2014), supermodular complementarities (Jacobides et al., 2018; Shipilov & Gawer, 2020), architectural leverage (Thomas, Autio, & Gann, 2014), data-driven learning and data network effects (Gregory, Henfridsson, Kaganer, & Kyriakou, 2021; Hagiu & Wright, 2020; Jernigan, Kiron, & Ransbotham, 2016), value co-creation (Ceccagnoli, Forman, Huang, & Wu, 2012; Marcos-Cuevas, Natti, Palo, & Baumann, 2016), community recognition (Jeppesen & Frederiksen, 2006), feedback and reputation systems (Tadelis, 2016), and value networks and service ecosystems (Lusch & Nambisan, 2015; Vargo & Lusch, 2010).

Although theoretical pluralism enables novel ways to see ecosystem synergies, it nonetheless introduces isolated lines of research and a compartmentalised research landscape in

[1] In Chapter 2, I initially planned to use the paper "Ecosystem benefits: An integrative framework" which I co-authored with Erkko Autio and Llewellyn Thomas and presented at the 2021 Academy of Management conference. After necessary adjustments, I worked on "Ecosystem synergies" with my understanding and with the support of Chris and Dmitry for Chapter 2. I acknowledge Erkko Autio and Llewellyn Thomas's efforts in the "Ecosystem benefits: An integrative framework" paper. Specifically, in that paper, Erkko pointed out some theories to review, suggested ways to integrate theories and frame gaps, and conducted final edits; Llewellyn offered the term "ecosystem benefits" to replace the "ecosystem synergies" I proposed and the "ecosystem effects" Erkko suggested, and performed final edits; I conducted thematic reviews, pointed out the new provision-side phenomena, proposed unique provision-side ecosystem benefits, proposed categorisation of ecosystem benefits drivers, and wrote the first draft.

which cross-fertilisation becomes challenging (Gioia & Pitre, 1990). Scholars tend to discuss ecosystem synergies through the lens of one or two concepts depending on their contexts and disciplines, as if there are obvious walls between different concepts. This, however, is not the case. An example is that phenomena and mechanisms discussed as indirect network effects (Katz & Shapiro, 1994) are similar to those of two-sided markets (Rochet & Tirole, 2003) and industrial ecosystems (Gawer, 2009a). To clarify and integrate these siloed streams is critical and in dire need because it is challenging to justify ecosystem uniqueness, comprehensively evaluate ecosystem strategies, and ultimately advance ecosystem theories without a systematic understanding of ecosystem synergies. Furthermore, novel phenomena such as IIoT and smart governments seem to find inadequate explanations about synergies and associated mechanisms in most ecosystem studies (Wright, 2017). Assumptions held by extant research face challenges by newly emerged ecosystem synergies such as operational efficiency enhancements.

Therefore, I address these needs in this chapter by systematically classifying existing studies on ecosystem synergies and explicating their assumptions and interrelations. I propose the umbrella notion of ecosystem synergies to envelop the combined ecosystem-level effect that is greater than the sum of separate effects. Through a thematic review, I propose a literature-based five-fold typology of ecosystem synergies: lock-in, efficiency and innovation, complementarity, optimisation, and sustainable equilibrium. I then discuss the interrelations of these five ecosystem synergies and uncover their assumptions. The meta-logic underlying these five ecosystem synergies is balancing evolvability (through positive feedback loops for lock-in and complementarities) and stability (through architectural mechanisms embedded in efficiency and optimisation) to achieve a sustainable equilibrium. A key assumption is the focus on the consumption-side synergies between complementors and consumers and the limited exploration of provision-side synergies. This review-based typology and analysis pave the way for exploring novel provision-side phenomena in the following chapters.

2.1 Organising Ecosystem Synergies: Categorisation

To examine the current research about ecosystem synergies, I conducted a thematic review of related concepts published in the past three decades and consulted experts for key papers to include. At the risk of oversimplifying scholars' complex views, I acknowledge significant differences between and within disciplines. The focus of this thematic review is to highlight themes related to developing ecosystem theories and ecosystem synergies especially. Reviewing the

received studies, I discovered five key ecosystem synergies, each with its leading purpose and analytic logic (see Table 2.1). These interrelated types collectively provide a comprehensive understanding of ecosystem synergies. In the following, I elaborate on the criteria I used for classification and provide detailed descriptions for each.

To avoid incompatibility of assumptions between concepts, I use the main criterion – *purpose* – to distinguish and formulate ecosystem synergies typology. Purpose in the context of ecosystem synergies refers to the goal or outcome of the synergistic offerings in ecosystems. The choice of purpose as the main criterion is inspired by Sandberg and Alvesson (2021)'s paper on theory classification. In that paper, they use purpose to help get around the ontological and epistemological incompatibility between theories. As suggested by Sandberg and Alvesson (2021), purpose can "*provide a more versatile typology and allow openness to novel thinking*", and the proposed types "*are not in themselves tied to a particular paradigm or meta-theoretical school*" (p. 493). Following their approach, I use purpose as the main distinguishing criterion to highlight what ecosystem synergies are for. Besides purpose, I also use secondary criteria such as mechanisms, key insights, empirical contexts, and boundary conditions to understand each type comprehensively. Furthermore, the five-fold typology framework also borrows insights from Amit and Zott (2001) who explore value-creation mechanisms for e-businesses. I summarise the final literature-based five-fold typology framework in Table 2.1. In the following, I elaborate on each type and illustrate them with examples.

Lock-in

My review suggests that ecosystem lock-in is a crucial type of ecosystem synergies. As the most developed and used ecosystem synergies in received papers, lock-in operates mainly through positive feedback loops. Following the principles of non-linearity, dynamic and recursion in complex systems (Anderson, Meyer, Eisenhardt, Carley, & Pettigrew, 1999), positive feedback loops in ecosystems happen when actions boost prior or other actions, leading to the magnification of small initial differences and ecosystem lock-in (Arthur, 1989; McIntyre & Srinivasan, 2017). In total, three mechanisms of positive feedback loops emerged in received ecosystem studies: 1) network effects and multi-sided markets, 2) data-driven learning and data network effects, and 3) reputation feedback loops. The main disciplines that have explored these synergies are economics and management. Essentially, the increase in ecosystem adoption (or network size) increases the value of ecosystems and, in turn, increases the same or other sides' adoption (or network size),

thus leading to ecosystem lock-in (McIntyre & Srinivasan, 2017). One activity of ecosystem participants influences another to eventually reach winner-take-all ecosystem dominance (Rietveld & Schilling, 2020). Some key drivers are standardisation, compatibility, and layered modular architecture. Ecosystem leaders orchestrate these positive feedback loops through pecuniary or non-pecuniary approaches. In the following, I elaborate on each type of positive feedback loop in lock-in ecosystem synergies.

Economists first explored positive feedback loops that lead to lock-in through the concepts of network externalities and network effects (Arthur, 1989; Farrell & Saloner, 1985, 1986; Katz & Shapiro, 1985, 1994). Studying empirical examples such as telephones, computers and video games, they found that "*the utility that a given user derives from the good depends upon the number of other users who are in the same "network" as is he or she*" (Katz & Shapiro, 1985: 424). They further distinguish direct and indirect network effects: 1) direct network effects happen directly between consumers as the utility a consumer derives is positively related to the number of other purchases (e.g., telephones); and 2) indirect network effects occur indirectly because consumers benefit indirectly from more purchases: the utility a consumer derives is positively related to the number of other purchases because the presence of more consumers attracts more complementary offerings (e.g., computer hardware and software) (Katz & Shapiro, 1985). As digital intermediaries became increasingly important in driving positive feedback loops, economists started to focus on platforms in ecosystems and explored positive feedback loops through the notion of two-sided and multi-sided markets (Armstrong, 2006; Hagiu & Wright, 2015; Parker & Van Alstyne, 2005; Rochet & Tirole, 2002, 2003). Examples such as payment cards, software, websites, video games and iPhone stores illustrate that most network effects are "*characterized by the presence of two distinct sides whose ultimate benefit stems from interacting through a common platform*" (Rochet & Tirole, 2003: 990). According to this perspective, positive feedback loops operate in the way that the more adoption on one side, the more likely the platform to attract other sides, and vice versa. Scholars have extensively studied various pecuniary and non-pecuniary strategies such as legal, technological, alliances, and industry standards instruments (Ceccagnoli et al., 2012; Eisenmann, Parker, & Van Alstyne, 2006; Gawer & Cusumano, 2002; Rochet & Tirole, 2003; Shapiro & Varian, 1999). Multi-sided platforms also follow the same principle (Boudreau & Hagiu, 2009). When these positive feedback loops start to unfold, they prevent consumers and complementors from leaving for competitors, leading to ecosystem lock-

Table 2.1 - A literature-based typology of ecosystem synergies

	Lock-in	**Complementarities**	**Efficiency**	**Optimisation**	**Sustainable equilibrium**
Mechanisms	Positive feedback loops (network, cost, and reputation)	Coordinating non-generic complementary relationships	Sharing generic resources	Facilitating resource integration and service exchange	Dynamic balancing tensions
Key ideas	The utility and reputation a user obtains from participating in an ecosystem are positively related to the number of other users and complementors, or the costs of switching to other ecosystems are positively related to the use of the ecosystem, thus creating ecosystem lock-in	The value a user obtains from a product/service provided by an ecosystem, or the returns an ecosystem obtains from producing a product/service, is positively related to the number of complementary products/services such ecosystem offers at the same time	The efficiency of production, transaction, and innovation is enhanced by sharing generic resources across ecosystem participants	Resource integration and service exchanges among ecosystem participants optimise resource mobilisation and value propositions, and optimisation manifests as context-specific utility enhancement for each participant	Dynamically balancing tensions of control and autonomy towards a sustainable equilibrium
Key concepts	Network externalities/direct and indirect network effects Two-sided and multi-sided markets Data-enabled learning and data network effects Feedback and reputation systems	Complementary offerings/outputs Components Unique complementarity Co-specialisation Supermodular complementarity	Internal platforms Supply chain platforms Industry platforms Industry/Innovation/Platform ecosystems Transaction platforms/market intermediary Architectural leverage	Value co-creation Value networks Value constellations Actor-to-actor networks Service ecosystems	Stability-evolvability paradox Dynamic balancing Coopetition Balancing value creation and value capture Generativity Open and distributed innovation Managed ecosystems
Representative works	Katz and Shapiro (1985) Gregory et al. (2021) Tadelis (2016)	Jacobides et al. (2018)	Gawer (2009b)	Vargo and Lusch (2004)	Wareham et al. (2014)
Key empirical contexts	Telephone, personal computers, video games, payment cards, iPhone store, e-commerce	The residential solar industry, 5G-compatible Internet-of-Things product systems, open-source software, e-commerce platforms	Automotive, manufacturing companies, airspace, computers, Wal-Mart, Microsoft, Intel, Cisco, game consoles, media, e-commerce, IoT, smart city	Supply chain networks, automotive, eBay, Google, IKEA, Apple	Mobile application ecosystems, enterprise software, open-source communities, digital infrastructure
Drivers	Standardisation, compatibility, architectural design	Modularity, standardisation	Standardisation, compatibility, open layered modular architecture	Digitalisation, liquification, layered modular architecture, servitisation	Paradox nature of digital technologies
Boundary conditions	Low adoption barriers, low compatibility barriers, zero marginal costs for distribution, intrinsic-driven participation (for nonmonetary), mainly for early adoption	The existence of components or complementary offerings that can be offered at the same time	Having stable and generic resources that are not confidential, discrete modules, easily standardised resources, and can be accepted and easily used by ecosystem participants without conflicts of interests	High level of services such as skills, knowledge and digital technologies	Generative systems with central actors to control
Key source disciplines	Economics; Strategy	Manufacturing and operations; Industrial economics; Strategy	Industrial economics; Engineering management; Operational management; Strategy; Technology management	Marketing management; Service innovation	Law; Information systems
Roles of orchestrators	Cultivate positive feedback loops through pecuniary and non-pecuniary adoption-incentive strategies to drive ecosystem lock-in	Cooperate with providers of components and complements to provide coherent ecosystem offerings together	Design and share standardised technological architecture, standardised interfaces, and other generic resources to enhance efficiency and innovation	Reconfigure value networks, processes, and time, and consider service platforms, service ecosystems, and value co-creation during orchestration	Coordinate distributed innovation by balancing stability-evolvability for effective governance
Analytical focus	Consumption side	Consumption and provision (co-production logic) sides	Consumption and provision (co-production logic) sides	Consumption side	Consumption side

in. The successful launch of these positive feedback loops relies on all sides' collective efforts and platform ecosystem owners' orchestration. The results are increasing utilities for all sides involved, which are impossible without the ecosystem arrangements.

As technologies advanced and data became a key resource, new positive feedback loops that lead to lock-in emerged in the form of data-driven learning and data network effects (Gregory et al., 2021; Hagiu & Wright, 2020; Hartmann & Henkel, 2020; Jernigan et al., 2016). Using examples such as search customisation and self-driving algorithms, Gregory et al. (2021) argue that data network effects emerge as a unique type of network effects and are manifested as "*the more that the platform learns from the data it collects on users, the more valuable the platform becomes to each user*" (p. 535). Data-driven learning is rooted in the logic of switching costs: the more a consumer participates in an ecosystem, the more learning the ecosystem conducts, and the more accurate and customised offerings the ecosystem offers, thus preventing the consumer from switching to competitors who take time to rebuild the learning. This develops into positive feedback loops - once a customer invests in an ecosystem by contributing his/her data for customisation, the customer is incentivised to keep participating. Moving beyond one customer to include the network of customers, data network effects are rooted in the logic of network externalities and switching costs. As more customers contribute their data to an ecosystem, the more accurate predictions the ecosystem can offer through technologies such as data mining, and the more valuable and attractive it is to all customers. In the data network effects, ecosystem lock-in operates not only through rising switching costs as learning increases but also by boosting utilities as the network size expands. The strength of such data network effects depends on ecosystem orchestrators' platform AI capability, defined as "*the ability of a platform to learn from data to continuously improve its products and services for each user*" (Gregory et al., 2021: 538). As more users adopt ecosystems, they provide more data for ecosystem owners to improve their AI capability, enable ecosystems to increase in value and attract more users, and thus generate ecosystem lock-in. Data network effects can be built from network effects. The increase in adoption through network effects contributes data that can be used to kickstart data network effects.

Lastly, from the perspective of social construction, scholars propose that ecosystems can also be understood as shared meaning production arrangements where collective sensegiving and recognition bring belonging and reputation to participants, increase the value and trust of ecosystems, and thus attract more participants to ecosystems and push for ecosystem lock-in

(Lakhani & Wolf, 2003; Tadelis, 2016). Unlike the network- and cost-oriented logic in the previous two mechanisms, this third mechanism is anchored in a reputation-oriented logic. Actors join an ecosystem because being part of it, contributing and improving it with others provide them with a reputation and a sense of belonging and meaning. Although shared identity and reputation can be found in other constellation forms, such as firms and supply chains, ecosystems' shared identity can not only be specified and promoted by hub players but can also be developed and produced by a variety of voluntary participants. This means that shared meaning production in ecosystems is a more distributed and open-ended process where ecosystem orchestrators do not need to constantly exert centralised monitoring (Iansiti & Levien, 2004b). This shared identity for belonging emerges most saliently in open-source communities, where participation is voluntary and uncompensated, and most innovations are freely shared. Without monetary incentives, economists find that intrinsic motivations (Lakhani & Wolf, 2003), peer recognition (Lerner & Tirole, 2002), and ecosystem orchestrator recognition (Jeppesen & Frederiksen, 2006) play essential roles in motivating participation. Participants identify with the ecosystem and its ideology and honour the people who created it (Belenzon & Schankerman, 2015). Therefore, when recognition and acknowledgement are given publicly from peers and the people who orchestrate ecosystems for their contribution, they feel fulfilled and are willing to contribute more and recognise others' contributions. The enhancement of reputation, in turn, increases ecosystem value and thus attracts more participants (Tadelis, 2016), creating positive feedback loops that lead to ecosystem lock-in. These findings reveal that some participants can respond to social motivations that are not self-interested, such as reciprocity and group identity (Benkler, 2017). Recognising the diversity of motivations is vital in harnessing and integrating diverse talents for collective outputs. For socially and intrinsically motivated individuals, a collective vision offers "*a shared identity and social meaning that keeps teams as persistent learning networks with long-term direct and indirect reciprocity and mutual social recognition*" (Benkler, 2017: 265). This reputation-related positive feedback loop can also be observed in e-commerce platforms slightly differently but with the same logic. Honest sellers with a good feedback history from previous buyers have a high reputation and thus a high percentage of obtaining future sales, pushing opportunistic sellers to behave honestly and driving other sellers to join ecosystems (Tadelis, 2016). This reputation and belonging feedback loop proved essential to orchestrate constellation activities and generate greater-than-individuals ecosystem synergies that benefit all.

To summarise, as the most studied ecosystem synergies, positive feedback loops operate in a way that 1) the primary purpose is to obtain lock-in and ultimately obtain ecosystem dominance, and 2) emergence is a result of mutually reinforcing interactions among participants along with ecosystem owners' strategic orchestration. There are three main mechanisms these positive feedback loops operate: network, cost, and reputation, leading to potential "*excess inertia*" to switch to better ecosystems (Zhu, Kraemer, Gurbaxani, & Xu, 2006). Most positive feedback loops discussed in received papers address synergies on the consumption side where joint adoption of specific products/services/platforms by actors such as consumers, providers, and complementors increases the value of ecosystems and thus attracts more for lock-in advantages. During these positive feedback loops, ecosystems flourish with increasing varieties in the types and roles of participants and increasing interdependencies among participants. Although effective in many contexts for ecosystem lock-in, this synergies type has boundary conditions that explain situations when lock-in does not work, e.g., high adoption and compatibility barriers, high marginal costs for distribution, and lack of intrinsic-driven participation (for nonmonetary) in ecosystems such as open-source communities.

Complementarities

My review also shows that complementarities are critical ecosystem synergies in primarily industrial economics and strategy studies. Complementarities occur "*whenever having a bundle of goods together provides more value than the total value of having each of the goods separately*" (Amit & Zott, 2001: 504). It is similar to, for example, the indirect network effects in the lock-in ecosystem synergies in the sense that user utility increases when complementors develop more complementary offerings in ecosystems. However, different from the lock-in that addresses synergies arising from co-adoption where interactions between participants are mutually reinforcing, complementarities focus on co-production and co-consumption where jointly producing or consuming products/services increase utilities. Unlike lock-in synergies which emphasise each side's contribution, synergies in complementarities are internalised by consumers or producers (Rochet & Tirole, 2003). Building on studies by Milgrom and Roberts (1990) and Topkis (1978) about manufacturing and operations on the production side, scholars with industrial economics and strategy backgrounds expanded the concept to the strategy field to discuss production and consumption complementarities. Specifically, ecosystem synergies come from the joint production of complementary outputs to customers or the joint consumption of

complementary outputs by customers. When customers' utility increases as more diverse and innovative complementary offerings are provided simultaneously with the core offering, it signals the strategic role complementarities play in generating revenue. Complementarities require ecosystem orchestrators and complementors to cooperate for complementary outputs in a coherent ecosystem offering (Brandenburger & Nalebuff, 1996).

Complementarities can happen on the consumption and production sides, creating unique and supermodular complementarity (Jacobides et al., 2018). Unique complementarity emphasises 1) joint consumption because separate consumption has less value and 2) joint production through a standard where non-coordination is impossible, e.g., residential solar industry (Hannah & Eisenhardt, 2018). The notion of co-specialisation describes the unique complementarity between complements (Teece, 1986). Supermodular complementarity emphasises 1) consumption-side: "*increasing returns of joint consumption of complements*" (Jacobides et al., 2018: 2266), e.g., Apple iOS and apps, and 2) production-side: "*when coordinated investments in both A and B yield higher returns than uncoordinated equivalents, or yield lower costs than the sum of costs of independent investments into A and B*" (Jacobides et al., 2018: 2262), e.g., open source software Android. Generic complementarities do not need ecosystems to coordinate and thus are not part of the ecosystem synergies (Jacobides et al., 2018). The extra synergies generated by non-generic complementarities stem from the specific relationships between complements and the core offering. Complements either cannot produce value themselves without the simultaneous participation of the core offering or can produce higher value with the core offering than themselves. This does not always mean complements must be directly related to the core offering (Amit & Zott, 2001).

The logic of complementarities on the *consumption* side can be the basis of the indirect network effects discussed in lock-in synergy. Because of the complementary nature of the core and other offerings, consumers can benefit from having more *complements* with the core. When external partners instead of in-house subsidiaries provide these complements in ecosystems, it enables the indirect network effects or two-sided markets. On the contrary, the logic of complementarities on the *production* side is rooted in the value-chain assumptions of classic industrial economics, in which discrete *components* are co-produced to form coherent final products for customers to purchase (Adner, 2006; Porter, 1980). All components of the final products are invested with the coordination of ecosystem orchestrators who set the standards and structure for co-specialised components, leading to increased quality and returns. Here,

complements are different from components in that complements are treated as direct customer-facing elements that customers can assemble themselves for consumption-side complementarities. In contrast, components are indirect customer-facing elements assembled by ecosystem orchestrators and sold to customers as an integral product. For example, the Apple App Store displays consumption-side supermodular complementarity where customers can combine complementary applications themselves. Apple iPhone components such as chips, operating systems, and microprocessors are components sold together to customers and provision-side unique complementarity presents. Other examples of production-side complementarities are 5G-compatible Internet-of-Things product systems, co-investment of in-house R&D and external technology sourcing (Cassiman & Veugelers, 2006), and co-investment of computer-aided design (CAD) equipment and software (Milgrom & Roberts, 1990). These examples reveal that the production side stems from the logic of co-production, where co-investments of specific activities from a wide range of suppliers can increase returns of producing the final customer-facing products. To achieve complementarities in *both* the consumption and production sides, an ecosystem orchestrator needs to move beyond its firm's boundary and coordinate a wide range of components and complements so as to integrate them into a coherent final offering (Adner, 2006; Davis, 2016).

To summarise, complementarities serve as a critical ecosystem synergy and operate through increasing returns of joint production or consumption of a bundle of products or services. The logic was initially used to discuss production-side complementarities where increasing returns are realised through co-investments in components for customer-facing products. It was then leveraged to describe consumption-side complementarities where increasing returns come from the co-consumption of complements, enabling indirect network effects.

Efficiency

My review also identifies efficiency as a key ecosystem synergy, operated mainly through sharing common resources. As a unique organisational form, ecosystems allow the sharing of common resources across various ecosystem participants via vehicles such as platforms. Grounded in assumptions of an industrial economy, this sharing logic drives the increase in efficiency of transaction, innovation, and production when unit costs decrease with more sharing participants (Bresnahan & Greenstein, 1999; de Reuver, Sørensen, & Basole, 2018; Gawer, 2009a; Iansiti & Levien, 2004b; Thomas et al., 2014). Efficiency happens when a wide range of ecosystem participants agree to accept, use, and share common resources in often standardised formats along

value chains instead of developing by themselves (Cusumano & Gawer, 2002; Robertson & Ulrich, 1998). The key source disciplines involve industrial economics, engineering management, operational management, and business strategy. Common resources can take various forms, such as manufacturing facilities, distribution channels, innovation modules, knowledge, physical data centres, network architecture, application interfaces, generic services, software development tools, and source codes. To enhance sharing, organisations often leverage a platform architecture that acts as a modular foundation upon which recombinative innovation and economies of scale and scope are realised as the number of adopters and products increases (Gawer, 2009b). With a heavy focus on enhancing efficiency and decreasing costs through sharing, this ecosystem synergy differs from the first and second types, which focus on increasing returns through interactive and collective efforts.

Product development and innovation research first explored the logic of sharing common resources for efficiency, where common product elements are shared within an organisation to enhance production and innovation efficiency (Wheelwright & Clark, 1992). Gawer (2009a) calls these internal platforms. Specifically, by sharing common elements and structures among products, organisations can enhance product development efficiency, save fixed costs, boost product design flexibility, and enhance derivative products' diversity and production efficiency. The aim is to efficiently produce a wide range of products that meet diverse and ever-changing customer demands while ensuring economies of scale and scope during the production process (Pine Ii, Victor, & Boynton, 1993). Examples such as automotive companies Toyota and Boeing show how low-cost, high-quality, and high-variety products can be rapidly provided through sharing common resources embedded in the internal platform architecture and associated economies of scale and scope. The most common type of product modification is a modular product platform where derivative products are developed by recombining product core elements and adding niche market elements (Meyer, Utterback, & James, 1993). According to Meyer et al. (1993), these product core elements may include common product platforms, common user needs of market segments, common distribution channels, common manufacturing processes, and common service infrastructure.

Sharing also happens beyond the boundary of an organisation when one organisation cannot fulfil all resources and capabilities required for manufacturing final products. Gawer (2009a) call them supply chain platforms, and Adner (2017) calls them innovation ecosystems. Like

internal platforms, supply chain platforms possess common, often modular, and standardised resources for scalable product development, reducing costs and improving manufacturing and innovation efficiency. Unlike internal platforms, supply chain platforms open the supply side to external participants, so common resources such as structures are shared across partners along a supply chain (Adner & Kapoor, 2010; Thomas et al., 2014), saving costs and improving efficiency across the supply chain. Examples used for illustrations are mostly automotive companies such as Nissan, Ford, and Volkswagen.

The above research on internal and supply chain platforms paved the way for researching industry platforms or industry ecosystems. When both the supply and demand sides of the platform are open for sharing (Thomas et al., 2014), Gawer (2009a) call them industry platforms or industry ecosystems where shared resources act as foundations upon which complementary offerings are provided. Resources to be shared move beyond dominant analogue resources to include digital elements such as digital interfaces, software development tools, and source codes. Using examples such as Apple iPhone, Google, Intel, and the Internet, they show how industry ecosystems improve innovation efficiency by sharing common resources such as digital interfaces and standards among a wide range of loosely coupled complementors and by enabling indirect network effects (Gawer & Cusumano, 2002; Iansiti & Levien, 2004a). The notion of ecosystems describes industry platforms because industry ecosystems are unclear about the scope of innovations from loosely assembled complementors, different from the internal and supply chain platforms that have clearly defined final assemblies and often cross-ownership and buy-sell relationships (Gawer, 2009a). This leads to unprecedented uncertainty and unique governance mechanisms. When the transaction stage of the value chain becomes common resources through platforms such as intermediary interfaces and standards, then two-sided or multi-sided markets are enabled, leading to the enhancement of transaction efficiency for participants (Armstrong, 2006; Baldwin & Woodard, 2009; Rochet & Tirole, 2006). This is similar to the consumption-side externalities, such as network effects discussed in the first synergies. The difference is that sharing common resources serves as the architecture that enables positive feedback loops.

To summarise, sharing common resources to enhance efficiency is a key type of ecosystem synergies. By sharing common resources, ecosystems can reduce transaction, innovation, and production costs. Although digital elements are discussed, this type of ecosystem synergies is mainly grounded in assumptions of industrial economics where sequential and product-focus logic

guide analysis. Although effective in most situations, sharing common resources may make it hard to develop ecosystem synergies when resources are confidential, impossible to be open, non-discrete, and hard to be standardised and accepted by ecosystem participants without conflicts of interest.

Optimisation

The purpose of optimisation has been articulated primarily by marketing management and service innovation scholars using concepts such as value networks, value constellations, and service ecosystems (Normann & Ramírez, 1993; Vargo & Lusch, 2004). It is achieved by facilitating service exchanges and value co-creation. Rooted in the service-dominant logic, this ecosystem synergy does not assume the value chain model that comes with the good-dominant logic. Service ecosystems are defined as "*a relatively self-contained, self-adjusting system of mostly loosely coupled social and economic (resource-integrating) actors connected by shared institutional logics and mutual value creation through service exchange*" (Lusch & Nambisan, 2015: 161). Instead of assembling tangible goods using the co-production model, optimisation focuses on facilitating exchanges of intangible services such as knowledge, skills, information and digital applications. This results from the increasingly pivotal role services play in driving competitive advantage and the growing involvement of customers in value co-creation in ecosystems. By incorporating participants' suggestions, optimisation can manifest as optimised resource mobilisation for the ecosystem and optimised value propositions for each participant. For example, Google provides optimised search results for users by integrating information and facilitating information exchanges between participants in shared platforms. Because different participants are after different values when joining ecosystems, the utility is context-specific, more than monetary measurements in cost reduction and efficiency enhancement, e.g., emotional and aspirational needs. The focus is on optimising such value propositions through value networks, actor-to-actor networks or service ecosystems instead of linear value chains and provider-consumer dyads. This optimisation logic differs from increasing-return logics in lock-in and complementarities synergies or decreasing-costs logics in efficiency synergies.

Tangible goods, such as physical facilities and natural resources, are static and are called operand resources that "*an actor acts on to obtain support*" (Lusch & Nambisan, 2015: 159), while services are dynamic and are called operant resources "*that act on other resources to produce effects - that is, they act or operate on other things rather than being operated on*" (Lusch &

Nambisan, 2015: 159). Services are far more versatile, transferable and prevalent than tangible goods in an increasingly digitalised world where customers participate substantially as ideators, designers, and intermediaries (Lusch & Nambisan, 2015). Therefore, they propose to base the analysis on services instead of tangible goods. In other words, the dominant mental framework is based on service exchanges rather than goods production. Shifting the focus of analysis revealed a new source of ecosystem synergy – optimisation. The optimisation is illustrated using the concept of maximum density by Normann (2001): "*the best combination of resources is mobilized for a particular situation—e.g., for a customer at a given time in a given place—independent of location, to create the optimum value/cost result*" (p. 27). Although possessing similarities, the optimisation discussed here differs from the efficiency discussed previously. Efficiency logic stems from reducing the necessary resources such as time and waste for transaction, innovation and production of mostly tangible products that consumers have to receive passively. Optimisation refers to finding the optimal configuration of resources for the best value propositions where consumers participate in value co-creation (Lusch & Nambisan, 2015). In other words, efficiency focuses on processes related to producing, delivering and transacting final offerings in relatively stable supply chains, while the focus for optimisation is on service offerings in parallel service-provision "supply chains" called adaptive value networks or service ecosystems where all participants are potential co-creators of value (Lusch, Vargo, & Tanniru, 2010). Service provision and value networks do not replace traditional linear supply chains but enhance them by optimising the processes. Moving beyond the efficiency enhancement within tightly held and rigid supply chains that are inefficient in adapting to changes, facilitating service exchanges in service ecosystems can spontaneously sense and respond to changes through flexible recombining and integrating services that may transform value chains and business models. Examples such as automotive firms, IKEA, ATMs, and social media platforms have been used to illustrate this optimisation synergy (Lusch et al., 2010).

Digital transformation blurs the boundary between physical products and intangible services, making service increasingly prevalent and dominant. Digital technologies support these optimisation processes through liquification, algorithm and automation. Liquification, decoupling information from tangible objects, increases services available to integrate and makes rebundle resources earlier (Ng & Wakenshaw, 2017). The information flow can be separated and independent from the physical flow in service ecosystems. For example, virtual logistics enable

the separation of information and physical flows in supply chain logistics, increasing outsourcing and the potential to obtain optimised logistic outcomes, different from efficiency through economies of scale and scope (Lusch et al., 2010). Liquified services form a nerve system that is fast and agile in sensing and adapting to changes and can be steered to optimise the physical flows. As data emerged as an essential type of service (Alaimo, Kallinikos, & Aaltonen, 2020), facilitating data exchange for optimisation became increasingly pivotal (Jernigan et al., 2016; Porter & Heppelmann, 2014). Real-time data monitoring, typically facilitated through standardised interfaces and standards, is often reluctant due to security and privacy concerns (Günther, Rezazade Mehrizi, Huysman, & Feldberg, 2017), but synergies realised in combination with algorithms, analytics, and automation are unprecedented. Not only the efficiency of production, innovation and transaction can be improved, but a wide range of operational processes such as governance, maintenance, and energy consumption can also be continuously optimised without limitation from production facilities, modular level, or human experiences (Jiang et al., 2021; Lim et al., 2018).

Optimisation reinvents value instead of adds value by reconfiguring roles and relationships (Normann & Ramírez, 1993) and by simultaneously considering three elements (Lusch & Nambisan, 2015): 1) service platform where a modular structure to store services and facilitate the integration of resources and actors; 2) service ecosystem which prepares common institutional logics and structures for service integration; and 3) co-creation of value that specifies actors' roles. The example they use for illustration is the Apple ecosystem: "*Apple with its iPhone as a service platform, iTunes as the service ecosystem, and iPhone discussion forums as a way to connect with actors involved in value cocreation*" (Lusch & Nambisan, 2015) (p. 171). Other examples of service ecosystems include: "*Digitally connected aircraft engines report status data in real time, enabling predictive maintenance and pay-per-use business models. Cars analyse driving behaviour based on sensor data, schedule workshop appointments, and provide optimised eco-feedback to drivers. Public trash bins equipped with sensors track the volume and kinds of garbage to help calculate the type and number of collection vehicles to be dispatched and the time of the collections, thus, increasing efficiencies of operation and cost savings. Wearable systems monitor people's health status and support their personalised treatment*." (Beverungen, Breidbach, Poeppelbuss, & Tuunainen, 2019: 1201). Ecosystem orchestrators' role moves from creating value

for customers themselves to enabling actors to develop their offerings from ecosystem orchestrators' integrated service platform, tools, and institutional logic.

To summarise, optimisation is an important type of ecosystem synergy and operates through facilitating resource integration and service exchange. The ecosystem orchestrators' role focuses on reconfiguring value networks and processes and simultaneously considers three elements: service platform, service ecosystem, and value co-creation. For ecosystem participants, their capabilities to integrate these services internally and externally in service ecosystems for innovative service provisioning is essential for their survival and success. The boundary conditions for this ecosystem synergies type involve a high level of services such as skills, knowledge and digitalisation.

Sustainable equilibrium

The fifth type of ecosystem synergies relates to the unique ecosystem governance mechanisms that drive towards a system-level sustainable equilibrium by dynamically balancing the control-autonomy paradox (Tilson, Lyytinen, & Sørensen, 2010; Wareham et al., 2014; Yoo et al., 2012; Zittrain, 2007). This serves as a key competitive advantage of ecosystems over alternatives because ecosystem governance, if appropriately implemented, brings in risk reduction of exploring new and diverse ideas external to ecosystem orchestrators while still ensuring stability and value capture of an enlarging ecosystem (Cennamo & Santaló, 2019; Gawer & Cusumano, 2002; Iansiti & Levien, 2004b). This means that ecosystems possess the coordination mechanisms to provide "*a large tent that can encompass creators who value autonomy and want to exercise control over their ideas*" (Baldwin, 2012: 21) while ensuring "*stability and homogeneity to leverage common investments in standard components*" (Wareham et al., 2014: 1195). These ecosystem-level coordination mechanisms lie between market-based and hierarchy-based arrangements, allowing heterogeneous participants enough autonomy for creative innovations and individualistic assemblies (Jacobides et al., 2018). Ecosystem governance specifies the rules that balance evolvability and stability, autonomy and control, as well as value co-creation and value capture through mechanisms such as access, control, and incentives (Chen, Tong, Tang, & Han, 2022a; Schmeiss, Hoelzle, & Tech, 2019; Wareham et al., 2014). Law and information systems are the main disciplines to explore these ecosystem synergies as Law scholars focus on governance and Information Systems scholars emphasise the paradoxical nature of digital technologies.

The evolvability side is summarised well with the term generativity by Law and Information Systems scholars (Tilson et al., 2010; Yoo et al., 2012; Zittrain, 2007), defined as "*the ability of a technology platform or technology ecosystem to create, generate or produce new output, structure or behavior without input from the originator of the system*" (Zittrain, 2006: 1980). Although the nature of digital technologies, such as homogeneity and decoupling of form and function, makes generativity increasingly salient, generativity existed before the digital age. Modularity and standardisation drive generativity in ecosystems (Baldwin & Clark, 2000; Jacobides et al., 2018). Modularity enables specialised and autonomous innovation through standardised interfaces and tools with reduced management and coordination. Instead of developing everything in-house with an integrated system, a modular architecture with open and standardised interfaces allows outsourcing innovation. Examples of modular systems can be LEGO brick ecosystems (Hienerth, Lettl, & Keinz, 2014) and automobile production systems in a supply chain platform discussed above. Ecosystems become even more generative by incorporating dynamic and malleable digital technologies (Yoo et al., 2012). Reprogrammability enables flexible recombination and addition of various functions into digital devices even after production and delivery. Layered architecture also helps shift the locus of innovation to the layer level, thus opening up for specialised innovations (Pisano & Teece, 2007; Yoo, Henfridsson, & Lyytinen, 2010). For example, in the case of the computer industry, it shifted from an integral or vertical architecture where each computer firm produces its computers and every component to a layered or horizontal architecture where firms can choose to specialise in one particular layer for innovation, e.g., operating systems (Microsoft), microprocessors (Intel), chips, and distribution (Dell). This layered architecture of digital products and associated industry enables independent innovation in each layer, leading to cascading changes in other layers. This generativity nature of ecosystems enables ecosystems as a whole to evolve rapidly and satisfy diverse and fast-changing consumer needs.

The stability side is manifested in the non-contractual govern mechanisms leveraged by ecosystem orchestrators (Wareham et al., 2014). Because ecosystem orchestrators do not hire external innovators as employees or agencies, ecosystem orchestrators need to rethink traditional command and control or ownership mechanisms to ensure coherency and steer collective efforts. A wide range of control vehicles has been explored, including legal, architectural, economic, and social channels. The notion of a control point illustrates the "*defining and controlling a set of*

connections in a sociotechnical system that largely determine the behaviors and constraints for other elements in the system" (Tilson et al., 2010: 7-8). It may involve the allocation of rights, approval of access and terms and conditions, controlling hard-to-replace segments, and nudging and stimulating behaviours that ensure a trustful and coherent environment (Alexy, West, Klapper, & Reitzig, 2018; Dattée, Alexy, & Autio, 2018; Uzunca, Sharapov, & Tee, 2022; Wareham et al., 2014; Yoo et al., 2010).

A key element for effective governance is to obtain a sustainable equilibrium by dynamically balancing key tensions such as evolvability and stability (Wareham et al., 2014). This is somewhat paradoxical (Tilson et al., 2010). On the one hand, autonomy is needed for ecosystems to be advantageable in distributed innovations as well as value co-creation; on the other hand, a certain level of control and coordination is required for shared goals and stability (Cennamo, Marchesi, & Meyer, 2020; Pisano & Teece, 2007; Wareham et al., 2014). The notion of boundary resources has been proposed to address this tension, defined as "*the software tools and regulations that serve as the interface for the arm's-length relationship between the platform owner and the application developer*" (Ghazawneh & Henfridsson, 2013: 174). They can be APIs, software development kits (SDKs), and social mechanisms such as incentives (Eaton, Elaluf-Calderwood, Sørensen, & Yoo, 2015). Successfully balancing these tensions requires collective efforts from both ecosystem orchestrators and participants, preventing "*a degenerative evolution of the ecosystem*" (Wareham et al., 2014: 1196) and leading to a sustainable equilibrium.

To summarise, sustainable equilibrium serves as a key purpose of ecosystem synergies, and it comes from dynamic balancing tensions using specific governance levers. Dynamically balancing tensions is achieved by simultaneously addressing evolvability and stability through governance mechanisms, including control, access and incentives. The synergies result in a sustainable equilibrium where rapidly changing and diverse needs are satisfied with coherent and stable ecosystem arrangements. One of the boundary conditions for these synergies is a generative system with central actors to control.

2.2 Interrelations and Assumptions

After classifying existing studies on ecosystem synergies into a five-fold typology, I now explicate their interrelations and assumptions to reveal how each theme relates to each other, the essence of ecosystem synergies and their limitations in explaining new phenomena such as IIoT.

Interrelations

These five purposes and associated synergistic mechanisms illustrate what existing literature has discussed about ecosystem synergies. Although each approaches ecosystem synergies from a unique angle and aims for different purposes, they are not incompatible. These five types are interrelated: each may concern some elements of the other, and some mechanisms may aim for multiple purposes simultaneously. For analytical simplicity, I chose the main mechanisms received papers discussed for each purpose in this thesis. Figure 2.1 below graphically illustrates the interrelations between different types of ecosystem synergies. The meta-logic underlying these five ecosystem synergies is balancing evolvability (through positive feedback loops for lock-in and complementarities) and stability (through architectural mechanisms embedded in efficiency and optimisation) to a sustainable equilibrium.

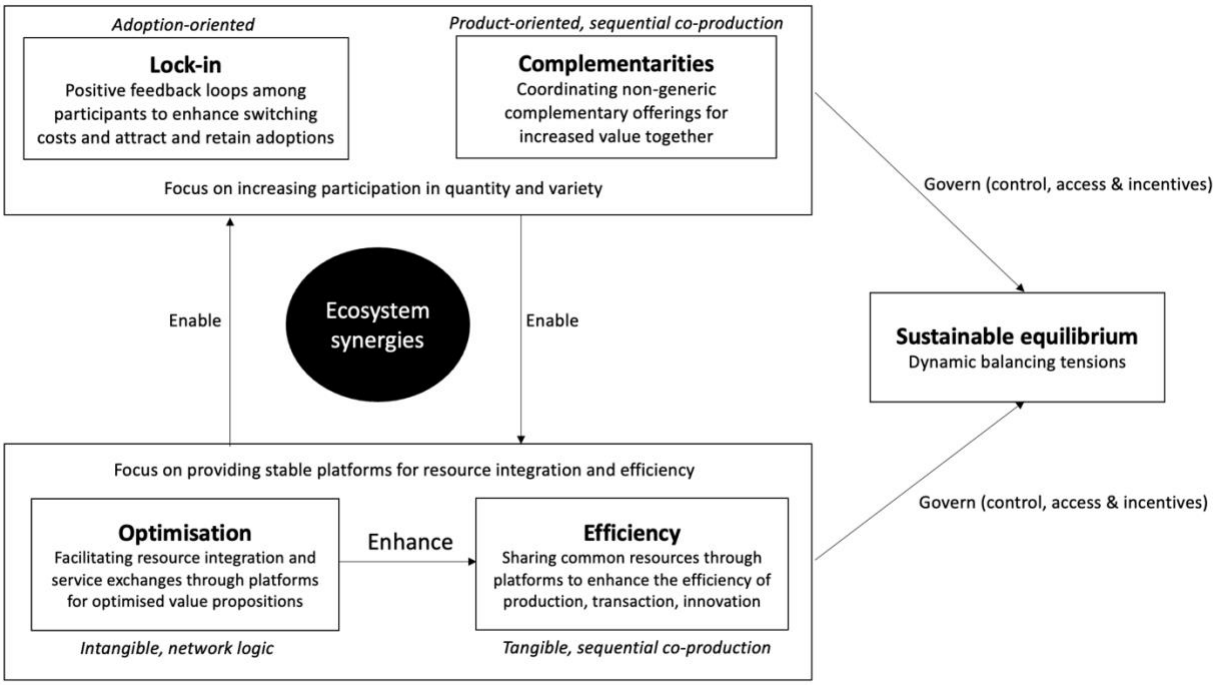


Figure 2.1 - The interrelation of the literature-based ecosystem synergies typology

First, lock-in and complementarities focus on increasing ecosystem participation in quantity and variety and are made possible by and enable architectural stability which efficiency and optimisation logics focus on. While sharing common resources for efficiency covers tangible resources with product-dominant assumptions, optimisation through resource integration and service exchanges is rooted in services with value network assumptions. Although they differ in the types of resources one focuses on and in the logic of value creation, they both emphasise

stability by having stable platforms with layered modular structures, shareable and exchangeable resources, and rules of exchange to facilitate interactions of ecosystem participants. These architectural elements in ecosystems drive evolvability in the form of positive feedback loops and complementarities. While positive feedback loops provide variety through mutually enabling interactions, complementarities offer variety by generating increasing utilities. Lock-in and complementarities also enable optimisation and efficiency by attracting more diverse participants to share common resources, which further reduces costs and enhances optimisation. Ecosystem orchestrators can leverage this meta-logic of architectural drivers by structuring or restructuring ecosystems to facilitate sharing, exchange, and value co-creation, driving positive network effects for ecosystem lock-in and complementarities.

Second, service-dominant optimisation enhances product-dominant efficiency. Extant research presents a shift of focus from goods to services. This is partly because the increasingly digitalised landscape drives resource liquification and thus boosts the importance of service in driving competitive advantage. When services such as knowledge, information and digital technologies are de-coupled from tangible products through digitalisation, services can be shared and analysed with the help of AI and automation to optimise physical flows and their complementarities, thus enhancing the efficiency of production, innovation and transaction processes.

Third, dynamic balancing for a sustainable equilibrium provides tools to govern lock-in, complementarities, efficiency and optimisation. Considering risks involved in extremes, dynamic balancing ensures that desirable and generative outputs can be effectively leveraged for the health of ecosystems without constraining the desired level of creativity. In order to achieve a sustainable equilibrium, ecosystem synergies come from dynamically balancing the two poles - evolvability and stability – to meet evolving user needs and leverage common resources. Other aspects of these two poles are variety-standard, autonomy-control, and individual-collective. The former pole is about generativity, which is what positive feedback loops and complementarities focus on. The latter pole refers to architectural stability and coherency, which is what efficiency and optimisation focus on, such as standardised platforms and institutional logic. This ecosystem synergy considers both poles' benefits and aims to develop ecosystem equilibrium sustainably and prevent extreme ecosystem disturbance.

Understanding the interrelations of different ecosystem synergies explored in the extant literature is important in developing a deeper and more holistic understanding of how ecosystems offer synergies. I acknowledge that this eclectic theoretical framework may face some challenges. For example, each type has boundary conditions, their interactions may bring unexpected adverse outcomes, and other factors may matter, e.g., strength and structure (Cennamo & Santalo, 2013; McIntyre & Srinivasan, 2017). However, this framework can potentially serve as a higher-level meta-logic when thinking about ecosystem synergies to prevent situations such as a myopic focus and collective unconsciousness (Jung, 2014).

Assumptions

Moving beyond contemplating the interrelations, interesting research often unveils hidden assumptions (Alvesson & Sandberg, 2011; Davis, 1971). All ecosystem synergies emphasise interdependency, implying the importance of considering the interests and relationships of a broad range of organisations for one's competitive advantage. This broad range of coverage means that interdependency involves actors across the boundary of organisations and industries, thus embedding an organisation within actor networks and pushing the locus of value creation externally (Altman, Nagle, & Tushman, 2022). To survive and out-compete, one needs to pay attention to its embeddedness by considering winning not only individually but also collectively as an ecosystem through which value co-created can be captured sustainably (Iansiti & Levien, 2004b).

Besides similarities in assumptions, what stands out from my review is the differences in assumptions of sides, specifically the demand (consumption) and supply (production/provision) sides, as well as the value creation logic. These differences are proved critical because the choice of sides not only reflects one's analytical focus and value creation logic but also reveals the limitation in one's insights when explaining new phenomena such as the IIoT. In the following, I picked some representative works to illustrate these differences in assumptions.

Some scholars follow the supply chain logic, treating 1) the supply side as upstream components (such as suppliers, manufacturers, and distributors that the focal firm assembles) and downstream complementors (that are assembled by customers) who are coordinated to together provide core and complementary offerings effectively and efficiently for 2) the demand side which are consumers (Ganco, Kapoor, & Lee, 2020; Kapoor, 2018). Typical examples include Airbus's super-jumbo passenger aircraft and semiconductor lithography equipment (Adner & Kapoor,

2010). See Figure 2.2 below of the graph used in Adner and Kapoor's paper (2010). Components and complementors are the supply-side participants, and consumers are the demand-side participants. Following the supply chain platform proposed by Gawer and Cusumano (2014), the synergies discussed here mainly come from sharing the same supply chain structure and ecosystem vision among an ecosystem of interdependent components and complementors who have to update their offerings accordingly to provide coherent products to customers together.

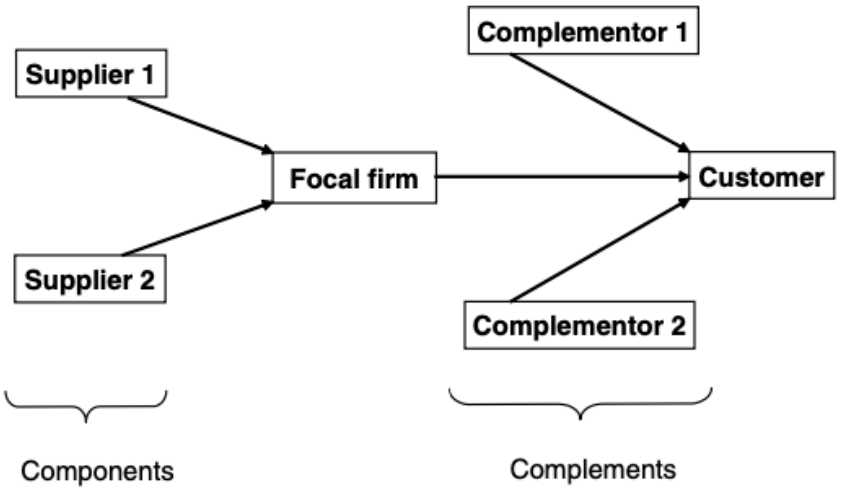


Figure 2.2 - Generic schema of an ecosystem. Reprinted from "Value creation in innovation ecosystems: How the structure of technological interdependence affects firm performance in new technology generations", by Adner, Ron & Kapoor, Rahul, 2010, Strategic Management Journal, 31 (3), 309. Copyright 2009 by John Wiley & Sons, Ltd.

Building on this, Tiwana (2014) further adds platforms to the discussion and suggests that, in a platform ecosystem, upstream actors include component suppliers, manufacturing partners, and infrastructure providers, and downstream actors include consumers (end-users) and complementors (app developers). He focuses on synergies in the downstream section but does not specify the supply or demand sides. See Figure 2.3 below for the graph in Tiwana's book (2014).

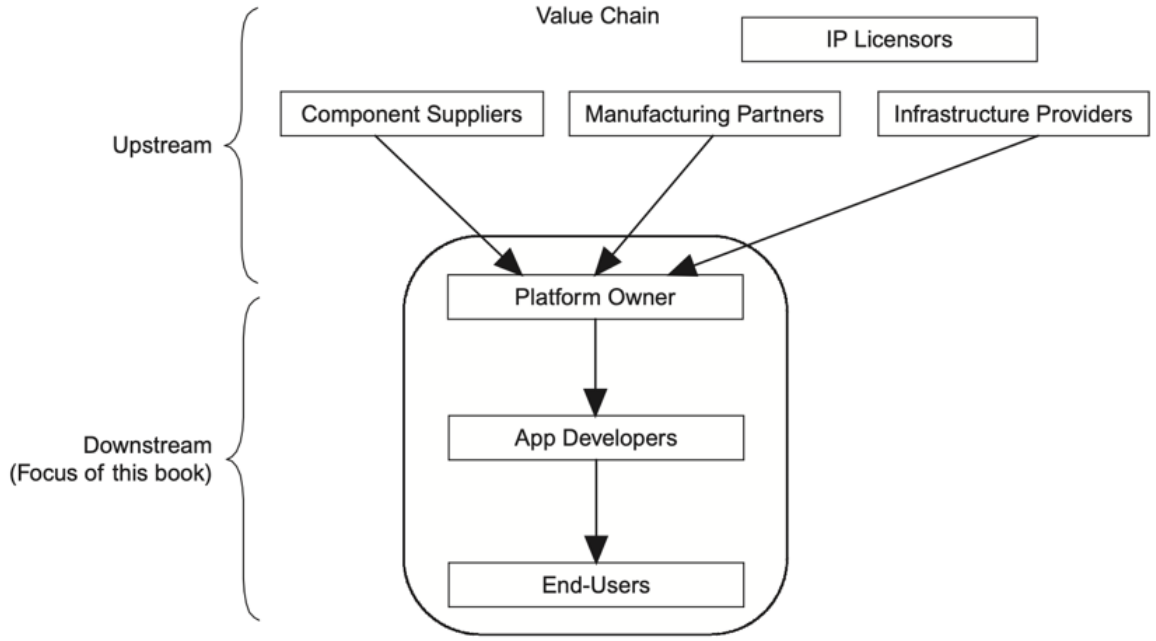


Figure 2.3 - Upstream and downstream parts of platform value chains. Reprinted from Platform Ecosystems: Aligning Architecture, Governance, and Strategy (p. 8), by Tiwana, Amrit, Waltham, MA: Elsevier. Copyright 2014 by Elsevier Inc.

Different from Adner and Kapoor's paper (2010), Jacobides et al. (2018) adopt the focal firm product as the anchor point for analysis and suggests that 1) the production side refers to non-generic complementary components that the focal firm coordinates and 2) the consumption side includes complementors who offer complements to focal products and final customers who buy focal products and assemble complements. Therefore, the difference lies in the treatment of complementors which is considered the supply side in Adner and Kapoor's paper (2010). See Figure 2.4 for the graph used in Jacobides et al.'s paper (2018). According to Figure 2.4, vertical supply-chain relations or "*vertically integrated firms or supply networks*" (p., 2267) consisting of component suppliers are considered outside the ecosystem (Jacobides et al., 2018).

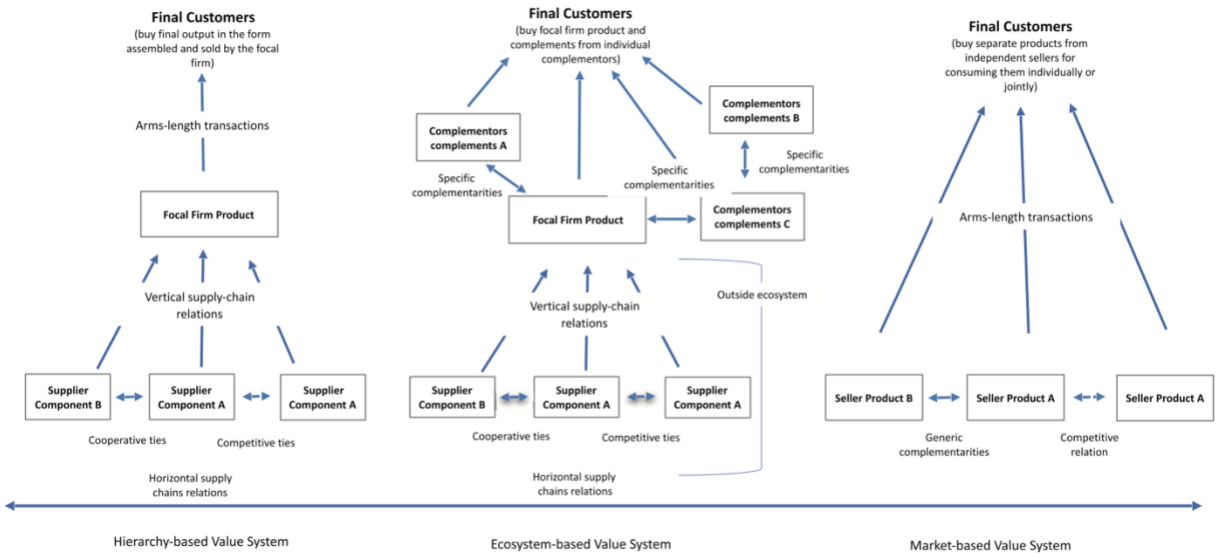


Figure 2.4 - Different types of value systems. Reprinted from "Towards a theory of ecosystems", by Jacobides, Michael G., Cennamo, Carmelo & Gawer, Annabelle, 2018, Strategic Management Journal, 39 (8), 2261. CC-BY-NC.

Without the value chain or downstream-upstream logic, some scholars focus their analytic angle purely on digital platforms, referring demand-side participants as platform users who use platforms – "end users", supply-side participants as platform users who produce complementary offerings with the core platform, platform providers as the point of contact for all participants, and platform sponsors as responsible actors for exercising IP, setting up access and developing platforms and associated technologies (Eisenmann, Parker, & Van Alstyne, 2009). For example, Linux has demand-side participants as individuals or organisations that use Linux, supply-side participants as developers of Linux-compatible applications, platform providers as hardware retailers, and platform sponsors as open-source developers that improve Linux OS. See below Figure 2.5 in Eisenmann et al.'s paper (2009).

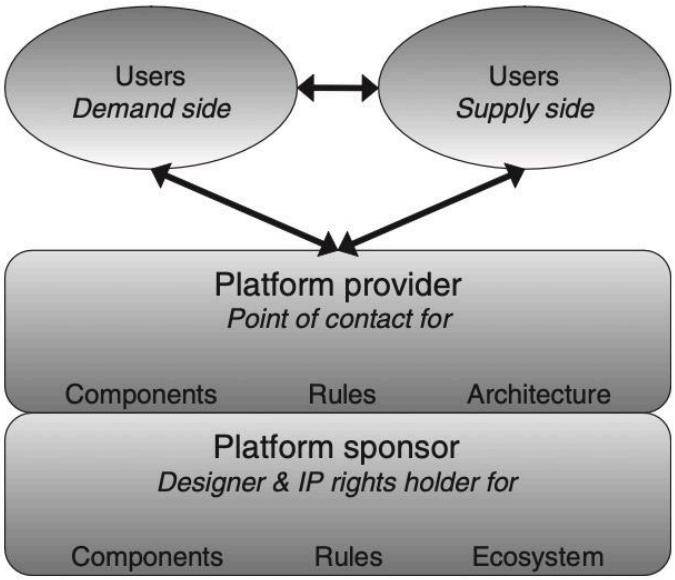


Figure 2.5 - Elements of a platform-mediated network. Reprinted from "Opening platforms: how, when and why?", by Eisenmann, T. R., Parker, G., & Van Alstyne, M. 2009. In A. Gawer (Ed.), Platforms, Markets and Innovation (p.135). Cheltenham, U.K. and Northampton, MA: Edward Elgar Publishing. Copyright 2009 by Annabelle Gawer.

Another platform-oriented classification is represented by Bonina, Koskinen, Eaton, and Gawer (2021). In their work, they define supply-side participants as the ones that contribute to the platform core while demand-side participants as complementors that provide complements to the platform periphery. See below Figure 2.6 in their paper.

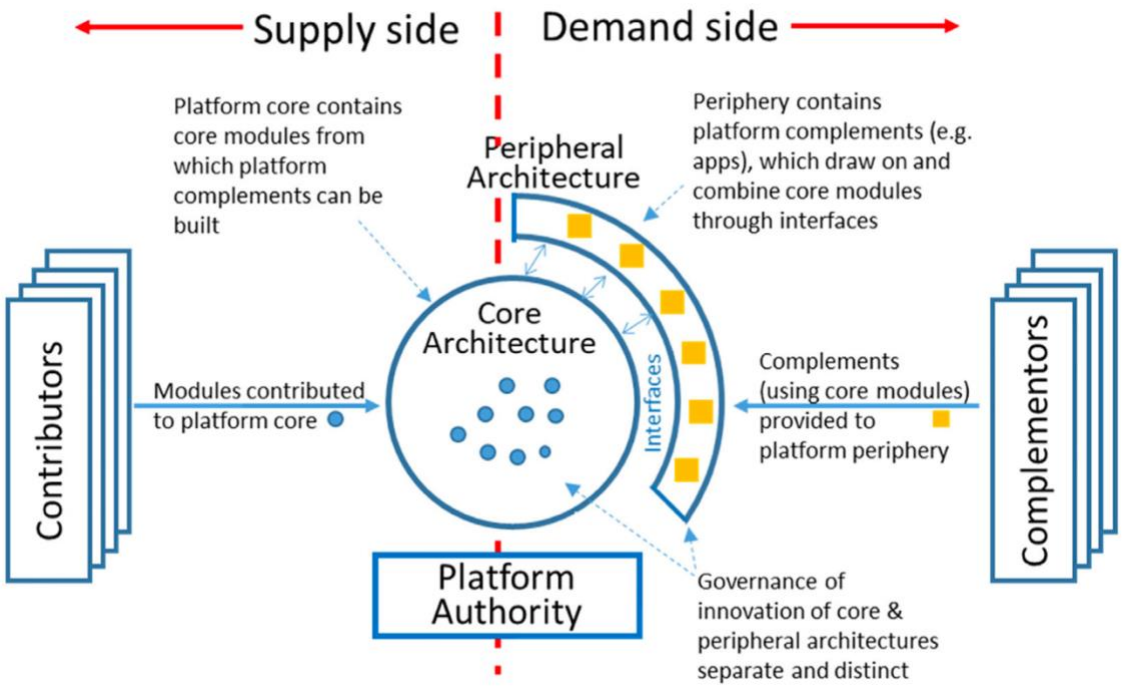


Figure 2.6 - Overview of innovation platform functional architecture. Reprinted from "Digital platforms for development: Foundations and research agenda", by Bonina, Carla, Koskinen, Kari, Eaton, Ben, and Gawer, Annabelle, 2021, Information Systems Journal, 31, 8. CC-BY-NC.

Approaching sides through the business model perspective, some scholars treat the supply side as a platform organisation's resources and capabilities, and the demand side as platform users, including customers and suppliers (Aversa, Haefliger, Hueller, & Reza, 2021). For example, in the case of Amazon, Amazon's resources and capabilities serve as the supply-side complementarities, and demand-side users include both online customers and sellers. Demand-side synergies come from increasing returns of joint consumption, including "*(within-customer group) one-stop shop effects (OE) and (between-customer group) network effects (NE)*" (Aversa et al., 2021: 4). See below Figure 2.7 in the paper.

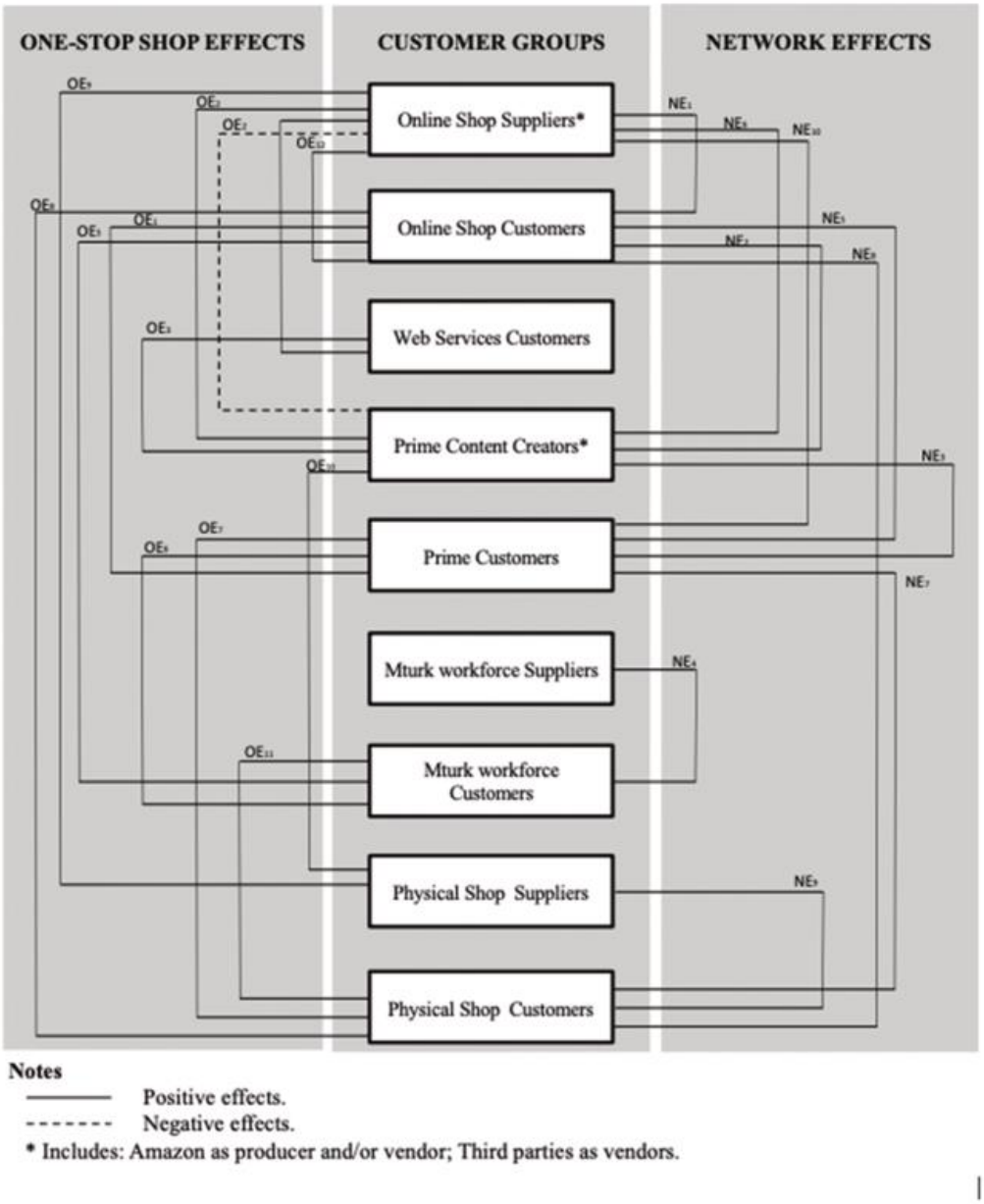


Fig. 1b. Customer complementarities.

Figure 2.7 - Customer complementarities. Reprinted from "Customer complementarity in the digital space: Exploring Amazon's business model diversification", by Aversa, P., Haefliger, S., Hueller, F., & Reza, D. G., 2021, Long Range Planning, 54(5), 101985.", Copyright 2020 Elsevier Ltd.

Lastly, some scholars, mainly from marketing management, adopt the service-dominant logic, viewing ecosystems from the angle of "*service-based, network-with-network relationships*" where "*resource integration and mutual service provision*" are the locus of analysis, and accordingly "*all actors are both providers and beneficiaries and the "producers" and "consumers"*

distinction vanishes" (Vargo & Lusch, 2010: 175). See below Figure 2.8 used in Vargo and Lusch's paper (2010). Without following the value chain logic embedded in mainly operand resources, they propose to have actor-to-actor analysis instead of the supplier-customer divide. Although they propose to stop thinking sides completely and studied some provision-side examples such as automotive value networks and supply chain management (Lusch et al., 2010), their empirical contexts are still mainly on the consumption side: App iTunes, Microsoft, YouTube, and Google.

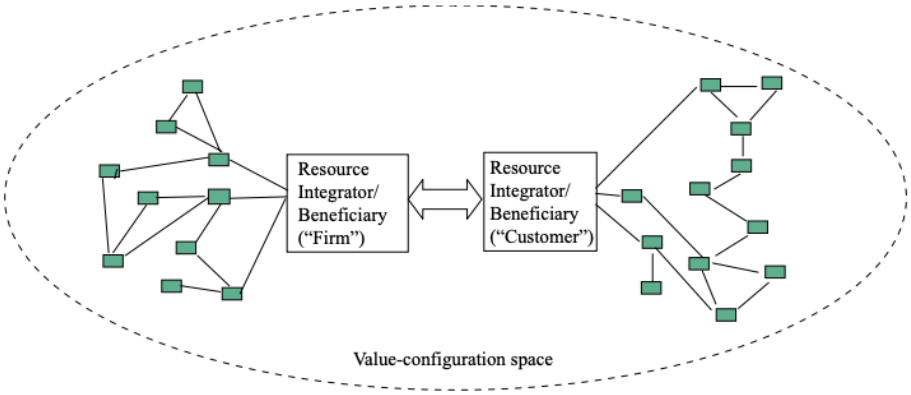


Figure 2.8 - The contextual nature of value creation. Reprinted from "From repeat patronage to value co-creation in service ecosystems: A transcending conceptualization of relationship", by Vargo, Stephen L. & Lusch, Robert F., 2010, Journal of Business Market Management, 4 (4), 173. Copyright 2010 by Gabler-Verlag.

To summarise, scholars from industrial economics tend to assume the value chain logic for mostly tangible products, suggesting a supplier-consumer divide where value is added as more inputs and components are assembled into final products. Generally, consumption-side actors are consumers, and provision-side actors are all involved in offering final customer offerings (Adner & Kapoor, 2010). Within this economics stream, some realise the increasing agency of customers who can assemble complements themselves instead of accepting the final products assembled by focal firms, thus giving complementors more autonomy and moving complementors to the consumption side (Jacobides et al., 2018). Scholars approaching ecosystems with platforms as the analytical focus tend to either 1) follow industrial economics scholars (Tiwana, 2014) or 2) redefine consumption-side and provision-side users as buyers and sellers in e-commerce platforms (Eisenmann et al., 2009). Scholars from the business model perspective address the divide from the firm boundary (Aversa et al., 2021). Scholars from the marketing discipline are relatively progressive in treating sides. They realise that the traditional supplier-consumer divide embedded

in the good-dominant logic and economics is unsuitable for analysing value creation, delivery, and capture in the digital age. Core offerings are no longer pure tangible products manufactured by specialised suppliers and delivered to final customers who can only passively accept them (Vargo & Lusch, 2004; Vargo, Maglio, & Akaka, 2008). Instead, customers are taking on a more proactive role as value co-creators, and services instead of goods are the base for exchange, leading to the dissolution of the supplier-customer divide and the emergence of actor-to-actor networks and service ecosystems where all actors are resource integrators (Lusch & Nambisan, 2015).

It is essential to highlight the differences in assumptions around the sides in the received literature to facilitate cross-fertilisation. Future research needs to specify their definitions of sides before analysing. To reduce confusion, in this thesis, when I mention the consumption-side and provision-side divide, I choose digital platforms as my analytical focus and follow mainly the economics stream of a supplier-consumer divide in the analysis. As ecosystems flourish and evolve, the service-dominant perspective is also considered when the consumption-side and provision-side divide does not help with my analysis. Specifically, *ecosystem provision-side participants* or *providers* refer to organisations or individuals providing the core services ecosystems strive to facilitate. *Ecosystem consumption-side participants* or *consumers* refer to organisations or individuals consuming the core services ecosystems strive to facilitate. *Ecosystem complementors* refer to organisations or individuals that provide complementary services that support core services ecosystems strive to facilitate. Following this classification, provision-side participants in the Alibaba e-commerce ecosystem include sellers and all component suppliers along supply chains, consumption-side participants are buyers, and complementors are actors who provide complementary services such as marketing and logistics. In the case of the Apple ecosystem, provision-side participants are component suppliers of the iPhone's core functions, consumption-side participants are buyers of the iPhone and associated services, and complementors are actors that provide complementary services such as applications in Appstore and music in iTunes. For Google, provision-side participants are information providers that can be all users who develop websites or use Google for searching, consumption-side participants are information seekers that can be all users who use Google for searching as well as advertisers who seek to match ads with targeted users, and complementors are actors that provide complementary services. See Table 2.2 below for the summary of different types of ecosystems and associated participant types.

Table 2.2 - Ecosystems user types under the assumption of provision-consumption divide

	E-commerce ecosystem	**Innovation ecosystem**	**Information ecosystem**
Core ecosystem function	Facilitate transactions between sellers and buyers	Provide products that are integrated with a wide range of complementary offerings	Facilitate information exchange and matching
Provision-side participants	Sellers and component suppliers	Component suppliers	Information providers
Consumption-side participants	Buyers	Buyers	Information seekers
Complementors	Software developers, complementary service providers	App developers in Appstore	App developers for complementary services
Ecosystem orchestrators	Alibaba, Amazon	Apple, Microsoft	Google, Facebook

My clarification of side-related assumptions further reveals that ecosystem synergies in extant research are mainly studied on the consumption side with complementors and consumers (or together called upstream) using concepts such as consumption externalities (Katz & Shapiro, 1985) and network effects (Parker & Van Alstyne, 2005). These consumption-side ecosystems are what Gawer (2009b) calls industry ecosystems, e.g., Apple Appstore, Google, and the Internet. Ecosystem synergies are realised by joint consumption of offerings between end-users and complementors and amplified through pecuniary and non-pecuniary incentivising strategies (Farrell & Saloner, 1985; Katz & Shapiro, 1985). Given the early disruption of digital technologies, consumption-side synergies can be understood following the service-dominant logic in marketing where end-users and complementors are both resource integrators without a supplier-customer divide. Contrarily, provision-side ecosystem synergies in extant studies are mainly understood through co-production or good-dominant logic, where non-generic supermodular complementary activities are co-invested and assembled by focal firms to provide core products to customers who cannot customise themselves. Synergies on the provision side have been influenced mainly by the value chain configuration coined by Porter (1980) for economies of scale, scope, transaction and innovation. This means that the baseline for analysis is the value chain model where value is created by assembling discrete components/inputs into products and delivery to customers after transactions. The processes are designed to reduce unit costs. Organisations must coordinate these collective efforts to understand interdependencies between component suppliers, disaggregate activities into building blocks, share common resources, and agree upon the sequence of activities. The inertia of the value chain model on the upstream or the provision side is reasonable as upstream activities involve mostly traditional manufacturing firms where products are developed through aggregating physical inputs/components. Downstream industries, especially the service industries, involve customer-facing services with little physical inputs assembly, first face challenges of applying the value chain model in strategy analysis (Stabell & Fjeldstad, 1998), and thus first

experience digital transformation such as mediating technology. Consequently, provision-side synergies in received literature still mainly inherit the assumptions of industrial economics and involve economies of scale and scope through sharing resources among providers or suppliers, such as manufacturing facilities and procurement systems in Wal-Mart (Iansiti & Levien, 2004b).

Issues emerge when new phenomena across countries find inadequate explanatory power in existing theories (Pei Breivold, 2020): as digital technologies permeate the provision side, providers or components in the upstream can be connected through vehicles such as IIoT platforms Siemens Mindsphere and Alibaba supET for operational efficiency enhancement with predictability and for innovation from a wide range of industrial application developers (Leminen et al., 2020). Instead of co-production logic in the "downstream and upstream" configuration for coherent value propositions for consumers, IIoT suggests operational efficiency enhancement for providers by connecting providers and complementors in shared platforms for knowledge and data exchange and complementary innovations. Boyes, Hallaq, Cunningham, and Watson (2018: 3-4) define IIoT as: "*A system comprising networked smart objects, cyber-physical assets, associated generic information technologies and optional cloud or edge computing platforms, which enable real-time, intelligent, and autonomous access, collection, analysis, communications, and exchange of process, product and/or service information, within the industrial environment, so as to optimise overall production value. This value may include: improving product or service delivery, boosting productivity, reducing labour costs, reducing energy consumption, and reducing the build-to-order cycle.*" Khan et al. (2020: 2) define IIoT as "*the network of intelligent and highly connected industrial components that are deployed to achieve high production rate with reduced operational costs through real-time monitoring, efficient management and controlling of industrial processes, assets and operational time*". Instead of tightly coupled value chains, IIoT resides in complex and multi-layered industrial value networks (Piller, Van Dyck, Lüttgens, & Diener, 2021). The focus of value creation in IIoT lies in the ability to connect intelligent industrial objects and industrial systems so that data and knowledge can be exchanged and industrial services or applications can be offered and shared across organisational boundaries to enhance operational efficiency and optimise industrial processes.

These definitions and new value-creation mechanisms reveal that provision-side ecosystems or provider ecosystems differ from consumption-side ecosystems or consumer ecosystems because consumption-side ecosystems address synergies between complementors and

consumers while provision-side ecosystems deal with synergies between providers or their industrial machines and systems. They are also different from the industry platforms (Gawer & Cusumano, 2014; Tee & Gawer, 2009) or industrial ecosystems (Ashton, 2008; Burstrom, Parida, Lahti, & Wincent, 2021; Parida, Burström, Visnjic, & Wincent, 2019; Sjodin, Parida, & Visnjic, 2022) in existing literature because existing literature is grounded in good-dominant or value chain assumptions where synergies come from unit cost reduction via economies of scale and scope and collectively producing coherent value propositions for consumers. Provision-side ecosystems generate synergies of operational efficiency by connecting providers and machines to shared industrial platforms through which data and industrial complementors can be leveraged continuously to enhance operational efficiency and optimise performance. As existing literature assumes, provision-side ecosystems are open to enhancing operational performances for any actors who join the platform without specifying who the consumers are.

Linking these new phenomena to my review uncovers an overemphasis on consumption-side synergies and limited coverage of these newly emerged provision-side synergies in the existing literature. Such an omission towards provision-side ecosystem synergies exists not only in economics-based ecosystem literature but also in ecosystem research with strategy, engineering management, product development, and information systems (McIntyre & Srinivasan, 2017). All five types of ecosystem synergies identified through the literature review have not considered these newly emerged provision-side synergies, let alone the combined synergies with existing consumption-side synergies. Some scholars with industrial marketing or computer engineering backgrounds have started some early explorations but have not addressed the newly emerged ecosystem synergies (Benitez, Ayala, & Frank, 2020; Hein et al., 2019; Jovanovic, Sjödin, & Parida, 2021; Khan et al., 2020; Leminen et al., 2020; Malik et al., 2021; Pauli, Fielt, & Matzner, 2021; Piller et al., 2021). Some practitioners have provided some empirical examples, but theoretical contribution is limited (Behrendt et al., 2021; Geissbauer, Vedso, & Schrauf, 2016; Kupper, Khulmann, Kocher, Dauner, & Burggraf, 2016; Russo & Wang, 2020; Schmitz, Tschiesner, Jansen, Hallerstede, & Garms, 2019; Shepley, Brady, & Cotteleer, 2016). Therefore, my research objective in Chapters 5 and 6 is to develop an empirical-based understanding of the newly emerged provision-side synergies, especially the IIoT platforms in the Alibaba ecosystem. With this goal in mind, I hope to develop a holistic understanding of ecosystem synergies and thus refine and extend existing theories.

2.3 Conclusion

I embarked on a thematic review of related literature to answer the question of what synergies ecosystems provide. I identify five distinctive but interrelated ecosystem synergies: lock-in, complementarities, efficiency, optimisation, and sustainable equilibrium. The analytical assumptions of these ecosystem synergies are on the consumption side with synergies between complementors and consumers, and new provision-side phenomena such as IIoT and smart governments challenge provision-side synergies following the co-production logic. This unexpected finding led to my subsequent empirical exploration for theory refinement. I aim to extend the ecosystem theory by uncovering new synergies and associated orchestration strategies from a detailed empirical case study – the Alibaba ecosystem.

3 ECOSYSTEM CHANGE AND ORCHESTRATION

"Indeed, what is the meaning of an arrow of time in a deterministic description of nature? If the future is already in some way contained in the present, which also contains the past, what is the meaning of an arrow of time? The arrow of time is a manifestation of the fact that the future is not given, that, as the French poet Paul Valery emphasized, "time is construction.""

Prigogine and Stengers (1984: 16)

Change happens. As technologies become more advanced, the environment becomes more connected and competitive, interactions become more fast-paced, and organising logics become more complex, change becomes increasingly unpredictable and salient. Ecosystem orchestrators' ability to cope with changes and understanding of ecosystem change may serve as a determining factor for an ecosystem's survival and success over time.

Over the last three decades, scholars from different disciplinary backgrounds have explored ecosystem change through distinctive lenses, ranging from evolutionary biology to information systems (See reviews: Constantinides, Henfridsson, & Parker, 2018; Gomes et al., 2018; Granstrand & Holgersson, 2020; Kretschmer et al., 2022; McIntyre & Srinivasan, 2017; Oh et al., 2016; Shipilov & Gawer, 2020; Suominen, Seppänen, & Dedehayir, 2019; Tsujimoto et al., 2017). Concepts mentioned include but are not limited to ecosystem life cycle (Moore, 1993), co-evolution (Tiwana, Konsynski, & Bush, 2010), governance tensions (Wareham et al., 2014), blueprint and design strategies (Adner, 2017; Jacobides et al., 2018), interdependencies (Shipilov & Gawer, 2020), generativity (Cennamo & Santaló, 2019), and collective actions (Thomas & Ritala, 2021). Although this diversity provides ever-increasing ways to understand how ecosystems change, insights remain limited by fundamental debates about the drivers and nature of ecosystem change (Ritala & Almpanopoulou, 2017; Shipilov & Gawer, 2020; Wareham et al., 2014). What drives ecosystem change? How do ecosystems change? Are changes intentionally designed by ecosystem orchestrators or emergent without predictability? Can ecosystem orchestrators deliberately engineer an ecosystem, or must they surrender to the emergent nature? Most critical to ecosystem orchestrators, what strategies can they leverage for sustainable ecosystem growth?

Ecosystem change in this study refers to the alteration of one state to another in an ecosystem. It represents empirically observable differences in ecosystem forms or quality over time. It is an ecosystem-level concept that accounts for ecosystem-level but not component-level changes, although the latter may be part of or drive the former. For example, ecosystem-level change may be changes in ecosystem architecture and ecosystem organising logic, and examples of component-level changes may be new functions, roles and types of participants. The nature, degree, and direction of ecosystem change depend on the perspective one adopts.

I aim to sharpen the discussion of ecosystem change in this chapter, thereby enabling scholars to apply this to future studies more effectively. To achieve this, I review and synthesise existing studies about ecosystem change to "*render increasingly expansive and redundant bodies of knowledge distinct and comprehensible*" (McMahan & McFarland, 2021: 341). Based on my review, I propose a typology framework for categorising ecosystem change and identifying their intellectual heritages. There are, in total, five themes: evolution, cyclicity, teleology, conflict, and complexity, each with a distinctive analytical focus and line of reasoning. Moreover, I uncovered the dominant dualism assumption about emergent and intentional change in received studies. By proposing a synthesis of the ecosystem change literature and uncovering the assumptions about the sources and nature of ecosystem change (Elsbach & van Knippenberg, 2020), this chapter opens up the field to a wide range of theories and guides me to explore the empirical context through which new theoretical contributions are made.

3.1 Organising Ecosystem Change: Categorisation

To examine the current research about ecosystem change, I conducted a thematic review in the Web of Science database of papers published in the past three decades[2]. I found that studies about the process of ecosystem change have grown significantly. Since ecosystems present complex and dynamic interdependencies, patterns of co-evolution, and parallel negative and positive feedback (Langley, 1999; Tsujimoto et al., 2017), scholars have started acknowledging the importance of process analysis rather than variance analysis when investigating ecosystems.

[2] Keywords used in the Web of Science search (Topics: title, abstract, author keywords, and Keywords Plus, through 2022): TS=(ecosystem evolution OR ecosystem change OR ecosystem emergence) NOT TS=(entrepreneurial ecosystem). I refined the initial results (166,618 articles) by document types (articles), categories (management and business), publication journals (mainly management related) and language (English only). The refinement led me to 275 articles that were then downloaded to EndNote. After excluding pure review pieces and journals with lower than 3 ranking according to the Academic Journal Guide 2021, I obtained 48 papers. As I added papers using snowballing technique by reading references, in total I obtained 98 papers for careful analysis.

In addition, two types of ecosystem change have been the main research areas: ecosystem emergence and evolution. The former became dominant because most ecosystems were nascent at the time of the study, and the latter became the focus because the initial popularity of the evolutionary approach drove subsequent traction among scholars. Lastly, research about processes of ecosystem change has initiated from practitioner-oriented journals such as Harvard Business Review and quickly diffused to mainstream academic journals such as the Academy of Management Journal, signalling the acceptance of ecosystems as a newly recognised construct in the management field.

I categorise received literature about ecosystem change into five themes: evolution, cyclicity, teleology, conflict, and complexity. This categorisation builds upon previous studies on organisational change (Van de Ven & Poole, 1995), which suggest the first four types. I added the fifth type that emerged from the ecosystem literature. The distinguishing criteria involve drivers, direction, nature, intellectual heritages, and strategies.

Figure *3.1* shows the evolution of these five themes, Figure 3.2 displays the key journal outlets, and Table 3.1 summarises the five key themes of ecosystem change. The final list of papers can be found in Table 8.1 in Appendix 1. Most papers focus on the teleology (49) and conflict (21) themes, and the complexity approach started to grow later. As some papers may touch upon more than one theme, I chose the central theme they adopt. When papers adopt more than one perspective with equal importance, I classified these papers in all themes. In the following, I elaborate on each type of ecosystem change, its intellectual heritages, drivers, direction, nature, degree, and orchestration strategies.

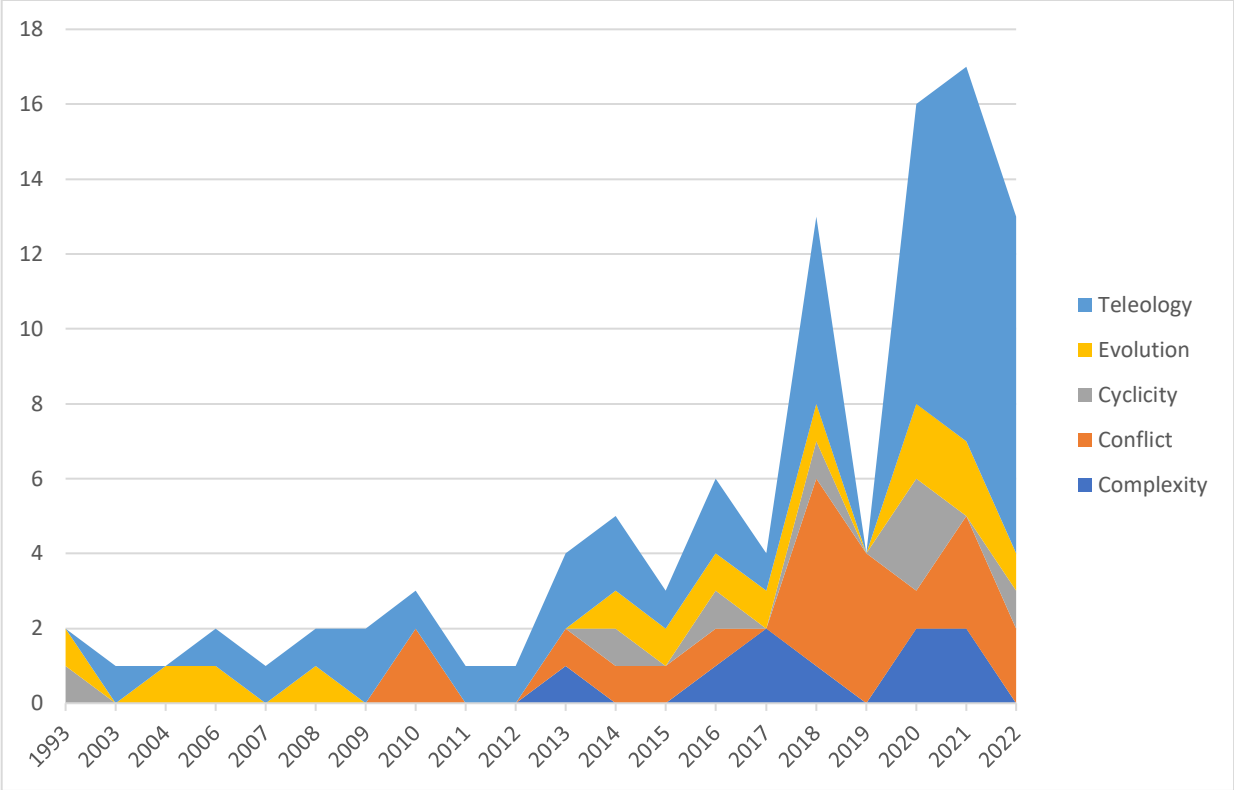


Figure 3.1 - Evolution of ecosystem change themes

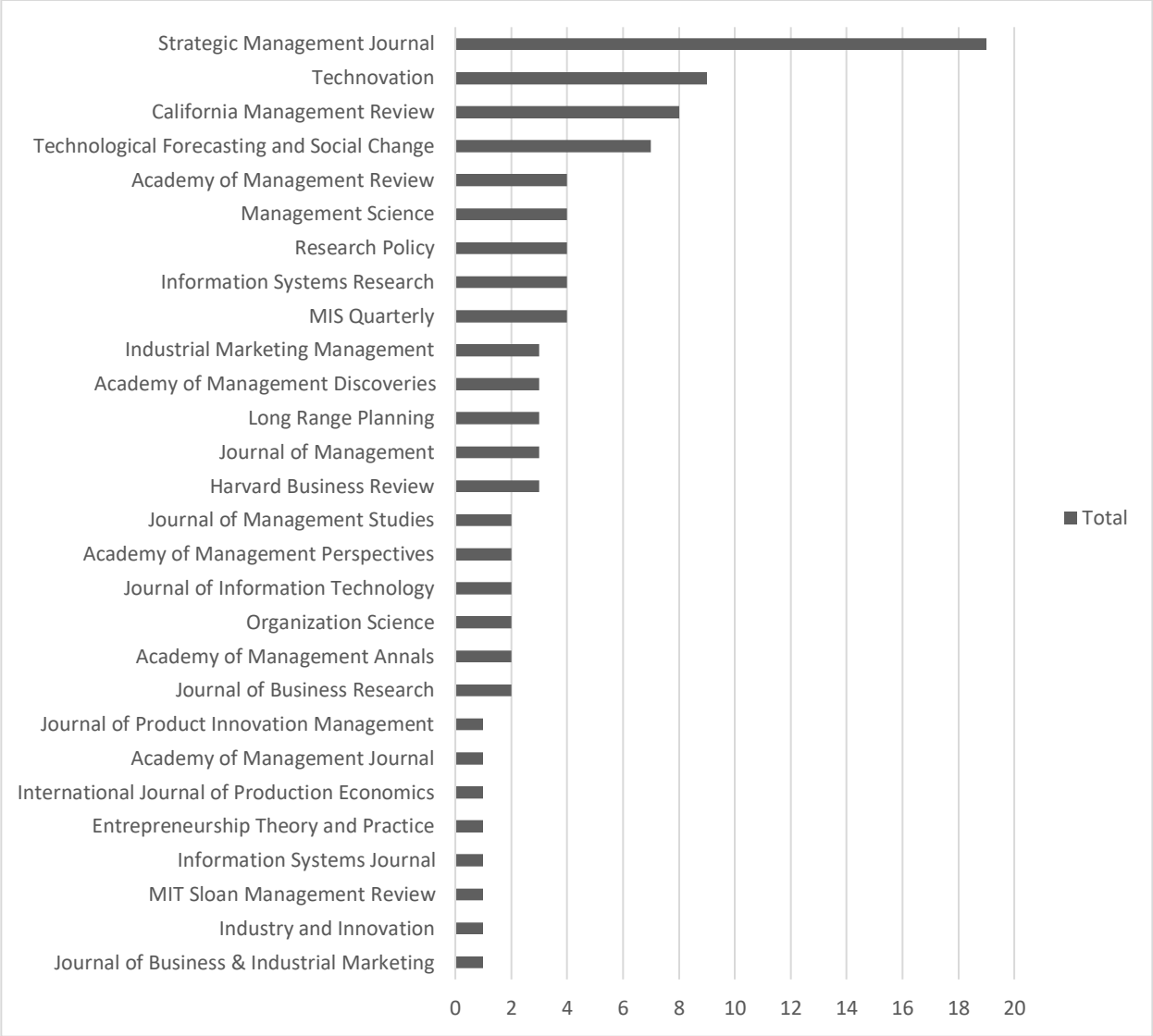


Figure 3.2 - Key high-impact journals in which business ecosystem change articles have been published

Table 3.1 - Themes and intellectual heritages of ecosystem change

	Evolution	**Cyclicity**	**Teleology**	**Conflict**	**Complexity**
Intellectual heritages	Darwin (1859) Spencer (1890)	Spengler (1918) Toynbee (1934–1961)	Kant (1790) Smith (1776)	Hegel (2018 [1807]) Weber (1968) Marx (1875)	Prigogine (1981) Gleick (1987)
Representative works in ecosystem literature	Moore (1993) Iansiti and Levien (2004b)	Moore (1993) Leong, Pan, Newell, and Cui (2016)	Adner (2006) Jacobides et al. (2018) Gawer and Cusumano (2008) Oh et al. (2016)	Boudreau (2010)Tiwana et al. (2010) Wareham et al. (2014)	Ritala and Almpanopoulou (2017) Phillips and Ritala (2019) Sandberg, Holmstrom, and Lyytinen (2020)
Key ideas	Fittest survives through winning competition and co-evolution	Recuring and predetermined life cycle	Planning, implementing, and leveraging network effects for predefined goals or value propositions	A dialectical approach to contradictory forces	Dynamic control and orchestration for emergent value propositions
Key concepts	Business ecosystems	Ecosystems	Innovation/platform ecosystems	Technology/software/platform/digital ecosystems	Ecosystems
Number of papers	14	8[3]	49	21	9
Key journals	Harvard Business Review Technological Forecasting and Social Change	Technological Forecasting and Social Change Technovation	Strategic Management Journal California Management Review	Strategic Management Journal Management Science	MIS Quarterly Technovation
Key disciplines	Strategic management Economics Technology	Strategic management Economics Information Systems	Strategic management Economics	Strategic management Information Systems	Information Systems Marketing Strategic management
Empirical examples	Apple, IBM, Ford, Wal-Mart, and Merck	Apple, Chez Panisse, Industry 4.0, Facebook	Michelin's run-flat tire, HDTV sets, Intel	TiVo, Cisco, 3D printing, blockchains, gaming	Internet, process automation industry, open crowds
Drivers	Natural selection through fierce competition	Genetic code or prefigured program	Intentional adaptation to external shocks	Endogenous tensions between two contradictory forces	External perturbation and internal instability
Direction	From simple to complex and from undifferentiated to differentiated	From birth to growth, to maturity, to decline, and then repeat	From expectation to planned results, e.g., promising applications of new technologies	Paradoxical flux and synthesis of two extremes, e.g., autonomy vs. control	Spontaneous self-organisation and social interactions can lead to unpredictable and unintentional changes at the system level
Nature	Co-evolutionary	Cyclical	Intentional	Dialectical	Emergent
Degree	Gradual	Depends on stages	Gradual & radical	Gradual & radical	Gradual & radical
Orchestration strategies	**Variation, selection, and retention** **Collaboration within an ecosystem** - Co-define value propositions	**Design strategies to fit the characteristics of each stage:** - Early stage - Growth stage - Mature stage - Death/self-renewal	**Strategies to choose, design, plan and implement:** - Develop a blueprint, roadmap and industry-wide goal - Mitigate risks of costly delays	**Balancing trade-offs dynamically and simultaneously** - Control-autonomy - Standard-variety - Collective-individual - Stability-evolvability - Open-closed	**Emergent strategising:** - Self-organisation through feedback loops - Dynamic alignment - Generative mechanisms - Constrained generating procedures (CGP):

[3] As the cyclicity theme tends to come with other dominant themes rather than as being the main theme, this number also shows the number of papers when cyclicity acts as the second theme.

	- Provide compelling vision to guide collective efforts - Work with innovators to bring new ideas - Network alliances and partnerships - Share a set of predictable and stable common resources for value co-creation - Share value with ecosystem participants **Outcompete rival ecosystems** - Protect ideas - Positioning - Establish market standards - Maintain high switching costs and bargaining power - Bottleneck strategies		- Partner alignment - Architecture choices (design principles) - Develop platforms, attract adoption and sustain contribution (architectural advantage) - Manage interdependencies - Dynamic and integrative capabilities - Institutional works - Build coalition and leverage collective actions and alliances - Merger and acquisition - Open innovation - Network management - Define access and control - Leverage cognitive artefacts - Framing - Governance strategies - Persuasion, coordination, scaling - Reducing transaction costs - Facilitate joint learning - Value co-creation and service exchanges - The practices of data complementarities - Dynamic capabilities - Standard setting - IP strategies - Modular design - Hackathons as social forums	- Centralised-decentralised control - Value creation-value capture - Centripetal-centrifugal - Scope-scale - Generativity-free-riding - Identity tensions	interaction rules, design control, and stimuli response variety - Dynamic control

Evolution

Originally, ecosystem theory was influenced by the evolutionary perspective (Darwin, 1859; Spencer, 1890), emphasising competition as the driver of ecosystem change (Moore, 1993, 1996, 2006). Although it emerged initially, this perspective has only been adopted by 14 reviewed papers. The top two journals publishing these papers are Harvard Business Review and Technological Forecasting and Social Change.

The first stream can trace its intellectual heritage to the evolutionary theory (Darwin, 1859; Spencer, 1890). It is considered one of the most recognised perspectives for understanding biological, social, organisational, and institutional change. The crux of their proposal is that change is inevitable, non-reversible and sequential, and actors are selected or retained through the negative feedback from the environment, i.e., natural selection - "*survival of the fittest*". Because of its progressive nature, change happens organically with increasing functions and levels of advancement, not the other way around. Nelson and Winter (1985) illustrate the progressive and selection feature in the evolutionary theory of economic change: "*through the joint action of search and selection, the firms evolve over time, with the condition of the industry in each period bearing the seeds of its condition in the following period*." (p. 19). Following that, Aldrich (1999) summarises four generic processes through which populations of organisations evolve: variation, selection, retention, and struggle. Variations can happen accidentally or intentionally, but sociologists question intentionality (Emirbayer & Mische, 1998) because institutional inertia and conformity constrain individual adaptation (Hannan & Freeman, 1977). Selection from external competition weeds out maladaptive variations that lead to poor performance. The retention process involves preserving and reproducing favourable variations so that the selected structures can appear again in the future. Struggle starts when resources become scarce and limited with the expansion of the population, so organisations start to suffer from competition over resources. Following these generic processes, the evolution stream puts environmental forces at the centre to explain the change in groups of organisations. Consequently, the evolution stream supports limited intentional change; the change of individual organisations results from processes that happen outside their control.

Ecosystem scholars who follow this intellectual heritage view ecosystem change as a result of competition and evolutionary selection. They propose that it is the competition among ecosystems instead of organisations that fundamentally drives ecosystem change (Moore, 1993)

by placing an organisation as a member of a business ecosystem that spans industry boundaries and by placing ecosystems as embedded in biological evolution. Here, they use the "business ecosystem" concept to signal the cross-boundary business context (Iansiti & Levien, 2004b; Moore, 1993). For any ecosystem, the attention that cannot be ignored here is "*the birth of new ecosystems or the competition among those that already exist*" (Moore, 1993: 76) because failure to evolve rapidly to these competitions may lead to demise. This competitive interdependency among ecosystems is highlighted in the concept of co-evolution: "*as a process in which interdependent species evolve in an endless reciprocal cycle – in which "changes in species A set the stage for the natural selection of changes in species B" – and vice versa*" (Moore, 1993: 75). The essence here is that the negative feedback process external to ecosystems, in the form of natural selection (Tiwana et al., 2010; Xu, Hazee, So, Li, & Malthouse, 2021), serves as the main driver for ecosystem change and the main selector of winners: "*it matters not which particular ecosystems stay alive; rather, it's only essential that competition among them is fierce and fair – and that the fittest survive*" (Moore, 1993: 86). Following this logic, ecosystem orchestrators need to pay close attention to competitors while collaborating with a community of ecosystem participants to sustain competitive advantage over other ecosystems (Ansari, Garud, & Kumaraswamy, 2016). In other words, ecosystem orchestrators need to master the "*complex interplay between competitive and cooperative business strategies*" (Moore, 1993: 76). Specifically, they need to work cooperatively with ecosystem participants around innovation in the way that they enable "*all ecosystem members to invest toward a shared future in which they anticipate profiting together"* (Moore, 1993: 76), and at the same time leverage competitive strategies towards other ecosystems to prevent them from imitating or developing alternative ecosystems. Apart from cooperative strategies, evolution speed matters as the one that evolves faster are more likely to adapt to environmental changes than those that do not (Tiwana et al., 2010). Subsequent research expands this co-evolution concept beyond just coopetition, e.g. the co-evolution of platform architecture, governance, and environmental dynamics (Tiwana et al., 2010), and the co-evolution of platform architecture, platform services, and platform governance (Jovanovic et al., 2021).

When ecosystem competition is the primary driver of ecosystem change, strategies tend to be somewhat emergent, focusing on collaboration within an ecosystem and out-competing rival ecosystems (Hannah & Eisenhardt, 2018; Iansiti & Levien, 2004b; Iyer, Lee, & Venkatraman, 2006). Although ecosystem orchestrators can develop a compelling vision to guide collective

efforts among participants in an ecosystem (Iansiti & Levien, 2004b), the specific value propositions of ecosystems can be subject to change and go beyond the intentions of ecosystem leaders depending on competitors' strategies and emerging new relationships (Jovanovic et al., 2021; Xu et al., 2021). The boundaries of ecosystems can fluctuate constantly, and the composition of ecosystems is usually loosely defined to allow change (Aarikka-Stenroos & Ritala, 2017). The emphasis here is more on effective strategies to collaborate within an ecosystem and benefit from co-evolutionary relationships to survive and outcompete emerged rivals and less on accurate prediction of successful value propositions (Ansari et al., 2016). Specifically, orchestration strategies for collaborative relationships may include co-defining value propositions, providing compelling vision to guide collective efforts, working with innovators to bring new ideas, network alliances and partnerships, sharing a set of predictable and stable common resources for value co-creation, and sharing co-created value with ecosystem participants to sustain their collective efforts (Iansiti & Levien, 2004b). Orchestration strategies to outcompete rival ecosystems may include protecting ideas, positioning, establishing market standards, maintaining high switching costs and bargaining power, and leveraging bottleneck strategies (Moore, 1993). In sum, ecosystem orchestrators can use dynamic pecuniary and non-pecuniary strategies to guide collective efforts in an ecosystem and adapt to competitors' moves for survival (Kretschmer et al., 2022).

To summarise, the evolution theme suggests that changes of ecosystems as a whole are driven by external competition and natural selection for survival and competitive advantage. Because of these co-evolution processes where changes depend on each other's moves, ecosystem change can hardly be accurately predicted and planned. The ecosystem orchestration proposed by this stream involves dynamic strategies to adapt to competitors' moves while collaborating within.

Cyclicity

The cyclicity approach emerged with the evolution theme in the classic Moore's piece (1993), assuming that ecosystem change follows a developmental path from birth, expansion, maturity, death or renewal, usually using the term "life cycle". Eight received papers have touched upon this perspective in combination with other perspectives. The top two journals that publish papers adopting this theme are Technological Forecasting and Social Change and Technovation.

This theme's intellectual heritage can be traced to the cyclical theory developed by Spengler (1918) and Toynbee (1934–1961). Contrary to the progressive evolutionary theory, this theory views change as a recurring and predetermined life cycle of birth, growth, maturity and decline.

After finishing all four stages, the subject to study will return to the first stage to restart the cycle. Therefore, there is no element of progressiveness, meaning that the same circle repeats itself every time and new cycles are not more advanced than previous cycles. These scholars tend to adopt civilisation as the unit of analysis to argue for the same cycle of growth and decline for each civilisation. Researchers studying organisational, industry, and institutional change also adopt this approach. For example, industry change studies propose a cyclical model of change through the concept of industry life cycle and technology cycle (Agarwal, Sarkar, & Echambadi, 2002; Anderson & Tushman, 1990; Karniouchina, Carson, Short, & Ketchen Jr, 2013; Klepper, 1997; Peltoniemi, 2011). Scholars propose slightly different stages along the industry life cycle, but the essence is the same. Different stages of the industry exhibit different degrees and types of innovation and thus require different strategies. When one cycle ends, a new cycle starts.

Ecosystem research has also followed this intellectual heritage. According to this perspective, ecosystems generally develop in a unitary sequence, meaning they follow a single sequence of stages. Changes are linear and cumulative as later stages assume the developments happen in earlier stages, and thus development is non-repetitive within one life cycle in the sense that later stages cannot repeat the primitive state in early stages. After these stages, ecosystems can either disappear or successfully renew to repeat the process for another life cycle. This theme assumes a universal developmental path and has limited consideration of cultural diversity and other differences. Resonating with the organisational development theories, the logic is that this developmental path "*is driven by some genetic code or prefigured program within the developing entity*" (Van de Ven & Poole, 1995). Received studies of ecosystem change have discussed many different types of life cycles and often adopt other themes, such as an evolutionary perspective simultaneously. For example, using the analogy with biological systems, Moore (1993) proposes that every business ecosystem evolves through four stages: birth, expansion, leadership, and self-renewal. According to Moore, each stage presents different characteristics and challenges and thus needs to match with different strategies. Other scholars that followed also assumed this sequential model of evolution, using different terminologies and classifying into a different number of stages (Benitez et al., 2020; Gawer, 2009a; Jha, Pinsonneault, & Dubé, 2016; Leong et al., 2016; Shi, Li, & Chumnumpan, 2021; Thomas, Autio, & Gann, 2022). The essence is the same - a cyclical perspective, assuming a fixed and limited number of stages in a given sequence. Therefore, strategies to drive change can be somewhat predictable. In the birth stage, strategies focus on

addressing newness liabilities, identifying value propositions, and preventing imitations. The expansion stage focuses on scaling at a fast speed while defeating alternatives. The leadership stage focuses on sustaining leadership. Finally, whether an ecosystem can self-renew depends on if the strategies can solve inertia quickly.

In summary, the cyclicity theme of ecosystem change suggests that changes are driven by external pre-programmed nature – a lifecycle of birth, growth, maturity, and death or rebirth. Consequently, ecosystem orchestrators can predict the direction of changes and match each stage with unique strategies to address associated challenges.

Teleology

As scholars from other disciplines started to join the discussion, a teleology theme gradually emerged, emphasising pre-defined goals and associated strategic actions that drive ecosystem change. Forty-nine reviewed papers adopt the teleology perspective, making it the most adopted theme among received studies. Most papers were written by scholars from the strategy discipline and published in strategy journals such as Strategic Management Journal and California Management Review.

The intellectual heritage of this stream is a teleological perspective, viewing change as a result of planned purposes. Teleology emphasises the existence of predefined goals which drive intentional actions and changes. Classic economic theories belong to this stream, assuming that a key goal of an economic system is market equilibrium achieved when each participant functions by maximising self-interests through his/her role in society (Smith, 1776). Functionalism is also influenced by teleology, suggesting that all actors and aspects of a society are not determined by their internal constitution but solely by their functions and roles when it comes to working together interdependently for the long-term health of the society (Barber, 1956). Each component, with its function and role, accepts the system's goal and works with other components towards the collective goal. The teleological perspective can also find its influence in the strategic choice stream of organisational research (Aldrich, 1999; Stacey, 1995). The strategic choice stream, i.e., adaptation, argues that organisational change results from intentional and rational adaptation to environmental changes. They assume that organisations can identify environmental changes to set goals to intentionally adapt, change, and transform themselves (Zajac & Kraatz, 1993). Many theories emerged to provide diversity in this strategic choice perspective. For example, learning theory highlights purposeful learning (Weick, 1995), resource dependence theory focuses on the

intention of avoiding dependence and thus obtaining control (Pfeffer & Salancik, 1978), and transaction cost economics points to reducing transaction costs (Williamson, 1994), and institutional entrepreneurship theory highlights institutions as a strategic tool for organisations to drive change and obtain competitive advantage (Hardy & Maguire, 2008). These theories actively assign goals to actions, assuming intentionality and causal relationships between actions and results.

Not surprisingly, some ecosystem scholars also adopt this perspective. Assuming low uncertainty, the goal-oriented perspective suggests that well-defined value propositions or adaptative moves can be predicted in advance to guide ecosystem design and orchestration (Adner, 2017; Gawer, 2009a; Overholm, 2015). Here, they use the "innovation ecosystem" concept to signal the final purpose – innovation (Adner, 2006; Adner & Kapoor, 2010). The goal orientation can find its influence in the definition Adner (2006) provides for innovation ecosystems: "*the collaborative arrangements through which firms combine their individual offerings into a coherent, customer-facing solution*" (p. 2). Because they mostly base their idea on the tightly held and stable value chain (such as Michelin's run-flat tire industry), participants' roles and product offerings can be defined contractually beforehand to guide the orchestration of collaborative arrangement. Uncertainties and incidents are exceptions where orchestrators can actively predict, assess, adapt, and manage (Adner, 2006).

These strategic choices ecosystem orchestrators intentionally adopt may involve design principles such as modularity (Baldwin & Clark, 2000; Baldwin & Woodard, 2009; Jacobides et al., 2018), decomposition (Tiwana et al., 2010), platform architectural design (Jha et al., 2016; Luo, 2018; Thomas et al., 2014), pricing and compatibility (Katz & Shapiro, 1985), openness (Eisenmann et al., 2009), and complementarity (Shipilov & Gawer, 2020). They may also involve an interplay between network design (openness and embeddedness) and innovation design (modularity) (Nambisan & Sawhney, 2011), and a combination of access and control while adapting to participants' concerns (O'Mahony & Karp, 2020). They may relate to identity change of "*new routines that forge novel relationships with actors within the ecosystem*" change (Lindgren, Eriksson, & Lyytinen, 2015: 229), strategic open innovation to remove ecosystem bottlenecks (Masucci, Brusoni, & Cennamo, 2020), and collective actions for ecosystem legitimacy (Thomas & Ritala, 2021). They can also be internal organisation factors such as "*organizational structure and processes as commitment mechanisms*" (Gawer & Henderson, 2007: 1). In all of these papers,

ecosystem change is understood as a result of strategic choices made by key ecosystem actors to achieve specific predictable goals and dynamically adapt to assessable environmental changes (Dushnitsky, Piva, & Rossi-Lamastra, 2022). Strategic actions and adaptation control ecosystem outcomes linearly because goals are considered direct results of strategic actions. Ecosystem orchestrators thus have a high level of agency to adapt to assessable risks and shape the ecosystem through strategic actions. Although some have highlighted that ecosystem emergence is a "*partly designed*" process (Jacobides et al., 2018), the main focus of analysis is the strategic agency, and insights remain limited by underexplored areas of undesigned processes.

In summary, the teleology approach assumes changes driven by strategic actions guided by pre-defined goals and are thus intentional and predictable. Strategies focus on enabling the successful prediction of killer value propositions and associated implementations to achieve pre-defined goals collectively.

Conflict

Besides the traditional division between evolution and strategic choice perspectives in management research, the conflict-driven perspective has also emerged in ecosystem change studies since 2010. Twenty-one of the received papers on ecosystem change adopt the conflict lens, making it the second most adopted perspective. Most of these papers are published in strategy and management journals such as Strategic Management Journal and Management Science. Some find their outlets in the Information Systems journals such as Information System Research and Information System Journal. The discussion mainly focuses on ecosystem governance tensions.

This approach can be traced to the intellectual heritage of paradox and dialecticism. Societal conflicts, economic (Marx, 1875) or social (Dahrendorf, 1958; Weber, 1968), drive social change. As the foremost advocates, sociologists have highlighted the instrumental value of conflicts when pushing for social change. Conflicts-driven social change resonates with the dialectic approach in philosophy. Hegel proposes a dialectical process of historical development involving thesis–antithesis–synthesis (Hegel, 2018 [1807]; Mueller, 1958). He argues that everything contains within itself its own negation and "*seeds for its own ineluctable destruction and transformation*" (Schmidt, 1988: 15). The concept of synthesis is a process wherein everything copes with its inherent contradictions and unfolds itself as a result. For example, some institutional change literature has also adopted this view, suggesting institutional change as an outcome of political contention and a process of resolving conflicts among related parties. Institutions evolve

according to "*a dialectical model in which a synthesis of new institutional policies and structures emerges from conflict and contestation among colliding groups espousing opposing ideas and antitheses*" (Hargrave & Van de Ven, 2006: 865). As a new synthesis emerges, it serves as the thesis for the next cycle of dialectical evolution. Organisational research has also had its influence from this paradoxical thinking (Smith & Lewis, 2011), for example, exploring tensions between exploration vs. exploitation, individual vs. collective, autonomy vs. control, and deliberate vs. emergent (Mintzberg & Waters, 1985).

In ecosystem research, fundamental conflicts that drive ecosystem change involve control-autonomy, standard-variety, collective-individual, and stability-evolvability (Eaton et al., 2015; Hagiu & Wright, 2019; Tiwana et al., 2010; Wareham et al., 2014). Here, they tend to use the concept of "technology ecosystem", "software ecosystem", or "platform ecosystem" to signal the paradoxical nature of digital technologies (Wareham et al., 2014). These four tensions are essentially four sides of the same dice, called the "paradox of change", i.e., to be stable and evolvable simultaneously (Tilson et al., 2010; Wareham et al., 2014). The control-autonomy paradox happens when "*a platform owner must retain sufficient control to ensure the integrity of the platform while relinquishing enough control to encourage innovation by the platform's module developers*" (Tiwana et al., 2010: 679), standard-variety can be described as "*technology ecosystems require stability and homogeneity to leverage common investments in standard components, but they also need variability and heterogeneity to meet evolving market demand*" (Wareham et al., 2014: 1195), and collective-individual refers to "*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*" (Wareham et al., 2014: 1198). These tensions are especially salient in technology ecosystems such as smartphones, desktop applications, and gaming. Not only ecosystem orchestrators but ecosystem participants at the same time also face these tensions (Miller & Toh, 2022; Nambisan & Baron, 2013; Tavalaei & Cennamo, 2021; Zhang, Li, & Tong, 2022). Besides control-related tensions, identity tensions between old inherited and aspiring new identities have also been explored during ecosystem change (Lindgren et al., 2015). In addition, tensions between ecosystem size and innovativeness as well as between value co-creation and value appropriation have been suggested to impact ecosystem strategies through users' preferences (Cennamo et al., 2020; John & Ross, 2021; Panico & Cennamo, 2022;

Zhang et al., 2022). Other tensions can be open-closed (Cenamor & Frishammar, 2021), centralised-decentralised control (Cennamo et al., 2020), centripetal-centrifugal forces (Holgersson, Baldwin, Chesbrough, & Bogers, 2022), scope-scale (Foerderer, Kude, Schuetz, & Heinzl, 2019), and generativity-freeriding (Cennamo & Santaló, 2019). Although the evolution perspective discusses tensions as well, the difference is that the evolution approach focuses narrowly on the coopetition conflicts that emerge within and across ecosystems (Moore, 1993), while the conflict approach has a broad coverage of tensions that emerge inside ecosystems (Tilson et al., 2010).

When focusing on endogenous tensions, strategies tend to be dynamic, emergent, and continuously adjusted to deal with new tensions (Khanagha, Ansari, Paroutis, & Oviedo, 2022). A core principle is "*to establish governance mechanisms that appropriately bound participant behaviour without excessively constraining the desired level of generativity*" (Wareham et al., 2014: 1195-1196). Attending to these two opposing extremes is often a delicate move: more on one side may tilt the power balance but bring minimised return (Boudreau, 2010; Holgersson et al., 2022; Mantovani & Ruiz-Aliseda, 2016). Such moves can be played differently depending on one's role, and multiple strategies can co-exist simultaneously (Cenamor & Frishammar, 2021; Kamalaldin, Sjödin, Hullova, & Parida, 2021). What is more, strategies can also differ depending on the stage of the ecosystem life cycle and the value proposition of ecosystems (Cennamo & Santaló, 2019; Panico & Cennamo, 2022; Uzunca et al., 2022; Wareham et al., 2014). For example, generativity may create more value for ecosystems in the emergence stage than in the mature stage because tensions between generativity and efficiency intensify as time progresses (Cennamo & Santaló, 2019). The essence is to balance trade-offs dynamically and simultaneously address conflicting tensions (Hannah & Eisenhardt, 2018; Parker & Van Alstyne, 2018; Wareham et al., 2014). Wareham et al. (2014) suggest strategies to "*simultaneously effecting stability and evolvability through a combination of variance-increasing and variance-decreasing mechanisms*" (p. 1211). Concepts such as ambidextrous governance, open adaptation, and paradox transitions between complementary and contradictory logics have been proposed to achieve such balance (Altman et al., 2022; Wareham et al., 2014).

In summary, the conflict theme suggests that tensions endogenously emerged to drive ecosystem change, and dynamic balancing of conflicts is critical in ecosystem governance.

Complexity

Ecosystem scholars have also leveraged the complexity approach to study ecosystem change, viewing ecosystems as complex adaptive systems where system-level changes are emergent and driven by internal and external factors (Engler & Kusiak, 2011; Ngongoni, Grobbelaar, & Schutte, 2022; Sandberg et al., 2020). Nine of the reviewed papers borrowed insights from the complexity theory since 2013. MIS Quarterly and Journals from the Academy of Management are the primary outlets for these papers, and insights were borrowed mainly from the Information Systems and Marketing disciplines.

Figure *3.1* shows the increasing proportion of this complexity perspective in ecosystem change research.

Contrary to the teleology theme that supports self-organisation equilibrium and treats instability as the exception, the complexity theme suggests uncertainty as a structural element that inherently generates unpredictable processes (Gleick, 1987; Prigogine, 1981; Sawyer, 2005; Waldrop, 1993). Originated from the Natural Sciences such as physics, biology, and mathematics that challenge the deterministic Newtonian paradigm, the complexity epistemological paradigm has started to diffuse into the Social Sciences due to its' usefulness (Condorelli, 2016; Simon, 1962; Stacey, 1995). Instead of seeking stability and equilibrium through linear causality and negative feedback, complexity theory contends that uncertainty, emergence, instability, and surprises are the rule rather than the system's exceptions that move systems away from equilibrium (Prigogine & Stengers, 1997). However, this is not to say that nothing can be predicted and determined like rolling a die – the unpredicted processes are generated from deterministic mechanisms in the system. Re-thinking the social system as a complex adaptive system (Byrne & Callaghan, 2014), complexity theory promotes the bi-directional causation link between individual components' actions and system structure with an emergent effect. Specifically, social change is an emergent self-organising process where individual interactions lead to unexpected system-level effects and order that may not be the intention of individuals and cannot be explained by reducing to individual interactions (bottom-up process). This new emergent system can then redirect individual actions until a new emergent self-organisation process (top-down) occurs. Regarding the causes of change, the complexity theory suggests external perturbation and internal instability (Harvey & Reed, 1997). As social systems adapt to and learn from environmental changes, are sensitive to initial conditions, and present uncertainty, they are in the paradoxical flux of stability and instability. The

complexity theory has also influenced organisational theories (Stacey, 1995), suggesting an emergent approach to understanding organisational change. Some existing theories following the essence of complexity include paradox (Eisenhardt, 2000; Smith & Lewis, 2011), spontaneous self-organisation, structuration model (Giddens, 1979), organisational becoming (Tsoukas & Chia, 2002), evolving to fit (Siggelkow, 2002), and positive feedback loops (Arthur, 1988). Instead of focusing on achieving equilibrium through negative feedback and monitoring, complexity theory argues that organisations are complex systems that exhibit self-organisation, non-linear development, positive feedback, lack of cause-effect link, and unpredictability.

According to this perspective, ecosystems are distinctive because they act as complex adaptive systems where interactions among interdependent actors lead to unintended system outcomes (Peltoniemi & Vuori, 2008; Ritala & Almpanopoulou, 2017). Because uncertainty acts as a system property instead of shock, the impact of interactions on system outcomes is non-linear and can involve negative and positive feedback loops. The inherent complexity and unpredictability of ecosystem outcomes mean that goals are unlikely to be stable and rapid adaptation is essential. Strategy scholars discuss double feedback loops and dynamic control strategies (Dattée et al., 2018). They propose the dynamic control strategy because of the unbound range of potential value propositions afforded by generativity; thus, firms need to leverage influencing, monitoring, and updating strategies to narrow the future and ensure both value creation and capture (Dattée et al., 2018). The crux is the emphasis on the lack of predictability, signalling the limited contribution of linear and stable approaches. Unlike the evolutionary approach focusing on gradual natural selection, this complexity approach suggests both disruptive and gradual changes driven by internal instability and external perturbation (Gómez-Uranga, Miguel, & Zabala-Iturriagagoitia, 2014). As digital technologies exponentially advanced and permeated almost every industry, the complexity approach became increasingly popular (Sandberg et al., 2020; Yoo et al., 2010). Understandingly, Information Systems scholars were the first to link the complexity approach to ecosystem studies. The generative nature of digital technologies (e.g., reprogrammability, decoupling, homogenisation) brings in a dynamic view of value propositions, meaning that value propositions are generative and realised ex-post through collective actions of heterogeneous but related organisations coordinated by focal firms (Yoo et al., 2010; Zittrain, 2006). Thus, innovation becomes distributed in the sense that self-governing firms or individuals develop creative outputs without ecosystem owners' guidance on what to

design or how much to charge (Baldwin, 2012). Because of distributed innovation, narratives of how to understand new innovation and innovative business models become prominent in pushing socio-cognitive sense-making during ecosystem development (Nambisan, Lyytinen, Majchrzak, & Song, 2017). To replace traditional top-down system design with a fixed design context, Hanseth and Lyytinen (2009) leveraged Complex Adaptive Systems theory and proposed two emergent problems in information infrastructures (IIs): the bootstrap problem and the adaptability problem. The bootstrap problem, defined as "*IIs need to meet directly early users' needs in order to be initiated*" (Hanseth & Lyytinen, 2009: 1), can be solved by "*generating early growth through simplicity and usefulness*" (p. 1). The adaptability problem, "*local designs need to recognize II's unbounded scale and functional uncertainty*" (Hanseth & Lyytinen, 2009: 1), is solved by "*promoting modular and generative designs*" (p. 1). Sandberg et al. (2020) further demonstrate digital ecosystems' multilevel and recursive characteristics, suggesting three endogenous mechanisms – interaction rules, design control, and stimuli response variety – through which digitalisation pushes platform transitions and shapes organising logic. Henfridsson and Bygstad (2013) summarise three self-reinforcing mechanisms that drive digital infrastructural change: macro-micro, action-formation, and micro-macro. This self-reinforcing mechanism drives ecosystem change through the process where an ecosystem grows in value as the more the ecosystem learns from the data it collects on participants.

In summary, the complexity theme suggests that ecosystem change is emergent and driven by internal and external factors. Consequently, although complexity theory suggests a lack of control over system outcomes, some actors can still strategically nudge for intended outcomes in the short run (Nenonen & Storbacka, 2020; Tsujimoto et al., 2017).

3.2 Interrelations and Assumptions

The above review and categorisation reveal the width and depth of ecosystem change research. Cross-fertilisation has increased as papers started to adopt more than one perspective. The most common one is the combination of evolution and cyclicity. Although cross-fertilisation has started to emerge, current research is still relatively siloed, meaning each perspective emphasises one or two angles with limited integration from other perspectives. Conflicting views about emergent and intentional change have also been a critical topic of debate.

Interrelations

I develop a 2x2 framework to understand these five themes further (see Figure 3.3 below). This categorisation was partly inspired by Van de Ven and Poole (1995) and Demers (2007)'s study of organisational change and partly influenced by the paradigm debate that emphasises the importance of uncovering field assumptions so as to understand existing theories and construct meaningful research questions (Alvesson & Sandberg, 2011). Regarding assumptions about the nature of change, ecosystem literature has highlighted both intentional and accidental changes. Scholars espousing intentional change assume a mechanical and top-down perspective of ecosystem change where ecosystem orchestrators can design and develop goals such as ecosystem value propositions beforehand (Adner, 2017; Hannah & Eisenhardt, 2018). Scholars proposing accidental change assume an emergent perspective of ecosystem change where ecosystem owners and participants co-design and co-create ecosystem value propositions through trial and error (Ansari et al., 2016; Dattée et al., 2018; O'Mahony & Karp, 2020). The fundamental question about the nature of change is the same – Is change the result of intention directed by ecosystem orchestrators beforehand or of complex and emergent interactions without predictability? In short, is the change intentional or emergent? Therefore, I chose one dimension to represent the intentionality of change. An intentional change refers to a situation when change can be intentionally predicted and planned, assuming strong agency power and certainty. An emergent change refers to the type of change that is unpredictable and emergent, assuming weak power of agency and certainty. This dimension resonates with the classic debates in organisational change theories about selection vs. adaptation. The importance is thus undeniable when it comes to understanding ecosystem change. In addition, regarding the assumption of the source of change, received papers have touched upon both endogenous and exogenous drivers. Endogenous drivers can be strategic actions, conflicts, and internal uncertainties. Exogenous drivers may include competition (natural selection) and technological advancement. The source of change is crucial as it determines the mechanisms and dynamics of change.

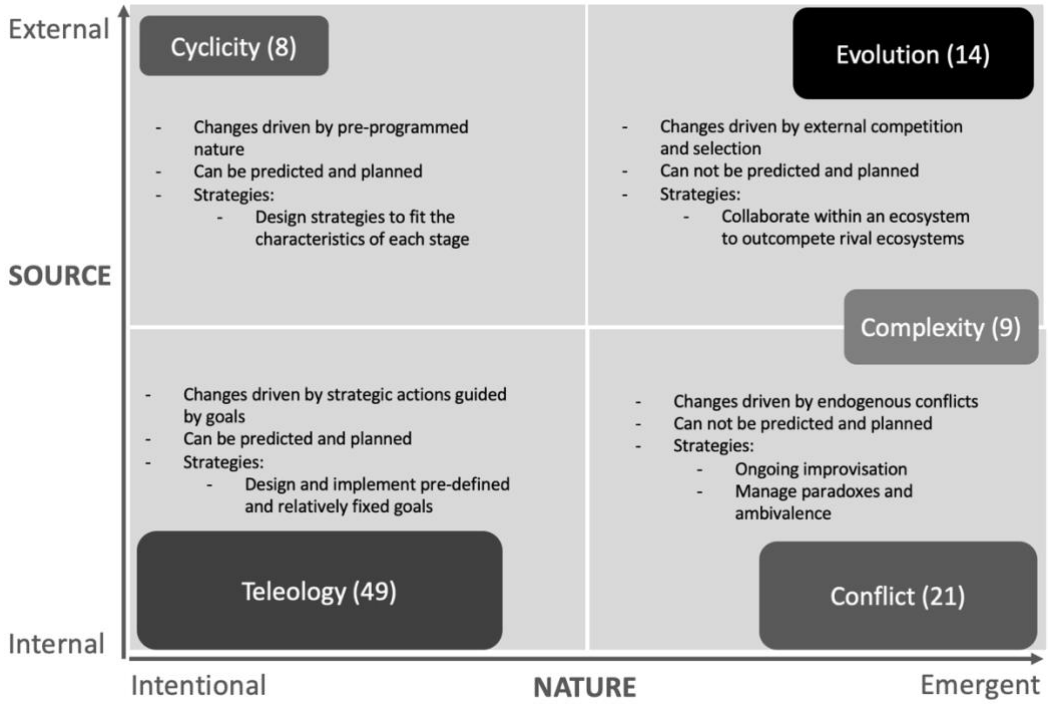


Figure 3.3 - The typology model and associated article quantity of ecosystem change

As shown in Figure 3.3, the five themes occupy different spots in the typology framework. The size of each theme signals the number of papers that adopt the theme. The evolutionary perspective focuses on external drivers, namely competition and natural selection, and does not suggest predictability in orchestration strategies given the uncertainty embedded in co-evolution. The cyclicity theme suggests changes caused by the predefined life cycle that is out of the discretion of actors but characteristics and challenges for each stage can be predicted, and thus actions can be planned. The conflict theme suggests that changes are driven by two contradictory forces developed endogenously, and the direction of synthesis can hardly be predicted. The teleology perspective proposes strong agency for change through intentionally planned strategic actions and thus substantial control for the direction of change. Finally, the complexity approach assumes that ecosystem changes are purely emergent and can be driven by both internal instability and external perturbation. Note that authors of reviewed articles may disagree with the typology because they were not equipped with this framework when they wrote these papers or were unaware of assumptions until they were pointed out (Alvesson & Sandberg, 2011). This paper, however, does not aim for agreement but suggests that this new classification serves as a useful way to understand and integrate extant research on ecosystem change. Building on this, future

researchers can also be aware of these hidden assumptions and thus be specific and explicit about the nature and drivers of ecosystem change when they develop their theories.

Assumptions

Upon further contemplation, I found that existing research, including the five streams, possesses a prevailing dualism assumption of emergent and intentional ecosystem changes. When dealing with these two contradictory elements, the dualism perspective "*shows a clear-cut and decisive contrast, a well-defined boundary, and no overlap*" (Farjoun, 2010: 203). This means that emergent and intentional ecosystem changes are separate, contradictory, and inconsistent. Although some may acknowledge the complementary relationship between emergence and intention, they predominantly choose to view them as unresolvable and inconsistent. Consequently, ecosystem changes can only be viewed as purely emergent or intentional but cannot be both, let alone discussing complementary relationships. Specifically, the teleology stream emphasises the strategic actions of the ecosystem orchestrator to drive ecosystem change and highlights the strong agency to predict and assess uncertainties and adapt beforehand. The complexity approach proposes a pure emergent view on ecosystem growth, denying any actor's ability to plan strategically. The cyclicity approach points out the pre-programmed rule of developmental sequence that supports the planned behaviours for each stage's unique challenges. The conflict lens highlights the importance of dynamically balancing tensions generated endogenously. Finally, the evolution stream emphasises the power of natural selection through which orchestrators' behaviours must constantly be adjusted and evolved.

This dualism assumption is conducive to using the either/or approach in explaining and managing ecosystem change. For example, Oh et al. (2016) argue that "*An innovation ecosystem is not an evolved entity. Rather, it is designed.*" (p. 2). Contrarily, Ritala and Almpanopoulou (2017) mention the pure-emergence complexity approach: "*In fact, innovation ecosystem could be fundamentally portrayed as a specific application of a complex adaptive system (see e.g., Anderson, 1999; Cilliers, 2005).*" (p. 39) Although Ritala and Almpanopoulou (2017) suggest that "*it is important for ecosystem scholars to understand which parts of the ecosystem are (and can be) engineered, and which parts are self-organized or co-evolved*" (p. 41) and Jacobides et al. (2018) mention that "*ecosystems as the result of a (partly designed) process*" (p. 2263), the implicit premise is more to manage intention and emergence in separate parts and less about the synergetic relationship between the two in fostering sustainable ecosystem growth.

Similarly, some papers that adopt more than one theme may have discussed both strategic and emergent ecosystem changes, but they have not explicitly touched upon the relationship between them. For example, Moore (1993) combines evolution and cyclicity themes to discuss different strategies ecosystems leverage to out-compete rival ecosystems throughout each stage of the ecosystem lifecycle. In this case, the developmental sequence takes on centre stage through which planned behaviours are suggested to address associated challenges for each stage. Cennamo and Santaló (2019) integrate conflict and evolution themes to discuss the evolutionary dynamics of platform ecosystems and ecosystem governance. In this case, ecosystem change is emergent as feedback mechanisms play out along the evolution of ecosystems. Ansari et al. (2016) touch upon evolution and teleology streams by discussing how TiVo continuously adjusted strategies to manage emergent coopetition tensions as a disruptor to the U.S. television industry ecosystem. In this paper, ecosystem change is considered a result of both deliberative and emergent strategic processes. As these papers illustrate, how these different streams interplay and affect the nature of ecosystem change remains poorly understood.

3.3 Conclusion

Over the last three decades, scholars have increasingly advocated ecosystem theory as a powerful lens to understand and manage change. However, as ecosystem change becomes increasingly pervasive in the research, its sources, nature, and orchestration still lack consensus. In this chapter, I reviewed existing literature on ecosystem change, categorised streams of perspectives, and surfaced the dualism assumption of emergent and intentional change. This review of the theoretical foundation guided me to explore the empirical context and identify important theoretical gaps to which new insights can contribute.

4 METHODOLOGIES[4]

Founded in 1999 by Jack Ma and his 17 friends, Alibaba has been known as a leading wholesale marketplace for global trade. From a simple website, Alibaba now orchestrates a complex digital platform ecosystem that spans four interrelated domains: core commerce, cloud computing, digital media and entertainment, and innovation initiatives. Moving beyond facilitating transactions, Alibaba is at the forefront of designing new synergy-creation mechanisms for both consumption-side and provision-side participants (see Table 9.1 for the definitions used in this research). For instance, on January 11th, 2019, Alibaba launched the A100 strategic partnership program in Hangzhou, aiming to provide a comprehensive one-stop solution to help its ecosystem participants accelerate their digital transformation. Its New Retail and A100 initiatives are paving the way for its supET IIoT platform ecosystem that focuses on developing and supporting the industrial operations of ecosystem participants. However, little is known about the new provision-side phenomenon or the Alibaba ecosystem's synergies that combine both provision-side and consumption-side offerings. Moreover, existing research provides a limited understanding of how Alibaba orchestrates participants and evolves following a sustainable growth path. As such, this thesis consists of a longitudinal and abductive field study and supporting archival research to understand Alibaba ecosystem synergies, change, and orchestration strategies.

4.1 Research Context

Alibaba is an appropriate research context for this study, as it is a multi-sided platform ecosystem with distinct and interrelated sets of participants such as ecosystem orchestrators, buyers, sellers, and complementors (independent third parties who provide complementary services). Each set of participants contributes distinctive capabilities and relies on other participants for their success. It takes a "hub and spoke" form, with a wide range of peripheral firms connected to the focal platform via shared interfaces (Ceccagnoli et al., 2012; Gawer & Cusumano, 2008). Alibaba not only provides participants with access to demand directly or indirectly but also with innovation opportunities (Ceccagnoli et al., 2012). Consumption-side participants (buyers) join Alibaba's platform to access provision-side users (sellers), other consumption-side participants, and complementors. Provision-side participants connect to

[4] In Chapter 4 – methodologies, I acknowledge the efforts of Erkko Autio and Llewellyn Thomas on early drafts of this chapter.

Alibaba's platform to access consumption-side participants and complementors, innovation opportunities, digital technologies, and opportunities to collaborate with other provision-side participants. Complementors connect to Alibaba's ecosystem to access demand and innovation opportunities. Alibaba is the ecosystem orchestrator.

For three reasons, it is appropriate to study the Alibaba case from the theoretical perspective of ecosystem theory rather than from the perspective of supply chain theory. *First*, supply chains are coordinated by supplier-specific, one-to-one contracts that define the flow of activities (from upstream to downstream), whereas ecosystem coordination is non-contractual and non-hierarchical, where roles and responsibilities tend to be informally agreed upon. In Alibaba's case, the value for a participant is not defined ex-ante but materialises through the active participation and contribution of numerous hierarchically independent ecosystem participants. *Second*, supply chains exhibit a command and control logic in their internal coordination, whereas ecosystems are mainly governed through role definitions and related expectations (Jacobides et al., 2018). Alibaba eschews formal, one-to-one contracts and instead relies on ecosystem coordination in the forms of agreed-upon roles and rules where participants join voluntarily and decide on their own offerings. *Third*, supply chains are sector-specific, whereas Alibaba's platform ecosystem spans industry sectors. Because it relies on the ecosystem mode of governance and because of coordination and its sector agnosticism, Alibaba provides an appropriate context to test and develop ecosystem theory.

Alibaba is an extreme case "*where hard-to-study dynamics are easier to observe*" (Pratt, 2008: 502), which makes it an ideal setting for this research. Alibaba is among the few platform ecosystems actively seeking to orchestrate both the consumption and provision sides to drive ecosystem leadership in the long run. Beyond e-commerce platforms that improve transaction efficiency, Alibaba's New Retail, A100 initiatives, and supET are three initiatives focusing on orchestrating provision-side participants to enhance their operational efficiency. Different from existing multi-sided platform ecosystems such as Amazon, which maintains both competitive and cooperative relationships with its provision-side participants, Alibaba adopts a platform ecosystem strategy that focuses mainly on orchestrating and empowering provision-side users rather than competing with them. Although the Alibaba New Retail initiative resembles the eBay Retail Revival program where eBay partnered with select cities to bring their local brick-and-mortar businesses online, Alibaba provides a wide range of services to provision-side retailers that far

exceed what eBay provides, notably by leveraging consumption-side data and other resources to enhance provision-side digital transformation and operational efficiency. The New Retail initiative paves the way for IIoT ecosystems, eventually enhancing the industrial operations of provision-side participants across industries. In addition to orchestration width and depth, Alibaba is among the very few ecosystems that claim to focus on long-term sustainable growth, i.e., lasting 102 years that span three centuries. This pursuit of sustainable growth has been articulated for example in Alibaba's annual reports: "*We do not pursue size or power; we aspire to be a good company that will last for 102 years*." (Alibaba Annual Report since 2020), and "*Our culture, business models and systems are built to last, so that we can achieve sustainability in the long run*." (Alibaba Annual Report since 2015). In summary, Alibaba serves as an ideal setting to study ecosystem synergies, orchestration, and change in the long run, specifically ecosystem sustainable growth.

4.2 Methodology

I adopt a case study method with abductive reasoning to investigate ecosystem synergies, ecosystem change, and ecosystem orchestration strategies. A qualitative case study is well suited for this research because it is to answer "*explanations rather than incidence questions*" (Yin, 1981: 59) such as "*What is happening?"* and "*How is it happening?*", although it cannot effectively answer questions such as how much of it is happening (Lee, Mitchell, & Sablynski, 1999; Pratt, 2009). Furthermore, a qualitative approach is appropriate because it can effectively address dynamic and interactive processes (Golden-Biddle & Locke, 2007; Lee, 1999), e.g., "*the study of dynamic phenomena like innovation ecosystems as it can provide rich understanding on the hows and whys of these processes*" (Ritala & Almpanopoulou, 2017: 40). Lastly, the qualitative method is chosen as it is suitable for studying new phenomena that are not fully understood (Barley, 1990; Strauss, 1987), e.g., IIoT ecosystems.

Abductive scientific reasoning was chosen as the epistemological approach of this study. Different from inductive (theory-building) and deductive (theory-testing) forms of reasoning, abductive reasoning is an interpretive approach (Folger & Stein, 2017; Mantere & Ketokivi, 2013; Sætre & Van de Ven, 2021). A deductive hypothesis testing approach is not possible in the Alibaba context because there is not enough theory to support the formulation of deductive hypotheses for empirical validation (Edmondson & McManus, 2007). While an inductive hypothesis-generating approach would be possible, it does not consider existing research that could be useful to explain part of the phenomenon (in this case, the reviewed literature about ecosystem synergies, change,

and orchestration). Therefore, the in-between method of abduction, which allows for analysing the data with pre-existing theories in mind to begin with, is appropriate (Alvesson & Kärreman, 2007; Behfar & Okhuysen, 2018). Abductive reasoning is based on a continuous dialogue between existing knowledge (what is known already) and pre-established understandings of researchers, acknowledging bounded rationality and behavioural biases (Reichertz, 2004). As such, it tends to be interpretive, meaning that the "*best explanation*" is always "*subject to negotiation between the authors and their audiences*" (Mantere & Ketokivi, 2013: 81). It "*begins when data call attention to some surprising anomaly, problem or unexpected phenomenon*" (Van de Ven et al., 2015: 2). In my research, having some existing literature in mind, I went to conduct fieldworks during which I observed some unexpected phenomenon, e.g., IIoT and phasic ecosystem growth, that extant theory cannot explain. To go from "best guess" further to a theory, the proposed explanation must be subjected to further tests through induction or deduction (Alvesson & Kärreman, 2007). The outcome of abductive research is theoretical refinement: "*modifying the theory based on either the failure of the new observations to match the theory, or the desire to develop an even deeper understanding of the phenomenon through the addition of more concepts*" (Wright, 2017: 386).

4.3 Data Sources

I gathered data from two broad sources: 1) primary data, including participant observations between July 2018 and January 2020 and three rounds of semi-structured interviews with Alibaba employees and provision-side participants; 2) secondary data (archival materials) such as news, conference presentations, SEC filings, and case studies. The broad coverage of data sources enabled a comprehensive triangulation among different data sources so as to ensure reliability (Yin, 1994). Interviews provided me with general perceptions of reality from the informants' perspectives influenced by their agendas and sensemaking, participant observations allowed me to observe their actual behaviours directly, and archival data enabled me to understand what happened and what has been documented in what ways. All sources were essential to understanding the case (Strauss, 1987).

Primary data. Initial data collection started in July 2018 with exploratory field research focusing on Beijing's start-up ecosystem. The field research comprised interviews, site visits and workshops. I attended two workshops that were specifically related to the Alibaba ecosystem topic: 1) the workshop on the e-commerce industry in the new era hosted by Tsinghua University and the China Electronic Commerce Association, where Alibaba was a key participant, and 2) an

internal meeting on the topic of start-up incubation between one of Alibaba's key competitors in China and Microsoft in July 2018. Site visits included Beijing's start-up areas, such as Innoway and Zpark Imway, and DiDi's headquarter in Beijing (Alibaba is one of DiDi's stakeholders). Interviewees included two managers working at the Beijing Zhongguancun Software Park Incubator, emphasising the critical role played by big internet firms such as Alibaba in China's entrepreneurial ecosystems.

This exploratory fieldwork led to the initial research focus on the influential role prominent players such as Alibaba play in China's innovation and entrepreneurial ecosystems. In June 2019, additional data was gathered from the admission interview session of the Tsinghua-Alibaba New Business Xuetang (Digital Transformation Training program for 52 industry leaders), during which the first round of exploratory interviews with Alibaba and associated provision-side participants was conducted. The research topic was narrowed down from the participant observation and exploratory interviews - provision-side ecosystem synergies. Between November 2019 and January 2020, I joined Alibaba Research Centre as an intern to further study such ecosystem synergies. The second round of interviews with Alibaba and some collaborating provision-side participants was conducted during that period. Additional data collection included attendance at several conferences organised by Alibaba, such as the Alibaba Taobao Village International Forum, the Alibaba One Business Conference, the New Economy Think Tank Summit, and the Digital Business Workshop 2020 Annual Conference. I undertook site visits with Alibaba to three cities in China to visit some Alibaba provision-side participants. Finally, the Alibaba Hangzhou headquarter was toured at the end of this fieldwork period. A competitor of Alibaba in IIoT was also interviewed in order to have a comprehensive picture of the IIoT industry. Due to the Coronavirus, the third round of interviews was conducted remotely in March 2020, with three managerial informants participating in some Alibaba IIoT projects. Besides first-hand interviews, I also used second-hand interviews of Alibaba executives published in news articles by the business press, online blogs, and books (e.g., McKinsey Quarterly, WSJ, Business ecosystems in China) and conducted by journalists in news programs (e.g., Bloomberg, CNBC, FT, tech.qq.com, Sina) to inform on the research questions.

Secondary data. For the secondary data, I extracted news, events, and reports related to Alibaba's ecosystem evolution from both English-language and Chinese-language websites. More than 20 books about Alibaba or written by Alibaba's employees, 42 case studies by Harvard

Business Review, and 37 academic studies on Alibaba were collected through a Google Scholar search. SEC files, press releases and analyst reports were also used. Alibaba's websites, blogs, news hubs (e.g., Alizila), and key conferences were reviewed and analysed.

See Table 8.2 for the summary of all data sources in Appendix 2 and Table 4.1 below for the match between data sources and Alibaba's stages of evolution. Historical events that happened in the past (before 2018) render some methods not applicable, "*where relevant informants may be unavailable for interview and relevant events unavailable for direct observation*" (Yin, 1981: 59). Therefore, I mainly relied on archival data and recalls from some informants for these historical events that happened before 2018.

Table 4.1 - Data sources and Alibaba's stages of change

Stages	**Stage 1**	**Stage 2**	**Stage 3**
Years	1999-2006	2007-2014	2015-2020
1) Interviews			
2) Participant observations			
3) Archival data			

Notes: Light grey means that only partial interviews covered associated stages.

4.4 Interviewee Selection

Interviewees were selected using the criterion of theoretical relevance and the snowballing technique (Eisenhardt, 1989; Yin, 1994). In total, 92 interviews were gathered. The interviews used a semi-structured protocol, each lasting approximately 1 to 3 hours.

For Alibaba's ecosystem, 26 interviews were conducted. The interviewees covered a wide range of positions in Alibaba (see Table 8.4 for details). 36 interviews were conducted with various provision-side participants in the Alibaba ecosystem. Generally speaking, there are three types of relationships between Alibaba and provision-side participants: 1) sales-related component collaboration (the New Retail initiative), 2) manufacturing-related component collaboration (the supET initiative), and 3) system collaboration (the A100 initiative). In total, nine firms were selected from all types of cooperation to ensure variation: New Retail (2 firms), A100 (3 firms), supET (1 IIoT platform and four firms). Table 8.3 in Appendix 2 shows the selected eight firms' descriptive information. The selection criterion is 1) the level of representation suggested by the informants of Alibaba, 2) covering different industries, 3) covering different sizes, and 4) having both public and private businesses. A high level of representation means a successful engagement of typical activities suggested by that type of collaboration. Where possible, multiple interviews

per firm were conducted to account for variance in perspectives. In total, I conducted 20 interviews with seven firms, five with government officials, and an IIoT joint firm in person. A Tsinghua collaborator conducted interviews with two firms on my behalf. I also conducted four interviews with Alibaba's two competitors.

In 2019, additional fieldwork was undertaken at the Alibaba One Business Conference in Hangzhou and other important conferences organised by Alibaba. At the conference, participation led to first-hand insights and interaction with senior managers and experts from Alibaba and other conference members. There were also frequent informal chats with Alibaba informants. All participants were guaranteed anonymity, and detailed field notes were written. Since Alibaba is a well-known company, the exact positions of interviewees have been abbreviated to protect anonymity. See Table 8.4 in Appendix 2 for the description of all informants.

Interview questions were open-ended and exploratory. The main questions for Alibaba aimed to understand the context of Alibaba's ecosystem, Alibaba's vision and strategy, how the ecosystem evolved, the triggers for each change and each initiative, Alibaba's benefits of collaborating with provision-side participants, types of provision-side participants Alibaba chose to collaborate with, Alibaba's contribution to provision-side participants, and Alibaba's strategy to get provision-side participants on board. For provision-side participants, informants were asked about how they participated with Alibaba, their rationale for participating, their benefits, their concerns, and how their participation changed over time. See Table 8.5 in Appendix 2 for the short list of interview questions.

4.5 Data Analysis

Data analysis consists of six stages: (1) writing a narrative account of Alibaba's platform ecosystems; (2) documenting a timeline of key activities; (3) distinguishing provision-side and consumption-side activities; (4) identifying the unit and level of analysis; (5) documenting the provision-side orchestration strategies; and (6) identifying a detailed list of Alibaba's key activities and writing the process model. Following the abductive approach, I extensively iterated between theory and emergent findings throughout the first half of the data analysis. Narratives in the result session integrate evidence and notes from different data sources: the same topic from different sources has been integrated, and the narratives have been organised around questions and propositions (Yin, 1981). The final case study represents a comprehensive analysis of data collected from various sources within the budget and time constraints.

Stage 1: Writing a case narrative. A narrative account of Alibaba's platform ecosystems was written based on many sources, including the field studies of 2018 and 2019, interviews and archival data (Pentland, 1999). There were in total 31 pages. The narrative involves Alibaba's four core ecosystems, success factors, and key strategies. See Appendix 3 for a shorter version of case narratives. These case narratives gave me a basic understanding of Alibaba's business model, mission, and key strategies.

Stage 2: Documenting a timeline of key events. A timeline of key activities during the evolution of Alibaba's ecosystem from 1999 to 2020 was documented based on data from primary and secondary data sources. This process enabled me to observe some exciting patterns that emerged.

Stage 3: Distinguishing provision-side and consumption-side activities. After having a basic understanding of Alibaba's core strategies and history, I observed a significant division of initiatives: 1) those targeted the consumption side and 2) those targeted the provision side. Therefore, I categorised these key initiatives based on whom they aimed to focus on to see if any patterns emerged. Provision-side initiatives such as New Retail, A100, and supET were identified, and consumption-side initiatives such as Double H, Live @ Alibaba, and 5 Global were documented. Combined with the theory review, this process helped me identify an important gap in the literature - the provision-side synergies and orchestration. It also enlightened me to explore further the underlying mechanisms that drove these initiatives, leading to the empirical study of ecosystem change and orchestration.

Stage 4: Identifying the unit and level of analysis. After obtaining a basic idea of the context and the theoretical gaps, I went on to identify the unit and level of analysis. Initially, I planned to focus on ecosystem synergies. In that situation, the unit of analysis is ecosystem synergies, and the level of analysis is ecosystem level. Later as I expanded the research to cover ecosystem change and orchestration, I came back to identify the unit and level of analysis for them. In terms of ecosystem change, the unit of analysis is ecosystem change. Although ecosystem change is an ecosystem-level concept, it involves and is a result of multi-level changes and thus was analysed in plural levels in this thesis. This is critical as ecosystems involve multiple stakeholders and levels of analysis (Hull, 1975), and focusing on only one level excludes the influences of other levels and ignores the intertwinement nature between different levels (Langley, 1999). Therefore, I touched upon both macro- and micro-level changes. In this thesis, macro-level

changes refer to broad factorial changes that shape the ecosystem as a whole (e.g., regulations, macroeconomic cycle, and technological upgrades), and micro-level changes refer to detailed behaviours of and interactions between ecosystem participants which are parts of the ecosystem, be them individuals or organisations. One thing I later came back to clarify is that my definition of ecosystems played a key role in defining my levels of analysis here. As I define ecosystems rather broadly as empowering engines that emerge and grow with the help of participants and empower participants in their own ways sustainably, they are by nature boundless. Therefore, ecosystems include not only direct ecosystem participants but also indirect participants, competitors, and the physical environment and society as a whole. Macro factors are thus parts of the ecosystem instead of hosting ecosystems. Regarding ecosystem orchestration, the unit of analysis is ecosystem orchestration. Similarly, given the multi-level characteristics of ecosystems, I studied orchestration activities conducted by the orchestrator and participants that target four key areas: (1) technology architecture, (2) orchestrator organisation, (3) institution, and (4) ecosystem adoption.

Stage 5: Provision-side orchestration. After crystallising the unit and level of analysis, I decided to focus on the provision-side initiatives first, given that limited research has been conducted on the provision-side orchestration. Each provision-side initiative was illustrated with cases: New Retail (2 firms), A100 (3 firms), and supET (1 IIoT platform and four firms). The chosen nine firms for the provision side were also briefly researched for case narratives.

After the case narratives, an initial line-by-line coding of all interviews and documents was conducted using the qualitative data software Atlas.ti 9 (Woolf & Silver, 2017). Conceptual categories derived in the theoretical development were leveraged for the initial coding scheme, e.g., various types of ecosystem synergies, benefits profiles (of ecosystem orchestrators, provision-side participants, consumption-side participants, and complementors), ecosystem dynamics, and orchestration strategies (Gioia, Corley, & Hamilton, 2013). The coding scheme started with these conceptual categories and then iterated and expanded while analysing data from fieldwork and archival sources. While coding, I realised that all key informants and secondary data emphasised the unique ecosystem synergies for the provision-side participants, i.e., operational efficiency enhancement, which is different from what the consumption side view typically focuses on, e.g., access to market and innovation efficiency enhancement. Because of the differences in benefits profiles, a key theme that kept emerging during interviews and archival data is the unique adoption

challenges for provision-side platforms, exerting a massive influence on the subsequent distinctive orchestrating strategies and evolutionary paths. For example, one key adoption challenge that prohibited Alibaba from scaling further into the provision side is the lack of industry-specific knowledge.

Stage 6: Alibaba's evolution and key activities. Following Langley (1999), I analysed how Alibaba orchestrated participants in the provision-side ecosystems (IIoT) to provide operational efficiency for provision-side participants. While analysing, I realised that Alibaba's provision-side orchestration strategies depend highly on the previous stages of Alibaba's evolution, as some key informants suggested. This path-dependency echoes Barley (1986)'s arguments about the interaction between the realm of action and the institutional realm: "*Since most technologies enter established contexts whose institutions will influence subsequent events, researchers must document traditional patterns of behaviour, interaction, and interpretation before the technology arrives*" (p 83). In other words, to fully comprehend how Alibaba orchestrated provision-side participants for enhancing operational efficiency since 2015, I needed to understand Alibaba's previous activities, strategic goals, and associated institutional contexts before the IIoT era. Therefore, after partially understanding provision-side orchestration, I returned to my data to develop an empirically grounded model explaining the process of Alibaba's evolution.

For data sources, I expanded the archival data to include key events from 1994. On top of the initial timeline documented in stage 2, a robust chronology of events pertaining to the Alibaba ecosystem since 1994 was then created. The approach is to analyse crucial events through triangulation to obtain a deep understanding of the underlying mechanisms. To ensure accuracy, I constantly compared data from different sources and understood narratives from different parties (Langley, 1999). To ensure simplicity and generality, I focused on critical events and underlying mechanisms while developing theoretical insights (Langley, 1999). First-order concepts were developed with iteration between theory and data (Gioia et al., 2013). For literature, I expanded my review to cover papers about ecosystem evolution dynamics and associated orchestration strategies. Like the provision-side orchestration coding scheme, I first leveraged conceptual categories from the literature review, including various ecosystem synergies, benefits profiles (participant-level), ecosystem architecture, governance, activities conducted by the ecosystem orchestrator and participants, and institutional activities. In addition, following Van de Ven and Poole (1990), I mapped out all stakeholders that contributed to the ecosystem evolution, including

Alibaba, employees, consumers, providers, complementors, global investors, start-ups, governments, educational organisations, research institutes, media, strategic partners, NGOs, the public, rural areas, industry associations, and non-human elements. While analysing the data, I noticed the emergence of several important themes, such as internal orchestration, platform spawning, ecosystem visions and missions, and ecosystem bottlenecks.

The process data analysis strategies I drew upon involve narrative and temporal bracketing (Langley, 1999). The phases were identified through the criterion that "*there is a certain continuity in the activities within each period and there are certain discontinuities at its frontiers*" (Langley, 1999: 703). Specifically, I identified three key phases of Alibaba's evolutionary path between 1999 and 2020 that differed in its key technology architecture and ecosystem visions. These breakpoints between phases were also suggested and perceived by informants as crucial shifts in Alibaba's history. After generating about 200 codes, I combine them with codes from the provision-side orchestration to comprehensively understand how Alibaba's ecosystem has changed from an e-commerce platform to an infrastructural provider. I iterated between theory and data to refine and challenge emerging understanding to ensure contribution to theories. Some codes have been deleted or combined with other codes due to repetition. Some codes have been developed to represent deeper mechanisms that drive other codes. Some codes have been added from existing theories to prevent duplication and to facilitate a contribution to theories. This process came out to be crucial – I managed to reorganise the code structure into four macro sections to explain ecosystem change: 1) macro-micro process; 2) intentional and emergent actions conducted by the ecosystem orchestrater; 3) emergent actions conducted by ecosystem participants and other stakeholders that contribute to ecosystem change; 4) micro-macro process. After adjusting with concepts from extant literature, I then arrive at the final code structure and framework (see Table 8.6, Table 8.Error! Unknown switch argument. and Table 8.8 in Appendix 5).

Throughout the process of data analysis, the trustworthiness of the findings has been ensured by four methods (Lincoln & Guba, 1985): (1) reflexivity by the discussion of emerging findings between supervisors and me (Alvesson, Hardy, & Harley, 2008); (2) constantly checking with respondents to validate emerging interpretation (Locke & Ramakrishna Velamuri, 2009); (3) using both real-time and retrospective data from several sources for triangulation (Eisenhardt & Graebner, 2007); and (4) keeping an audit trail throughout the data analysis process to document every step taken (Lietz, Langer, & Furman, 2006).

4.6 Conclusion

This chapter documents the research methodology for the thesis. I chose the Alibaba ecosystem as the research context and abductive reasoning as the epistemological approach. My data sources cover primary and secondary data, and data analysis was conducted using the qualitative data software program Atlas.ti 9. Data analysis consists of six stages, and the final case study represents a comprehensive analysis of data collected from various sources within the budget and time constraints.

5 THE ALIBABA ECOSYSTEM

"We believe that we are heading toward a new synthesis, a new naturalism. Perhaps we will eventually be able to combine the Western tradition, with its emphasis on experimentation and quantitative formulations, with a tradition such as the Chinese one, with its view of a spontaneous, self-organizing world."

Prigogine and Stengers (1984: 22)

So far, I have reviewed various frameworks relating to ecosystem synergies, organised them into five themes, and revealed their interrelations and assumptions. After that, I examined the literature on ecosystem change and orchestration by classifying screened studies into five streams and surfacing the dominant dualism assumption about emergent and intentional changes. After exploring theoretical concepts and frameworks, I now move to present my results of an empirical study about the Alibaba ecosystem and discuss how it poses challenges and provides opportunities to refine extant research on ecosystems. Note that although I present theories and empirical results linearly, my research process was iterative, meaning I jumped back and forth between theories and data (Eisenhardt, 1989). Novel phenomena I observed during my fieldwork prompted me to read related literature, and reviews of related literatures enabled me to see phenomena in new ways. Therefore, I base my conclusions on existing theories and data from various sources, including extensive secondary data, primary interviews, and on-site participant observations. In the following, I discuss my analysis of the Alibaba ecosystem case and highlight surprising findings towards ecosystem synergies, change, and orchestration in the discussion area of this chapter. I will elaborate on the general contribution to theories in the Discussion chapter.

My analysis of the Alibaba ecosystem revealed that, from 1999 to 2020, Alibaba evolved through three key phases: 1) phase 1 – platform empowering (1999-2006), 2) phase 2 – ecosystem empowering (2007-2014), and 3) phase 3 – infrastructure empowering (2015-2020). As I mentioned in the above Methodologies chapter, these three phases were identified by the criterion that "*there is a certain continuity in the activities within each period and there are certain discontinuities at its frontiers*" (Langley, 1999: 703). These breakpoints between phases were also suggested and perceived by my informants as crucial turning points in Alibaba's history. Inspired by Henfridsson and Bygstad (2013) and Coleman (1986) while respecting findings that emerged from the case, I organised Alibaba's ecosystem change into four key processes: 1) *macro-micro*

process refers to the process through which endogenously generated and new macro factors trigger and support micro-level behaviours, 2) *intentional and emergent actions of ecosystem orchestrators* address micro actions taken by ecosystem orchestrators, 3) *emergent actions of participants* refer to the unpredictable micro behaviours of ecosystem participants other than ecosystem orchestrators, and 4) *micro-macro process* explains the emergent process where participants' actions and their interactions drive unexpected ecosystem outcomes and, when reaching a tipping point, engender existing ecosystem vision and architecture constraining. A new phase of ecosystem change is then triggered and supported by endogenously generated and new macro factors to restart the process.

Specifically, four key areas of ecosystem orchestrator-led activities emerged in my data analysis: 1) architectural activities, 2) adoption activities, 3) internal activities, and 4) institutional activities. *Architectural activities* refer to the technical design of the ecosystem architecture, which defines an ecosystem's overall technical structure, the quantity of layers and platforms, how platforms are partitioned into modules, how modules are decoupled and recombined, the interfaces between platforms and modules, the interdependencies between modules and platforms, and how modules are allowed to be varied (Baldwin, 2015; Tiwana et al., 2010). *Adoption activities* specify actions taken by ecosystem orchestrators to encourage and support participants in adopting ecosystem services that contribute to ecosystem sustainable growth. Given that realising ecosystem synergies depends on participants' adoption, this activity theme stood out from my data to play a key role in driving ecosystem change and sustainable growth. *Internal activities* refer to the adaptive activities taken by the ecosystem orchestrator internally to support the orchestrator's organisational performance and ecosystem sustainable growth. The co-evolvement of Alibaba and the ecosystem emerged from my data as an essential factor in driving ecosystem change, and its importance became increasingly salient as time passed. *Institutional activities* focus on the contextual fields where all participants operate and are influenced by, emphasising institutions' supporting and constraining role (Lawrence & Suddaby, 2006: 215). I summarise the key findings in Table 5.1 below to provide general guidance. Each phase is characterised by its unique ecosystem phasic vision, types of participants, synergies, orchestration activities, and specific processes in ecosystem change. Building on Zeng (2018b), I define ecosystem phasic vision as the overarching goals that guide collective actions in that phase.

Table 5.1 - Three key phases of Alibaba's evolution

	Phase 1 1999-2006	**Phase 2** 2007-2014	**Phase 3** 2015-2020
Mission	**"To make it easy to do business anywhere."**		
Phasic vision	**Platform empowering**	**Ecosystem empowering**	**Infrastructure empowering**
Direct ecosystem participants and associated participant-level benefits	***Providers (Retail and wholesale sellers)*:** market access, reduced transaction costs ***Consumers (Buyers):*** market access, convenience in transaction ***Service providers:*** market access	***Providers (Retail and wholesale sellers):*** market access, reduced transaction costs, marketing, finance, and innovation ***Consumers (Buyers):*** convenience in all areas of life ***Complementors (Service providers, app developers, and other third-party participants):*** market access, increase in sales and ease of development ***Employees:*** Operational efficiency enhancement	***Providers:*** market access, operational efficiency enhancement ***Consumers:*** convenience in all areas of life ***Complementors*:** market access, operational efficiency enhancement ***Employees*:** operational efficiency enhancement ***Organisations*** (***Governments*:** operational efficiency enhancement, ***University and research org*:** operational efficiency enhancement, ***NGOs*:** operational efficiency enhancement**,** ***Start-ups*:** operational efficiency enhancement**,** ***Media*:** operational efficiency enhancement**,** ***Society*:** operational efficiency enhancement and social value, ***Competitors*:** operational efficiency enhancement, and ***Non-human elements such as the physical environment*:** environmental protection) ***Industries:*** operational efficiency enhancement ***Regions:*** operational efficiency enhancement
Indirect ecosystem participants	***Employees, investors, governments, universities, competitors, society***	***Investors, governments, universities and research organisations, media, NGOs, start-ups, competitors, society, non-human elements such as the physical environment***	
Ecosystem synergies (newly added)	***Support generative changes through:*** - Two-sided network effects - Trust and reputation systems - Consumption-side complementarities ***Share generic resources for efficiency and optimising:*** - Technological architecture (IOE), standardised interfaces and markets - Transaction efficiency	***Support generative changes through:*** - Direct and indirect network effects - Data-driven learning and data network effects ***Stack generic resources for efficiency and optimising***: - Cloud services, standardised interfaces, markets, generic modules, tools, logistics, data - Transaction and innovation efficiency ***Sustainable growth***	***Support generative changes through:*** - Network effects among organisations, industries, and regions ***Stack generic resources for efficiency and optimising***: - Data, knowledge, and capabilities - Operational efficiency - Large-scale customisation ***Sustainable growth***
Macro-micro processes	***Trigger***: New technologies, infrastructural gap opportunities, and macroeconomic cycle ***Support***: Regulatory support, demographic advantages, and geographical advantages	***Trigger***: Path-dependent ecosystem bottlenecks ***Support***: Regulatory support, macroeconomic cycle, and increased internet access and broadband penetration	***Trigger***: Path-dependent ecosystem bottlenecks ***Support***: Regulatory support, thriving VC market, new technologies and booming middle class
Architectural activities	***Develop architectural support*** - Adopt a monolithic architecture with simplicity - Adapt the architecture incrementally to meet growing demands	***Update architectural design*** - Shift to a micro-service distributed and open architecture to solve performance bottlenecks - Take off IOE, embrace open source and develop own core technology system to solve cost bottlenecks - Develop the Data Middle Platform to enhance data management and utilisation efficiency	***Restructure architectural design*** - Shift to the cloud-native architecture to enhance efficiency and scalability - Adopt the "thick generic platforms and thin front-end applications" framework to enhance reutilisation, efficiency, and scalability - Adopt the "1+N model" to enhance sharing and support industry-specific platforms
Internal activities	***Develop internal support and adaptation*** - Acquire resources through visionary leaders and an altruistic culture - Promote internal incubation and updates for adaptation	***Conduct internal consolidation and systematic updates*** - Enact Shared Service Division, One Company strategy, Decouple, and leadership rotation to enhance internal synergies - Set up the Horse Racing process to systemise internal incubation - Develop ecosystem-friendly KPIs and social enterprise governance mechanisms	***Enact platformed architectural reform*** - Launch the Middle Platform Strategy to enhance synergies and adaptation - Streamline and integrate for coherence and synergies - Incubate platforms as pilots to experiment and demonstrate innovations
Adoption activities	***Incentivise platform adoption***	***Promote ecosystem adoption***	***Foster infrastructural adoption*** - Neutralise risks to reduce mistrust and support adoption

	- Promote free models and subsidies to reduce adoption barriers - Provide value-added services to enhance adoption benefits - Solve trust issues and ensure safety to reduce adoption concerns	- Leverage dynamic enabling to develop new markets and enhance platform adoption - Spawn platforms to increase ecosystem adoption and enhance data gathering - Ensure fairness and protect rights through nine principles to reduce opportunistic behaviours	- Leverage generality and interoperability to attract a wide range of adopters - Prioritised demonstration and customisation to showcase successful pilots and concepts in vertical fields - Synchronise activities across boundaries for simultaneous adoption and synergies - Leverage collaborative and digital regulation to reduce opportunistic behaviours
Institutional activities	***Build legitimacy and signal new institutions*** - Obtain credibility by aligning goals to support resource acquisition and adoption - Share e-commerce knowledge and cultivate e-commerce talents	***Maintain legitimacy and develop new institutions*** - Get buy-ins from incumbents and governments to reduce concerns and legitimate expansion - Develop a new civilisation with a wider range of participants to support expansion and knowledge diffusion	***Enhance legitimacy and diffuse new institutions*** - Align with the government to reduce monopoly concerns and enhance legitimacy - Leverage training, conferences, and white papers to systematically diffuse new institutions
Emergent actions of participants	***Suggest new opportunities*** - Present new demands - Propose new roles - Present win-win opportunities - Present pressure for differentiation	***Suggest new opportunities*** - Present new demands - Propose new roles - Present win-win opportunities - Present pressure for differentiation	***Suggest new opportunities*** - Present new demands - Propose new roles - Present win-win opportunities - Present pressure for differentiation
Micro-macro processes	***Expand***: Ecosystem synergies and re-envision ***Constrain***: Performance and cost bottlenecks	***Expand***: Ecosystem synergies and re-envision ***Constrain***: Performance and scalability bottlenecks	

5.1 Phase 1 – Platform Empowering (1999-2006)

"What is needed in 10 years, we start to do it today!"

- Jack Ma

The ecosystem vision for the first phase – platform empowering - was cemented when Alibaba officially launched in 1999. Specifically, its phasic vision at that time was: "*to become the number one destination for buyers and sellers at small- and medium-sized enterprises (SME's) to find trade opportunities, promote their businesses and conduct transactions online*" (Alibaba Press Release, December 19, 2000). The vision came with a mission that "*remained constant throughout the life of the company*" - "*To make it easy to do business everywhere*" (Zeng, 2018b: 144). Inspired by his US trip through which he first encountered the Internet, Jack Ma, the key founder, articulated the vision with more nuances: "*From the first day we started Alibaba, we had three main goals. We want Alibaba to be one of the top ten websites in the world. We want Alibaba to be a partner to all business people. And we want to build a company that lasts 80 years*" (Erisman, 2015: 13). Later, the number of years that Alibaba aimed to last was updated from 80 to 102 years to "*cover at least three centuries*" (Jack Ma and A24 I interviewed), but the principle remains the same – to have a sustainable business that aims for long-term growth.

Jack Ma and Ming Zeng (the Strategy Advisor of Alibaba) mentioned in their various speeches that this vision was a direct guide and direction for Alibaba's strategy and actions in the following ten years. While the mission came from the "*heart*" to represent the change Alibaba aimed to make in the world, the vision articulated the future and how the Alibaba ecosystem could evolve to get there. Without a vision that served as "*an assumption of the future*", ecosystems would develop like "*a blind man feels an elephant - he will not be able to figure out a whole picture in the end*" as there was no starting point to iterate with (Souhu News, Ming Zeng, January 16, 2020). Jack Ma also emphasised thinking big in the vision design and truly believing in it to guide day-to-day actions, "*So we proposed to be a top 10 website at that time, today it developed faster than we imagined. After 17 years, we still believe that we have the potential to become a top 10 website. But at that time, you couldn't even achieve that with a missile. But if you don't think about it and aim for it, do you think you can achieve that?... With this vision, the strategic steps you design are different (than without). With this vision, the people you hire are different (than without). With this vision, the KPI you design is different (than without). If you don't have this vision, you will never find someone with a similar vision to join Alibaba."* While setting a vision is important

to guide actions, it is also changeable, phasic and fine-tuned periodically because of emergent changes. But in this phase, Alibaba was guided by its mission and phasic vision of platform-empowering without significant quality changes. Alibaba became the world's leading e-commerce platform seven years later and initiated its first IPO of Alibaba.com in Hong Kong in 2007, marking the success and end of the platform-empowering phase. In the following, I map out the key ecosystem participants and discuss ecosystem synergies specific to this phase before explicating the processes and activities underlying the change.

Ecosystem participants. Direct ecosystem participants in this phase included providers (sellers), consumers (buyers), and service providers. Buyers and sellers joined the Alibaba ecosystem for market access and reduced transaction efficiency. Service providers obtained market access by joining the Alibaba ecosystem while providing key value-added services for Alibaba to promote ecosystem adoption from buyers and sellers. At this phase, service providers were limited and selected by Alibaba for users to choose from, and complementarity synergies occurred on the consumption side. For example, the leading logistics providers that joined the Alibaba ecosystem to co-create the Freight Forwarding Quotation and e-Contract System were able to gain access to Alibaba's sellers and buyers and digitalise part of their supply chain. Trade show organisers also benefited financially by joining the Alibaba ecosystem in 2006 by tapping into Alibaba's community of buyers and sellers. China Post gained access to Alibaba's online platform and communities to enhance its profits by joining forces with Alibaba to co-develop parcel delivery and money remittance services in 2006. These service providers were coordinated by the ecosystem orchestrator Alibaba to together produce value-added services and higher returns than the uncoordinated equivalents.

Indirect participants also benefited from and provided benefits to the Alibaba ecosystem development. Employees provided human capital in return for salaries, "*enhanced capabilities, happiness*" (Alibaba CSR Report 2007) and a sense of purpose. Investors provided capital in exchange for "*good financial returns*" (Alibaba CSR Report 2007). Governments offered legitimacy and at the same time satisfied their KPIs. Universities worked with Alibaba to develop new educational materials, accelerate knowledge diffusion, and train e-commerce talents. Competitors provided coopetition opportunities. The society provided Alibaba with contextual support while benefiting in areas such as "*alleviating employment problems, supporting the disadvantaged*", and "*having the internet trust system*" (Alibaba CSR Report 2007). Although

these non-key participants have not been the direct users of Alibaba's core services, they benefited indirectly and played important roles in Alibaba's development by providing resources and win-win opportunities.

Ecosystem synergies. Key ecosystem synergies covered two dimensions at this phase: 1) supporting generative changes for variety and 2) sharing generic resources for efficiency. Generative changes were realised through two-sided network effects, trust and reputation systems, and complementarities.

Support generative changes through two-sided network effects. Specifically, two-sided network effects involved "*a "virtuous circle": More merchants and product listings meant more shoppers were attracted to the site, which meant more merchants and products, etc.*" (Clark, 2016: 72). Specifically, this network effect happened in all three e-commerce sites: 1) Alibaba.com linked merchants from China and other countries, 2) 1688.com connected Chinese wholesalers and retailers, and 3) Taobao.com connected small Chinese retailers to Chinese consumers.

Support generative changes through trust and reputation systems. Trust and reputation systems could be seen in the online and offline community Alibaba proactively developed, fostering generative changes through trust, knowledge exchange, belonging, and reputation among participants. Programs such as discussion forums facilitated interactions among sellers and provided them with a sense of community where learning and knowledge sharing happened. Reputation can also be gained through programs such as the online Feedback Forum, "*a live online platform in which members with TrustPass can view and post comments on the quality and service levels of other members*" (Alibaba Press Release, September 10, 2001).

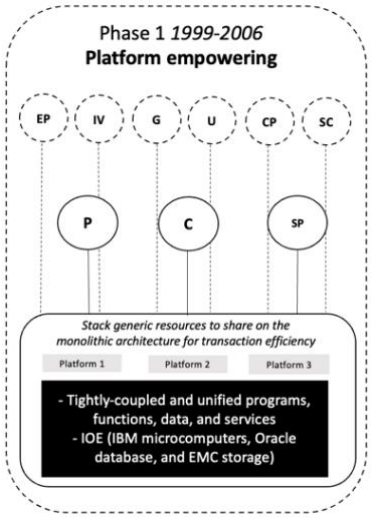
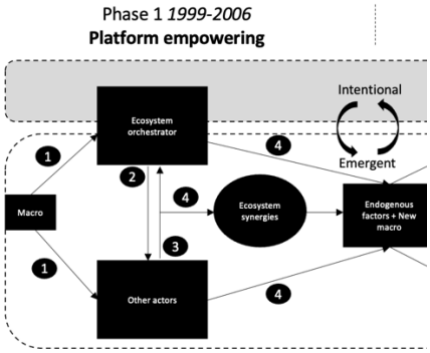
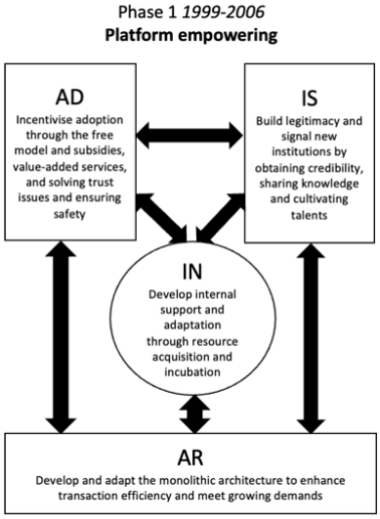
Support generative changes through consumption-side complementarities. Complementarities, in the form of co-providing services with ecosystem service providers through contractual mechanisms such as logistics, TrustPass, Alipay and SME loan programs, enhance participants' utility when using these services together and thus increase the variety and number of buyers and sellers.

Stack generic resources for sharing and optimising. Besides increased variety, generic resources could be shared in the Alibaba ecosystem for efficiency at this phase, including technological architecture (IOE), standardised interfaces and markets. Through sharing generic resources across a wide range of participants in e-commerce, transaction efficiency can be enhanced and value propositions can be optimised with limited geographical constraints.

Specifically, transaction efficiency between domestic buyers and sellers in wholesale markets can be enhanced by using the same e-commerce platform called 1688.com and in retail markets can be enhanced by using Taobao.com. Transaction efficiency across borders can be enhanced by sharing the same cross-border platform called Alibaba.com. For each participant, the transactions they obtain through the shared platforms are the optimised results, e.g., price and variety of offerings.

In the following, I will detail how Alibaba emerged and evolved in the first phase. See Table 5.2 for the graphical illustration of ecosystem synergies, ecosystem change and associated orchestration strategies and Table 8.6 in Appendix 5 – Findings for the code structure and representative quotes.

Table 5.2 - Alibaba phase 1 ecosystem synergies, change and orchestration

Ecosystem synergies	Ecosystem change	Ecosystem orchestration
		
Direct participants (solid circles): **P**: Providers, **C**: Consumers, **SP**: Service providers **Indirect participants** (dash circles): **EP**: Employees, **IV**: Investors, **G**: Government, **U**: Universities, **CP**: Competitors, **SC**: Society **Support generative changes through:** - Two-sided network effects - Trust and reputation systems - Consumption-side complementarities **Share generic resources for efficiency and optimising:** - Technological architecture (IOE), standardised interfaces and markets - Transaction efficiency	**1**: Macro-micro processes **2:** Actions of orchestrators **3:** Actions of others **4:** Micro-macro processes	**AR**: Architectural activities **IN**: Internal activities **AD**: Adoption activities **IS**: Institutional activities

Macro-micro processes. My data suggest that the launch of Alibaba was triggered and supported by multiple macro factors around 1999, including technology advancement, regulatory support, macroeconomic cycle, infrastructural gap, and demographic and geographical advantages. How exogenous events impacted subsequent events depended on actors' interpretations and their embedded contextual environment (Barley, 1986). To start with, the advancement of digital

technologies triggered new value-creation opportunities. In this case, the Internet that emerged around the 1990s opened new ways of obtaining information and conducting transactions online, as illustrated by Alibaba in 2001: "*Thanks to Alibaba.com and its most important tool, the Internet, 1,000,000 corporate representatives from 202 countries and territories can easily meet and do business online*" (Alibaba Press Release, December 27, 2001). Inspired by his trip to the USA where he witnessed the Internet future, Jack Ma was motivated to start an Internet company in China to apply this new technological innovation. The infrastructural gap in China further confirmed the promising opportunities to bring the Internet to China. On top of that, the macroeconomic cycle ignited the urgency of launching Alibaba at that time. Dot-com companies were valued at an inflating price at that time: Sina raised 25 million in 1999, Sohu raised 10 million in 1998, and NetEase raised its series A in 1999, serving as a strong motivation for Alibaba to "*catch the attention of VCs or catch up with the portal pioneers*" (Clark, 2016: 44-45).

Besides triggering, supporting processess also played a crucial role in Alibaba's launch, including regulatory support, demographic advantages, and geographical advantages. Specifically, government policy, "informatisation", helped Alibaba to take off by making the Internet more affordable: "*in March 1999, the government scrapped the installation fee for second phone lines and made it cheaper to surf online, too, cutting the average price from $70 per month in 1997 to only $9 by the end of 1999*" (Clark, 2016: 45). China's entry into the WTO at the beginning of the 2000s enabled opening up of Chinese market and opportunities of internationally minded entrepreneurs who could seek opportunities to draw inspirations from abroad (Tse, 2015). China's scale and rapid growth fueled Alibaba's potential success, meaning that potential Alibaba users were large in number and had massive room for benefits if adopting the Internet (Tse, 2015). The advantage of Hangzhou (where Alibaba's headquarter was) relative to Beijing and Shanghai was reflected in cheap labour costs, low turnover, and distance from the central government (Liu & Avery, 2021). In sum, macro factors triggered and supported the context-specific micro-level interpretations and actions, leading to the launch of Alibaba and the design of its first ecosystem phasic vision – platform empowering in 1999. See Appendix 3 – Case Narratives for details of some emergent pre-launching processes from 1994 to 1999.

Jack Ma and his founding team materialised their interpretations of these macro factors by launching the first e-commerce website Alibaba.com in 1999. Other participants co-evolved with Alibaba with the influence of Alibaba's orchestration to together unleash the ecosystem synergies

enabled by e-commerce transaction platforms. My data revealed that no one knew how exactly Alibaba was going to develop at that time; Alibaba's moves did not involve much planning, as illustrated by Jack Ma: *"If you plan, you lose. If you don't plan, you win."* (Tse, 2015: 23). Although with little planning, Alibaba did proactively look into the future and design vehicles to motivate collective actions for ecosystem synergies to materialise, including the ecosystem mission "*to make it easy to do business anywhere*", a changeable phasic vision - platform empowering, and a disciplined way to experiment and iterate the vision by "*constantly looking for the right combination of opportunity and competence…bring together the biggest opportunity and the most important leverage point*" (Tse, 2015: 23). Comprehensively, four themes of activities were orchestrated in this phase to support Alibaba's emergence: 1) develop architectural support, 2) develop internal support and adaptation, 3) incentivise platform adoption, and 4) build legitimacy and signal new institutions.

Develop architectural support. My data shows that developing a solid technological architecture was essential to support Alibaba's vision of becoming China's number one e-commerce platform as transactions online relied heavily on sharing stable and reliable digital foundations and interfaces. Initially, Alibaba developed a monolithic architecture on traditional mainframe and storage equipment and built it with technologies mostly from abroad. As Alibaba evolved, rapid increases in visits and data pushed Alibaba to fine-tune this monolithic architecture incrementally so as to satisfy emerging needs and enhance storage and process capabilities.

Adopt a monolithic architecture with simplicity. According to Taobao engineers, Alibaba developed Taobao from a purchased website based on a monolithic architecture: LAMP (Linux + Apache + MySQL + PHP). They decided to purchase this website because purchasing was easier than developing themselves, and it had "*relatively low maintenance costs*" and was "*able to expand easily with low secondary development costs" (Zhao, 2013: 13)*. Specifically, LAMP was a typical website architecture with advantages such as "*no need to compile, fast release, powerful PHP language, can do everything from page rendering to data access, and the technologies used are open source and free." (Zhao, 2013: 13)* After purchasing, they conducted numerous incremental customisation and improvements to ensure this architecture and associated functions and formats can work in the Chinese contexts. For example, updates could involve adjusting some data formats, increasing functions such as backstage management, and adding Alibaba-specific content. This monolithic architecture was characterised by 1) programs and functions were tightly rather than

loosely coupled, 2) all components had to be present in order to allow codes to be executed and applications to run, 3) the architecture was single-tiered, meaning every application is composed of multiple components (some are repetitive across applications) and 4) any changes to an application requires the redeployment of the entire application. Although it had some advantages, such as being simple and easy to install, the monolithic architecture suffered disadvantages, such as a lack of scalability and agility. These downsides led to a huge size of codebases that became cumbersome to manage when the ecosystem reached the end of phase one.

Adapt the architecture incrementally to meet growing demands. After the initial architecture was set up, rapid adaptation followed in response to increased users. This was to ensure delivering services effectively, efficiently, and reliably. At the end of 2003, due to rapid transaction increases, Alibaba replaced MySQL (free) with Oracle SQL (paid), a database management system with higher capacity, stability, safety and performance. Oracle also seemed to be a better choice because Alibaba had a good number of Oracle experts to support this technology. In 2004, due to again the rapid increase in not only visits and data in Taobao but also growing functionalities proposed by users, Alibaba shifted to Java language. Java was advantageous in saving development costs because it was the most mature website development language with wide adoption and well-trained and cheap talents to maintain. At the end of 2004, Alibaba used the IOE (IBM microcomputers, Oracle database, and EMC storage) IT architecture to address the rapid increase in visits and data. However, at the end of 2005, Taobao had 16.63 million products, 89.91 million pages per view, and 13.90 million registered members, putting enormous pressure on data storage and processing. To help store and process this large scale of data effectively and efficiently, Alibaba again did some incremental updates, such as incorporating a search engine, cache, and Content Delivery Network (CDN).

Develop internal support and adaptation. Besides the technical architectural activities that targeted the tech employees and broader tech community, Alibaba also developed strong internal support for successful ecosystem emergence by 1) acquiring resources through visionary leaders and an altruistic culture and 2) promoting internal incubation and updates for adaptation. These internal activities proved to play an increasingly important role as Alibaba evolved to later phases.

Acquire resources through visionary leaders and an altruistic culture. Emerging from my data, the critical resources for Alibaba at the initial stage were human and financial capital. Alibaba obtained vital human resources by following visionary leadership and an altruistic culture. Jack

Ma is a visionary, experienced, and selfless leader who can sell a promising future. His charisma and selfless nature helped Alibaba attract a team of devoted talent, even with limited legitimacy and certainty initially. Specifically, he showed his conviction for the future by devoting his resources, such as his house and money. Such altruistic behaviours at the initial stage also promoted loyal followers to contribute their resources selflessly, whom Joe Tsai called "*disciples*" (Clark, 2016). His passion for English and charisma also helped him attract international talent and investors for his global expansion plan, which I will discuss later in the institutional activities. Besides Jack's character, a culture of selflessness and family was cultivated inside Alibaba to ensure continuous inflows of loyal employees (Tse & Li, 2022). For example, from the start, Jack Ma leveraged the culture of Knight and its discourses to showcase how Alibaba operated. The Knight culture asked all employees in Alibaba to have their second name from famous Knight stories, making everyone unconsciously equipped with Knight's spirit in work which normally refers to helping others with righteousness and generosity. Everyone in the company calls each other the second name. Knight's words also labelled the company value, such as Nine Swords of Solitude in 2000 and Six Vein Excalibur in 2004. Besides the famous Knight culture, in 2003, Alibaba also promoted a Family Culture to enhance the legitimacy of selfless contribution. Culture played a crucial part in attracting devoted employees at the beginning.

Promote internal incubation and updates for adaptation. While resource acquisition solved Alibaba's resource gap, internal incubation and updates helped Alibaba to adapt to internal and external changes. Alibaba "*has strong internal incubation capabilities*" (A14 and many other informants I interviewed), which helped Alibaba to develop new platforms for niched e-commerce opportunities, innovate on new revenue streams, and develop new complementary services to satisfy emerging demands. Many data sources show that an apartment in the Hupan Garden, the launch place of Alibaba and Ma Yun's house, served as the incubation location for many projects in Alibaba and thus "*has a strong symbolic significance that Alibaba is and remains an entrepreneurial firm*" (A24 I interviewed). Specifically, new platforms and services were incubated internally in response to competition and newly emerged demands. The first niche marketplace was china.alibaba.com (later changed to 1688.com), a Chinese marketplace for domestic wholesale trade. Unlike the first English website Alibaba.com which connects importers and exporters, 1688.com was incubated in 1999 to satisfy users' unanticipated and emerging needs for a Chinese wholesale website that connects Chinese wholesalers and retailers. The second niche

marketplace was Taobao.com, which connects small retailers to Chinese consumers. It was incubated from the Hupan Garden and launched officially in 2003 to compete with eBay, which entered the Chinese market in 2002 as a C2C retail marketplace. Although Alibaba has not predicted niche platforms, these new platforms, driven by emerging demands and competitions, expanded the scope of the Alibaba ecosystem while still working towards the vision set up by Alibaba in 1999. Note that although these two were the only platforms that survived and succeeded, many other platforms were incubated during this period but did not succeed. Alibaba's role during this period is to promote internal experimentation and then to pick the successful incubations to scale. Besides new platforms, Alibaba also incubated complementary services in response to revenue pressure and emerging demands. For example, after leveraging external finance to support the free model for several years, pressure to generate revenue became prominent. Internally, Alibaba put pressure on employees to come up with new revenue streams, as detailed by Erisman (2015), "*the company launched a new initiative each day, trying to find a product idea that would generate revenues and cover the company's growing costs. We tried banner ads, revenue-sharing partnerships, website development for small businesses. We tried everything, but nothing stuck. It was a race for revenue"* (p. 22). Eventually, an initiative called the TrustPass service successfully charged users and thus became a sustainable revenue stream for Alibaba. New complementary services other than the core offering of e-commerce websites were also incubated by first operating as an integrated function of e-commerce platforms and then, if proved successful, spawned out as a separate team or entity. For example, Alipay was also incubated from the Hupan Garden and first launched in 2003 as a prototype to ensure a trustful payment process. By 2004, Alipay was only an integrated tool of marketplace platforms in the Alibaba ecosystem to drive adoption by solving trust issues. In 2004, Alipay was spawned as a separate entity, gradually shifting from an integrated tool to a separate payment system. Alipay's rapid adoption contributed significantly to the robust growth of Alibaba's e-commerce platforms, thus revealing the necessity to have its team. During these rapid internal incubations, signs of potential chaos emerged as new teams and departments were formed and disbanded quickly. Moreover, inefficiency became noticeable as each e-commerce platform and project operated as a separate subsidiary inside Alibaba once it was proved successful, meaning each had its team without sharing staff, resources, or services. Nonetheless, these strong internal incubation capabilities helped Alibaba to adapt successfully to

internal and external changes in the initial phase when the number of participants and applications were relatively small.

Incentivise platform adoption. Apart from the tech community and internal employees, direct ecosystem participants played a crucial role in Alibaba's emergence and ecosystem synergies. Given that ecosystem synergies for transaction efficiency relied on the participation of sellers and buyers, incentivising adoption was crucial. To achieve the platform-empowering vision, Alibaba incentivised platform adoption through three key strategies: promoting a free model and subsidies to reduce adoption barriers, providing value-added services to enhance adoption benefits, and solving trust issues to reduce adoption concerns. I elaborate on each in the following.

Promote free models and subsidies to reduce adoption barriers. The first salient strategy that emerged from my data to incentivise adoption was the pecuniary one - a free model and subsidies. Jack Ma has the tenet of "*if you build it, they will come*" (Clark, 2016: 54), and he responded to investors in 2000, "*There are lots of ways we can make money someday. But right now our website is totally free, because we want to attract new members. Once our members make money, we will make money.*" (Erisman, 2015: 17). Following Jack Ma's lead, posting listings on the website is free for sellers and buyers on Alibaba.com and Alibaba helped vendors with translation for free so that these vendors can attract buyers from abroad. This free model played a key role in driving adoption in the early phase and staying ahead of rivals for Alibaba.com: by the spring of 2000, more than a thousand new members a day were signed up. Similarly, my interviews and several archival data show that, to combat eBay, which argued for charging websites for sustainable growth, Alibaba focused on bringing in as many sellers to Taobao.com as possible by actively offering no charges or rebates during a set of times or at certain events. After three years of such a free model, Taobao published another "*free for three years*" marketing push in 2005 (Alibaba Press Release, October 20, 2005). Only after successfully accumulating a critical mass of sellers in 2005 did Taobao start to attract buyers (Zeng, 2018b). These numerous pecuniary incentives proved very effective for gaining early adoption of platforms as well as fending off competitors when certainty and legitimacy were low at the beginning. China's unique cultural arrangements also helped: China has a low-trust environment, and "*people wanted to try something first before they had to pay for it*" (Erisman, 2015: 38). Ensure being free also served as an excellent opportunity to get to know the needs of participants, validate the platform business model and popularise online shopping behaviours (Alibaba Press Release, October 20, 2005). As Jack

predicted, once early adopters obtained transactions from the platform, they became sticky to it and developed loyalty (Erisman, 2015).

Provide value-added services to enhance adoption benefits. Besides pecuniary strategies, my data shows that Alibaba also leveraged non-pecuniary ones – providing value-added services – to foster adoption. Jack Ma mentioned in 2004 that "*The survival and growth of Taobao are not because of free service…Taobao is more eBay than eBay China [because] Taobao pays more attention to user experiences*." (Clark, 2016: 74). The better user experiences Jack mentioned include a wide range of value-added services. To start with, Alibaba designed the website strictly following the Chinese taste – packed with graphics, pop-ups and information instead of clean and standardised in the West. Alibaba also proactively hosted online and offline gatherings of buyers and sellers to facilitate knowledge sharing, increase sales, and keep participants up-to-date on industry information. In 2002, keyword bidding services were launched on Alibaba's international marketplace to create more sale opportunities for sellers. In 2003, Alibaba launched its TradeManager instant messaging software to facilitate direct and real-time communications between buyers and sellers. In 2004, Alibaba launched an escrow account system to facilitate trustful payments between buyers and sellers when no credit cards and/or remote payment options were available in China. Also, around 2004, Taobao built an instant-messaging service called Aliwangwang to help with customer interactions before, during, and after transactions to develop trust between sellers and buyers and thus increase sales, a classic example of user-driven innovation. In 2005, Alibaba acquired Yahoo! China to "*integrating search in our development of e-commerce*" (Shiying & Avery, 2009: 160). These value-added services emerged from the demands of potential and existing adopters and increased platform attractiveness and participants' utility when offered together.

Solve trust issues and ensure safety to reduce adoption concerns. Besides providing benefits, Alibaba also worked on solving pain points to increase platform adoption. The key pain point of e-commerce lay in the lack of trust: "*Suppliers worried that customers they had never met might never pay for their orders. Buyers overseas were concerned about fake or defective goods, or shipments that never arrive*" (Clark, 2016: 55). To remove this trust concern, Alibaba developed trust systems with feedback from online and offline communities and third parties. Specifically, Alibaba launched the Partner Feedback Forum in 2001, an open feedback online forum "*in which members with TrustPass can view and post comments on the quality and service levels of other*

members" (Alibaba Press Release, September 10, 2001). Users can learn from others on Alibaba's online platform through reviews and comments on product or service innovations and provide feedback. Offline trust-building events were also leveraged in the form of offline gatherings and knowledge-sharing meetings when members actively met to discuss business and deepen friendships. Alibaba also actively organised national road shows where customers were invited to member gatherings, and Alibaba could have the opportunity to meet customers in person for trust building (Erisman, 2015). Further, feedback and reputation can also be issued by a third party. Specifically, in 2001, Alibaba collaborated with the Credit Management Company to launch the TrustPass project as "*the businessperson's passport to trust online*" (Alibaba Press Release, September 10, 2001). This mechanism examined and enhanced the integrity of merchants applying for the service of TrustPass through five aspects: third-party certification, certificates and honours, Alibaba activity records, credit reference, and member evaluation. Merchants with TrustPass credentials obtained a higher reputation in the marketplace, thus obtaining a higher potential for a successful match. This was very helpful, given that international traders had limited information about Chinese traders online. A new revenue stream also came up for Alibaba through TrustPass services, serving as a primary driver for Alibaba's cash flow positive in 2002. Some value-added services also resolved the trust issues. For example, Alibaba officially launched Alipay in 2005 to provide "*buyers and sellers with a comprehensive solution that resolves the issue of trust in online transactions while providing an efficient platform for transacting online*" (Alibaba Press Release, February 2, 2005). Together, these online and offline communities, third-party verifications, and value-added services helped solve trust issues and ensure safety to reduce adoption concerns.

Build legitimacy and modify existing institutions. In analysing data, I found that legitimacy building emerged as an important activity for Alibaba to foster ecosystem emergence due to the liability of newness (Aldrich & Fiol, 1994; Suchman, 1995). Legitimacy activities involved a wider range of participants, including not only direct participants but also financers, governments, competitors, media, and educational organisations. The goal was to modify the institutional patterns at the beginning of the first phase for a new institutional structure to support ecosystem emergence by proactively enhancing Alibaba's credibility as a new organisation and e-commerce's acceptance as a novel business model.

Obtain credibility by aligning goals to support resource acquisition and adoption. To start with, Alibaba found it easier to obtain credibility from outsiders, partly because traditional players

and government officials in China present strong resistance in response to institutional constraints (Alibaba documentary "Jack Ma, Founder of Alibaba | The Brave Ones", 2017) and partly because western venture capitalists were enthusiastic about investing in Chinese internet companies before the dot.com bubble (Clark, 2016). Therefore, Alibaba reached out to global stakeholders who were ahead of technology advancement then and did not resist as strongly as stakeholders inside China. To achieve this, Jack Ma hired Joe Tsai in 1999 from Goldman Sachs, who was knowledgeable about international laws and corporate structure. Joe Tsai helped Jack Ma raise the first-round funding (US$5m) from Goldman Sachs that year. After settling the funding, Goldman Sachs helped spread the word about Alibaba through media and local television station interviews. Even before the arrival of venture capitalists, multiple media channels had already started to cover Chinese internet stars, further enhancing Alibaba's legitimacy among Western investors. The Economist magazine wrote about Alibaba as "*America has Jeff Bezos, China has [Jack] Ma Yun",* Business Week magazine named Jack one of "*China's Web Masters*", and South China Morning Post predicted that Alibaba "*may turn out to be a global powerhouse*" as Jack expressed that "*We don't want to be number one in China. We want to be number one in the world.*" (Clark, 2016). With the validations from these coverages and Jack Ma's vision and loyal team, Jack Ma raised US$20 million in the next year from an investor group led by Japan's SoftBank, teed up by Goldman Sachs. In 2004, another US$82 million was raised from leading investors such as SoftBank, ranking as the largest private equity obtained by internet companies at that time. Such endorsements from leading international investors such as Goldman and SoftBank and media provided Alibaba with the finance for its free model and, most importantly, the legitimacy to attract other stakeholders, including providers, consumers, and employees, to get on board. For example, right after the US$20 million investment from SoftBank, Jack convinced John Wu, a then-Yahoo executive, to join Alibaba as the Chief Technology Officer, bringing his Yahoo experiences into Alibaba to help Alibaba build first-class technology.

Regarding support from Chinese stakeholders, although the regionally decentralised totalitarian system presented pressure for regional rather than market competition, Alibaba turned this constraint into an opportunity to co-build legitimacy – aligning the government's KPI to the ecosystem's value propositions for win-wins. As the 2008 Alibaba.com Annual Report mentioned, "*We see more provincial and local governments in China demonstrating appreciation for the power of e-commerce to drive sustainable economic growth and boost exports. In line with the*

China central government's directive to support SMEs during the economic downturn, over 10 provincial and local government organizations have partnered with Alibaba.com to promote B2B e-commerce and will subsidize membership fees for SMEs that become our paying members". For example, Alibaba collaborated with the Hangzhou government to not only promote the adoption of its e-commerce platforms but also promote Hangzhou as the hub for e-commerce, leading to a top ranking for the city of Hangzhou among all cities in China. This top ranking gives Hangzhou a high potential for subsidies or other support from the central government. This materialised in the form of conferences. The first Webpreneur Summit was launched in 2004 with the Hangzhou government and China Electronic Commerce Association (CECA) to promote the theme of "*Changes in the business model of Chinese companies*" when e-commerce business models had just started to make an impact, the second in 2005 to promote "*Trustful e-commerce*", and the third in 2006 to promote "*Innovation to win the world*" when the impact of Alibaba and CECA has been extensive. Given the critical role of governments in China, these legitimacy-building events with the government played a huge role in driving Alibaba's successful emergence.

Rivals were also leveraged to build up Alibaba's legitimacy collectively. The rivalry is defined differently by Jack Ma, "*If you can't tolerate your opponents, you will be definitely beaten by your opponent…If you treat your opponents as enemies, you have already lost at the beginning of the game. If you hang your opponent as a target, and practice throwing darts at him every day, you are only able to fight this one enemy, not others…Competition is the greatest joy. When you compete with others, and find that it brings you more and more agony, there must be something wrong with your competition strategy.*" (Clark, 2016: 62). Because of this different view on rivalry, Alibaba approached rivals more as an opportunity and resource and less as a threat. For example, in 2000, Jack invited the then three portal founders, who had successfully gone IPO, to a conference themed "Sword Discussion by the West Lake" that he held in Hangzhou not only to promote Hangzhou as the city of "Silicon Paradise" but also to "*to demonstrate Alibaba's continued relevance in China's Internet sector...Even though the company had not yet secured an IPO*" (Clark, 2016: 64). These types of initiatives brought not only rivals with benefits such as publicity but also Alibaba with enhanced relevance and credibility.

Share e-commerce knowledge and cultivate e-commerce talents. Besides gaining credibility from resourceful and powerful stakeholders, cognitive sensemaking of the Internet and the new e-commerce business model was collectively developed through education and

conferences where Alibaba and ecosystem participants articulated the business logic of platforms and participation benefits. These activities were designed to modify existing institutions that specified acceptable behaviours and rules using taken-for-granted knowledge and languages before the Internet and e-commerce platforms arrived. Because "*no one knew about the internet or the business model*", Jack Ma mentioned how difficult it was for Alibaba to hire employees at the beginning of the phase (Jack Ma, speech at Hupan University, 2016). To bridge the institutional gap, Alibaba actively pushed the diffusion of knowledge about the newly emerged professionals on the platforms, mainly e-commerce sellers, as adoption started. A widespread understanding of how these e-commerce businesses work and fit into the economy gradually inserted in and modified old institutional structures by developing training materials, issuing credentials, and awarding top performers. For example, on its fifth anniversary, Alibaba launched the Ali Institute in 2004 as the first business educational institute established by an Internet business in China. The goal was to popularise e-commerce knowledge and establish the first complete set of corporate and personal e-commerce training and management systems. Later in 2006, Alibaba launched Taobao University and an e-commerce certification system to train and certify e-commerce professionals. By cooperating with universities nationwide, Alibaba's e-commerce certification system also helped introduce practical teaching courses to related majors. This institutionalised knowledge can not only facilitate the broad adoption of e-commerce platforms but also enhance the cognitive legitimacy of both platforms and new occupations. In this way, the institutional context was gradually modified to support the emergence of Alibaba and its new platform ecosystem business.

To summarise, four co-evolved and aligned themes of orchestration activities drove Alibaba to realise its first phasic vision - become the top e-commerce platform in China - around the end of 2006. Specifically, Alibaba orchestrated the tech employees and community in developing and fine-tuning shared technology architecture. Internally, Alibaba focused on securing loyal human capital and promoting internal incubation. To promote platform adoption, Alibaba offered a free model, provided value-added services with complementors, and solved trust issues. In the broad context, Alibaba orchestrated a wide range of stakeholders to build legitimacy and modify institutions through credibility and knowledge diffusion. These four activity themes were mutually supportive. Technological architecture shaped and was shaped by organisational structure and process as well as institutionalised roles and patterns of interactions (Barley, 1986).

Internal activities reflected the architectural design and supported the adoption and institutional activities by providing necessary resources and pointing out general directions. Adoption activities were designed to fit the architectural activities and supported by internal and institutional activities. And finally, institutional activities supported technological architecture, adoption, and internal orchestration activities by driving the credibility and sensemaking of new technologies and business models in a broad context.

Although without a specific value proposition as the blueprint, Alibaba devised a mission and phasic vision to guide its strategic actions in the first phase. The abstract and stable mission suggested changes Alibaba aimed to make to the world, while the narrow and improvable vision showed directions and guidance of Alibaba's actions. The vision of platform empowering was set up as a starting direction and constantly revisited during the phase to test its validity by considering new opportunities in the form of new demands and roles. While Alibaba may know the general mission or vision, they were not fully aware of participants' needs and perceptions of ecosystems. Participants played a crucial role in guiding the emergence of ecosystems by suggesting unsatisfied needs, presenting new opportunities for value co-creation, and proposing new roles in ecosystems. Without ecosystem participants' interpretative contribution, Alibaba could not foresee the new niche platforms, new demands for complementary offerings such as pay and online communications, or new credibility enhancing programs such as TrustPass, which was necessary for ecosystem sustainable growth. Emergent activities from competitors were also essential in that they forced Alibaba to crystalise its core strength, facilitated Alibaba's legitimacy building, and sought win-win collaborations to develop a bigger pie in the long run. These intentional activities (such as setting up and improving vision, developing architectural support and incentivising adoption) enabled and simultaneously were enabled by emergent activities (such as proposing new demands and roles), together driving successful ecosystem emergence.

Micro-macro processes. When reaching a tipping point, micro-level interactions led to unexpected qualitative changes at the macro level, specifically ecosystem phasic vision and architectural design. Micro-macro mechanisms happened in two ways: expanding and constraining. Ecosystem expansion can take the form of positive feedback loops: "*Taobao's popularity was fueled by a "virtuous circle": More merchants and product listings meant more shoppers were attracted to the site, which meant more merchants and products, etc.*" (Clark, 2016: 72). New demands emerged from participants also contributed to ecosystem service expansion and

confusion of future development, pushing for a necessary re-envision. According to Ming Zeng, new services added were either 1) unsure whether to split as separate platforms or continue to be complementary services for existing e-commerce platforms (Alipay) or 2) did not perform well for a clear direction of future development (e.g., Yahoo and AliSoft). Moreover, the increasing amount of data accumulated from users and their interactions suggested new opportunities beyond the platform-empowering vision set out at the beginning. It became apparent to Alibaba that the platform-empowering vision, even with incremental updates, has become narrow and uncomprehensive to incorporate and guide emerging services and opportunities. A transformative re-envisioning was needed to qualitatively update the ecosystem vision and propel a new phase of ecosystem growth.

Besides expanding, emergent micro-macro processes also involved constraining in two aspects: performance and cost bottlenecks. At the end of the first phase, the disadvantages of the monolithic architecture, i.e., lack of scalability and agility, became salient as adoption accelerated. Specifically, from around 2006, the Taobao platform experienced performance bottlenecks when hundreds of people maintained a front-end core application, each with one million lines of code, and database connections reached congestion with repeated codes written in multiple business systems (Zhao, 2013). New people hired were unfamiliar with the codes and thus could not efficiently conduct updates. The technological system became increasingly bloated, services increasingly coupled, and application development speed slowed down gradually. The performance bottlenecks happened not only at the architectural level but also at the processing equipment level. As Hua Chuang Security summarised, "*The processing power of an Oracle is limited by the number of connection pools, so the data processing capacity is limited. In addition, its query speed is inversely proportional to its capacity. When the data volume reaches hundreds of millions and the query volume reaches hundreds of millions, it reaches its limit…The architecture of this centralised database makes the database become the bottleneck of the entire system and has become less and less adaptable to the huge demand for computing power from massive data*." (Hua Chuang Security Report, 2019: 8). At the same time, the traditional IT architecture – IOE (IBM microcomputers, Oracle database, and EMC storage) – has cost Alibaba a massive amount of money, and it became apparent that the expenses from IOE gradually caught up with the revenue. These cost bottlenecks made Alibaba realise that processing structure and equipment changes were inevitable to support ecosystem growth. These performance and cost

bottlenecks in the technological architecture have substantially limited the growth of the Alibaba ecosystem if no architectural change was conducted (Zhong, 2017). An architectural update was thus needed to prevent growth deceleration at the end of phase one.

To summarise, macro factors triggered and supported the micro-level actions - the launch of Alibaba and the emergence of Alibaba's first ecosystem vision in 1999. During this phase, Alibaba orchestrated the tech community, employees, and direct and indirect participants to work towards the platform-empowering vision while allowing emergent activities to test and improve the vision. By combining the emergent changes from ecosystem participants and intentional nudges of the ecosystem orchestrator, the Alibaba ecosystem was able to scale and grow to not only satisfy the initial participants but also attract new participants with newly proposed services for emerging needs. Micro-macro endogenous activities gradually expanded ecosystem value creation potentials and rendered the initial vision obsolete and technological architecture constraining, leading to the end of the first phase.

5.2 Phase 2 – Ecosystem Empowering (2007-2014)

*"Nobody knows the future. You can only **create** the future."*

Jack Ma

"As the board changes, strategy also shifts."

Shiying and Avery (2009: 160)

Path-dependent micro-macro processes from the first phase and new macro factors entering the second phase together prepared for an ecosystem phasic change. In this transition, my data shows that the vision shifted from platform empowering to ecosystem empowering, and the architecture moved to an open and micro-service distributed design. The start of this phase was officially signalled by Jack Ma's speech at the Hong Kong IPO in 2007, where he first mentioned the term ecosystem in public: "*Alibaba.com's IPO ushers in a new era of e-commerce development and we look forward to pioneering an e-commerce ecosystem that benefits businesses in China and around the world"* (Alibaba Press Release, November 6, 2007). Jack Ma further elaborated in the Alibaba.com Annual Report 2007, "*We aim to become a provider of e-commerce infrastructure for SMEs in China and Asia and, by using Alibaba.com's e-commerce platform, to create a global manufacturing, trading and servicing ecosystem within 10 years."* This new phase was solidified when Alibaba set up its "*Cloud and Data*" Strategy in 2008, suggesting that "*Alibaba is a big data company*" and "*Alibaba aims to make Cloud computing an infrastructure just like water and utility*" (Tmtpost News, July 17, 2014). The strategy for the next ten years was "*fostering the development of an open, collaborative, and flourishing e-commerce ecosystem*" (Zeng, 2018b: 41). Moving beyond developing transaction platforms and associated value-added services, this phase involved cultivating an ecosystem of a wide range of participants for innovation and operational efficiency by opening up Alibaba ecosystem's generic resources (e.g., services and data) to ecosystem participants and allowing participants to contribute complementary services through standardised interfaces. In 2012, Jack Ma and Ming Zeng further clarified the strategic steps of the ecosystem empowering vision through the "*Platforms, Finance, and Data*" Strategy, where all Alibaba's services were systematically coordinated to ensure data can flow across for new ecosystem synergies to realise. Ming Zeng summarised, "*Alibaba is no longer an e-commerce platform, but an e-commerce collaborative platform. It has resigned itself to be a "service-providing" platform to support merchants who serve customers instead of directly serving customers. Its ultimate goal*

is to accumulate data while providing services for merchants. The data platform hidden behind the business platform will support the financial business through data accumulation in 5-8 years. During the process, the data platform itself will be improved through the financial business. In 10 to 12 years, the data platform will replace the business platforms and come to the forefront, and by that time Alibaba will become a data exchange platform." (Sinotf News, December 17, 2012). In the following, I map out the ecosystem participants and discuss new ecosystem synergies before discussing the processes of ecosystem change.

Ecosystem participants. Following the ecosystem-empowering vision, Alibaba gradually identified three main direct participants in this phase: one on the provision side (sellers), one on the consumption side (consumers), and one providing complements. According to Alibaba's 2015 Annual Report, the value proposition Alibaba ecosystem offers to sellers includes "*cost-effective customer acquisition with scale…brand building and promotions…infrastructure support for sellers…direct sourcing for merchants…financing for sellers*" (p 58-59). The value proposition to buyers includes "*anything you want, anytime, anywhere…delightful shopping experience (selection and value for money, personalisation, reliability, product quality and customer protection, convenient payment, reliable and timely delivery)*" (p 57-58). Besides buyers and sellers, Alibaba's 2015 Annual Report specifies complementors as "*third-party participants*", which include "*a payment services provider, logistics providers, retail operational partners, marketing affiliates, independent software vendors and various professional service providers*" (p 59). The complementors, specifically ISVs (independent software vendors), differ in three aspects from the service providers in the first phase: 1) complementors in this phase started to be coordinated through standardised interfaces and rules without one-on-one contractual relationships with Alibaba, 2) complementors joined voluntarily without much selection from Alibaba, and 3) complementors developed services for not only sellers, such as designing websites, taking product photos and accounting, but also individual buyers, e.g., maps and delivery. Besides the above three, employees also shifted from indirect to direct participants as they started to utilise shared generic resources such as Cloud computing to enhance their operational efficiency while contributing their human capital.

The ecosystem boundary expanded for indirect participants as well, including investors, governments, universities, competitors and society in the first phase and research organisations, NGOs, media, start-ups, and non-human elements such as the physical environment. *Investors*

benefited financially from participating while providing legitimacy and capital for ecosystem growth. *Governments* provided legitimacy for the ecosystem while achieving performance indicators such as job creation and taxation. *Educational and research organisations* gained the latest practices, technologies and digital business models to train talents and reputation gains while providing legitimacy to the ecosystem. Leveraging the market reach of ecosystems, *NGOs* could achieve their mission more easily by passing through their messages while providing the legitimacy of social responsibility to the Alibaba ecosystem. *Media* also played an essential role in ecosystem development by serving as a channel to connect user data and helping spread the ecosystem's messages in return for the latest news. *Start-ups* could obtain ecosystem resources to develop their business and provide ecosystems with innovative technologies and legitimacy. *Competitors* indirectly supported Alibaba to crystallise its core strength while sometimes presenting opportunities for win-win collaborations. *Society* indirectly supported Alibaba's growth by suggesting new demands while obtaining social value, such as the "*practice of public welfare, promotion of social employment, and narrowing gaps between rural and urban areas*" (Alibaba CSR Report 2014-2015). *Non-human elements,* such as the environment, also benefited from ecosystem development in ecological value while providing new demands for ecosystem expansion. In the next phase, I will discuss that most of these indirect participants in this phase became direct ones as digital infrastructural services became essential utilities for all.

Ecosystem synergies. Accompanying the expansion of ecosystem participants, ecosystem synergies also extended with the guidance of the new ecosystem vision. Specifically, building on top of the synergies from the first phase, generative changes that enhance variety were materialised through newly added 1) direct and indirect network effects and 2) data-driven learning and data network effects. Generic resources stacked to share for efficiency and coherency became thickened and expanded to Cloud digital infrastructure, standardised interfaces, markets, generic modules, tools, logistics, and data. Moreover, after rapid customer acquisition at the first stage, sustainable growth has emerged as a key type of ecosystem synergy to support variety while maintaining stability for the ecosystem's long-term growth.

Support generative changes through direct and indirect network effects. Specifically, indirect network effects happened, for example, in the Taobao App Store where the utility one obtains is positively related to others' adoption because more adoption of buyers as well as sellers will attract more complementary offerings from third-party developers who develop applications

for both buyers and sellers. These third-party complementors participated through standardised interfaces and developed services and pricing independently without much intervention from Alibaba, which was different from the limited complementors in the first phase that contractually collaborated with Alibaba on a case-by-case basis. Direct network effects occurred through, for example, platforms Alibaba spawned, such as Weibo, a social networking app, and Youku, a video-sharing platform. In these platforms, a participant's utility of joining positively relates to other participants' adoption, as broad adoption will attract more same-type participants.

Support generative changes through data-driven learning and data network effects. Data-driven learning and data network effects were realised by accumulating and mining data from participants interacting with platforms to provide services such as customised offerings and data-driven decision-making insights. By opening up the ecosystem and expanding the coverage of ecosystem services through complementary innovations, Alibaba was able to gather an increasing amount of data and improve the quality of data-driven insights through AI and machine learning. Jonathan Lu, President and CEO of Taobao at that time, described the Data-as-a-service (DaaS) as "*an initiative to help small businesses harness the power of data-mining to make sound strategic growth decisions by offering for the first-time access to its database of aggregate consumer transaction records*" (Alibaba Press Release, March 31, 2010). The more data gathered from participants, the more learning Alibaba was able to obtain and the more accurate information Alibaba provided for participants, which in turn drives more participants to the ecosystem. Taobao has demonstrated the scale of data-driven insights in the Single Day promotion: "*Singles Day 2016 was the "year of genesis" for Alibaba's mobile recommendation engine. In twenty-four hours, the platform made trillions of smart matches between consumers and items, using machine learning to generate nearly a hundred billion customized product displays. Personalized recommendations were updated every hour as users browsed sales and special offers. The recommendation engine drove sales, ensured a variety of offerings for users, and increased conversions. Most of all, it operated with minimal management from employees. It was a triumph of smart business, repeated in 2017."* (Zeng, 2018b: 85).

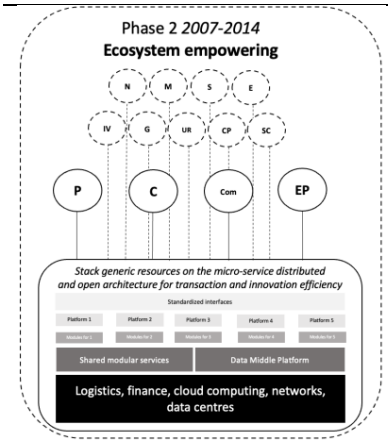
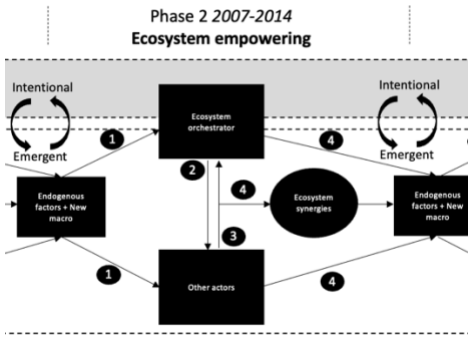
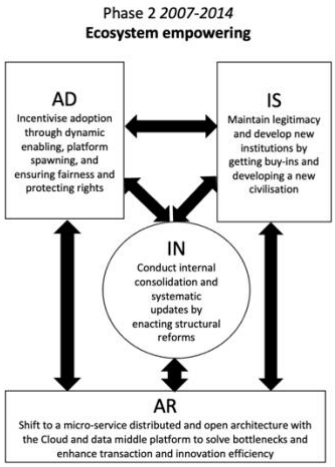
Stack generic resources for sharing and optimising. Besides generative changes through direct and indirect network effects and data-driven synergies that increased variety to the ecosystem, generic resources that can be shared kept stacking and becoming thicker, enabling more opportunities for efficiency enhancement and ecosystem coherency. Specifically, on top of the

generic resources shared in the first phase for transaction efficiency, standardised interfaces, generic modules, tools and APIs were shared with complementors in the Taobao App Store to enhance innovation efficiency. Moreover, data were shared with participants to enable efficient and optimised decision-making and performances, and Cloud services such as storage and computing, logistic services, and financial services were shared among participants to enhance operational efficiency. Data-oriented synergies became so dominant in this phase that Alibaba proposed the "*Platform, Finance, Data*" Strategy in 2012 to stack the data platform and promote it to become the core service in 10-12 years so Alibaba could become a data exchange platform. The more services Alibaba ecosystem provided, the more data Alibaba could accumulate in the data platform to provide data sharing.

Sustainable growth. Lastly, passing the viral customer growth in the first phase, sustainable growth emerged as a critical ecosystem synergy where increased adoption brought diversity and integration through platforms brought coherency. Specifically, rapid growth in buyers, sellers and other direct and indirect participants brought diversity and vibrancy to help the ecosystem adapt to changes, scale and embrace new opportunities. At the same time, enhanced risks of instability such as untrustful transactions and unexpected economic and societal impacts were addressed to prevent detriments. "*As the scale of the enterprise becomes larger and larger, the social responsibilities we have to undertake become more and more extensive*" (Alibaba CSR Report 2007). In response to this, Alibaba started to systematically support ecosystem sustainable growth in 2007. Moving beyond an emergent manner, Alibaba shifted into an orderly state to ensure sustainable growth using the method of "*standardisation, institutionalisation and systematisation*" (Alibaba CSR Report 2007). I will discuss more details in the following adoption orchestration section.

See Table 5.3 for the graphical illustration of ecosystem synergies, ecosystem change and associated orchestration strategies in phase 2. Following the graphical illustration, I will detail how Alibaba developed in this phase.

Table 5.3 - Alibaba phase 2 ecosystem synergies, change and orchestration

Ecosystem synergies	Ecosystem change	Ecosystem orchestration
		
Direct participants (solid circles): **P**: Providers, **C**: Consumers, **SP**: Service providers **Indirect participants** (dash circles): **EP**: Employees, **IV**: Investors, **G**: Government, **UR**: Universities and research institutes, **CP**: Competitors**, SC**: Society **Support generative changes through:** - Direct and indirect network effects - Data-driven learning and data network effects **Stack generic resources for efficiency and optimising:** - Cloud services, standardised interfaces, markets, generic modules, tools, logistics, finance, data - Transaction and innovation efficiency **Sustainable growth**	**1**: Macro-micro processes **2:** Actions of orchestrators **3:** Actions of others **4:** Micro-macro processes	**AR**: Architectural activities **IN**: Internal activities **AD**: Adoption activities **IS**: Institutional activities

Macro-micro processes. Similar to the first phase, the second phase of the Alibaba ecosystem emerged due to macro factors that trigger and support micro-level behaviours. Triggering elements were mainly the path-dependent ecosystem-level bottlenecks. Specifically, path dependency influenced the trajectory of changes in the present and future through endogenously generated forces. In the case of Alibaba, path-dependent ecosystem-level bottlenecks trigger qualitative changes in ecosystem phasic vision and micro-level behaviours. This differs from the classic path dependency theory, which mainly brings inflexibility, inertia, and potential lock-ins (Sydow, Schreyögg, & Koch, 2009). As Alibaba started to have an increasing number of applications (e.g., three e-commerce platforms, Alipay, Aliwangwang, and Yahoo) where users contributed their personal data and interaction data, new ecosystem synergies presented new opportunities and the speed of architectural development could not catch up with the speed of growth in services and data. Moreover, a new type of provider - born online sellers – started to boom and posed challenges for Alibaba to provide all the online versions of offline services internally. These constraints of ecosystem vision and architectural bottlenecks pushed for a new ecosystem phasic vision.

Moreover, macro-level factors supported the ushering of the new ecosystem vision. The regulatory environment also ensured this new ecosystem vision's probability in China: government officials allowed and supported the various experimentations conducted by Alibaba as they helped the government's goals, the Chinese government's growing support for Alibaba's main users – SMEs, and foreign competitors very often found the Chinese regulatory environment hard to adapt (Tse, 2015). Moreover, the macroeconomic cycle supported Alibaba's expansion both in economic growth and VCs' demand for Chinese internet stocks. Lastly, increased internet access and broadband penetration supported the scalable growth of the new ecosystem vision.

Driven by endogenously generated and new macro-level factors, Alibaba qualitatively adjusted its vision. Inside Alibaba, an important strategy meeting was set up in 2008 where the ecosystem-empowering vision was first articulated to all Alibaba employees. According to Ming Zeng and other informants, this new vision gained inspiration through four mechanisms: 1) learning from history such as the Roman empire and infrastructural services including water, electricity and gas; 2) learning from new innovations around the world such as Apple and Facebook open ecosystems; 3) learning from inside Alibaba by listening to front-line employees and managers about participants' needs and summarizing successful cases of Alibaba's services for example the success of Wangpu platform (Zeng, 2018b); and 4) learning from external environments such as industry dynamics, competitors' moves and participants' successes. For example, participants' success such as Mengniu's ecosystem model inspired Alibaba to adopt the ecosystem mindset, new demands from the born-online businesses pushed Alibaba to open up its ecosystem, Apple and Facebook's journeys provided Alibaba the lessons to learn in terms of how to open ecosystems, and infrastructural services in the industrial age provided Alibaba with the necessary requirements to develop infrastructural services.

These sources of inspiration gave Alibaba a good and solid idea of what "*the finale*" would look like for each service, laying out the necessary steps Alibaba needed to take in the next 1, 3, 5 and 10 years to achieve it. In order to develop the infrastructural services including information flows, finance flows, and physical flows, Alibaba needed to push standardisation and leverage the data layer to connect these three flows, thus giving the logical foundation for data strategy in this phase. To achieve this vision, Alibaba needed to do well in not only the B2B platforms (Alibaba and 1688) but also the C2C ones (Taobao) so that information can flow across consumers and businesses and ecosystems can empower information access and transactions through finance

flows. Facilitating physical flows, logistics also became an essential infrastructural service Alibaba needed to develop in this phase. By the time Alibaba achieved this ecosystem vision in about 10 years, Alibaba would transition from "meet at Alibaba", to "work at Alibaba" and then "trade at Alibaba" and "live at Alibaba". Ming Zeng also gave a reason for Alibaba's transition from e-commerce to data-exchange platform – The data market will be bigger than the e-commerce market.

Guided by this new vision, four areas of activities were orchestrated in this phase: 1) update architectural design, 2) conduct internal consolidation and systematic updates, 3) promote ecosystem adoption, and 4) maintain legitimacy and develop new institutions.

Update architectural design. To resolve architectural bottlenecks and support the new ecosystem vision and scalability, Alibaba started the journey of ecosystem architectural updates, involving mainly three aspects: 1) shifted to the micro-service distributed and open architecture, 2) embraced open source and then developed its core technology systems such as Cloud computing, and 3) launched a data platform in between applications and cloud that stores data from all applications in Alibaba ecosystem. These architectural updates' principles included efficiency (operation, innovation, and cost), openness, modularity, standardisation, reliability, reusability, and scalability. Openness, modularity and standardisation played an essential role in determining how much data can be collected and aggregated and thus how much ecosystem synergies can be generated. Distributed system configuration allows modifying and extending a system while running, leading to dynamic modification and scalability (Kramer & Magee, 1985). Although the micro-service distributed and open architecture in the Alibaba ecosystem advanced significantly after the initial 1985 paper about distributed systems, according to Alibaba developers, Alibaba's architectural updates were based on the essence of that paper to solve architectural bottlenecks.

Shift to a micro-service distributed and open architecture to solve performance bottlenecks. Alibaba's ecosystem architecture gradually shifted from monolithic to micro-service distributed and open architecture. The core is to solve the data processing, storage and access bottlenecks through distributed systems and architectural coordination, e.g., modularisation, openness, and shared interfaces, thus enhancing composability and malleability (Tiwana et al., 2010). This ecosystem architecture balances efficiencies, generativity, and fast decomposition and recombination to meet emerging diverse demands (Tiwana et al., 2010). Specifically, according to Alibaba engineers, ecosystem architecture has evolved through six steps: 1) servicing, 2) modularisation, 3) Java middleware and session architecture, 4) openness, 5) standardisation for

compatibility, 6) authorisation, and 7) productisation. The first three steps enabled Taobao 3.0, characterised by high stability, low cost, high scalability, fast iteration, and internal product innovation. The last four steps enabled external innovation. The result was a micro-service distributed and open architecture that enhanced stability, efficiency, and (both in-house and open) innovation.

According to Alibaba engineer Zhao (2013), Alibaba started to servitise activities from around 2007, including category attribute, user centre, and trade centre, to enhance reusability and scalability. In 2008, Alibaba launched a "Wucaishi" initiative to modularise all Taobao services for efficiency. In this initiative, Taobao's architecture was disassembled into three key layers, each with multiple independent service modules: 1) basic services, e.g., UIC (User Information Centre) and Forest (category attribute); 2) key services, e.g., TC (Trade Centre), IC (Item Centre), and SC (Shop Centre); 3) service system, e.g., TM (Trade Manager), IM (Item Manager), and SM (Shop Manager). This layered modularisation allowed each module within or from different layers to be operated and developed independently with simple service and specialised personnel. Scaling thus became easier as these modules can be reused to develop new services. To enable effective and efficient communication between these modules, Alibaba launched a Java middleware, including 1) the distributed message middleware Notify that implements loose system coupling and asynchronous processing, 2) the remote call framework HSF that defines the rules to connect services, and 3) the distributed data layer TDDL that helps efficiently search data from multiple databases. Tbsession architecture was later launched to enable dynamic resource allocation to manage the server's information. In summary, 1) servicing and 2) modularisation enabled the decoupling of services, and 3) Java middleware and Tbsession architecture supported the decoupling. The result is the Taobao 3.0 system, characterised by high stability, low cost, high scalability, fast iteration, and internal product innovation.

After the first three steps, a micro-service architecture has been established internally. Then the following steps focused on external open innovation through 4) openness, 5) standardisation, 6) authorisation and 7) productisation. During the development of the Taobao 3.0 system, one team in Alibaba did some trials by opening Alibaba's data and own applications through the standard interface for more developers to deploy. For example, you can develop a heart-shaped Taobao shop design and a diamond-shaped one and then put them on Taobao for merchants to purchase. The openness design addresses the long-tailed characteristics of SMEs' demands, encouraging

third-party participants to design services and applications to satisfy the unique needs of SMEs. Initially, the platform only opened partially to Taobao-recognised partners, using the strategy of restricted access to test the water (Boudreau & Hagiu, 2009). After a year of platform development, the participation from external software developers was not high – only three different CRMs were developed by staff inside AliSoft. Alibaba's newly joined Chief Architecture then reached out to the platform architecture team in AliSoft to discuss the potential of opening the platforms. Following Yahoo's open model, they developed a prototype of the open platform, initiating a five-year openness journey. Specifically, to control risks associated with openness, internal services need to be well isolated and servicing the internal architecture became the first step to pushing openness. Alipay's service architecture SOFA, Taobao's service architecture HSF and AliSoft's service architecture ASF were all developed at that time for this purpose. In 2008, a prototype of the open platform was developed. The platform opened 30 Taobao services, leading to 2000 daily employment. This year, the open platform developers mainly developed applications for SMEs on Alibaba and Taobao sellers. At the end of 2009, the open platform opened more than 100 services and had 4,000 daily deployments after combining AliSoft with Taobao. The key applications developed were for Taobao sellers. Tools such as APIs allowed third-party developers to coordinate online efficiently. Such an increase in volume asked for updates in architecture again for efficiency and stability. At the end of 2010, Alibaba opened more than 300 Taobao services, leading to 0.8 billion daily deployments and numerous enriched Taobao Software Development Partners. In addition to applications for sellers, the popularity of SNS (Social Networking Service) triggered the development of applications for buyers. Numerous game applications were developed. The roles of Alibaba extended from simply providing APIs to supporting deep application integration and building communities. Architectural updates for reliability and efficiency also followed; for example, automation of API access was launched to enable efficient maintenance of more than 100 APIs. At the end of 2012, Taobao opened up more than 900 services and had 2.6 billion daily deployments. This year, mobile popularity enabled other Alibaba platforms to open up with APIs, such as ticket booking, financial, and hotel booking platforms. At the same time, app developers started to develop applications for not only Taobao sellers but also Tmall's brands and vendors. In 2012, Alibaba developed an open platform security system to ensure security and reliability. This 5-year journey of the open platform (2007-2012) marked the

completion of the switch from a monolithic architecture to a micro-service distributed and open architecture.

Take off IOE, embrace open source and develop own core technology system to solve cost bottlenecks. During the transition from monolithic to micro-service distributed and open architecture, Alibaba also shifted from relying on commercial software developed from abroad to embracing open source and developing its core technology system such as Cloud computing. This was partly driven by the cost bottlenecks that emerged at the end of the first phase where the expenses from the data processing structure (IOE) gradually caught up with the revenue and party driven by nationalism as these technologies were developed in the West (Wang, 2016). On top of that, Alibaba decided to develop Cloud computing technologies itself rather than rely on open source because it took a long-term view on scalability bottleneck. Open source cannot satisfy the scalability requirement in the long run: "*open source technology only solves the problem of software use costs, but ignores the upgrade and maintenance costs of open source software.*" (Wang, 2016: 112). Therefore, to reduce scalability costs in the long run, Alibaba launched the "Taking off IOE" initiative in 2008 and decided to develop its cloud computing power. Compared with traditional computing, cloud computing provides a variety of advantages, including cost savings, security, speed, computing power, and scalability. Alibaba started to research and develop the super large-scale computer in 2008 independently. In 2009, AliCloud was launched due to scale constraints to support its first Single's Day (11.11) Taobao shopping festival – with 2.4 billion page views in 24 hours. AliCloud offers various services, including elastic computing, database and storage and large-scale computing services. The goal is to "*building the first platform for Internet data sharing and becoming a data-centric cloud computing service company"* (51CTO, December 27, 2012). The same year, Alibaba launched Apsara Cloud OS and started the development of ODPS (Open Data Processing Service), a data storage and analysis platform built on Alibaba's cloud computing platform. Users can use the data model tools and services provided on the ODPS platform, and the ODPS platform also supports users in releasing data analysis tools themselves. ODPS was critical in getting the data flows across participants and a wide range of user innovations. The first phase of the ODPS platform only temporarily provides large-scale data storage and offline data analysis services. In 2011, with the entrance of mobile, Alibaba launched the internally developed cloud-based mobile device operating system "Aliyun OS" for mobile devices, the Internet of things and set-top boxes, which was integrated into the cloud computing

offerings. And in the same years, after successfully solving Alibaba's internal performance bottlenecks, Alibaba Cloud started providing services to other users. In 2013, all services were off IOE, and AliCloud holds all of Alibaba's platforms, saving significant operational costs for Alibaba. Alibaba ensured that all data and platforms were technically integrated and can be used across the ecosystem. Independent research and development of cloud computing technology proved to be a very significant move as the surplus of these computing, storage, and network resources also paved the way for the birth of Alibaba's cloud computing services in the future and provided solid technical backing for the establishment of Alibaba's "Sharing Division", "Big Middleware System", and DaaS vision.

Develop the Data Middle Platform to enhance data management and utilisation efficiency. The third architectural update was the Data Middle Platform strategy alongside the open ecosystem and cloud journey, according to the Alibaba Bid Data Product Expert Deng. As the ecosystem grew, data was accumulated inside shared platforms from all platforms, leading to ever-comprehensive and accurate insights of consumers. According to Ming Zeng, Alibaba decided to build the data layer as early as 2008 in its annual strategy meeting, after which it hired a CTO to be responsible for that. They named this project "Flying to the Moon". Specifically, according to an Alibaba Cloud manager, Alibaba started the Data Middle Platform strategy in 2012 to support the DaaS strategy and facilitate data sharing across departments inside Alibaba. Alibaba's Data Middle Platform strategy centred on the three major systems of "unified data construction and data asset management capabilities" (OneData), "unified entity link identification and label portrait efficient production capabilities" (OneEntity), and "unified data service capabilities" (OneService). To enhance data collection access points, Alibaba pushed mobile device applications and associated production efficiency to be a top priority in 2012. The essence is to launch a data platform between applications and the cloud that stores data from all applications in the Alibaba ecosystem. Note that at this phase, this Data Middle Platform concept was only applied inside Alibaba to enhance Alibaba's operational efficiency. Alibaba's success in implementing this concept served as a key proof-of-concept for scale in the next phase externally.

To summarise, ecosystem architecture in this phase 1) shifted from monolithic to micro-service distributed and open architecture to solve performance bottlenecks and set up a solid foundation to scale open ecosystem, 2) embraced open source and developed its core technology system – Cloud computing – to stack key generic resources and ensure scalability, and 3) launched

middle data platforms to support data flow across applications and thus synergies such as data-driven learnings and data network effects. These technological architecture updates provided the Alibaba ecosystem with dynamic modification, scalability, efficiency, and cost reduction, serving as the technological foundation for adoption, internal orchestration, and institutional works.

Conduct internal consolidation and systematic updates. While ecosystem architecture updates provided a stable and scalable technological foundation, internal orchestration was crucial in supporting the ecosystem-empowering vision and ecosystem sustainable growth. At this phase, internal orchestration focused on 1) enhancing synergies and efficiency among business units by launching the Shared Service Division, One Company and Decouple strategies, and leadership rotation, 2) systemising the process of internal incubation for adaptation, internal needs and external empowerment, and 3) developing ecosystem-friendly KPIs and social enterprise governance mechanisms. These internal efforts supported ecosystem vision and external growth by 1) consolidating internal business units into a distributed, de-centralised, and shared service structure to enhance internal efficiency and facilitate ecosystem adoption, 2) providing successful experiments on digitally transformed business processes and structures that could later commercialise to and empower ecosystem participants, and 3) solving internal tensions around profit sources for internal and ecosystem sustainable growth.

Enact Shared Service Division, One Company strategy, Decouple, and leadership rotation to enhance internal synergies. My data shows that multiple challenges pushed Alibaba towards internal reforms. As Alibaba services proliferated, unpredictable system chaos emerged. Moreover, Alibaba's existing services were still organised linearly and centrally, preventing each business unit from having autonomy and flexibility to innovate and develop its own ecosystem. This chaos and outdated organisational structure significantly inhibited Alibaba's internal capabilities to support ecosystem vision and sustainable growth because ecosystem vision around data accumulation and ecosystem empowering required Alibaba to have an internal structure that enabled the sharing of generic resources across business units and strong flexibility and efficiency to innovate and scale. Therefore, internally, Alibaba faced the challenges of reorganising existing services and internal business structure to ensure efficiency, internal synergies and support for ecosystem vision and external ecosystem growth. Specifically, my data shows four key initiatives Alibaba enacted that reflected this internal reform. *First*, in 2009, Alibaba launched a new unit - Shared Service Division - to provide shared services for all of Alibaba's platforms and thus

enhance resource reutilisation, operational efficiency and internal synergies. The chaos that led to this change started around 2008 when Tmall was launched and separated into an independent Business Unit inside Alibaba. Although Tmall kept pace with Taobao as the two e-commerce Business Units, Taobao's technical team supports both Taobao and Tmall's businesses. Such an organisational structure determined that the technical team's priority for meeting the business needs of Taobao must be higher than that of Tmall, which made Tmall's business team complain and seriously affected Tmall's business development. Another problem lies at the business structure level. At that time, the e-commerce systems of Taobao and Tmall were two completely independent business systems, but they shared many similar services. To illustrate, the Taobao platform shared more than ten components with Tmall and other platforms (>25), such as pricing, products, categorisation, users, transactions, reviews, and data. Having separate databases, teams, and components for these platforms wastes resources. Because of this, in 2009, Alibaba launched the Shared Service Division where the main members were from the previous Taobao technical team, and it became a business at the same level as Taobao and Tmall in terms of organisational structure. In this way, Alibaba hoped to allow the shared technical team to better support the business of Taobao and Tmall at the same time. By depositing the two platforms' common and general business functions into one platform, the Shared Service Division avoided duplicating the construction and maintenance of generic functions and made more rational use of technical resources. However, in the beginning, because Taobao and Tmall had more power than the Shared Service Division, the Shared Service Division struggled to survive. The launch of Juhuasuan (group buy website) in 2010 solved this struggle. As Juhuasuan rapidly increased adoption, Taobao and Tmall expected to connect with Juhuasuan to increase sales. Later, 1688.com joined Taobao and Tmall to connect with Juhuasuan, overwhelming the newly established Juhuasuan team. It was during this time that Alibaba made a significant decision to successfully solve the struggle facing the Shared Service Division and unleash its power. This decision was that if the three major e-commerce platforms wanted to connect with the Juhuasuan platform, they must go through the Shared Service Division. This decision significantly enhanced the power of the Shared Service Division, allowing it to become the glue of all applications in the Alibaba ecosystem to improve efficiency, resource reutilisation and internal synergies.

Second, my data shows that after successfully setting up the Shared Service Division for e-commerce platforms, Alibaba went beyond e-commerce platforms to enhance efficiency,

flexibility and internal synergies for all Alibaba businesses. Specifically, in 2012, Alibaba proposed the One Company strategy to reorganise the organisational structure into seven business clusters and encouraged all clusters to work together to provide synergetic offerings within Alibaba as one company. In 2013, following the One Company strategy, the Decouple initiative was launched to further reorganise and split the seven business clusters into 25 business units to enhance efficiency and resource reutilisation. This reconstruction was crucial as after Decouple, each business unit was responsible for a small common shared service and could proactively break the silos of applications and initiate data and service sharing flexibly across platforms for efficient recombinative innovations and effective resource reutilisation. As each business unit was only responsible for a small part, the power was divided and decentralised, and the dependence between business lines increased. Moreover, such a move shifted the organisational structure from a linear and centralised fashion to a distributed, decentralised and networked manner, leading to enhanced autonomy to innovate and scale with efficient resource utilisation. After these reorganisational activities, Alibaba classified these 25 business units into two main categories: 1) the resource type, such as AliCloud and AliData, for sharing, and 2) the service type, such as Taobao, Tmall and other applications, targeting final users. The principles were "*resource type is for share, service type is promoted to self-develop and has the ability to share the resource type*" (Sina News, 2013, April 4). Resource-type units include knowledge (cloud computing and big data) and talents. The analogy could vividly illustrate the relationship: "*the resource type units are like Alibaba Group's land, while the service units are like crops growing on this land*" (Sina News, 2013, April 4). According to Ming Zeng, the One Company strategy involved both internal and external ecosystem development. Internal ecosystem development refers to the internal reorganisation of Alibaba Group, and external ecosystem development refers to the external reorganisation of Alibaba ecosystem participants. Alibaba started with an internal reorganisation to ensure resource-type units have been decoupled from service-type units and shared internally. Only after these successful internal experimentations on resource sharing could Alibaba open these shared resource units for external ecosystem development, as illustrated by Ming Zeng, "*First test internally, then open externally after internal maturity*" (Sina News, 2013, April 4). By opening up the internal shared resources (big data and cloud computing), Alibaba could then provide data-driven insights and DaaS to all ecosystem participants and later become the data-exchange platform. To ensure this organisational change was communicated to all Alibaba employees, top leaders (evangelists)

were rotated across different business clusters. For example, Jeff Zhang, the VP of the Taobao product and engineering team, was transferred to lead the Alibaba.com team. This way, Taobao's Shared Service Division insights could be leveraged to restructure Alibaba.com from a vertically integrated company to a horizontally shared platform. Through rotation, a common technology platform and infrastructure were in place inside Alibaba where experimentation can be initiated and executed across the organisation. Culture has also been updated to accommodate the shift to an open ecosystem and platform synergies inside Alibaba – new culture logans have been proposed, such as "*One Family, One Vision*" and "*Embracing Change*". In 2010, Alibaba established the Alibaba Partnership to "*ensure the sustainability of Alibaba's mission, vision and values*" (Alibaba Annual Report 2020). These initiatives worked together to ensure all business clusters inside Alibaba work together synergically to enhance internal efficiency and resource reutilisation and thus support external growth and ecosystem vision.

Set up the Horse Racing process to systemise the internal incubation of platforms. Beyond internal consolidation, Alibaba also started to systemise the process of internal incubation from the second phase. Moving beyond the first phase where internal incubation emerged randomly to help Alibaba adapt to changes and participants' needs, this phase gradually set up a formal system and process to promote internal incubation for adaptation, internal needs and external empowerment. The internal incubation process, Horse Racing, was set up in 2010 when Alibaba started showing the inertia prevalent in large organisations. Formalising this internal incubation process could promote and reward entrepreneurial innovations routinely and systematically. According to a Product Manager at Alibaba, in the beginning, there were two ways to develop new projects: 1) pure bottom-up, free topic selection, free team formation, and started working after passing the review, and 2) Alibaba provided propositions, free team formation, bidding, and the winning team started working. Selected from about 350 submissions in 2010, the ten winning projects were given resources, rights to hire new people, and a deadline of half a year. Conflicts arose during the first year. For example, employees struggled to balance their workload between their primary job and these side projects. In subsequent years, Alibaba initiated several incremental updates to improve the Horse Racing process. For example, in 2011, the Horse Racing competition was shifted from an annual event to a quarterly one to increase the frequency of innovations. In 2012, the Horse Racing process expanded from the initial Taobao team to the whole Alibaba organisation. This led to a rapid increase of innovation potential across Alibaba business units and

a separation of the central and segment competitions. In 2013, resources for winning projects were distributed in a milestone manner instead of all at once. Moreover, projects could also be proposed in more innovative ways, and the assessors have been expanded. Successful projects from the Horse Racing process included not only products and services for participants such as Tmall, AliExpress and DingTalk but also theme-based conferences, Alibaba books, and innovations to enhance internal operational efficiencies. In this way, Alibaba developed a system and process to cultivate, rather than purely select, innovative talents who are self-motivated to propose things they like, and to incentivise hardworking through fierce internal competition. Successful internal experimentations could also promote external adoption by serving as pilots.

Develop ecosystem-friendly KPIs and social enterprise governance mechanisms. As the Alibaba ecosystem expanded, tensions emerged. Although the prevalence of low-priced products in the Alibaba ecosystem brought widespread adoption, it nonetheless caused issues that made small businesses on the platform hard to survive, e.g., over-competition, homogeneity of products, and low-quality or fake products. The healthy development of ecosystems thus became a key issue that grabbed the top management team's attention. Internally, this issue was reflected in the design of KPIs for each business unit and the governance mechanisms. Firstly, KPIs provide performance goals for employees to shoot for and milestones to evaluate progress. To orient employees' attention and efforts for ecosystem sustainable growth, Alibaba realised that "*KPI is the realization of ideals, not the indicators of performance*" (Sina Finance, Four Strategic Turning Points Affecting Alibaba's Historical Trend, March 30, 2020) and KPIs need to "*be completely consistent with the principle of ecosystems*" (Ming Zeng, Hupan University 2nd class, 2016). This means that the design of internal KPIs of ecosystem orchestrators needed to support the long-term sustainable growth of the ecosystems, instead of aiming to "*being an empire*" measured by profitability indicators such as GMV. In 2012, in response to issues related to tensions, Jack Ma changed the KPIs to the famous "Double Million", i.e., to have 1 million sellers with more than 1 million sales in three years. This KPI shifted the focus of business unit managers from relying on low-priced products for traffic to aiming to improve search engines and empower small businesses. Another example illustrated by Ming Zeng is the shift from "*Taobao is shopping, Alibaba is for small businesses, Alipay is an online payment tool, and AliCloud is for computing*" to "*Shopping is Taobao, Small business is Alibaba, Payment is Alipay, and computing is AliCloud*" in 2010. This shift reflected Alibaba's focus on securing the rights of setting standards for each platform instead

of competing with rivals for specific markets. Moving KPIs to standard setting from competitive positioning drove Alibaba employees to focus on ecosystems' sustainable growth as standardisation drives ecosystem expansion as a whole while ensuring Alibaba's leadership position. Secondly, tensions around Alibaba's role in the ecosystem drove Alibaba to rethink its identity which guides its internal governance mechanism. After 2010, as the ecosystem scaled up with increasing complexity, e.g., increasing involvement in rule formulation, Alibaba gradually realised that its identity was fundamentally a social enterprise. Without this clear understanding of the orchestrator's role, ecosystem growth would encounter swelling obstacles such as lack of participant trust and frequent emergence of unconvincing decisions on rules and regulations. To renew its identity, Alibaba learned from a wide range of social organisations, e.g., the Senate system in ancient Rome and the Singapore government, and formed "*the prototype of the partner responsible person and cultural inheritance + strategic decision-making committee responsible for top-level strategic design + strategy executive committee responsible for implementation*" for internal governance (Sina Finance, Four Strategic Turning Points Affecting Alibaba's Historical Trend, March 30, 2020). In this way, strategic decisions could have wide participation and would not be impacted by frequent employee turnovers, supporting ecosystem sustainable growth.

To summarise, internal orchestration was essential in supporting the realisation of ecosystem vision and driving sustainable ecosystem growth. By aligning organisational structure with the technological architecture, reorganising structure and process to ensure decentralisation and flexible sharing of generic resources, systematising internal incubation and adjusting KPIs and governance mechanisms, the ecosystem orchestrator enhanced internal synergies, adapted to external change, solved tensions, and supported ecosystem vision and sustainable growth.

Promote ecosystem adoption. The monopoly position in the e-commerce market enabled Alibaba to shift from focusing on adoption incentivisation to balancing viral adoption and stability for sustainable growth. This confirms what Wareham et al. (2014) suggest – "*In intermediate stages, stricter control may be appropriate as achieving critical mass and network effects become less imperative, and the ecosystem can mature and evolve at controlled rates*" (p. 1212). However, while control enhanced in the second phase, incentivising generative changes to reach critical mass was still imperative because the types of ecosystem synergies expanded. The focus shifted from promoting the adoption of transaction platforms for two-sided network effects to promoting the adoption of innovation and data platforms for indirect network effects and data network effects.

On top of the generic technical strategies, proprietary consideration was also leveraged by Alibaba to promote generativity and ensure Alibaba's control.

Leverage dynamic enabling to develop new markets and enhance platform adoption. Incentivising adoption for indirect and data network effects was achieved through dynamic enabling. Different from mainly brick-and-mortar retail businesses in the first phase, the arrival of a new user group in this phase – born-online sellers – demanded "*building their businesses completely from scratch, online*" (Zeng, 2018b: 41). Alibaba tried to satisfy these new demands itself through AliSoft, a new company launched by Alibaba in 2007, but soon realised that there was no way Alibaba could provide all offline services itself. Although 2007 was a year Alibaba started to be conscious of ecosystem strategy, the process was unpredictable, meaning that Alibaba was not clear about the route to open up and govern ecosystems successfully. It is a process of "*crossing the river by feeling the stones*" and "*guided by users' emerged demands*" (A22 I interviewed). One thing to note is that Alibaba decided to open up the applications first before opening its data as opening up the data first would create competition between applications. In 2008, Alibaba started the opening journey from the Taobao application by proposing the Big Taobao Ecosystem Strategy so as to drive the Taobao ecosystem first. Through testing and experimenting, in 2010, Alibaba gradually figured out three fundamental guiding principles and summarised them in the Alibaba Ecosystem White Paper: 1) what resources are needed to provide to promote openness, 2) what services to open, and 3) the sequence of opening up in terms of markets/industries. Essential resources were mainly non-pecuniary and boundary resources, such as APIs, searchable depository, SDKs, design references, training and developer manuals, resonating with existing studies (Chen et al., 2022a). Specifically, as illustrated in the ecosystem architecture section, Alibaba focused on three key things: 1) setting up service routing to ensure that external participants can obtain internal information, 2) service interface standardisation to enable standardised information to be obtained through a unified approach, and 3) authorisation to ensure legally obtaining internal information from outside. After setting up these three activities, the open platform started to welcome external participants. When it comes to what services to open and when, this phase witnessed a shift from control to dynamic enabling. Instead of doing everything itself and command-and-control everything third-party participants developed, such as price and content, Alibaba adopted a dynamic enabling strategy to allow ecosystems to grow on their own accord. Specifically, Alibaba allowed participants to enjoy autonomy and trusted each

participant with the capabilities to make smart decisions themselves. Alibaba was responsible for 1) developing ecosystem architecture, 2) providing inspiration, 3) pointing out directions, 4) providing basic and generic services for free, and 5) designing platform ecosystem rules. Complementors or service providers were mainly responsible for developing supplementary services where Alibaba lacked energy or ability. Alibaba opened up markets and technologies so that complementors could follow Alibaba's direction to the collective goal: "*to make the cake bigger together*" (A6 I interviewed). Some of the areas have just emerged with few service providers, then Alibaba had to develop the services itself first to stimulate the demand and create a market (Cusumano, Gawer, & Yoffie, 2019). Some of the services Alibaba developed first through either self-development, incubation, acquisition, or strategic investment but had to give them up to newly emerged complementors to develop so as to encourage recruitment of complementors and ecosystem growth. It is a dynamic enabling process where Alibaba's participation in the complementors' market dynamically changed to ensure enabling complementors' participation and ecosystem expansion. The goal again was to enlarge the ecosystem for more and more complementors to make profits. This required Alibaba to not only spend energy on building up the platform but also dynamically participate or cut off certain complementary services to enable third-party adoption and innovations. This dynamic enabling strategy helped solve part of the "*killer app paradox*" suggested by Zeng (2015): "*If your vertical application does not win the marketplace, the platform cannot roll out to other adopters. And, making that one vertical very strong requires that most resources be used to support this particular service, rather than expanding the platform to support more verticals. But a platform must expand basic infrastructural services to support different verticals with different (and often conflicting) needs and problems. In other words, platform managers must balance reliance on a single vertical with the growth of basic infrastructure, which in all likelihood may weaken your commitment to continuing the success of your killer app*." (p. 29)

Besides new markets, dynamic enabling also applied to new roles from participants. To support adoption, Alibaba defined roles fuzzily to allow experiments from participants and only stepped in to control after seeing signs of success. Specifically, according to Ming Zeng, the Chief Strategist at Alibaba, "*To achieve flexibility, you cannot plan any network meticulously. It must develop according to the actors that enter and the consumers it serves. In practice, this means that participants' roles initially need to remain fuzzily defined*." (Zeng, 2018b: 45) New roles typically

emerged in response to new needs from platform users. Some platform participants first reacted to new demands by developing new solutions. New roles became clear after the effective satisfaction of emerging demands. Allowing participants to experiment and develop their unique solutions pushed the growth of the initial platform. Only after consistently solving new problems through these emerging roles did Alibaba step in to provide official recognition and design rules and regulations to control. New roles were only codified when revenue emerged. For example, a new role that appeared at this stage is the Taobao University lecturer. New sellers on the Taobao platform normally lacked experience and knowledge, so they contacted experienced sellers for advice about using the platform. When some experienced sellers effectively trained new joiners, Alibaba realised the importance of this new role. Alibaba started an online education platform and provided offline facilities to facilitate experienced sellers to give lecturers to new joiners in 2006. In terms of training content, Alibaba developed frameworks for experienced sellers. New joiners would pay to gain access to the training materials provided by experienced sellers. In this way, new roles were collectively developed to foster more ecosystem synergies, driving the platform's expansion. Like roles, rules for participating in the platform were also collectively developed in this stage. The initial experimentation by problem-solvers guided what types of rules would help foster development. Alibaba then created the rules for mediating the interactions. The co-developing of ecosystem roles and rules provided agreed-upon guidance on joining and co-evolving with the platform ecosystem.

Spawn platforms to increase ecosystem adoption and enhance data gathering. While dynamic enabling focused on promoting adoption for platforms' multiple sides, platform spawning served as an important strategy to promote ecosystem adoption as a whole. Given the complementary relationship among these platforms, participants' willingness to join the Alibaba ecosystem as a whole increased as more platforms were set up. Also, by picking some emerging and generic demands to spawn platforms for the ecosystem, Alibaba could provide and improve its data-sharing and data-driven decision-making services because spawned platforms served as data access points to facilitate data accumulation. When it comes to selecting which platform to spawn, the more generic a platform, the more chances for future proliferation across industries, the more potential of influencing more participants in the value chains, and the more value creation for all and more value capture for Alibaba. New platforms were spawned by either setting up itself, acquiring existing platforms, or strategically investing in some existing platforms. Three types of

platforms were spawned in this phase: niched transaction platforms, platforms for the provision side, and platforms for the consumption side.

Driven by emerging needs, Alibaba developed multiple niched e-commerce platforms that targeted the needs of slightly different participants. Some of these new platforms were developed through the internal incubation process. These niched platforms facilitated data collection and provided focused markets for complementary innovations. Specifically, in 2008, Alibaba set up a group inside Taobao called Taobao Mall to explore the growing potential of the B2C marketplace. Then, in 2011, it reorganised Taobao, so Tmall became a separate platform connecting branded sellers and Chinese consumers. To ensure broad coverage of branded sellers, Taobao Mall followed the openness principle through which commitments from leading Chinese B2C sites were obtained, such as Intime (Yintai), Vancl, No. 1 Store (Yihaodian), Newegg, M18, Cool8 and Redbaby. These 38 leading B2C vertical sites set up a flagship store on the tmall.com platform so consumers can access "*the widest range of quality brands and authentic products in a single shopping destination*" (Alibaba Press Release, September 19, 2011). In 2010, Alibaba launched Juhuasuan, a platform that facilitates transactions between Chinese consumers and sellers in a group selling fashion to save money for consumers. In the same year, Alibaba launched the AliExpress e-commerce platform for consumers to buy directly from China. After this, Alibaba expanded coverage to global businesses and consumers to capture the growing demand in international B2C trades. In 2014, Alibaba set up Tmall Global, an extension of Alibaba Group's B2C Tmall business, which enabled overseas businesses to enter China's online retail market. By joining Tmall Global, businesses could get exposure to consumers on Taobao.com and Tmall.com from overseas without setting up physical operations in China, and Chinese consumers could get access to a wide range of global brands fulfilled from outside China. See Figure 8.1 in 8.4 Appendix 4 – Data Analysis for the graphical illustration of Alibaba's niched e-commerce platforms.

Besides niched transaction platforms, platforms for the provision-side participants were also spawned by expanding upstream and downstream of the value chain to support third-party complementors, e.g., Wangpu (2006), SaaS (AliSoft in 2007), marketing (Alimama in 2007), finance (Micro Financial Services Company in 2012), logistics (Cainiao Network in 2013), and organisational operation (DingTalk in 2014). At the end of phase 1, sellers saw opportunities to provide services to other sellers, such as taking photos of products. As requests for services from

sellers grew, independent service providers started to grow from ad hoc part-times offered by sellers to full-time professionals. To foster such indirect network effects, Taobao spawned a platform called Wangpu, "*a series of standard templates for storefronts, to enable sellers to better manage their online business*" (Zeng, 2018b: 40), and opened it up to allow independent service providers to join. One example is the modelling services where sellers hire to model for their products. Taobao spawned a platform to help organise these modellers and help them find sellers. The early success of the Wangpu model and failure to provide all services itself enlightened Alibaba to adopt the open ecosystem strategy and led to the closure of AliSoft in 2010. Talents in AliSoft were channelled to existing B2C (Taobao) and B2B (1688) platforms to redesign them in an open manner so as to facilitate innovation from a wide range of third-party developers. The B2B provider-side app store website was fuwu.1688.com, offering various third-party complements, including website management, marketing, ERP, and others. The B2C platform Taobao launched the Mobile Taobao App and App Store in 2010 to encourage third-party service providers to participate in application development where "*for Taobao sellers, the applications will aim to improve their business management and back-end operation functionality while buyers will be offered tools to improve their shopping experience. Software developers will be able to generate revenue from their applications through subscription fees, commissions or advertising, depending on the type of service offered and popularity of the product.*" (Alibaba Press Release, January 15, 2010). Other platforms Alibaba set up to help diversify the provision side included a marketplace for marketing called Alimama in 2007, Cloud computing services called AliCloud in 2009, a financing platform called Micro Financial Services Company in 2012, a logistic platform called Cainiao in 2013, and instant-messaging platform called DingTalk in 2014. Specifically, for each platform spawned, Alibaba focuses on setting up shared standards and systems without much participating in bargaining or becoming a provider or complementor. For example, in developing the Cainiao logistic platform, Alibaba led the development of online billing with a uniform format and provided technology solutions and system supports without participating or setting up its own logistic business. In this way, Alibaba can steer collective efforts to share and reuse the same standards, designs, and interfaces through which it can optimise the express delivery operation process. To accelerate collective efforts, Alibaba mostly adopts partnerships in the forms of joint ventures, equity investments, and (global) collaboration partnerships. Shared assets also involve

partnered warehouses, local supermarkets, convenience stores and mom-and-pop stores, which function as pick-up and delivery locations named Cainiao Post.

Similar logic applies to spawning platforms on the consumption side, except not through value chains but through customers' various needs in life. Driven by the advancement of mobile technologies, 2011 was a year of transition for Alibaba from attracting provision-side participants to enhancing consumers' experiences. As illustrated in Alibaba's Press Release, "*Alibaba.com's business in the early years was driven by a focus on rapidly increasing the number of manufacturers, trading companies and wholesalers that pay a subscription fee to sell products on the company's marketplaces in order to maximize revenue growth. Last year, the company implemented a major initiative toward improvements in the quality of the buyers' experience on the company's online marketplaces… Alibaba.com outlined this strategic shift….*" (Alibaba Press Release, February 21, 2012). As the Alibaba platform ecosystem evolved with open architecture and third-party participation, new demands for efficiency emerged in various aspects of consumers' lives, e.g., search engine, entertainment, news, navigation, travel, and ticket purchase. Alibaba has strategically picked some platforms to own or control to increase user adoption, leverage synergies, and limit competitors' expansion. The first consumption-side platform Alibaba acquired was Yahoo in 2005. Four years later, the dominance of Baidu in the search engine market gave Baidu an advantage over Alibaba in obtaining user data. To compete with Baidu, Alibaba invested in UCWeb, the top browser platform in China, and limited access to Alibaba marketplaces from Baidu search. Later in 2013, Alibaba and UCWeb launched the Shenma mobile search engine and replaced the default search engine for UCWeb from Baidu to Shenma. Consumers can search for information on Alibaba marketplaces through Shenma in a more specific manner than through Baidu. To deepen collaboration, in 2014, Alibaba fully acquired UCWeb to "*enable deeper synergies between the companies by marrying Alibaba's strengths in e-commerce, cloud computing and big data technology and UCWeb's leading market position and technology in mobile*" (Alibaba Press Release, June 11, 2014). For example, Shenma linked applications such as map AutoNavi (Alibaba's) and travel Mafengwo, while Baidu has links to applications in the Baidu ecosystem. Having a search engine access point is critical for Alibaba as this not only can gain more comprehensive data of users but also can limit the dominance of competitors. In 2010, Taobao and Wasu Media collaborated to launch Taohua.com, "*China's first comprehensive digital products platform offering single-stop sharing and purchase of video, e-books, music and other*

digital entertainment and educational products" (Alibaba Press Release, June 29, 2010). In the same year, Alibaba also started to incubate Taobao Travel (trip.taobao.com), and then in 2014, they officially announced Alitrip to be an independent online travel booking platform as part of their 'Live@Alibaba' vision. In 2014, Alibaba invested in complementor Beijing Shiji Information Technology Co. Ltd, a hotel information technology provider to further push and steer the development of the travel vertical. In 2013, Alibaba invested in Weibo (a social networking app), developed Laiwang (a communication app), acquired EMUMO, and acquired TTPOD. In 2014, Alibaba developed YLB, Zhao Cai Bao, Taobao Movie, and Alibaba Pictures, acquired AutoNavi, and invested in Youku (a video-sharing platform), and AliHealth (a healthcare platform). Given their complementary relationships, these newly spawned platforms produced data-driven synergies inside the Alibaba ecosystem and enhanced ecosystem adoption.

Ensure fairness and protect rights through nine principles to reduce opportunistic behaviours. Besides incentivising ecosystem adoption for indirect and data network effects, Alibaba also needed to ensure stability for sustainable ecosystem growth. Specifically, Alibaba at this phase focused on ensuring fairness and protecting rights to prevent detriments that inhibit the ecosystem's healthy growth. My data shows that Alibaba initiated various programs to ensure trustful and fair transactions by asking providers to pass a specific verification process conducted by an independent third-party agency. Besides sellers, authorisation mechanisms have also been used in complementor markets to ensure the recruitment of good-quality service providers and the safety of data sharing. Besides authentication programmes, Alibaba also designed rules to regulate unlawful behaviours at this phase. For example, in 2010, Alibaba published the first e-commerce rules in China – Taobao rules. In 2011, Alibaba published its first Platform Governance Report, summarising nine principles in governing platforms: personalisation, humanisation, ecosystem, integrity, openness, informatisation, dynamic, integration, and innovation. *Personalisation* was reflected in the personalised terminologies and penalties (about 22), which were restrictive rather than coercive. This means that different from laws and regulations, these rules did not cause any damage to the inherent rights and interests of the punished users, nor did they limit the property of the punished users. They were entirely to correct the behaviour of ecosystem users by providing services conditionally. In terms of implementing these penalties, warnings came first, and then implementation was only carried out when the warnings were invalid, which fully reflects the personalisation and humanisation characteristics. *Humanisation* was also reflected in the

interventional mediation method Alibaba adopted, meaning that Alibaba not only mediated disputes but also took the initiative to take full responsibility when fraudsters evaporated and consumers' rights and interests could not be guaranteed. *Ecosystem* characteristic was reflected in the emergence of collaborative governance: "*Effectively combating the counterfeiting issue requires the active involvement from different government agencies and authorities, as the root of the counterfeit problem is offline. By collaborating with China's Public Security Bureau, the General Administration of Quality Supervision, China's State Intellectual Property Office and State Administration of Press, Publication, Radio, Film and Television and leveraging new tools such as the Internet and big data, Alibaba hopes that these measures will be impactful in combating fakes in the real world*." (Alibaba Press Release, December 23, 2014) The Alibaba governance ecosystem comprised eight key parties: quality inspection agencies, enterprise identity authentication companies, cyber security research institutes, credit evaluation companies, Shenzhen Arbitration Commission, Binjiang 12315, Buyers, and information security volunteers. Alibaba also proactively collaborated with NGOs as its corporate responsibilities to showcase its leading effort in enhancing the quality of online trades and sustainability in general. For example, in 2014, Alibaba collaborated with TRAFFIC "*to join forces to address the illegal wildlife trade that is devastating threatened and endangered species of wild plants and animals worldwide*" (Alibaba Press Release, October 14, 2014). *Based on integrity* means that the integrity system established by Taobao with transaction records as the core has become the cornerstone to promote the healthy and orderly development of the entire online shopping ecosystem. It has gradually become the de facto standard in the domestic online retail industry. It has become the consensus of consumers in the online shopping industry to look at the credit rating first, and then decide whether to spend it here. *Openness* was reflected in the Alibaba ecosystem integrity volunteers, where ecosystem users were encouraged to identify and make decisions about illegal activities through programs such as Alibaba Public Review (pan.taobao.com) and Report on the whole network (jubao.taobao.com). *Informatisation* refers to automatic governing methods using data and information Alibaba gathered. This became especially important when the ecosystem's daily transactions and requests exceeded human capacity. For example, data such as transactions, logistics, and customs clearance collected on the cross-border wholesale marketplace Alibaba.com can also be used to "*serve as the credentials of expert businesses*" and "*an export-focused credit system*" on Alibaba's platform, as explained by Sophie Wu, the Vice President of Alibaba Group

and Head of Alibaba.com in 2014. Data can also be shared with government agencies to "*bring about effective enforcement against counterfeiters who operate offline*" (Alibaba Press Release, December 23, 2014). *Dynamic* characteristics emphasised the timely adjustment of all rules in the Alibaba ecosystem. *Integration* was reflected in comprehensively considering and integrating diverse rules in the Alibaba ecosystem, diverse participants, and diverse governance goals. Finally, *driven by innovation* highlighted Alibaba's focus on innovative ways to govern ecosystems.

Maintain legitimacy and develop new institutions. By analysing data, I found that institutional works involved maintaining legitimacy for peaceful growth and knowledge diffusion at this phase (Lawrence & Suddaby, 2006). Gradually becoming an established, scalable and profitable ecosystem, Alibaba could not stay unseen by traditional incumbents who started to perceive Alibaba as a powerful competitor rather than a fledging start-up. In response to the emergent competitive moves, Alibaba had to get buy-ins from multiple parties and collaborate with indirect users such as the government, media, and educational organisations to maintain legitimacy. Because of ecosystem expansion, legitimacy development became increasingly systematic and involved a more comprehensive range of participants at this phase.

Get buy-ins from incumbents and governments to reduce concerns and legitimate expansion. As Alibaba obtained more market shares and consolidated more industries, it became essential for Alibaba to get buy-ins from governments and incumbents for legitimate expansion. To do that, Alibaba strategically positioned itself to avoid being perceived as a competitor or disruptor and proactively leveraged win-wins. Having an expansion plan supported by the government's national strategy helped Alibaba's growth, e.g., the government's rejuvenation plan after the 2008 Financial Crisis was to develop domestic consumption, which was in line with Alibaba's strategy to promote consumption online (Clark, 2016). These win-win activities were leveraged in numerous circumstances throughout Alibaba's journey, as emphasised by one informant, "*Find the win-win points when working with others, so that you can complete the task together. If you can't find it, but instead find a pit, you both fall into it, or you can't find it, then you will do yours, and he will do his. This co-creation ability is very important in Ali…Without this, you can't work at Alibaba*" (A1 I interviewed). For example, Alibaba found a win-win when collaborating with Guangdong Provincial and Guangzhou Municipal People's Governments to hold the first "*Online Merchant Trade Fair*" (Alibaba Press Release, May 17, 2009). While Alibaba promoted its business, Guangdong could obtain a competitive advantage over other

provinces and increase provincial performances. In other words, governments were bought in through win-wins to help build Alibaba's sociopolitical legitimacy. Aiming to support private sector growth through financing, governments were also supportive of Alibaba's entering into the banking sector by issuing Alibaba its banking license in 2014 (Clark, 2016; Tse, 2015). Similarly, incumbents were also approached through collaborations for win-win solutions. For example, Alibaba collaborated with traditional banks, including China Construction Bank, ICBC, and PSBC, to co-create innovative financial services when "*Alibaba transfers to the bank the transaction and behaviour data and credit records left by the loan applicants*" to help banks control risks (Alibaba 2011 CSR Report). When a win-win could not be achieved immediately, other strategies, such as differentiating, were leveraged. For example, to avoid direct competition with the traditional banks who did not have an interest in financing small businesses, Alibaba chose to focus on microloans for small businesses in 2012 as "*lending to small and medium-sized enterprises (SMEs), a substantial and standard part of the US business finance market, has been beyond the scope of most Chinese banks*" (Zeng, 2018b: 57-58). Later, Alibaba chose Ant as the name of its finance arm in 2014 because "*besides appealing to small businesses, we hoped that the name would also communicate our strategy: since each ant only eats a little, we were not threatening the traditional big lending business*" (Zeng, 2018b: 58). Although there were subsequent fightbacks from traditional banks and governments after the success of Yu'e Bao online mutual fund in 2013 and Jack Ma wrote an opinion piece on People's Daily to argue for more private participation, Alibaba "*continued to push the boundaries of private sector involvement in financial services, including providing microloans to the merchants and consumers trading on its platforms*" (Clark, 2016: 16).

Develop a new civilisation with a wider range of participants to support expansion and knowledge diffusion. Regarding the cognitive aspect of institutional structure, the second phase started to adopt a more systematic and comprehensive approach. Collaborators began to expand, and channels covered various formats, including training, media, conferences, and foundations. Alibaba ecosystem participants worked together to design and export a new mental framework or worldview, setting the mental foundation for commercial and social activities. Alibaba framed it as a "*New Commercial Civilisation*" (A1 I interviewed) and proposed it around 2009. This "*New Commercial Civilisation*" coherently guided participants' cognition, behaviours, and evaluations (Mullins, 1972). It is defined as "*a new state of human progress achieved under the conditions of the Internet, led by e-commerce, and realised through changes in economic, social and cultural*

development methods. The changes in productivity, production relations and production methods triggered by the information technology revolution will eventually promote the formation of new economic, social and cultural civilisation paradigms and progressive states on this basis" (New Commercial Civilisation Report, 2010). According to the 2009 Alibaba CSR Report, "*In the old era of commercial civilisation, enterprises were self- and profit-centred, not society-centred. The 21st century will be an era of new commercial civilisation. "Openness, sharing, responsibility, and globalisation" are important connotations of the new commercial civilisation, and "commercial civilisation in the information age" will be its evolution direction. Such a new commercial civilisation puts forward new requirements for every enterprise. It requires enterprises to rethink the relationship with customers, employees, shareholders, partners, social and economic environment, natural environment, etc., and make substantial changes for this*."

Following this "*New Commercial Civilisation*" institutional framework, ecosystem growth led to an ever-increasing demand for training for these newly created vocations and new ideologies. Without accepted vocabularies or conceptual frameworks in traditional universities, new participants, including providers and complementors, face significant hardship in getting the necessary skills to join the Alibaba ecosystem. Therefore, at this stage, Alibaba proactively established *educational institutions* or collaborated with some *traditional universities* to help train new talents and push the institutionalised diffusion of knowledge about these new professionals. For example, Taobao University invited successful providers to share their experiences through various seminars and programs. Most of the lecturers at Taobao University had selling experiences in Taobao. To become a lecturer in Taobao Education, sellers had to pass through six verification processes. The high threshold of becoming certified provided lecturers with a high reputation once obtained, thus leading to a high intention to contribute to the development of the ecosystem. Similarly, Alibaba Cloud launched free training and professional certifications related to cloud technologies. These certificates provided participants with opportunities to expand their career trajectory. According to Sina Education, in 2017, over 5,000 participants obtained certificates from Alibaba Cloud. After obtaining certificates, Alibaba helped enrich certificate holders' resumes by providing them with an official portrait of their skills and then helped them land jobs by matching these resumes to Alibaba's ISVs and providers who had such talent demand. Alibaba also actively promoted the integration of these certification classes into other platforms to benefit more learners. These reputation gains were vital to facilitating adoption and igniting ecosystem generativity. On

top of the Taobao University launched in 2006, Alibaba launched the Alibaba Research Centre in 2007 to develop leading-edge case studies of SMEs, research reports, and new business knowledge by leveraging Alibaba's big data and openly collaborating with experts and organisations worldwide. By partially opening Alibaba's big data for leading external researchers, Alibaba can accelerate the diffusion of new knowledge and influence the direction of research outputs. Leading research institutes that participate in Alibaba Research Centre's research projects also provide Alibaba with socio-political legitimacy as to Alibaba's vision of the digital ecosystem and business models. In 2008, Alibaba partnered with Hangzhou Normal University, Jack Ma's alma mater, to launch Alibaba Business School. This collaboration for Hangzhou Normal University aimed to establish a leading business school by collaborating with the leading business Alibaba. Alibaba used it to train new talents, diffuse new knowledge, and obtain cognitive legitimacy. Hangzhou leveraged it to contribute to Hangzhou's mission to become "China's e-commerce capital". In 2009, the 2nd China University Students "*Tomorrow e-commerce business*" Challenge was held, with more than 100 thousand university students participating. Moreover, in the same year, Alibaba Education Technology Co., Ltd. was launched to comprehensively help upgrade university students and corporate talents, boost employment, and promote the realisation of a new commercial civilisation. In 2010, AliExpress University was launched with the official launch of aliexpress.com, targeting importers and exporters. Two years later, 1688 SMEs Business School was launched as the incubation base for e-commerce talents. Note that at this stage, the educational organisations were still not accredited as official schools or universities by the government but served an essential role in knowledge diffusion.

On top of training, Alibaba also collaborated with *the media* to expand the acceptance of digitally enabled business models and new institutional norms. In 2009, Taobao collaborated with Hunan TV and launched a joint venture called Happy Taobao, aiming to use television media to promote e-commerce and shopping through digital television. The expansion from mobile to television signalled Alibaba's strategic goal at this stage – data accumulation and commercialisation. Television media not only promoted cognitive understanding through content but also added another access point of consumer data to help Alibaba gain a better understanding of consumers. Besides partnership, Alibaba also launched its web-based news organisation itself called Alizila in 2010 to push the institutionalised diffusion of knowledge, e.g., developments of Alibaba, new business models, new applications of digital technologies, and new developments of

the international e-commerce industry (Alibaba Press Release, September 9, 2010). Later in 2014, Alibaba leveraged various media channels, including the State Administration of Press, film, television, radio, and publication, to advance the diffusion of anti-counterfeiting culture (Alibaba Press Release, December 23, 2014). Combating counterfeiting is vital to enhance the legitimacy of the Alibaba ecosystem, especially the e-commerce platforms, to assist its data accumulation and commercialisation strategy through increased adoption.

Besides educational organisations and media, Alibaba also leveraged other vehicles to support the development of new institutional norms, including foundations, shopping festivals, and conferences. *Foundations* were leveraged to steer collective efforts to cultivate new talents and new ideologies. Following the collaborative publication of the New Commercial Civilisation Research Guide and the New Commercial Civilisation Manifesto in 2010 between Alibaba Research Center and various scholars and experts, Alibaba launched the Alibaba Foundation in 2011 to promote sustainability and civil responsibilities. In 2014, Alibaba launched the Jack Ma Foundation, focusing on improving education, the environment, medical care and other areas. *Shopping festivals* were also developed not only to pilot-test Alibaba's new ecosystem technologies but also to establish a new collective identity. Employees of Tmall proposed the Single Day (Double Eleven) shopping festival in 2009. The handling of this Single Day shopping festival showed effective collaboration among different subunits inside Alibaba's platform ecosystem, especially the three key edges: payments, logistics, and front-end e-commerce websites (Clark, 2016). *Conferences* served as a critical context for knowledge diffusion and legitimacy building. Many series of conferences have been held annually, including Web Engineer Xiakexing Conference (1st - 3rd), Netrepreneur Summit (4th - 9th), China Local Website Development Forum (1st - 2nd), APEC SME Summit in 2009, and AliCloud App Developer Conference (1st - 4th). To enhance the legitimacy of such conferences, internationally well-known thought leaders were invited. For example, in 2009, the SME Summit had well-known presenters, including President Bill Clinton; Olympic Gold Medalist and NBA Champion Kobe Bryant; Howard Schultz, chairman, president and CEO of Starbucks Coffee Company; Nobel Peace Prize Laureate Muhammad Yunus; and Liu Chuanzhi, Chairman of the Board of Lenovo Group Limited.

To briefly summarise, Alibaba orchestrated ecosystem participants through four themes of activities to work together towards the ecosystem-empowering vision at this phase. The ecosystem technological architecture was updated from a monolithic design to a micro-service distributed and

open architecture with open source, cloud computing and data middle platform to solve bottlenecks and enhance efficiency. Internally, Alibaba focused on enhancing synergies and efficiency among business units, systemising the process of internal incubation and developing ecosystem-friendly KPIs and social enterprise governance mechanisms. Ecosystem adoption was promoted by leveraging dynamic enabling, spawning platforms, and ensuring fairness and protecting rights. Institutional activities involved getting buy-ins from incumbents and governments and developing a new civilisation to maintain legitimacy and develop new institutions. These four activities interplayed and supported each other in driving ecosystem sustainable growth. The architecture updates provided a stable and scalable technological foundation necessary for viral ecosystem adoption, internal restructuring, and institutional development. The efforts of internal orchestration provided ecosystem-friendly KPIs and successful experiments on digital business structures that could commercialise to support ecosystem adoption and institutional updates. Ecosystem adoption made possible more architectural updates that enhanced efficiency and scalability, supported internal learning and re-envisioning, and provided ample success examples to give life to new institutions. Institutional activities supported all three by offering the necessary legitimacy and institutional arrangements for ecosystem expansion.

Micro-macro processes. These above four interdependent micro activities co-evolved while adapting to external changes, leading to the end of phase two marked by Alibaba's second successful IPO in 2014. Two micro-macro processes that drive ecosystem-level changes were in play – expanding and constraining. Expanding processes involved ecosystem synergies and re-envisioning. Ecosystem synergies brought ecosystem-level changes through mutually reinforcing micro-activities between participants. Direct network effects and data network effects enabled and stacking common resources bring in new possibilities for Alibaba to further expand to stack more generic resources in a systematic manner to enable participants. These micro-level actions and interactions gradually made the ecosystem vision expand beyond only opening up the ecosystem for external participation and by the end of 2014 shifted to providing the fundamental technology infrastructure to empower participants. It became apparent that the gradually stacked and thickened generic resources became increasingly important in empowering participants.

At the same time, endogenous bottlenecks emerged and started to inhibit Alibaba's ecosystem expansion by the end of 2014. Increasing volumes of data and complexity started to cause issues and pose challenges to Alibaba's existing technological architecture, calling for a new

wave of architectural updates. Specifically, Alibaba had to increase its investment in physical computing facilities for the transaction peak in the annual Double 11 Shopping Festival, which brought up the issue of idle facilities that cost Alibaba a considerable amount of money on normal days. In other words, existing distributed cloud architecture could not solve the lack of elasticity. Besides technological bottlenecks, this second phase also exhibited a non-technical bottleneck – a lack of industry-specific resources, including knowledge, experience, and assets. The lack of complementary resources was a critical bottleneck for Alibaba to expand to specific industries. One informant vividly illustrated this bottleneck: "*Alibaba was born as an Internet company which is good at ToC businesses. Compared with born ToB businesses such as Huawei, Alibaba does not have the advantage because Alibaba does not have experience working in businesses or governments nor does it have the industry knowledge. Traditional ToB businesses have accumulated so many years of experience and networks with businesses and governments. Businesses and governments do not trust Alibaba*." (A10). As further digitalisation to new stages of value chains and industries has become harder given the increased complementarity between new industries and the internet, Alibaba needed to adjust ecosystem architecture and vision again to rejuvenate ecosystem growth. Instead of competing with traditional industry players, Alibaba adopted a path based on its advantages. When reaching a tipping point where bottlenecks started to constrain growth and new technologies became mature enough, a new ecosystem vision emerged to propel a new phase of growth.

5.3 Phase 3 – Infrastructure Empowering (2015-2020)

> *"We believe that the services provided by Alibaba in the future will be the fourth indispensable business infrastructure resources for enterprises after water, electricity and land… We empower merchants engaged in buying and selling, rather than compete with merchants."*
>
> *- Jack Ma, CEO's Letter to Shareholders, 2015*

> *"The middle platform is not designed, but the result of natural evolution to meet business transformation needs."*
>
> *- Alibaba Industrial Internet Platform White Paper 2020*

Bottlenecks endogenously emerged and new macro supporting factors pushed for another qualitative shift of the Alibaba ecosystem around 2015. My data revealed that Alibaba updated its phasic vision non-incrementally from ecosystem empowering to infrastructure empowering: to empower participants through providing intelligent digital infrastructure, including data, knowledge, and capabilities. This shift was viewed as a significant turning point in Alibaba's history by informants and can be observed as early as the second half of 2014 when Alibaba redefined itself as providing: "*the fundamental technology infrastructure and marketing reach to help businesses leverage the power of the Internet to establish an online presence and conduct commerce with hundreds of millions of consumers and other businesses*" (Alibaba Press Release, May 12, 2014). In 2016, Alibaba's vision became more explicit in infrastructural empowering when it incorporated "infrastructure" in its aim: "*The company aims to build the future infrastructure of commerce. It envisions that its customers will meet, work and live at Alibaba, and that it will be a company that lasts at least 102 years*" (Alibaba Press Release, October 20, 2016). AliCloud's then-director has made analogies of the infrastructural nature: "*Internet is like fire (infrastructure), data is like new land (means of production), and cloud computing is like electricity (energy and power)*" (Wang, 2016: 213). Although Alibaba mentioned its goal as early as 2007 in its Alibaba.com Annual Report to "*become a provider of e-commerce infrastructure for SMEs in China and Asia*", the infrastructural focus at that time was still restricted to e-commerce. In this third phase, commerce has replaced e-commerce because every business was involved in some elements of digital technologies by that time, thus rendering "e-" meaningless. Jack Ma summarised this shift in his CEO's letter to shareholders 2016: "*We are not merely trying to shift*

buy/sell transactions from offline to online, nor are we changing conventional digital marketing models to squeeze out a little additional profit. We are working to create the fundamental digital and physical infrastructure for the future of commerce, which includes marketplaces, payments, logistics, cloud computing, big data and a host of other fields. Supported by the twin pillars of cloud computing and Big Data, our goal is to empower merchants with the ability to transform and upgrade their businesses for the future." To reflect digital infrastructure's inclusive and utility nature, Alibaba started to address itself as a digital economy from 2018 (Alibaba Press Release, November 2, 2018).

Ecosystem participants. The infrastructure empowering phase witnessed a rapid expansion of direct participants as indirect participants converted to direct ones and ever-expanding generic resources were stacked as infrastructural services. Specifically, provision-side direct participants expanded by adopting Alibaba's software applications for businesses or joining Alibaba IIoT platforms to enhance operational efficiency. Governments can shift to direct users of Alibaba's digital infrastructure, such as edge, Cloud computing and other PaaS- and SaaS-related services, to enhance operational efficiency in initiatives such as Smart Government and Smart City. Similarly, NGOs, start-ups, media, and education and research organisations can all potentially become direct participants of Alibaba to enhance their operational efficiency. The all-inclusive nature of infrastructural resources means that participants were broader than those in previous phases with the provider-consumer focus, and activities were more comprehensive, covering buy, sell, pay, deliver, travel, social, live and work, and social activities such as poverty relief, environmental protection, and job creation. Roles started to lose specificity because all types of participants could be viewed as customers and at the same time resource providers of Alibaba's infrastructural services. As Alibaba described in 2015, "*We believe that concentrating on customers' needs and solving their problems – **whether those customers are buyers or sellers** – ultimately will lead to the best outcome for our business. We have developed a large ecosystem for online and mobile commerce that enables participants to create and share value on our platform. Our decisions are guided by how they serve our mission over the long-term, not by the pursuit of short-term gains.*" (Alibaba Annual Report 2015) and updated in 2019, "*We believe that concentrating on customer needs and solving their problems – **whether those customers are consumers, merchants or enterprises** – ultimately will lead to the best outcome for our business. We have developed a large digital economy that enables participants to create and share value on*

our platforms. Our decisions are guided by how they serve our mission over the long term, not by the pursuit of short-term gains." (Alibaba Annual Report 2019). In Alibaba's Annual Reports 2015, Alibaba distinguished buyers and sellers - "*buyers and sellers are at the heart of our ecosystem*" and illustrated specific value propositions to consumers, sellers and complementors. However, Alibaba has not mentioned the buyer-seller division in its annual reports since 2015. The expansion of coverage and disappearance of the consumer-provider logic signified the broad range of infrastructure-empowering services Alibaba's digital economy could provide in this phase.

Ecosystem synergies. Building on previous synergies and exploiting new opportunities, this phase unveiled some new potential. Moving beyond network effects on the consumption side in platform and ecosystem empowering, infrastructural empowering suggests generative changes from network effects among providers (organisations), industries, and regions. Generic resources became more thickened and comprehensive, including data, knowledge and capabilities, than those in the previous phase. Sustainable growth was a critical focus to generate increasing value for all participants.

Support generative changes through network effects among organisations, industries, and regions. Besides being automated and smart, generative changes started to enter deep into the provision side and became increasingly platformed. This means two things. *First*, direct participants of ecosystems expanded in the provision side to include providers of components and raw materials in various industries such as steel, electronics, machinery, and chemicals. Generative changes thus came from more than just buyers, retail and wholesale sellers and complements or consumer-facing industries such as apparel, cosmetics, and food in the previous phases. All tiers of component providers and associated complementors in the supply chain can adopt the ecosystem infrastructural services to generate changes and variety. *Second*, participants themselves shifted into layered platform architecture and could join the ecosystem as platformed organisations, industries, and regions. Organisations, comprising different departments in middle-platform architecture, can generate organisation-specific knowledge for cross-organisational monetisation and coordination. Industrial platforms, comprising different providers and complements in associated industries and organised in middle-platform architecture, can generate industry-specific knowledge and applications for cross-organisation and cross-industry monetisation and coordination. Regional platforms, organised in middle-platform architecture and comprising key regional providers, governments, complements and others, can generate region-

specific knowledge and applications for cross-organisation, cross-industry and cross-regional monetisation and coordination. These three levels of platformed participants can reinforce each other – "*As a "surface", the regional-level Industrial Internet Platform can fully release its capabilities in technology, resources, links and operations to empower the growth of the "line" (industry-level Industrial Platform). Moreover, the regional-level Industrial Internet Platform relies on the professional capabilities of the "line" in the vertical field to together empower "point" (organisational-level industrial platform). At the same time, the growth of "line" and "point" will also support the continuous expansion of "surface", thus forming a self-circulating ecosystem*." (Alibaba New Generation Industrial Internet Platform Model and Success Practices White Paper 2020). Therefore, network effects emerged across organisations, industries, and regions: the utility one obtains from joining the ecosystem is positively related to others' adoption because more adoption from organisations, industries, and regions attracts more organisations, industries, and regions to join to enhance performance, specifically operational efficiency.

Stack generic resources in layered digital infrastructure for sharing and optimising. At the same time, generic resources stacked for sharing thickened and became increasingly layered and magnified in scale, scope, and depth, including data, knowledge and capabilities, to enhance operational efficiency and optimise value propositions for a wide range of participants. Specifically, according to the Alibaba supET White Paper 2019, data stacked to share across participants expanded – "*from production equipment, instruments, industrial software, images, voice and video, and even e-commerce data and weather data*". Knowledge stacked to share expanded from e-commerce-related to "*industrial knowledge*" in the "*SaaS, APP, and micro-service format*". The capabilities stacked to share involved more than just IaaS Cloud capabilities, generic modules, tools, and logistics in the second phase but also PaaS architectural functions such as IoT capabilities to collect industrial data and industrial application development, integration, hosting, and operation capabilities. These changes resulted from advancements in digital technologies such as Cloud computing, Edge computing, data mining, digital twin, and Cyber security. Through digital transformation, businesses and industries could leverage the same digital infrastructure where data, knowledge, and capabilities could be shared and optimised as more participants join. One informant illustrated the architecture: *"the bottom layer is the device, and the device has edge computing. The data collected on the device is put on the IaaS layer, and there is a PaaS on it. The core thing in PaaS is the algorithm. Of course, the algorithm may be called*

software, which is fragmented and deposited on the industrial PaaS layer. Industrial App is the repackaging of various fragmented functional components and deposited in the PaaS layer. The purpose of packaging is to optimise equipment operation and enhance software fluidity so the software can be oriented to various services. This is an industrial internet platform." (A2 I interviewed)

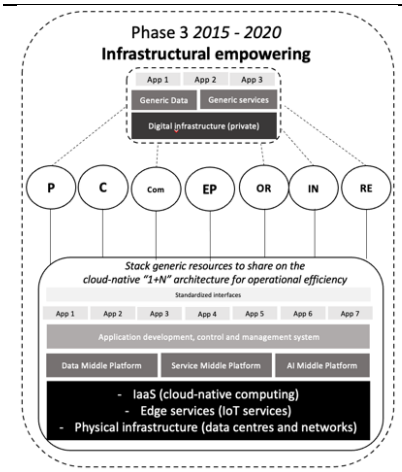
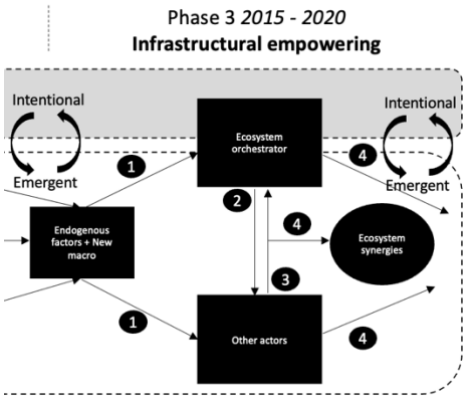
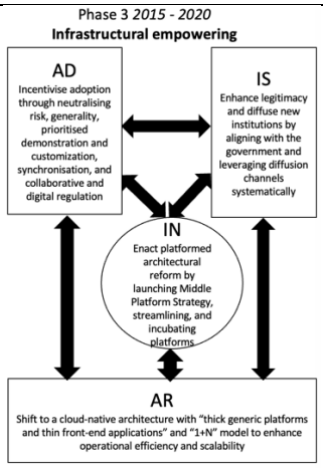
Sharing generic resources at this phase provided nuances in efficiency and optimisation. *First*, moving beyond transaction and innovation efficiency, operational efficiency takes centre stage. By sharing digital infrastructure (edge, IaaS, PaaS, and SaaS) and stacking generic data, services and AI across organisations and industries, participants do not need to waste resources to develop basic shared infrastructure, services and modules and thus can be more focused on providing satisfying services to customers and innovating in their fields. At the same time, as more and more participants become digitalised and join and contribute to shared infrastructural platforms, more and more resources can be abstracted, generalised, modularised, applicationised, and stacked to better support each participant with insights across boundaries. Shared data, knowledge and capabilities among participants along value chains also helped enhance operational efficiency when coordinating demand-supply and innovation. *Second,* getting consumption-side participants and provision-side participants from all tiers and industries onto a shared digital infrastructure made optimising data-driven *large-scale customisation* possible. Alibaba coined this effect as the twin flywheels of consumer Internet and industrial Internet in its Reconstruct Growth Engine Report in 2019. Specifically, when provision-side and consumption-side participants are both digitalised and reside on the same digital infrastructure, this increases the efficiency and effectiveness of data-driven customised demand-supply matching for the economy as a whole. Digital transformation of businesses on the provision side served as the first driver, upgrading their traditional legacy systems to the new Cloud-based and IoT-based smart ecosystems. Digitalising the supporting services for consumer experiences was the second driver, requiring IoT to connect physical stores, online experiences, and applications. The upgrading of consumption-side ecosystems drove provision-side transformation by unearthing potential consumer needs that were data-driven and non-existent before the digital age. These newly discovered needs through data aggregation and analytics provided opportunities for provision-side participants to create new offerings, serving as a strong flywheel effect. Through this process, providers not only increased operational efficiency but also developed the ability to directly serve the massive, personalised

demand of individual consumers. Shopping festivals such as Double 11 further accelerate the Flywheel speed, as explained by one informant from Alibaba: "*Double 11 festivals held by Alibaba every year serve as a pulse effect to push the provision side to transform digitally – more customised, more agile, more online, more fast delivery, more flexible production, and easier to match demand. Just like strong water comes through each time and eventually to push the canal into a river. Specifically, if only 20 percent of the demand from the consumption side is customised, agile, and flexible, the raw materials industries may not feel the change. However, if 40%, then they will start to face the reality that they have to transform to meet these fast-changing and customised demands. Now for example we have 20 percent, ToC providers feel the most, and some wholesalers have started to feel as well. The percentage keeps increasing, and digitalisation accelerates this process.*" (A6 I interviewed). These twin flywheels of consumer Internet and industrial Internet pushed providers to digitalise and become more flexible to meet ever-personalised and ever-changing demands constantly. In other words, when data from consumption-side participants and provision-side participants are linked, providers can not only sell products or services to consumers but also get to know in real time what consumers want and how much to meet this individual demand on time. In this way, providers can eliminate excess inventories and enhance operational efficiency. Consumer data can further predict future demand and help providers in all tiers schedule and plan. The platform ecosystem orchestrator's role is more than a market intermediary that promotes multi-sided network effects but a digital transformation accelerator to enable more efficient, effective and data-driven customised matching of supply and demand, leading to more efficient resource allocation for the economy as a whole.

Sustainable growth. With the inclusive, collaborative and integrative approach, ecosystems showed the potential to adapt and grow sustainably. This can be observed in two aspects: 1) sustained value creation for stakeholders by empowering even-expanding participants, and 2) sustained efficiency enhancement by sharing continuously improved generic resources. The core of ecosystem sustainable growth lies in *"collaboration, empowerment and symbiosis. When thousands of organisations gather together, share resources, attract and complement each other, forming a community of collective wisdom and interests, the platform ecosystem can prosper and individual interests can be satisfied.*" (Alibaba supET White Paper, 2019) Moreover, sustainable growth relies heavily on balancing the benefits of resource sharing while eliminating risks of

inappropriate usage. See Table 5.4 for the graphical illustration of ecosystem synergies, ecosystem change and associated orchestration strategies in phase 3.

Table 5.4 - Alibaba phase 3 ecosystem synergies, change and orchestration

Ecosystem synergies	Ecosystem change	Ecosystem orchestration
		
Direct participants (solid circles): **P**: Providers, **C**: Consumers, **Com**: Complementors, **EP:** Employees, **OR**: Organisations, **IN**: Industries, **RE**: Regions **Support generative changes through:** - Network effects among organisations, industries, and regions **Stack generic resources for efficiency and optimising:** - Data, knowledge, and capabilities - Operational efficiency - Data-driven large-scale customisation **Sustainable growth**	**1**: Macro-micro processes **2:** Actions of orchestrators **3:** Actions of others **4:** Micro-macro processes	**AR**: Architectural activities **IN**: Internal activities **AD**: Adoption activities **IS**: Institutional activities

Macro-micro processes. I found that this phase was mainly triggered by endogenously generated bottlenecks. Although accumulated competitive advantages such as data and cloud technologies and emergent ecosystem synergies such as network effects and data network effects provided the Alibaba ecosystem with a competitive edge in providing even more digital infrastructural services, this advanced legacy also limited Alibaba's expansion into industry-specific verticals, as a further expansion to complicated industries required a high level of industry-specific knowledge. Moreover, various problems that emerged from increasing data volumes and complexity could not be resolved by incrementally updating existing technological architecture and ecosystem vision. In addition to triggering factors, this ecosystem phasic change was also supported by many macro factors. Regarding technological advancements, the 2016 Alibaba Business Service Ecosystem White Paper has summarised six main digital advancements that supported the new ecosystem vision, including cloud computing, Big Data, the Internet of Things, Mobile Internet, Machine Learning, and Virtual Reality. What is more, necessary regulatory support emerged. For example, in 2015, the Chinese government launched the "*Internet Plus*" policy to encourage innovation and facilitate industry digital transformation and efficiency by

leveraging digital technologies. In the same year, the Chinese government also launched the "*Mass Entrepreneurship, Mass Innovation*" policy to encourage people to start their own businesses and to innovate. Later, the "*Supply-side Structural Reform*" policy was launched in 2016 and the "*Internet + Advanced Manufacturing*" initiative was launched in 2017 to support the digital transformation of traditional industries. In addition, the Chinese venture capital market in 2015 was booming, providing strong financial support for business initiation and growth. Lastly, China was witnessing strong middle class growth, serving as a strong engine of economic growth for China and Chinese businesses.

Together, these triggering and supporting factors pushed the Alibaba ecosystem to initiate the re-envisioning process again and qualitatively shift to a new ecosystem vision – infrastructural empowering in the third phase. Although there was significant uncertainty, the abstract mission and this new ecosystem vision guided Alibaba to co-evolve with participants in four activity themes: 1) restructure architectural design, 2) enact platformed architectural reform, 3) foster infrastructural adoption, and 4) enhance legitimacy and diffuse new institutions.

Restructure architectural design. My data reveals that Alibaba's ecosystem architecture was restructured in three ways to prepare for the intelligent digital infrastructural empowering: 1) shifted to the cloud-native architecture, 2) adopted the "thick generic platforms and thin front-end applications" framework, and 3) adopted the "1+N model". The goal is to become a more "*technologically inclusive platform*" (Alibaba Press Release, March 21, 2019) for infrastructure-empowering vision by thickening the layers of generic resources and reorganising the structure and rules for more open access, more contribution from a wide range of participants, and higher scalability than previous architectural design offered.

Shift to the cloud-native architecture to enhance efficiency and scalability. To solve the scalability bottlenecks and add efficiency to the distributed cloud hosting architecture in the previous phase, Alibaba adopted the cloud-native architecture, characterised by container technologies, Kubernetes, and ServiceMesh service grids. The generic resources that could be shared become thickened through the cloud-native architecture. Specifically, by stripping non-functional and generic features (such as elasticity, resilience, security, and observability) from business codes to IaaS and PaaS layers between the upper cloud application layer and the various cloud computing technologies at the lower layer, the cloud-native architecture unifies the cloud application technology upwards and manages various cloud computing technologies and assets

downwards. This update enables the reusability of non-functional and generic features across various technical solutions, thereby reducing the coverage of developers and computing costs and allowing them to focus on developing business codes efficiently. Moreover, instead of having different closed and proprietary technological architectures for different businesses, the cloud-native architecture proposed open and standard architecture, enabling businesses to connect, exchange, co-develop, and co-innovate across boundaries. It is distributionless, open, standardised and elastic. Businesses and developers can build and run systems on the cloud that are elastically scalable, fault-tolerant, easy to manage, and easy to observe, with reduced computing costs and enhanced operational efficiency. According to the online Alibaba Cloud community, Alibaba Cloud-native White Paper, Alibaba Cloud-native Large-scale Application Landing Guide 2020 and other data sources, Alibaba and critical partners collaboratively worked on the cloud-native architecture to ensure it was fully ready for commercialisation from 2015 to 2019.

Adopt the "thick generic platforms and thin front-end applications" framework to enhance reutilisation, efficiency, and scalability. Besides cloud-native architecture, Alibaba also proposed the framework of "*thick generic platforms and thin front-end applications*" in 2015 after successfully piloting the Shared Service Division inside Alibaba in the second phase. Again, similar logic guided this architectural update: generic resources that could be shared become thickened, and front-end applications become micro-serviced and modular for more ecosystem synergies and operational efficiency. As more and more platforms spawned with emerging demands, Alibaba became more aware that it was a waste of resources to develop and manage applications separately or one at a time. Therefore, building on the Shared Service Division across Taobao, Tmall, 1688 and Juhuasuan in the previous phase, Alibaba further distilled, deposited, and shared common components (or codebase) that exhibited low variety and high reusability into lower platforms in order to achieve economies of production and innovation of services or platforms. Specifically, in 2015, Alibaba developed the middle platforms that resided between all platforms and the cloud to replace the old version, where every platform in the Alibaba ecosystem resided independently in Alibaba Cloud. Components were also remade to become more modularised so as to ensure no ripple effect when one component changes. This way, new platforms or services could be created easily and agilely to deal with changes by recombining and reusing shared codebase stored in the middle platforms such as the user centre, commodity centre, transaction centre, and evaluation. According to Zhong (2017), more than 25 front-end business

units of Alibaba (such as Taobao, Tmall, Juhuasuan, Quah and other well-known businesses) were not independently built on Alibaba Cloud's cloud platform. The Shared Service Division in the previous phase embodied the "*thick generic platform*", providing the most professional and stable business services to facilitate operational and innovation efficiency for various front-end businesses of Alibaba. This architecture was also crucial to initiating ecosystem synergies on the provision side, e.g., the Industrial Internet of Things, as thin micro-serviced and modular front-end applications and thick generic resources can enhance the efficiency of industrial application development. After successfully testing the architecture with Alibaba's own applications in the ecosystem, Alibaba started to empower ecosystem participants externally in two ways: 1) Alibaba proactively promoted the contribution of ecosystem participants and shared the generic services in the "thick generic platforms" such as data and services with ecosystem participants to enhance their operational efficiency and 2) Alibaba can help ecosystem participants to develop such framework themselves to enhance their operational efficiency and better connect with Alibaba ecosystem for contribution and synergies.

Adopt the "1+N model" to enhance sharing and support industry-specific platforms. Building on the cloud-native architecture and "*thick generic platforms and thin front-end applications*" framework, Alibaba launched the "*1+N model*" around 2018 to support further expansion of digital infrastructural services into vertical markets, for example, IIoT infrastructure. The same logic guides this architectural update - to thicken platforms of generic resources for operational efficiency. According to the Alibaba supET White Paper 2019, the "1" of the "*1+N model*" refers to the layer every industry, regional and enterprise platform resides on, responsible for not only gathering and stacking product technology and data capabilities from all industries and regions for sharing but also selecting and developing industry-agnostic algorithms and data models that can be reused and recombined for future innovations. This stacking and abstraction process typically involves developing generic applications for the SaaS model and modularisation. "1" also includes the general-purpose technologies (e.g., AI chips and IoT processors) and physical infrastructure (e.g., data centres and networks) that are industry-agnostic. In this way, the "N" industry and regional platforms can focus on developing industry-specific algorithms and data models to better serve customers with product, process and business model innovations. Vertical platforms for specific industries can use the "1" super platform to learn from other N's best practices and algorithms. Data sharing inside the super-platform can also keep improving each N.

In this way, the common 1 super platform can deposit capabilities from leading companies of each industry in a digital and modular format to share with SMEs in each vertical with cheap and easy-to-connect solutions. The economy's resource allocation and operational efficiency can be improved by sharing data, knowledge and capabilities in this architecture. This "*1+N model*" can also apply within each industry-specific vertical platform by connecting and stacking generic resources across organisations inside an industry. When equipment from upstream components and downstream providers connect to one shared cloud-based IoT platform and is equipped with chips and networked sensors, these machines are able to communicate with each other, assess one another's capacity, and coordinate with machines across firms and locations to optimise the production process. As more and more supply chain participants join the industry-specific IIoT platform, more resources can be stacked and used for share, and more data can be leveraged by big data analytics to optimise operations. Any changes made on the platform can be updated across the entire supply chain so that any provider on the platform can know what is changing and what has been changed. In 2018, the Alibaba Cloud Industrial IoT platform reached a cooperation agreement with nearly 200 partners to support the interconnection of up to 500 types of industrial devices. The Industrial Brain Open Platform was released the same year, opening up three industry knowledge maps, 19 business models, and more than 20 industry algorithm models.

To summarise, architectural activities at this phase laid the technological foundation for the vision of infrastructural empowering. Through stacking modularised and generic resources into shared thick platforms across layers where intelligent digital infrastructure consists, Alibaba could expand to more complex industries, and more and more businesses and industries could benefit from using, contributing and optimising shared digital infrastructural services and ecosystem synergies.

Enact platformed architectural reform. Internally, Alibaba enacted a systematic architectural reform focusing on developing an internal platform ecosystem to enhance internal efficiency and adaptation and thus support the vision of infrastructure empowerment. This was a response to the growing concerns that "*the company's immense size is making it harder for Alibaba to innovate… On one hand, you need more management policies and rules, but you also need to keep things simple in order to move fast. Alibaba is figuring out that balance.*" (The Wall Street Journal, April 15, 2014) Specifically, Alibaba launched a Middle Platform Strategy, streamlined and integrated services, and incubated platforms as pilots to experiment and demonstrate

innovations. These internal architectural reforms towards the internal platform ecosystem model helped solve the problems of a significant increase in organisational complexity dealing with fast-changing market needs and environment, such as work procedures, vertical hierarchies, coordination bodies and decision-making approval steps. The previous chimney-style organisational structure and associated siloed organisational units and processes could not fulfil the requirement of fast adaptation with minimum costs as it was hard to share resources across units and respond to emerging needs rapidly.

Launch the Middle Platform Strategy to enhance synergies and adaptation. Intending to develop the internal platform ecosystem, in 2015, Alibaba launched the Middle Platform Strategy to enhance synergies and efficiency among all business units. This internal reconstruction aligned with the architectural technology updates, e.g., the "*thick generic platforms and thin front-end applications*" framework. While architectural technology updates focused on digital devices, applications and modules, business reconstruction targeted departments, business units and human resources. Specifically, a Middle Platform business group was established, including "*the Search Division, Shared Business Services Platform, Data Technology and Product Department*" (Hua Chuang Securities Report, March 11, 2019). These middle platform business units are responsible for generic and shared resources to reduce repetitive efforts and support front-end application-oriented business units and the whole Alibaba group to operate and innovate more efficiently. Front-end application-oriented business units were given some degree of autonomy and responsibility for profits, and middle-platform business units aimed to integrate generic resources used across different applications and to share across all business units in Alibaba. Innovations can be initiated from the front-end application business units and supported by different middle-platform business units through internal market mechanisms. All middle platform business units adopted unified rules of resource exchange, such as standard resource library and resources transaction mechanism, so generic resources can be efficiently utilised to support internal front-end innovations. In this way, the traditional organisational model of top-down selection and micro-managing innovations can be improved by adding this organisational form to empower innovation through the internal platform ecosystem structure and process. In this organisational structure, instead of top-down management, managerial roles focused on pointing out the general direction, allocating responsibilities, communicating goals and organisational culture, motivating autonomy and innovation, and developing external collaborations. When it comes to employees in this

organisational form, they were required to have high cross-boundary collaboration capabilities - the ability to proactively initiate projects that align parties from different departments inside and outside the organisation for co-creation. From interviews and participant observations, I have experienced and witnessed the power of such cross-departmental collaborating capabilities in Alibaba to support internal adaptation and ecosystem sustainable growth. Each department head did not have strong control over employees within the department. Employees were encouraged to think outside their department boundaries when producing high performance. Instead of following instructions, employees were encouraged to develop initiatives involving multiple departments, business units and external participants. Every time an employee thought of a new initiative, they needed to stop and think about how this initiative could be designed or expanded to benefit as many parties as possible and then start talking to as many parties as possible. If others were willing to join the initiative, it showed that the initiative was meaningful and needed by not only one's department but also other departments. "*Everybody is like an octopus in Alibaba*" (A14 I interviewed). After successfully engaging multiple parties, a temporal team was set up to make decisions together. Such organisational structure and processes promoted internal market selection mechanisms and were powerful in generating initiatives that collaborate widely for greater impact.

Streamline and integrate for coherence and synergies. In addition, to promote internal collaboration and synergies in the internal platform ecosystem, Alibaba streamlined and integrated internal services. This also reduced adoption barriers and ensured comprehensive coverage of market needs so that participants could choose. Having the right to choose and options to choose from gave participants a sense of security and empowerment where they did not have to adopt services or give up their own resources when they had concerns. Specifically, Alibaba developed and comprehensively assembled services to showcase widespread applications across industries, helping users gain efficiency, reduce costs, and monitor risks. This comprehensiveness could be seen in the framing of a "*one-stop shop*" and "*comprehensive suite of solutions*". For example, to demonstrate the cross-industry application of AI technologies, Alibaba developed a comprehensive list of solutions and showcased them with partners in various situations in 2016, including video recognition of Basketball Movement, Image Processing, Smart Customer Hotline, Real-time Broadcast Transliteration, Customised Recommendation, Warning of Industrial Malfunctions, Monitoring Malicious Behaviours in e-Commerce, Forecast of Public Trends, Financial Risk Control, Prediction of Heart Disease, and Real-time Traffic Prediction. To ensure

businesses interested in using Alibaba services can easily find customised solutions with a coherent logic that "*string them together*" (A2 I interviewed), Alibaba launched the ABOS program in 2019, short for Alibaba Business Operating System. Specifically, the ABOS will empower organisations' digital transformation through 11 elements: branding, products, sales, marketing, channels, manufacturing, services, finance, logistics, organisation, and IT. With an integrated and streamlined system for all products and services provided by Alibaba, different business units inside Alibaba will not "*fight alone*" but "*become a fist*" when talking to potential users (A5 I interviewed).

Incubate platforms as pilots to experiment and demonstrate innovations. While the internal platform ecosystem organisational form efficiently promoted internal innovations, the piloting process complemented it by ensuring fast experimentation and demonstration. Specifically, initiatives and innovations were tested first through pilots that generally required a small amount of investment, and if proved successful, then scaled. According to many informants, in Alibaba, these initiatives typically emerged through initiatives proposed by internal employees. The idea generators first have to come up with a convincing case when talking to managerial staff. If managers are convinced, they support the initiatives by providing some resources and proposing requirements such as using certain apps or improving certain aspects of the idea. Once the idea proposers obtain initial support, they can develop the pilots to test feasibility and profitability. After successfully demonstrating the success of pilots, managers then propose scale requirements in the form of quantity and market and geographical coverage in a certain period. These internal successes have not only helped Alibaba adapt and innovate but also provided legitimacy when pushing for external adoption for ecosystem expansion. By incubating pilots in the form of new business models or platforms themselves, Alibaba demonstrates the feasibility of the future. Also, through real-life examples, the new concepts and frameworks proposed through white papers or conferences can be easily understood and trusted by providers. For example, in 2015, Alibaba incubated Freshippo supermarket, "*an internet and technology-powered cashless supermarket aimed at providing a blended online and offline consumer experience to make grocery shopping much more entertaining*" (Michel, D'Amore, Shokanov, & Zhang, 2020: 2). Freshippo mainly focused on the fresh food products, especially fresh seafood and meat. According to informant A14, Freshippo resulted from trial and error, initiated by a newly-joined Alibaba employee with related industry backgrounds and supported by Alibaba top executives by providing finance, KPIs

and scale requirements. The basic incubating mechanism in Alibaba was to "*have executives convinced by new initiatives proposed by employees, try to have one pilot for the experiment, scale across the nation if the first pilot is successful, and then aim for breakeven once a certain number of pilots has been reached*" (A14 I interviewed). The success of Freshippo served as the "*pathfinder of New Retail*" strategy Alibaba later proposed in 2016, according to various sources such as IMD Freshippo case studies, Alibaba websites and news. Freshippo supermarket demonstrated to providers how the New Retail-powered grocery retail chain works – data from Alibaba can facilitate online and offline integration and eventually enhance operational efficiency and customer satisfaction. Specifically, Alibaba demonstrates that customers' data can be used to choose optimal store location as well as products, physical stores are leveraged to drive traffic to online stores where customers can order through mobile apps, and delivery platforms are synchronised to achieve 30-minute fast delivery for customers locating within 3 miles from the stores. Another example was the new model in the manufacturing sector–- the C2M (consumer-to-manufacture) model. Alibaba established the C2M model on its platform and successfully helped manufacturers produce products based on consumer needs. Its secret project – Xunxi (Rhino) Digital Factory – started in 2017 in Hongzhou, has successfully leveraged its consumer data and technologies to help the multi-trillion-dollar manufacturing arena improve efficiency and meet rising consumer expectations. What normally takes months for providers to bring a new apparel design from the runway to stores only needs 25% of the time with the help of Xunxi Digital Factory services. Similarly, cloud-native technologies were also demonstrated inside Alibaba first before commercialising to participants. Given that the cost bottleneck mainly happened during the Double 11 shopping festival, it was leveraged as a technological touchstone to test these new technological developments' scalability, reliability and security. As a pilot, the cloud-native architecture was first adopted as a hybrid-cloud architecture in the Double 11 Shopping Festival to reduce costs. Alibaba started to run the Double 11 Shopping Festival application using the Alibaba Cloud, starting with 10% of the traffic in 2015, then 50% in 2016, and finally 100% in 2019. The success of the Double 11 shopping festival showed how these new technological updates ensured reliability and saved costs. After that, 2020 started the age of cloud-native Double 11. The success of Double 11 for Alibaba showed that this updated architecture was now ready to shift towards empowering the whole society by being the infrastructure of the new digital economy. Again, Alibaba always followed the scaling sequence regarding new technologies - "*self-research,*

self-use and then open to the public" (Leifeng website, Dingyu, Alibaba Cloud-Native Application Platform manager, June 10, 2021). Besides demonstrating the success of platform technologies and services, Alibaba also demonstrated and exported company culture, which was required to be successful in the digital age. These successful early pilots verified the future Alibaba proposed and gave providers confidence in trusting Alibaba's vision and ability to transform traditional business models digitally.

Foster infrastructural adoption. Fostering infrastructural adoption from provision-side participants for ecosystem synergies in this phase faced unique challenges. Compared with the consumer Internet that connects humans for transactions and interactions, the provision-side industrial Internet is extremely complex. The complexity can be seen in both technological and social dimensions. Technologically, it is paramount in industrial platforms to ensure accuracy, in-latency, security, and safety so that harm and threats to personnel, assets, and the environment can be prevented. However, technological challenges are significant when connecting equipment and organisations for operational efficiency, including "*industry heterogeneity…equipment and system heterogeneity…differences in communication and application protocols…poor data acquisition accuracy, and difficulty in data integration and interoperability*" (Alibaba supET White Paper, 2019). Socially, provision-side participants are mostly for-profit organisations that are very risk-averse, cautious of trusting other organisations and present a high level of inertia for change. Resistance also comes from the high costs of replacing legacy systems and human capital. These challenges mean that provision-side adoption may be less demand-driven but more supply-driven in the sense that most providers "*may not have an immediate need to get on shared infrastructural platforms due to high costs and lack of ready-to-implement technology*" (A10 I interviewed). They also mean that the adoption path needs to first "*focusing on personalisation and differentiation in vertical fields*" and then "*seek common needs across fields and provide relatively common industry solutions and services*" (Alibaba supET White Paper, 2019). Therefore, fostering infrastructural adoption in this phase needed distinctive strategies. Unlike the adoption strategies in previous phases, this phase focused heavily on finding creative ways to solve the technological and social complexity that prevent large-scale adoption from provision-side participants. Specifically, Alibaba adopted five strategies: 1) neutralising risks to reduce mistrust and support adoption, 2) leveraging generality and interoperability to attract a wide range of adopters, 3) synchronising activities across boundaries for simultaneous adoption and synergies,

4) prioritised demonstration and customisation to showcase successful pilots and concepts in vertical fields and 5) leveraging collaborative and digital regulation to reduce opportunistic behaviours. In the following, I elaborate on each in detail.

Neutralise risks to reduce mistrust and support adoption. To start with, neutralising risks emerged as a key strategy to reduce mistrust and support infrastructural adoption. Because of the complexity embedded in further expanding to provision-side ecosystems and associated higher risks for provision-side participants that are profit-driven and highly risk-averse, purely economic benefits such as the free model and subsidies illustrated in the consumption-side perspective were not enough. To neutralise risks, Alibaba promoted a "give-before-take" mindset, leveraged easy-to-understand analogies, reframed discourses, and ensured non-competition to inform providers in extensive interactions that the risks were low and that Alibaba also had skin in the game. If providers do not succeed after joining forces with Alibaba, then Alibaba also cannot sustain itself. During a strategy meeting with a provider, one executive noted, "*Not only you are worried, but I am more worried. You may lose a production because of one mistake made by the platform. For me, my whole business model is not successful because of that one mistake. I am more worried than you. I will discuss with you how to control the safety*." (A9). They also designed goals using a Valuation Adjustment Mechanism with milestones in the sense that providers only pay Alibaba if the promised benefits are realised at each milestone. Analogies have been frequently used on many occasions in my fieldwork to reduce the perception of risks in joining, e.g., "*The fact that the cloud is more secure than the original approach is like putting your money in the bank or under your pillow, which is safer. The bank must be safer.*" (Wang, 2016: 20) Ali Cloud's then Direct and multiple informants I have met during the fieldwork mentioned the same analogy they tried to convince providers to join the cloud: "*In fact, the cloud is more secure than the original method, just like putting the money in the bank or under the pillow, which is safer? The bank must be safer! It is the psychological barriers that the use of cloud computing needs to overcome.*" (A9, A10 and some other informants). Regarding incumbents' resistance, Alibaba strategically positioned itself to emphasise empowerment rather than competition. As illustrated by an executive from Alibaba, "*When we started, we used the word disrupting. Then we changed to enabling or energising, then we found it was not working, we further changed to assisting… we gradually have the right mindset… if you come to kill their lives with flags saying I will come to slap you in the face, do you think this is going to work?*" (A10 I interviewed) Through this iterative learning, Alibaba

changed its discourse framing to de-emphasise disruption so as to neutralise risk embedded in the dyad relationships with providers. The empowering roles were consistently emphasised in numerous conferences Alibaba attended or hosted, framing "*Alibaba is here to provide the digital infrastructure to help every company to achieve their digital transformation goal*". Dealing with digital transformation through joining the IIoT ecosystems was hard, but Alibaba was there to help them go through this journey. After joining the platform, providers were also concerned about Alibaba's entering their own area. To address this concern, Alibaba ensured that their role was only a technological enabler, and they would not enter the provider's field as they did not have the necessary industrial knowledge. Another discourse development used by Alibaba is de-emphasising the division between the Internet and Industrial firms. As one informant mentioned at the 2018 Yunqi conference, "*There are no so-called Internet firms in the world, and there are no so-called traditional firms in the world. It all depends on what mindset you use to think and what tools you use to work*." Through de-emphasising disruption and division, Alibaba made sure that stakeholders can perceive that their well-being has been taken care of and improved rather than disrupted by Alibaba's services and vision of provision-side ecosystems.

Leverage generality and interoperability to attract a wide range of adopters. Generality and interoperability also emerged as key principles from my data which Alibaba leveraged to promote infrastructural adoption. Generality refers to the ability to apply to various situations. It contains basicity, versatility, reusability, recombination, flexibility, and scalability characteristics. As provision-side platforms need increasingly industry-specific knowledge and experiences which Alibaba lacked, Alibaba focused on generic infrastructural services to drive network effects. This principle has guided Alibaba to choose which services to focus its efforts on as it served as the leveraging points for not only adoption and scalability across boundaries but also future value capture. Digital infrastructure typically includes four layers: edge, IaaS, PaaS, and SaaS. As Alibaba expanded to more complex industries, edge and IaaS layers represented the most generic layer compared to PaaS and SaaS "*because every firm will need to store and compute data using only 0 and 1"* (A2 I interviewed). Therefore, besides assisting providers with developing vertical platforms, Alibaba proactively worked on and even obtained proprietary ownership in IaaS areas such as Cloud computing, edge computing, data centres, IoT processors, and chips. For PaaS, following the generality principle, Alibaba put efforts into providing enabling infrastructural services that support specific industry IIoT platforms. Enabling industry-agnostic services might

help connect internal systems and staff, facilitate using big data and AI for smart decision-making and help set up application development systems. Similarly, for the SaaS layer, as illustrated in the previous phase, Alibaba worked on picking generic services for platform spawning. To ensure a clear boundary of Alibaba's services, Alibaba has mentioned in many instances that it did not do SaaS or specific services but focused on providing generic services to empower SaaS, service providers and participants. Moreover, in this phase, Alibaba chose to work with provision-side participants to develop generic killer industrial applications. Together, following the generality principle, Alibaba's role focused on developing three generic areas: capabilities, data, and knowledge (Alibaba supET White Paper 2019). Generic capabilities may be data resource management, Cloud computing and storage, machine learning platforms, algorithms, and industrial mechanism models. Generic knowledge typically took the form of applications, which could be generic business and industry knowledge. This generality principle adopted by Alibaba helped the Alibaba ecosystem to become the super-platform for other industry-specific platforms and ecosystems. As the 2016 Alibaba Business Service Ecosystem White Paper illustrated: "*Comprehensive service platforms and industry service platforms should prohibit low-level competition, fully maintain and give play to their respective advantages, continue to move towards cooperation and even integration, and construct a new service model of "mutual platform*" (p. 41). For generality to work, interoperability needed to be in place as well. My data shows that Alibaba worked with a wide range of participants to enhance interoperability across devices, industries, and organisations so that different devices, businesses, and systems can get on the same generic infrastructure. Specifically, in IIoT platform development, Alibaba proactively joined forces with industry players to apply the right to develop the Identification and Resolution framework so as to ensure data and resource flows with standardised and interoperable identifications.

Prioritised demonstration and customisation to showcase successful pilots and concepts in vertical fields. Prioritised demonstration and customisation emerged as an essential principle in fostering infrastructural adoption with high complexity and mistrust at this phase, as the prioritised adopters and industries could serve as a benchmark and exemplar for subsequent adopters. While the consumption side used subsidies and non-pecuniary strategies such as APIs and complementary services, the provision-side adoption needed more customisation before building platforms and more demonstration to solve the trust bottleneck. Specifically, the prioritised demonstration and customisation is the practice Alibaba leveraged for every new offering. It

served three purposes: 1) testing the validity and effectiveness of new offerings, 2) demonstrating applications using successful cases to lower barriers of mistrust, and 3) co-creating customised offerings to scale to other participants. It all followed a pattern of experimentation, demonstration and then scale. To "*get the ball rolling*", Alibaba approached prioritisation in two ways: incubating pilots themselves and piloting with advantaged participants. Incubating pilots themselves have been formalised internally and discussed in the last section. Besides piloting themselves to kick off the adoption domino effect, Alibaba also piloted with the advantaged participants in terms of regions, industries, and providers. For regions, Alibaba focused on regions that have a high willingness or need to collaborate with Alibaba. These regions do not need to be very competitive as "*many firms have already come to talk to these large cities*" (A10 I interviewed). These regions had to have leaders that are also very visionary to try to push digital transformation. Regarding advantaged industries, Alibaba prioritised discrete industries over continuous ones, as discrete ones are more standardised, leading to easier adoption and scalability. Those industries also had to be the target of government subsidies so that extra incentives could help providers get on board. Regarding organisations, Alibaba targeted large organisations that are leaders of industries that tend to be more willing to collaborate. These organisations also had to be led by visionary leaders who could understand the significance of IIoT. Interestingly, the advantaged or prioritised for the provision-side ecosystems differ from those for the consumption-side ecosystems. The consumption side prioritised small businesses, but the provision-side ecosystems chose to help large companies first. As the Vice-President of Alibaba illustrated: "*The strategy (was) not to take on the rich but to educate the poorer firms that can't afford (to go online)… on how our services work*" (quoted in Tan, Tan, & Pan, 2016). Through piloting the advantaged, Alibaba becomes a certification and accreditation body that spreads what is good and what is bad: presenting what is exemplary behaviour and providing them with respect and honour. Alibaba puts enormous efforts into the first several prototype projects so they can use this as a signal to convince others to get on board. To get started, Alibaba focuses on the top players in the field and uses awards and ranking tools to maximise the positive effects of joining the platform. The key is to use their mouth as much as possible. For example, in one of its awarding ceremonies, Alibaba invited thousands of suppliers to witness the top 7 performers with the help of Alibaba's ecosystem. In the afternoon session, Alibaba invited these top performers to share their experiences with Alibaba and how it improved their performances. Specifically, many informants paid significant attention to the

exemplar effect: "*Many companies need a process. Before he can see the local partner companies get on the cloud, he does not believe it, Also, the cloud, he said that unless you take me to have a look at the computer room, it is really like I can only believe that once I take a look at your base station and your server. It is just to use the power of example to do things.*" (J1) Regarding advantaged regions, other examples include Wuxi Xuelang Town and Wuxi Hongshan Town. The first one was a pilot example of an IIoT town, aiming to optimise and enhance the performance of a regional industrial district by connecting providers upstream and downstream in one IIoT platform. The second one was a pilot exemplary of an IoT town, aiming to enhance the operational efficiency of a town by digitalising the whole town, e.g., adding sensors to all traffic lights and rivers. Expanding to cities, Alibaba piloted the Smart City project with Suzhou, increasing the resource utilisation rate by 17% by dynamically adjusting bus departure time. Finishing or even during every collaboration, Alibaba increased publicity through visualisation and writing successful cases. Visualisation normally used display centres to show external visitors that the projects are indeed "*a real thing*" (TL6 I interviewed). Alibaba research fellows wrote cases frequently to emphasise the achievement of productivity, sales, or operational efficiency through white papers, Alibaba forums, and conferences. Besides publicity of successful cases to drive adoption, Alibaba also tried to quickly make the collaborated pilot into a product so Alibaba can collaborate with the advantaged providers to sell to other providers together. In this way, the advantaged providers can not only benefit from the pilot themselves but also can obtain profits even after the first piloting phase by selling to other providers. During the promotion, instead of using its networks, Alibaba emphasised leveraging networks of the advantaged providers as these providers are normally very powerful in their industries.

Synchronise activities across boundaries for simultaneous adoption and synergies. As participants became increasingly diverse and ecosystem synergies relied on growing collaborative efforts across components and boundaries, synchronisation became essential to ensure ecosystem-wide operation without breakdowns or bottlenecks. Instead of focusing on one or two services, in my data, I found synchronisation manifested in different layers, application levels, participants, industries, and geographical locations. The first two focused on offering synchronisation, and the last three worked on user synchronisation. *First*, activities have been carried out by Alibaba with partners to accelerate the adoption of multiple interdependent layers in digital infrastructure simultaneously. For Edge, Alibaba has worked on multiple hardware upgrades with partners to

ensure comprehensive data collection and edge processing. For IaaS, Cloud has always been one of Alibaba's top priorities since 2015, and Alibaba upgraded "*from Cloud-to-Cloud Intelligence*" in 2019 (Alibaba Press Release, March 21, 2019). For PaaS, Alibaba started to export its successful Shared Service Division strategy piloted in its ecosystem in the previous phase to ecosystem participants from various industries and locations to build up their data and service operating systems and platforms and adopt Alibaba's IaaS and PaaS services. For SaaS, Alibaba decided not to develop industry-specific applications itself but to provide digital knowledge and expertise through programs such as accelerators or codevelop with industrial participants. Synchronising these four interdependent layers prevented ecosystem breakdowns and expanded the IaaS adoption by participants from diverse backgrounds. The goal is to achieve a network of connected participants and systems across industries and locations on one IaaS super platform for maximised ecosystem synergies. *Second*, different levels of IIoT platform applications were carried through synchronically. IIoT, according to the informants, can be used on multiple levels. For the equipment level, IIoT can put real-time monitoring devices and collect real-time data to optimise the algorithm and to provide software-as-a-service offerings along the lifecycle of the equipment usage. This has been the most popular application where value comes mainly from real-time data-driven insights, e.g., predictive maintenance. For the production-line level, IIoT can connect different processes within a production line to optimise production efficiency. The next level is the organisation level – IIoT can connect different departments in an organisation, and different organisations in the supply chain, including producers, suppliers, and sellers, to optimise operational efficiency and supply-demand matching. The last level is the regional level, whereby organisations within a regional cluster or city can be connected to an IIoT platform to facilitate regional digital transformation, optimise the management and synergies of these regional organisations and industries, and facilitate the development of a regional smart city. Alibaba pushed these four levels synchronically with different participants, given the natural advantages of the participants. Some participants may have the natural advantages of offering SaaS by connecting equipment or optimising operations in a cluster by connecting cluster members. One participant did not need to provide all levels of applications, but all four applications were promoted for adoption. Besides offering synchronisation, there was also synchronisation among participants, industries, and regions. When it comes to participants, businesses, NGOs, governments, education and research institutes, start-ups, and other participants can all benefit by

being direct rather than indirect users of Alibaba's ecosystem in this phase. The Middle Platform strategy and, later on, the ABOS strategy were good examples of synchronisation. For example, Alibaba proactively collaborated with local governments to help them transform into a middle platform structure to improve operational efficiency. NGOs such as the Olympics and WFP (World Food Programme) also reached out for middle platform reconstruction. Start-ups were also shifting to direct users through accelerator programs or competitions such as the Create@Alibaba Cloud Global Start-up Contest in 2017, where leading start-ups were selected to gain access to Alibaba Cloud services and resources in the Alibaba ecosystem. Regarding industries, Alibaba worked on upgrading multiple industries with partners simultaneously. In 2016, Alibaba proposed the "*Five New Strategy"* to enhance operational efficiency and support digital transformation for five industries: retail, manufacturing, technology, finance, and energy. According to Jack Ma, New Energy refers to data as a type of new resource that empowers participants, New Technology refers to technologies related to cloud computing, AI, ML and Big Data, New Retail refers to the digital transformation of the retail industry to enjoy online-offline integration and other new benefits, New Manufacturing refers to the digitally empowered manufacturing sector that is smart and adept of mass customisation, and finally, New Finance refers to the data-driven credit system that provides finance efficiently and effectively to all businesses and individuals. New Energy, New Technology, New Finance, and New Retail have achieved certain milestones in the second phase, focusing on the demonstration by Alibaba and some partners. New Manufacturing has reported significant success through the Xunxi Smart Manufacture project in the third phase. Although these milestones were reported sequentially, the operation was simultaneously carried through to ensure the realisation of ecosystem synergies. As more and more industries were ready to be digitally transformed, in 2019, Daniel Zhang proposed to upgrade the "*Five New Strategy*" to the "*Hundred New Strategy*" to signify the digital transformation of hundreds of industries. When it comes to regions, the geographical location was also part of the synchronisation in the sense that Alibaba made sure services for multiple regions were carried out simultaneously in China and globally. In China, multiple provinces and cities were reached up simultaneously to provide location-specific platforms and services. With synchronising globally, Alibaba aimed to build "*the future infrastructure of commerce to realise a globalised digital economy where trade is possible for every country around the world*" (Daniel Zhang, CEO of Alibaba Group, Press Release 2018). Alibaba proposed the "*Global Five*" initiative, emphasising five core aspects of globalisation, each

led by one or multiple business units, including Global Fun (Fliggy), Global Buy (Alibaba.com and others), Global Sell (Alibaba.com and others), Global Pay (Ant Finance), and Global Delivery (Cainiao). Different types of users at the organisation level, industry level, and region level presented different needs for ecosystem offerings but together leveraged all offerings to push ecosystem development in all areas. In this way, synchronisation promoted infrastructural adoption by simultaneously working on different areas of the infrastructural layers or applications depending on participants' advantages and needs.

Leverage collaborative and digital regulation to reduce opportunistic behaviours. While adoption and generative changes were fostered, stability and safety were also ensured for sustainable ecosystem growth through collaborative and digital governance. The importance of governance has been emphasised on multiple occasions. For example, Alibaba CEO Yong Zhang mentioned in 2017, "*Platform governance is the lifeline of Alibaba*." (E-commerce News, May 31, 2017). Alibaba's Chief Platform Regulator emphasised in 2019, "*For good people, we provide empowering tools to create a sense of business security for businesses; for bad people, we resolutely crack down, and for malicious behaviours, we firmly say no*." (E-commerce Online Official website, December 31, 2019). As participants diversified, interdependency increased, and societal impact broadened, ecosystem governance shifted to collaborative governance at this phase. This means that instead of regulatory bodies and ecosystem orchestrators assuming the majority of a governance role, various ecosystem participants joined forces to govern the ecosystem for its sustainable growth collectively. Specifically, governance entities, platforms, regulatory agencies, media, businesses, industries, NGOs, and the public were orchestrated to build a comprehensive governance network for ecosystem stability. This collaborative governance method became the central mode of governance at this phase. It was marked by events such as Alibaba appointing its first Chief Platform Regulator in 2015 and 2016, issuing its first Platform Governance Report, issuing its first Platform Governance Report, holding the first "Alibaba Group Rights Holders Collaboration Summit", and launching the rights holder co-construction platform. According to the Alibaba Group Platform Governance Report 2016, "*Legal protection, government involvement, and collaboration with rights holders are all essential to safeguarding the development of a healthy and sustainable business environment*." Alibaba coordinated with multiple organisations and industries in establishing collective organisations such as "China Enterprise Anti-Fraud Alliance", "China E-commerce Integrity Community", and "E-Commerce Anti-Counterfeiting

Federation" to effectively reduce the risk of fraud through mutual supervision and learning from platform companies. Alibaba also collaborated with local governments through innovative organisational forms. For example, in 2019, Alibaba collaborated with 439 district and county law enforcement agencies in China and arrested more than 4,000 suspects for producing and selling fake products. Businesses also contributed to ecosystem governance through channels such as the co-construction platform and "Business Security" product where businesses can not only efficiently report fraudulent behaviours but also "*continuously cultivate the artificial intelligence model algorithm by feeding back information to the platform*" (E-commerce Online Official website, December 31, 2019). Digital governance also served as an essential means at this phase to ensure sustainable ecosystem development at a larger scale. Specifically, as rules have been gradually digitalised with technologies such as big data, AI, and VR, they can be automated to govern ecosystem performance without much human intervention. For example, Alibaba technology expert Menglei Jia mentioned in the 2017 Alibaba Yunqi Conference, "Data Power, Collaborative Governance" sub-forum, that Alibaba launched "Leiyin Shizi" technologies which can monitor nearly 2 billion products on the entire platform and automatically uncover products that violate regulations. The accuracy rate is 97.6%, which is close to the recognition ability of the human eye. Moreover, participants' digital credit history and feedback data left on platforms became an alternative governance mode to regulate fraudulent behaviours and promote a positive trust environment. When it comes to smart city projects, data and AI have been leveraged to govern cities so as to optimise performances. For example, in Xiaoshan District, Hangzhou, participation in Alibaba's ET City Brain platform made several optimisations: the average speed of the road traffic in sections with automatic signal light timing has increased by 15%; the average traffic time has been shortened by 3 minutes; the arrival time of emergency vehicles has been saved by 50%, and the rescue time has been shortened by more than 7 minutes. Lastly, blockchain technologies such as Hyperledge and Ant Blockchain have also been leveraged to ensure safe and reliable ecosystems through decentralised and distributed storage and anti-tampering features. All these collaborative and digital mechanisms enhanced the trust and adoption of the Alibaba ecosystem in the third phase.

Enhance legitimacy and diffuse new institutions. As participants increased in number and types and were coordinated by new mechanisms such as real-time data and machine learning, an institutional context that facilitated such multi-stakeholder ecosystem dynamics emerged. Because

the Alibaba ecosystem has built up leadership and teamed up with key stakeholders in previous stages, they no longer work as individuals. At this stage, collective organisations such as industry councils, trade associations and educational bodies became more critical to enhancing legitimacy, shaping institutional contexts and transforming society. More and more agencies came out of Alibaba to initiate and direct institutional change in this phase as Alibaba grew in power (Greeven & Wei, 2018). As Alibaba, participants and collective organisations gave life to the new institutional patterns of signification in the previous stage, e.g., "*New Commercial Civilisation*", Alibaba started diffusing such new institutional arrangements in China and abroad, specifically to countries it collaborated with to support infrastructural adoption and empowerment.

Align with the government to reduce monopoly concerns and enhance legitimacy. To reduce monopoly concerns, Alibaba became more closely aligned with government policies. The collaboration can be seen in two ways. *First*, governments listened to leading ecosystem players such as Alibaba about their learning in developing digital infrastructures. Government officials were organised to learn how Alibaba's digital economy works, the impact on China's competitive advantage, and the rules of participation. *Second*, Alibaba proactively resonated with governments' initiatives and work plans to ensure the legitimacy of the ecosystem's empowering efforts. Specifically, Alibaba echoed new government policies and regulations by issuing their interpretations through white papers, conferences, or funds. For example, in 2015, the state government published the Mass Entrepreneurship and Mass Innovation Initiative and "Internet +" action plan to promote entrepreneurship, innovation and widespread application of Internet technology. This initiative supported the Alibaba ecosystem's role in creating jobs and promoting entrepreneurship. In 2016, the state government initiated the supply-side structural reform to reduce overcapacity and costs. Manufacturing reform was part of the supply-side structural reform, aiming to release consumption potential and enhance the state's competitive advantage by improving product quality and upgrading the manufacturing industry. In the same year, the state government issued the 13th 5-year plan (2016-2020), emphasising three key areas: "New Technologies", "New Industries", and "New economy". Alibaba's vision of leveraging digital technologies to reconstruct the traditional economy aligned with these initiatives. "Internet + Advanced Manufacturing" initiative was launched in 2017, and the IIoT Development Action Plan 2018-2020 was published in 2018. In 2020, the "New Infrastructure" initiative was issued to encourage all members to co-develop the new infrastructure so as to maximise the benefits of

digitalisation for all members of society. Alibaba echoed these government initiatives through various channels, such as writing white papers and proposing new projects. Specifically, for provision-side ecosystems, Alibaba actively involved regulatory parties and industry associations to signal that their vision aligned with the political agenda and thus is responsible for public welfare. Regulatory parties are essential, as emphasised by Alibaba, "*The essence of the IIoT platform is state action. And the key is governments participate, governments invite, and governments lead."* (A11 I interviewed) Alibaba constantly mentioned that "*approaching firms directly will never work*" because "*they have very high resistance, and they don't listen to you*". Therefore, Alibaba said, "*you have to find someone that has power over them*". Leveraging administrative power to signal legitimacy can be done in several ways. *First*, Alibaba actively brought government officials with them when they went to talk to the firms. This signals endorsement from the government. As an informant from Alibaba mentioned, "*Why are there many companies that are willing to talk with us at least? The government has strong support behind it. Therefore, every time a project like this starts, we will bring the government with us to the initiation meeting. There are many benefits to have the government involved. First, easier communication and easier handling. Second, the other party's level is higher. Otherwise, you say that you will let the staff of a project make decisions. No. But, for example, if we go with a deputy mayor, he will have a chairman to come and talk to us.*" (A11 I interviewed). Alibaba also approached government officials directly to sign contracts for the mass adoption of Cloud services in one region. For example, Alibaba signed 133 Projects with Jiangsu province government officials in 2018 to help 300 manufacturing providers in Jiangsu get on the Cloud platform. *Second*, internally, Alibaba hired people with government and university backgrounds to signal the legitimacy of their vision. As one informant mentioned, "*The first batch of employees of Alibaba's Research Center came from news and advertisement. The second batch mainly has a consulting background. Now you will see more and more people with the background of the government, educational and research institutions. We gradually started to talk like government officials."* (A6 I interviewed) To signal legitimacy in the technology field, Alibaba's Cloud initiator was selected to become the first academician who comes from business. While talking to businesses, they also mentioned the current status of its Cloud initiator to imply their leading position in the cloud business, "*The news just released today is that the China Industrial Internet Research Institute also hired our academician to be their scientist*". *Third*, to ensure they are not accused of being monopolistic, Alibaba invited government officials

to events to signal their support from regulatory parties. Other methods include visiting in person and having group training with government officials. Through these preaching events, Alibaba helped them to make sense of Alibaba's vision, reduced monopoly concerns and obtained legitimacy for infrastructural adoption.

Leverage training, conferences, and white papers to systematically diffuse new institutions. Alibaba worked with multiple participants and collective organisations locally and globally to systematically diffuse the new civilisation proposed in the previous phase, including co-training new talents, co-hosting conferences, and co-writing white papers and reports. *First*, new educational curriculums co-developed by Alibaba, educational and research organisations and other participants prepared new talents and diffused new civilisation that facilitates the acceptance and adoption of digital infrastructure. On top of launching its educational organisations outside of traditional educational institutions in the previous phase, Alibaba and its collaborators conducted more activities during this phase, including 1) getting into established educational curricula for younger children through Yungu School in 2017, 2) organising business elites' training through which elites communities were formed to facilitate knowledge sharing and infrastructural adoption, e.g., Hupan University in 2015 which aims to train fewer than 3,000 business elites in 30 years, 3) setting up open courses with partners, e.g., Alibaba collaborated with CNCF (Cloud Native Computing Foundation) to develop the "CNCF x Alibaba Cloud Native Technology Open Course" launched in 2019, and 4) collaborating with local governments to achieve economies of scale in training, e.g., in 2015, Taobao University launched the "County E-commerce Trainers" project with local governments and e-commerce businesses to help cultivate e-commerce trainers and facilitate county development. As of September 2016, Taobao University's "County E-commerce Trainers" project has covered 27 provinces in China and cultivated more than 100 thousand e-commerce talents. Globally, training was promoted through programs such as eWTP (Electronic World Trade Platform, 2016) to systematically help associated countries such as Malaysia (2017), Rwanda (2018), Belgium (2018) and Ethiopia (2019) with their "*digital economy policy, digital transformation of businesses, and global e-commerce training program*" (A24 I interviewed).

Second, conferences are co-organised with a broader range of participants from different industries and communities than in previous phases. The transition can be seen through the official change of name of Alibaba's flagship annual conference series: from Ali Cloud App Developers Conference to Yunqi (a town that specialises in the cloud computing industry and belongs to the

city of Hangzhou, where Alibaba was launched) Conference which has more comprehensive coverage of participants and topics, including not only cloud computing but also other important topics such as big data and AI. Yunqi Conference chose a theme each year to resonate with the important state policies of that year and demonstrate the new civilisation with success stories and award ceremonies. For example, in 2015, Yunqi Conference picked "Internet, Innovation, Entrepreneurship" as the theme when the state proposed "Mass Entrepreneurship, Mass Innovation" and "Internet +" initiatives that year as a national strategy to rejuvenate the economy. Besides the flagship Yunqi conference every year, specific theme-based conferences were co-organised after 2015, e.g., 1st Annual Data Technology Day in 2015, 1st Annual Global Conference on Women and Entrepreneurship in 2015, 1st Annual Rights Holders Collaboration Summit in 2016, 1st Annual Taobao Maker Festival in 2016, 1st Annual Tmall 9.9 Global Wine & Spirits Festival in 2016, 1st Annual Xin Philanthropy Conference in 2016, 1st Annual Global SME Business Summit in 2017, and 1st Annual Alibaba ONE Business Conference in 2019. Through these theme-based conferences, not only the knowledge of new digital infrastructural technologies and business models diffused, but values that facilitated digital infrastructural development, such as social mission, collectivism, inclusiveness, altruism, innovation, and creativity, were also promoted and diffused. For example, in 2016, Jack Ma spoke to the press about the importance of a people-centred and inclusive approach that is empathetic of and supports disadvantaged groups: "*The G20 leaders have acknowledged the importance of free, more inclusive and innovation-driven trade to extend the benefits of globalisation to those that have been left behind in the current model. The eWTP will benefit small and medium-sized businesses and consumers. It is about the people, not big business.*" (Alibaba Press Release, September 6, 2016). During the festival, innovative businesses were invited to introduce their creative ideas on stage and performances around creativity were presented. In the same year, at the second Women and Entrepreneurship conference, "*Altruism, Inclusiveness, and Dreams*" was set up as the theme to help close the inequality gap. In 2019, Jack Ma highlighted the respective role played by entrepreneurs in the Africa Webpreneur Prize Initiative (ANPI) grand finale: "*It is my strong belief that entrepreneur heroes, like these finalists, will change the world – creating companies that drive inclusive growth and opportunity for the continent. Everyone is a winner tonight*." (Alibaba Press Release, November 17, 2019). These activities all helped spread and export the knowledge of Alibaba's infrastructural

empowering model and norms of good behaviours, i.e., creativity and innovation, driving infrastructural adoption locally and abroad.

Lastly, white papers, reports and books were crucial channels to promote this new civilisation. Alibaba Research Centre or Alibaba Cloud normally co-wrote these files with universities, research institutes, and consulting firms such as BCG and Deloitte. It specified the future vision and guided participants' cognition on what is the right way of thinking and behaviours to achieve such a future to benefit all. For example, the Reconstruct Growth Power – 2019 Business Digital Transformation Development Report specified the suitable protocols for digital transformation for businesses, showcasing examples of different types of digital transformation and the associated mental and knowledge requirements for CEOs and employees. Books about Alibaba's success, learning, and experiences have flourished, helping systematically broadcast this new institutional structure.

5.4 Discussions

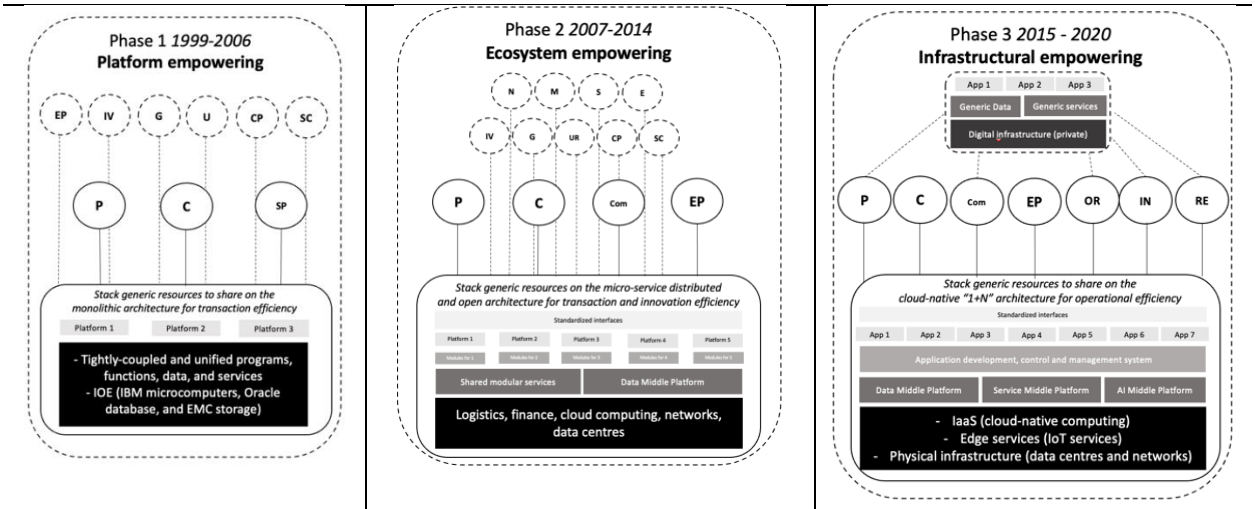
One of the key findings from analysing the Alibaba ecosystem is that of Alibaba's sophistication and systematisation in strategising to orchestrate an ever-expanding quantity and variety of participants for ecosystem sustainable growth. Specifically, Alibaba's case has provided important insights about ecosystem synergies, change, and orchestration that surprise and complement existing literature. In this section, I discuss the surprising and complementary findings from the Alibaba case. Later in the Discussions section, I further elaborate on the implications for existing theories in general.

Ecosystem synergies

Extant studies of ecosystem synergies have been challenged and complemented by findings of the Alibaba ecosystem in several ways. Figure 5.1 demonstrates the evolution of ecosystem synergies along the three critical phases of the Alibaba ecosystem, and Table 5.5 shows how existing research is refined in light of my analysis.

In the first phase of platform empowering, the Alibaba ecosystem was dominant in consumption-side ecosystem synergies, including two-sided network effects, trust and reputation systems, consumption-side complementarities, and sharing some generic resources to enhance transaction efficiency and optimise matching. As the Alibaba ecosystem evolved and digital technologies transformed more than the transaction stage of the value chain, provision-side ecosystem synergies started to play a pivotal role. Specifically, in the second phase of ecosystem empowering, indirect network effects happened on the provision side, where third-party complements were innovated to assist providers with marketing, decision-making, human resources, financing and planning. Data-driven network effects also happened among providers since data gathered from providers gave increasingly comprehensive insights. Generic resources to be shared expanded and aimed to enhance transaction and innovation efficiency for optimised performance of multiple value chain stages. In the third phase of infrastructure empowering, digital transformation on the provision side enabled network effects to move beyond connecting providers to consumers or connecting providers to complementors for efficient and innovative product delivery. Direct interactions and exchanges among providers across supply chains and industries became possible (Stabell & Fjeldstad, 1998). Network effects happened among providers, industries, and regions. When providers along supply chains are connected in a platform ecosystem to share generic resources and directly interact, operational efficiency among them can be

enhanced and the utility of one increases as more providers join. Similarly, resources can be shared across industries and regions for enhanced operational efficiency and large-scale data-driven customisation when industries or regions are connected in a shared platform ecosystem. The ever-expanding types of ecosystem synergies and participants reflect ecosystems' constantly emerging and growing characteristics, rendering the goal of ecosystem equilibrium incomplete.



Direct participants (solid circles): **P**: Providers, **C**: Consumers, **SP**: Service providers **Indirect participants** (dash circles): **EP**: Employees, **IV**: Investors, **G**: Government, **U**: Universities, **CP**: Competitors, **SC**: Society **Support generative changes through:** - Two-sided network effects - Trust and reputation systems - Consumption-side complementarities **Share generic resources for efficiency and optimising:** - Technological architecture (IOE), standardised interfaces and markets - Transaction efficiency	**Direct participants** (solid circles): **P**: Providers, **C**: Consumers, **SP**: Service providers **Indirect participants** (dash circles): **EP**: Employees, **IV**: Investors, **G**: Government, **UR**: Universities and research institutes, **CP**: Competitors, **SC**: Society **Support generative changes through:** - Direct and indirect network effects - Data-driven learning and data network effects **Stack generic resources for efficiency and optimising:** - Cloud services, standardised interfaces, markets, generic modules, tools, logistics, data - Transaction and innovation efficiency **Sustainable growth**	**Direct participants** (solid circles): **P**: Providers, **C**: Consumers, **Com**: Complementors, **EP:** Employees, **OR**: Organisations, **IN**: Industries, **RE**: Regions **Support generative changes through:** - Network effects among organisations, industries, and regions **Stack generic resources for efficiency and optimising:** - Data, knowledge, and capabilities - Operational efficiency - Data-driven large-scale customisation **Sustainable growth**

Figure 5.1 - Alibaba ecosystem synergies

See Table 5.5 for the updated typology of ecosystem synergies after incorporating the nuances from the Alibaba case. *First*, my analysis highlights that positive feedback loops for lock-in can happen on the provision side, extending existing studies focusing mainly on the consumption side between consumers and complementors. For example, in Alibaba supET IIoT platforms, when more providers join the same platform to coordinate activities, develop and trade complementary applications, and share data, the more valuable such platform ecosystem becomes, attracting more providers and provision-side complementors to join the ecosystem. This means that providers can join platform ecosystems to not only find customers and complementors for consumption-side network effects but also connect with component providers, coordinate operation and logistic activities, automate specific processes and activities, work out performance benchmarks, and obtain data-driven insights for operation optimisation. Furthermore, when

automation is added to platform ecosystems, human costs can be reduced by, e.g., automatically informing the platform to obtain more inputs when smart equipment detects a low level of inputs. This enhancement is unlimited and far exceeds knowledge derived from human experiences as data-driven learning becomes increasingly intelligent when the range of data collected expands (as more providers agree to share data), and thus more optimisation insights are generated for ex-ante predictions. Consequently, the first refinement of the literature-based typology framework after considering the new provision-side phenomena (IIoT) is the addition of positive feedback loops at the provision side, including provision-side direct and indirect network effects, provision-side two-sided and multi-sided markets, and provision-side data-driven learning and data network effects. This addition of provision-side positive feedback loops has important implications for ecosystem research. As summarised in Chapter 2, existing research on provision-side ecosystem synergies tends to be based on the value chain configuration and co-production logic, which suggests that components are co-invested and assembled by focal firms linearly to provide core products to customers who typically only have limited customisation options. Although insightful, this good-dominant value chain analysis omits the non-linear positive feedback loops among providers for operational efficiency, thus resulting in a partial understanding of ecosystem synergies. Not only can providers get on a shared platform to coordinate efficiently with data-empowered and automatic decision-making, but complementors can also get on the shared platform to develop complements for providers, and so can customers so as to engage in customised product design down to the component level. For example, Apple can not only coordinate complementors to develop applications for individual consumers in the way consumption-side positive feedback loops suggest but can also orchestrate for provision-side positive feedback loops: 1) get provision-side participants – component providers, e.g., chips and microprocessors – to a shared platform to enhance operational efficiency and promote provision-side network effects and data-related ones, 2) orchestrate complementors to develop applications for providers to enhance their operational efficiency and cultivate indirect network effects, and 3) if customers are to be connected to the provision-side platform to communicate with component providers, then consumers can also flexibly assemble components for their final offerings, leading to another positive network effects, operational efficiency enhancement and effective inventory management. Besides business-related organisations, positive feedback loops can also apply to the public sector, such as governments, universities, research institutes, and NGOs. Following the same logic, these organisations can get

on a shared digital infrastructural platform with organisations they coordinate for service delivery to enhance operational efficiency and can be connected to complementors for complementary offerings. Moreover, positive feedback loops can happen not only at the organisational level but also at the industry and regional levels. The more related industries or regions join a shared platform, the more valuable such a platform ecosystem is for participants, as more resources can be shared and optimised for improved efficiency and performance.

Second, regarding complementarities synergies, my analysis of the Alibaba ecosystem confirms the consumption-side complementarities and extends the provision-side complementarities to move beyond the sequential co-production logic to a real-time network and platform logic. Provision-side complementarities in the existing literature develop value through the co-production logic where ecosystem orchestrators assemble or integrate component providers sequentially for coherent final products, leaving customers little room to customise. Therefore, ecosystem orchestrators often predict product updates with few consumer inputs and communicate sequentially to each component provider. This linear sequence and lack of customisation carried by complementarities synergies in the upstream components have been challenged by the innovative provision-side platform ecosystems Alibaba helps providers develop. Specifically, Alibaba's provision-side ecosystems suggest that component providers from all stages of the value chain have the potential to interact directly in real-time with final product providers and even consumers through the shared IIoT platforms using middle platforms and Cloud architecture in a network instead of a linear and sequential manner. When a component has innovative updates, they can be reflected in real-time in shared platforms where other components can see and then update their offerings accordingly. Therefore, there are few overlaps of information or coordinating delays between components, resulting in an increase in operation and innovation efficiency. When customers are also connected to the shared platforms, consumer needs can be communicated to component providers in real-time to guide their volume and updates in supply. See Figure 5.2 as the graphical illustration of the shift from the sequential chain logic to the value network logic on the provision side using the example of the automobile industry provided by Alibaba. The graph on the left shows the traditional sequential chain logic where each first-, second-, third-, and fourth-tier component provider connects with different departments of integrated product providers, and component providers need to sequentially update their components after an update in one component. The graph on the right shows the network and

platform logic where all component providers, all departments within an automobile company, and even consumers can be connected through a shared platform, through which they communicate and share resources, which significantly reduces the number of connections, lowers coordination costs, enhances the agency of component providers and increases the participation of customers for complements innovations. Alibaba's role is to provide empowering and supporting services (e.g., Cloud computing, network, platform development) to help providers build such network and platform architecture to enhance operational efficiency. This transition moves beyond the higher-return and lower-cost mechanisms of provision-side complementarities in the existing literature: "*when coordinated investments in both A and B yield higher returns than uncoordinated equivalents, or yield lower costs than the sum of costs of independent investments into A and B*" (Jacobides et al., 2018: 2262) to include operational efficiency enhancement and higher demand-supply matching and customisation through connecting to shared platforms in a networked manner.

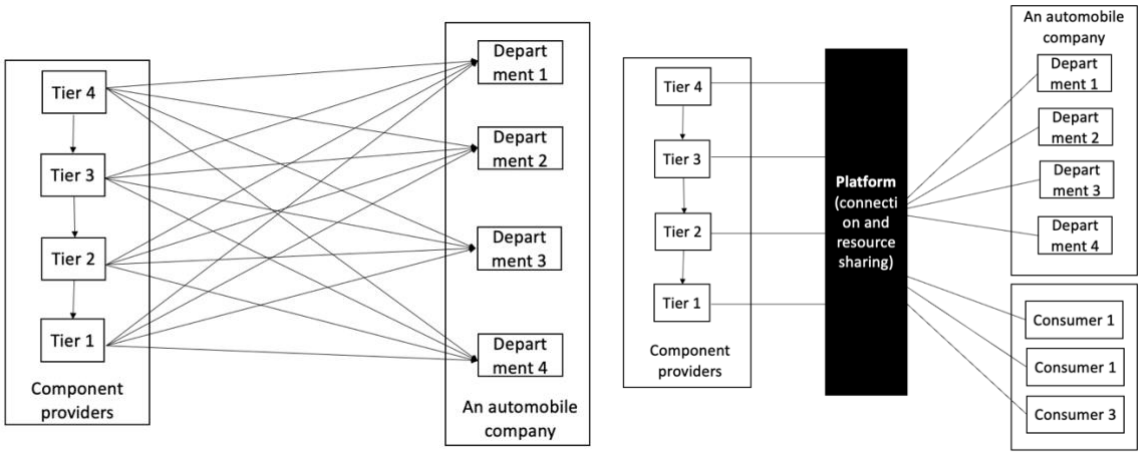


Figure 5.2 - Sequential co-production logic to network and platform logic for provision-side complementarities

Third, efficiency synergies have also been surprised by the findings in the Alibaba ecosystem in three ways: 1) sharing width and depth broadens: sharing infrastructural resources and capabilities across departments, firms, supply chains, industries and regions, and 2) sharing becomes real-time and automatic, and 3) sharing enhances operational efficiency. Existing research focuses on sharing generic resources to enhance the efficiency of product production, transaction, and innovation. Following this logic, generic resources can be manufacturing facilities, distribution channels, common innovation modules, software development tools and transaction platforms. Although insightful, the understanding of sharing logic can be expanded by the findings

from the Alibaba case. In the case of Alibaba, infrastructural resources and capabilities can be cloud computing, data centres, analytic algorithms, data, knowledge and capabilities. Specifically, Alibaba supET IIoT ecosystems suggest three types of sharing across firms and industries: 1) ability-sharing platform where generic resources can be data resource management, computational storage, machine learning platform, algorithm model, and industrial mechanism model, 2) knowledge routing platform where generic resources can be digitalised knowledge in industrial applications through which knowledge exchange and trading across boundaries can be easier and knowledge enhancement can be faster, and 3) data plaza where generic resources can be secured data from all firms and industries. Within firms, Alibaba suggests the Middle Platform architecture through which data, service, and AI can be shared across units within a firm. Component providers can also leverage the Middle Platforms to directly interact with firms without sequential coordination. This sharing can enhance connections, reduce information overlaps, enhance coordination and operational efficiency, and optimise decision-making. The Alibaba case broadens the width and depth of generic resources, opening the door for more ecosystem synergies. Furthermore, my analysis of the Alibaba case highlights the increasingly important role played by real-time and automatic sharing. Together, the untapped ecosystem synergies by existing research are the enhancement of operational efficiency. Providers join ecosystems not just for efficient production, transaction, and innovation but also for general operational efficiency. For example, the Alibaba provision-side platform ecosystems enhance providers' marketing efficiency through Alimama, procurement efficiency through 1688 and IIoT platforms, human resource efficiency through DingTalk, logistics efficiency through Cainiao, project management efficiency through DingTalk, finance efficiency through Ant Finance, and computing and data management efficiency through AliCloud. One specific IIoT platform example is Leihui International. Together with Alibaba Cloud aIoT, it has created a representative industrial Internet platform for the craft beer industry in China. Based on the Alibaba Cloud aIoT industrial Internet base, it provides a complete set of digital factory systems for craft brewing production lines. Through this platform, Lehui can better provide end customers with spare parts and equipment operation and maintenance services using big data and AI insights. At the same time, Lehui provides Alibaba Cloud Digital Factory Operation Center for businesses connected to its industrial Internet, including cloud applications such as production management, warehouse management, and supplier management tailored for the craft beer industry, to improve the operating efficiency of equipment factories and

reduce operating costs. Alibaba provides generic platform support such as Cloud computing as well as industry-level platform support to help Lehui develop smart applications specific to the craft beer industry and enhance its service, operation and innovation capabilities.

Fourth, optimisation synergies are broadened to cover provision-side synergies and take on a central role as suggested by the Alibaba case. Services in digital applications become increasingly prevalent on the provision side due to liquification, leading to increasing service exchange and value co-creation potentials for optimising resource mobilisation. With more services being digitalised and de-coupled from tangible objects, they become more malleable and transferable. These intangibles can be easily reprogrammed in the virtual world to adapt to changes and optimise physical resource mobilisation. These optimisation synergies become vital mechanisms in the Alibaba ecosystem by digitalising both the provision and consumption sides. When provision-side ecosystems are increasingly digitalised using the Middle Platform architecture within or across firms and industries, the services and data flows are de-coupled from physical flows to stores in shared platforms where service exchanges and value co-creation can happen across boundaries. At the same time, as consumption-side ecosystems are digitalised through the increasing number of applications, more consumer data can be collected for value co-creation, which optimises provision-side resource mobilisation. Getting consumption-side and provision-side participants and complementors onto a shared platform leads to a new optimising synergy in ecosystems – data-driven customised supply-demand matching. The Alibaba Xunxi Smart Factory illustrates this as the twin flywheels of consumer Internet and industrial Internet. It enables customers to place customised orders in very small numbers because it leverages Alibaba's big data to predict customer demands and smartly merges similar orders to efficiently match high-quality factories that are good at undertaking this kind of order. Digital transformation of businesses on the provision side served as the first driver, upgrading their traditional legacy systems to the new Cloud-based and IoT-based smart ecosystems. Digitalising the supporting services for consumer experiences was the second driver, requiring IoT to connect physical stores, online experiences, and applications. The upgrading of consumption-side ecosystems drove provision-side transformation by unearthing potential consumer needs that were data-driven and non-existent before the digital age. These newly discovered needs through data aggregation and analytics helped provide opportunities for provision-side participants to create new offerings, serving as a strong flywheel effect. Through this process, providers not only increased operational

efficiency but also developed the ability to serve the massive and personalised demands of individual consumers directly. The more digitalised the consumption side becomes, the more data can be collected, and the more provision-side participants will sense the urgency of upgrading to customised small-volume offerings. The human knowledge boundary is expanded with the facilitation of algorithms, deep learning, and big data analysis. Instead of enhancing efficiency according to experiences and human knowledge, digital data and analytics re-exam existing mental models and propose new models using data and services across firms and industries. The results are increasing and continuous optimisation of operating models.

Fifth, my analysis of the Alibaba case extends the existing study of sustainable equilibrium by proposing sustainable growth as the fifth type of ecosystem synergy. This refinement stems from the finding that ecosystems do not always reach an equilibrium state between stability and evolvability. Instead, ecosystems are constantly evolving, becoming and growing. Reaching a sustainable equilibrium assumes a relatively static view of ecosystem participants, structure and synergy types instead of a dynamic one (McIntyre & Srinivasan, 2017). In other words, these studies focus on "*letting a thousand flowers grow*" in one ecosystem architecture through one synergy type and balancing tensions between opposing forces. However, as ecosystems evolve, flowers can expand, ecosystem architecture can adjust, orchestrator-participant interactions can evolve, and new ecosystem synergies can emerge. Therefore, the goal can move beyond reaching sustainable equilibrium by balancing stability and evolvability within a certain ecosystem structure and synergy to reach a higher understanding of tensions (Raisch, Hargrave, & Van De Ven, 2018). This higher state takes a process perspective and focuses on encouraging sustainable growth by taking into account the evolving features of ecosystem architecture to meet the needs of expanding ecosystem participants and enabling emerging ecosystem synergies while ensuring cost and efficiency for all. In this way, ecosystem synergies go beyond cost, return, and social and leadership considerations in the short term for an equilibrium state. Ecosystems can follow a long-term vision of growing the pie by constantly re-tuning and evolving ecosystem architecture and associated synergies, participants and governance. In the case of Alibaba, participants expanded from business-related ones such as buyers, sellers and complementors to all stakeholders such as governments, universities, and society. Generative changes emerged from not only consumption-side network effects for transaction and innovation efficiency but also provision-side ones for operational efficiency. Generic resources to share thickened as ecosystems evolved, leading to an

exponential growth of value creation potential. During the process, while participants benefit from enhanced operational efficiency, cost reduction and profit growth, ecosystem orchestrators also gain revenue because "*I am adding value, I am not taking it out of your original plate, I am creating another plate for you*" (A9 I interviewed). Sustainable growth covers not only economic growth but also responsibilities for society and the environment. In the ESG Report, Alibaba defined sustainability "*as focusing on long-term value creation that drives sustainable profits"* and suggested that *"The pursuit of sustainability requires that we do the right thing when our business impacts the environment and society.*" (p. 5) In this way, ecosystem orchestrators can engage in new rounds of sensemaking and expand their focus to explore new representations of tensions as ecosystems grow and participants expand sustainably.

Table 5.5 - The literature-based and empirically-refined typology of ecosystem synergies

	Lock-in	**Complementarities**	**Efficiency**	**Optimisation**	**Sustainable growth**
Mechanisms	Positive feedback loops (network, cost, and trust logic)	Coordinating non-generic complementary relationships	Sharing generic resources	Facilitating resource integration and service exchange	Dynamic balancing tensions
Key ideas	The utility a user obtains from participating in an ecosystem is positively related to the number of other users and complementors, or the costs of switching to other ecosystems are positively related to the use of the ecosystem, thus creating ecosystem lock-in	The utility a user obtains from a product/service provided by an ecosystem, or the returns an ecosystem obtains from producing a product/service, is positively related to the number of complementary products/services such ecosystem offers at the same time	The efficiency of production, transaction, innovation, and operation is enhanced by sharing generic resources across ecosystem participants	Resource integration and service exchanges among ecosystem participants optimise resource mobilisation and value propositions, and optimisation manifests as context-specific utility enhancement for each participant	Dynamically balancing tensions of control and autonomy towards sustainable ecosystem growth
Key concepts and changes	Network externalities/Direct and indirect network effect (C&P) Two-sided and multi-sided markets (C&P) Data-enabled learning and data network effects (C&P + Automation) Feedback and reputation systems (C&P) Customised supply-demand matching (C+P)	Complementary offerings/outputs Components Unique complementarity Co-specialisation Supermodular complementarity in the consumption side and production side Move from the sequential co-production model to the real-time network and platform orchestration logic with the active participation of customers	Internal platforms Supply chain platforms Industry platforms Industry/Innovation/Platform ecosystems Transaction platforms/market intermediary Architectural leverage Infrastructural leverage Platforms sharing data, knowledge, and abilities Sharing width and depth broaden Sharing becomes real-time and automatic Platforms to enhance operational efficiency Platforms to support data-driven decision making that is automatic and optimised Digital twin lowers experimentation costs	Value co-creation Value networks Value constellations Actor-to-actor networks Service ecosystems Broadened to provision-side synergies Data-driven mass customisation Optimised supply-demand matching	Stability-evolvability paradox Dynamic balancing Coopetition Balancing value creation and value capture Generativity Open and distributed innovation Managed ecosystems Coordination becomes real-time, automatic, and across layers
Key empirical contexts	Telephones, personal computers, video games, payment cards, iPhone store, e-commerce, Industrial Internet of Things, Smart Government	The residential solar industry, 5G-compatible Internet-of-Things product systems, open-source software, e-commerce platforms, Industrial Internet of Things	Automotive, manufacturing companies, airspace, computers, Wal-Mart, Microsoft, Intel, game consoles, media, e-commerce, IoT, smart city, Industrial Internet of Things, Smart Government	Supply chain networks, automotive, eBay, Google, IKEA, Apple, Industrial Internet of Things, Smart Government	Mobile application ecosystems, enterprise software, open-source communities, digital infrastructure, Industrial Internet of Things
Drivers	Standardisation, compatibility, architectural design	Modularity, standardisation	Standardisation, complementarity, interconnectivity, layered modular architecture	Digitalisation, liquification, layered modular architecture, servitisation	Paradox nature of digital technologies
Boundary conditions	Low adoption barriers, low compatibility barriers, zero marginal costs for distribution, intrinsic-driven participation (for nonmonetary), mainly for early adoption	The existence of components or complementary offerings that cannot be provided solely by one firm	Having stable and generic resources that are not confidential, discrete modules, easily standardised resources, and can be accepted and easily used by ecosystem participants without conflicts of interests	High level of services such as skills, knowledge and digital technologies	Generative systems with central actors to control
Key source disciplines	Economics; Strategy	Manufacturing and operations; Industrial economics; Strategy	Industrial economics; Engineering management; Operational management; Strategy	Marketing management; Service innovation	Law; Information systems
Roles of orchestrators	Cultivate positive feedback loops through pecuniary and non-pecuniary adoption-incentive strategies to drive ecosystem lock-in	Cooperate with providers of components and complements to provide coherent ecosystem offerings together	Design and share standardised technological architecture, standardised interfaces, and other generic resources to enhance efficiency and innovation	Reconfigure value networks, processes, and time, and consider service platforms, service ecosystems, and value co-creation during orchestration	Coordinate distributed innovation by balancing stability-evolvability for effective governance
Expanded analytical focus	Consumption and provision sides, private and public organisations, industries, and regions	Consumption and provision sides (network logic gradually replaces co-production logic), private and public organisations, industries, and regions	Consumption and provision sides (network logic gradually replaces co-production logic), private and public organisations, industries, and regions	Consumption and provision sides, private and public organisations, industries, and regions	Consumption and provision sides. private and public organisations, industries, and regions

Notes: C refers to the consumption side, and P refers to the provision side. Words in red signal refinements in light of my analysis of the Alibaba case.

Ecosystem change

> *"An ecosystem cannot be perfectly designed ahead of time because it evolves organically. Alibaba's development therefore must embrace rapid change according to our evolving environment."*
>
> *Jack Ma 2014 Letter from CEO*

> *"One is the guidance of the vision and the sense of mission, which must be one of the main driving forces. Competition is also a main driving force. Demand from sellers and buyers is also a driving force. Internal needs too. So do external needs."*
>
> *A6 I interviewed*

Insights from my analysis of the Alibaba ecosystem extend prior studies of ecosystem change in three main ways: 1) the duality rather than dualism relationship between emergence and intentionality, 2) the phasic change model instead of the default lifecycle model, and 3) the critical role ecosystem architectural bottlenecks play in driving ecosystem change.

First, the development of the Alibaba ecosystem shows that strategic and emergent actions, as a duality, play a mutually enabling role in driving ecosystem change, extending the mutually exclusive view that is dominant in existing ecosystem research (Oh et al., 2016; Ritala & Almpanopoulou, 2017). Following duality, ecosystem orchestrators do not engineer an ecosystem with certainty and sole agency nor surrender entirely to emergent incidences; instead, ecosystem change results from both. Although these two actions seem contradictory on the surface, they are, in fact, mutually enabling. In Alibaba's case, Alibaba did not pre-design the ecosystem's evolutionary path with certainty or implement a fixed plan throughout the journey. Instead, Alibaba emphasised the lack of certainty, followed a stable mission and experimented with an improvable vision in orchestrating ecosystem change and sustainable growth. While a mission is fixed and set up initially by following founders' beliefs on how to make a change in society, a vision is changeable, proposed and constantly updated by learning from history and existing front-runners, taking into consideration emergent changes, and looking ahead to the trends. In the experimentations, Alibaba was open-minded about the emergent needs and roles from participants, welcoming them to join forces in testing and updating the assumptions embedded in the vision through their ideas on new demands and roles. Such a re-envisioning approach has been

highlighted on multiple occasions by Jack Ma and others from Alibaba. It is thus logical to summarise that, although with a high level of uncertainty, ecosystem orchestrators' engineering role in ecosystem change and sustainable growth still exists through setting up a fixed mission and implementing a re-envisioning process. The re-envisioning process is vital for Alibaba to proactively design the future by providing general guidance to its specific orchestration strategies while remaining open and vigilant about emerging activities and organic growth. When it comes to emergent actions that Alibaba did not predict, although they may pose challenges to Alibaba's vision (especially competitors), they nevertheless helped Alibaba to figure out core problems to solve, settle the appropriate participants to charge, and nail down the critical control points for future value capture. Emergent activities also helped Alibaba by offering services Alibaba was not aware of or did not have capabilities to satisfy, thus driving adaptive capability and sustainable growth of the ecosystem. For example, the first sustainable revenue stream in Alibaba's history, the TrustPass service, was unplanned and enabled through ecosystem positive feedback loops (two-sided network effects) and newly emerged demands. When a critical mass of buyers and sellers got on the Alibaba platform freely, Alibaba found out that buyers "*needed to have some assurance that the person they were dealing with was legitimate*" (Erisman, 2015: 30), leading to the launch of the charging service TrustPass. TrustPass charged by providing the certification through a third-party authentication-and-verification process that made free accounts "*seem less trustworthy*". These emerging needs for trust enhancement helped Alibaba to "*crack the code of e-commerce*". I also observed in person during my fieldwork at Alibaba. When a regional government approached Alibaba for Alibaba's services in Smart City, Alibaba found out with the mayor that their city could hardly benefit from the current smart city services (mainly for traffic congestion issues) Alibaba provided. They together worked out the core problems that the city faced – industrial updates – and thus led to the innovation of a new IIoT business model for Alibaba and new services for the mayor. As discussed in detail in the above case analysis, besides these two instances, this mutually enabling relationship between strategic and emergent actions has been presented throughout the evolution of the Alibaba ecosystem (see Appendix 5 for more representative examples and quotes). By highlighting how duality drives ecosystem sustainable growth, I add to the understanding of factors driving ecosystem change and extend the literature on ecosystem emergence and evolution.

Second, Alibaba's evolutionary path follows a phasic pattern instead of the by-default, taken-for-granted and dominant lifecycle narrative that involves birth, growth, maturity, and decline/rebirth (Moore, 1993; Thomas et al., 2022). Specifically, in contrast to a predefined lifecycle where maturity and decline came right after growth, my analysis of the Alibaba ecosystem demonstrates an alternative path where growth can be sustainable and enabled by re-tuned visions and flexible ecosystem forms. In the case of Alibaba, the three phases that followed unique ecosystem visions all exhibited growth before transitioning into the next phase. Every phase's performance indicators kept growing even after the end of each phase. For instance, although the performance indicators in the second phase were related to ecosystem services and the third phase infrastructural services, the primary performance indicator of the first phase – Gross Merchandise Value (GMV) – still presented rapid growth during the second phase as well as the third phase. In addition, in contrast to the imprinting effects of the past that mainly serve as change-inhibiting factors (Beckman & Burton, 2008), my analysis highlights the various mechanisms that support ecosystem change and sustainable growth. Specifically, my analysis shows three mechanisms prohibiting lock-ins: *ecosystem synergy accumulation*, *re-envisioning*, and *architectural restructuring*. To start with, growth in prior phases accumulates ecosystem synergies that make new types of ecosystem synergies possible for a new round of growth. For example, data accumulation in the first phase made data-driven learning and data network effects in the second phase possible through two-sided network effects. In the third phase, network effects among providers, industries and regions were prepared and enabled by accumulating data, participants and services in the first and second phases. In addition, proactively updating ecosystem vision is possible and crucial in resisting inertia from path dependency and preventing falling into maturity and decline. By incorporating emergent activities and the changing understanding of the future, a new ecosystem vision is designed to specify the general direction and resource organisation logic and guide collective actions for each phase. Although visions are updated incrementally throughout one phase, a qualitative shift of ecosystem visions across phases only happens when micro-level activities reach a tipping point that produces ecosystem architectural bottlenecks and expands ecosystem potentials for synergies. Lastly, bottleneck-driven architectural restructuring counters the inflexibility and inertia that lead to maturity and decline. Alibaba proactively restructured the ecosystem from the monolithic architecture to the micro-service distributed and open architecture to solve the performance and cost ecosystem

bottlenecks at the end of the first phase, and then proactively shifted to the cloud-native architecture and 1+N model in the third phase to solve bottlenecks at the end of the second phase. Internally, Alibaba also proactively reconstructed the organisational structure and process to break internal rigidities and flexibility throughout the three phases. These three mechanisms made the phasic model possible and drove ecosystem sustainable growth. In summary, the dominant lifecycle model that involves birth, growth, maturity, and decline/rebirth assumes the classic path dependency theory, which suggests one growth engine, inflexibility, rigidities, inertia, and potential lock-ins due to persistent legacy and routines (Sydow et al., 2009). My analysis of the Alibaba case challenges these assumptions by suggesting that ecosystem change goes through phases enabled by ecosystem synergies accumulation, proactive re-envisioning, and bottleneck-driven architectural restructuring to address inflexibility and inertia for sustainable ecosystem growth. This means that the cyclicity theme needs to be reconsidered in future studies - the birth-growth-mature-decline/rebirth lifecycle may not be a taken-for-granted assumption that applies to every ecosystem.

Third, the case of Alibaba highlights the critical role ecosystem technology architectural bottlenecks play in driving ecosystem change. Extant research on ecosystem change has discussed external drivers, such as competition and technological upgrades, and internal drivers, such as strategic actions to solve component bottlenecks and tensions. However, the internal driver of solving ecosystem architectural bottlenecks has barely been discussed. Alibaba's case complements existing research by revealing this internal driver. In the case of Alibaba, the internal need for ecosystem architectural updates to address rapidly growing visits and mounting applications pushed Alibaba to shift its architecture from a monolithic architecture based on IOE to a micro-service distributed and open architecture based on cloud and later to a cloud-native architecture. These architectural bottlenecks identified in Alibaba's case extend existing literature's findings on component bottlenecks defined as "*components that constrain the overall growth or performance of the ecosystem due to poor quality, weak performance, or scarcity*" (Hannah & Eisenhardt, 2018: 3164) or "*a component in a complex system whose performance significantly limits the performance of the system as a whole*" (Baldwin, 2015). My analysis highlights the architectural-level bottlenecks that constrain ecosystem growth and performance. This resonates with the studies of industry architecture change as critical leverage for value creation and capture (Jacobides, MacDuffie, & Tae, 2015; Jacobides, Knudsen, & Augier, 2006).

Because ecosystem architecture involves more complexity and more systematic changes than components do (e.g., paying for digital music in the iTunes music store (Hannah & Eisenhardt, 2018)), resolving ecosystem architectural bottlenecks requires more than just component-level change such as entering and controlling one or multiple component bottlenecks or orchestrating complementors to fill bottlenecks (Baldwin, 2015; Masucci et al., 2020). Instead, ecosystem architectural change to solve architectural bottlenecks requires an ecosystem-level change, in which it is impossible to change one component without influencing the others. It needs a sequential, piloting and long-term approach to systematically alter the architectural design where components are embedded in and updated. For example, Alibaba's change from monolithic architecture in the first phase to micro-service distributed and open architecture in the second phase took six steps in five years. The transition from phase two to phase three - open cloud-native architecture - also took many sequential processes across multiple years. The change involved a complete rethink of how the components are organised, stacked and constituted. Because a considerable number of components are involved in changing together systematically in resolving architectural bottlenecks, the resource commitment, risks of making mistakes and adoption barriers are higher than those of addressing component bottlenecks, but the returns can be high. To reduce risks and spread resource commitment, addressing architecture bottlenecks can adopt a piloting approach – testing the feasibility and performance of new architecture inside the orchestrator and then, if successful, attracting adopters by showcasing successful outcomes of the in-house pilots. In the case of Alibaba, I found many pilot examples, e.g., container architecture's initial pilot in Taobao and the cloud-native architecture's initial test in the Double 11 Shopping Festival. It was only after successfully testing the feasibility, stability and effectiveness of new architectures for internal needs that Alibaba started to commercialise to ecosystem participants. This piloting approach will also be discussed in the ecosystem orchestration section below.

Ecosystem orchestration

My analysis of the Alibaba ecosystem orchestration confirms existing studies on the technological architecture orchestration where design principles such as modularisation and standardisation drive architectural updates for efficiency and scalability (Baldwin & Clark, 2000; Jacobides et al., 2018; Tilson et al., 2010). In addition, my analysis suggests three key insights that complement and extend prior discussions: 1) the unique role internal orchestration plays, 2) the

distinctive mechanisms in participant adoption activities, and 3) the expanding role of institutional activities.

First, my analysis of the Alibaba case surprises existing research by pointing out the critical role internal orchestration plays in supporting external orchestration and ecosystem sustainable growth. While it has been acknowledged that orchestration activities need to expand to target ecosystem participants outside of orchestrators because ecosystem synergies rely on external parties across industries for value co-creation (Adner & Kapoor, 2010; Gawer & Cusumano, 2002; Masucci et al., 2020), my analysis highlights the critical role played by various internal activities on employees and the organisational structure of ecosystem orchestrators to support external activities, ecosystem vision and sustainable growth. Although extant studies have touched upon some internal activities, such as scoping (how many assets an orchestrator decides to own instead of enabling complements) through the lens of transaction cost economics (Gawer, 2020; Gawer & Henderson, 2007; Hagiu & Wright, 2015), developing internal practices when transitioning from a supply chain logic to a platform or ecosystem logic (Dattée et al., 2018; Gawer & Phillips, 2013), and adaptation and ambidexterity capabilities for simultaneously managing multiple governance structures (Altman et al., 2022; Ansari et al., 2016; Foerderer et al., 2019; Khanagha et al., 2022), their analytical focus of internal activities remains restricted and inward focused - to support ecosystem orchestrators' own organisational competitive advantage. There seems to be a presumption that internal activities are separately strategised from external orchestration because internal orchestration follows the cost-benefit analysis of the ecosystem orchestrator while external orchestration focuses on growing the ecosystem. In other words, if internal activities are in the short run outside the scope of existing offerings, are not cost-effective, or do not bring profits for the ecosystem orchestrator, they face strong internal resistance and even cancellation. However, my analysis of the Alibaba case highlights the strategic role of internal activities in actively supporting external orchestration and the ecosystem as a whole in the long run. This means that, instead of solely aiming for internal logic and profit objectives, an internal activity can be considered holistically with other internal and external activities with macro-coordination and alignment to together support ecosystem vision and sustainable growth. When strategised together, even if some internal activities do not make sense separately for corporate objectives following a cost-profit analysis or an institutional logic, if they support other internal and external orchestration, ecosystem vision and sustainable growth, they can be supported and promoted by the ecosystem

orchestrator. Managerial roles inside ecosystem orchestrators thus can act as the macro-coordinators to control and allocate resources for organisational and ecosystem strategic visions by considering the interconnections and mutually supporting potentials between internal and external activities. In addition, because of the inward orientation, internal activities studied in extant research tend to take on a reactive role in response to external changes (Gawer & Phillips, 2013) or delay internal investments until external participants lock in to enact resonance (Dattée et al., 2018). My analysis of the Alibaba ecosystem orchestration extends the existing discussion by highlighting internal activities' proactive role in supporting external orchestration and ecosystem growth, e.g., front-running investments to create and experiment with the future. Lastly, having acknowledged the internal activities' outward-facing tendency, ambidexterity literature suggests the need to balance outward growth with internal control (Altman et al., 2022). For example, spatial separation can be implemented internally for such balance, e.g., with some parts of the organisation developing internal products and some supporting third-party complements (Cusumano et al., 2019). My analysis of the Alibaba case highlights an alternative mechanism to address ambidexterity – through reconfiguring organisation architecture with ecosystem-friendly KPIs. A platformed organisation where low-cost and fast internal piloting can support both internal innovation and external participation, and ecosystem-friendly KPIs motivate internal employees to work towards the long-term benefits of ecosystems. In the following, I elaborate on how Alibaba proactively and holistically strategised internal momentum to support external orchestration and ecosystem sustainable growth through re-envisioning, internal piloting, and organisation architectural reconfiguring.

I define *re-envisioning* as the ability of an ecosystem orchestrator to design and proactively redefine long-term ecosystem visions in response to external changes to guide short-term resource allocation and strategic activities. My analysis of the Alibaba case highlights the importance of being long-term vision-driven and setting up the organisational structures and processes to constantly re-tune ecosystem visions for sustainable growth. It is particularly important when the uncertainty is high, changes are rapid and innovations "*seem impossible to achieve*" (Wang, 2016: 115). Although the future is uncertain and unpredictable, long-term visions can be designed and set up initially as the "*best assumption*" of the ideal future, which specifies how the orchestrator and participants may fit in and work towards it. They are used to guide strategic actions and unite employees and ecosystem participants to "*work together to generate synergies that drive long-*

term sustainable growth" (Alibaba ESG Report 2018). These united efforts by sticking to the same vision can be reflected internally in 1) new employees are hired only when they commit to the vision, and 2) performance evaluation includes both performance and value dimensions (each with 50%). According to Ming Zeng in Alibaba, vision-driven ecosystems differ from opportunity-driven ones, although both may lead to success. When an ecosystem is driven by opportunities that emerge along the way for short-term or mid-term profits, for example the hot industries or products that attract investments, it relies on opportunity-cost analysis and does not have a long-term strategy to guide imminent decisions. In other words, opportunity-driven ecosystems focus on short-term gains with hardly any long-term strategising. On the contrary, vision-driven ecosystems are guided by long-term assumptions of the future to make short-term decisions. Some opportunities may not seem apparent as important in the short term but long-term visions may suggest otherwise. By considering interdependencies and co-evolvement of different elements to imagine and design an ideal future, backwardly steering short-term actions to work towards such vision and proactively re-tuning visions when changes are deemed necessary, vision-driven ecosystem orchestrators possess capabilities of system and structural thinking and associated implementation. Because of the firm belief in long-term visions, vision-driven ecosystems tend to take an "all-in" approach with proactivity in important nodes even without enough short-term evidence for support. As summarised by Ming Zeng, the important process for re-visioning takes the combination of three things to give thought to long-term and short-term trends, "*look forward for ten years, think for three years, and take actions in one year*". When designing long-term visions, orchestrators need to look forward to trends of at least ten years, e.g., AI. Regarding executing such visions, orchestrators need to think carefully about the specific areas of applications for the three years ahead as the long-term trends may not be technologically or institutionally feasible to realise in some areas in the short run, e.g., AI applications in financial investment (not ready yet). Orchestrators then need to take actions to achieve results in the imminent one year ahead with the lowest costs of trial and error for the most needed areas, e.g., AI in customer service. Contemplating the three timespans at the same time is crucial to facilitating iterations of applications arising from the feedback among them, leading to gradually approaching improvable visions. It is a process of continuous re-envisioning through which visions are always becoming. This re-tuning made vision-driven differ from the goal-driven planning approach as the latter tends to come with a linear process where clearly defined and fixed goals dictate road maps and

execution without flexibility but the former comes with a non-linear process where emerging changes and new information can be flexibly incorporated in improving and updating visions when they are based on outdated assumptions (Sull, 2007). My analysis highlights the importance of setting up internal organisational structures and processes in ecosystem orchestrators to re-tune visions in response to short-term iterations and external changes. Specifically, orchestrators must set up organisational processes to 1) allow the managerial level to explore the ecosystem's future with imagination and power, 2) allow information about external and emergent changes to circulate from front-line employees and ecosystem participants to managerial staff, and 3) provide resource macro-coordination and innovation selection from top-down where interrelations between different projects are considered. In the case of Alibaba, its senior management team and business unit leaders conducted strategy meetings 2-3 times annually to re-tune its visions. The vision-setting department staff constantly interact with front-line customer-facing employees to obtain updates and emergent changes from participants. Many informants mentioned an important mechanism called co-creation, "*Gong Chuang*", which refers to meeting with related employees, managers and participants to discuss important vision-shifting changes and opportunities whenever they emerge so as to co-create new services and visions. New visions or incremental updates can be collectively proposed and agreed upon during these co-creation meetings to guide internal reorganisation and external orchestration.

I define *piloting* as the ability of an ecosystem orchestrator to proactively experiment and incubate innovations internally and, if successful, showcase and scale to external ecosystem participants. When piloting, Alibaba does not work passively in response to external needs or only relies on promoting external innovations; instead, proactive internal experimentations following the future-oriented ecosystem vision serve as pilots to facilitate adaptation and external adoption. This proactive approach is in line with the vision-driven ecosystem orchestration as, different from the opportunity-driven approach that tends to follow the tide, the vision-driven requires thinking ahead about long-term trends and backwardly steering short-term actions to work towards the vision. By deliberately conducting experimental pilots internally to prove concepts and demonstrate success, external participants can be attracted to the ecosystem to work together towards such a vision. This proves to be crucial, especially when the uncertainty of new concepts or updates is high, the connection between long-term visions and short-term opportunities is unclear, and adoption among ecosystem participants faces strong resistance. By leveraging internal

markets and fierce internal competitions, new updates in the ecosystem and services, such as resolving architectural bottlenecks and developing new business models, can be experimented and validated internally and then diffused to hard-to-command external ecosystem participants for adoption. Successful internal pilots are widely publicised to ensure observation by ecosystem participants, thus influencing their cognitive mental map and reducing their perceived risk and uncertainty. This can be time-invariant feedback loops used across ecosystem phases as a key steering mechanism. Even though Alibaba may not have a complete package of skillsets for new experiments, Alibaba proactively collaborated with suitable participants or partners as early adopters to co-develop pilot projects. Internal organisational structures and processes have been set up and evolved to facilitate such piloting processes. Specifically, as I discussed in the case analysis, Alibaba set up an internal competition program called Horse Racing to incentivise and systemise internal incubation in the second phase and later in the third phase Alibaba shifted to the platformed organisation architecture through which generic resource business units are centralised and can be flexibly and directly accessed by front-end customer-facing employees to autonomically conduct large-scale internal agile experimentations in a cost-efficient manner. In this way, Alibaba can substitute some external market mechanisms, especially in less well-functioning markets, and leverage the internal market to efficiently and effectively allocate resources and incentivise innovations (Guillen, 2000). Alibaba's case reveals that, in the case of high uncertainty and low adoption, setting up proper organisational structures and processes to enable and support internal piloting can help internal adaptation and support external adoption. Especially when innovative projects find it hard to attract early adopters externally, this internal piloting can help test and implement first and then shift to external influencing by showcasing successful pilots. One informant emphasised the type of employees suitable for this rapid experimenting process – the ones that "*constantly experiment with perseverance*" (A14 I interviewed). The informant further summarised that, unlike the Western staff who design plans cautiously before trying, employees who succeed in Alibaba tend to experiment as soon as they come across a new opportunity or idea "*without too much thinking*". They tend to try as many methods as possible until being completely beaten and then stop and pick one or two feasible methods to continue experimenting until success. Fierce internal competition in the internal market and ranked employee evaluation systems support and nurture this type of employees and behaviours for fast experimentation.

I define *organisation architectural reconfiguring* as the ability of an ecosystem orchestrator to proactively reconfigure its organisational structure and process to support ecosystem vision, external orchestration activities and ecosystem sustainable growth. Existing research discussed spatial separation, for example Intel's Job 1 for selling more microprocessors (platforms) and Job 2 for competing with complementors for profits in complementary markets, to manage tensions (Cusumano & Gawer, 2002; Cusumano et al., 2019). However, my analysis of the Alibaba ecosystem highlights a systematic and proactive change across an organisation - an organisational reconfiguration to a platform organisation architecture with ecosystem-friendly KPIs to support macro-coordination of resources for internal agile experimentation and external adoption. This means that instead of organising businesses into Job 1 and Job 2 according to the competitive relationship with complementors, Alibaba organised and reformed businesses into Middle Platform units and front-end business units according to the level of generality where 1) front-end business units focus on developing generic platform applications without entry into complementary markets to compete with external complementors and 2) Middle Platform units take charge of generic infrastructural capabilities that support the development of applications internally and externally. As described in the case, Alibaba's organisational architecture evolved with multiple reconfigurations, from the chimney and centralised organisational form in phase one to the distributed, de-centralised, and shared service structure in phase two, and to the internal Middle Platform organisational architecture in phase three. Each phase witnessed a proactive and systematic reconfiguration of the internal organisation from the "*company + employees*" to "*platform + individuals*"[5] logic. In the platform-based organisation architecture, generic resource business units gradually became modularised and acted as shared platforms to support low-cost experimentation and fast innovation internally. Such architectural reconfiguration moves beyond spatially separating hierarchical control and innovation to fundamentally rethink how the whole organisation is structured so as to shift *"from managing to enabling employees*" (Zeng, 2018b: 157). Instead of organising services into different product business units with centralised bureaucracy without synergistic coordination and autonomy (Weber, 2005), middle platform architecture organised business units into platforms based on the degree of generality. By leveraging such platform organisation architecture, business units of generic resources can support other units to innovate independently through standardised transaction rules, internal free-market,

[5] http://www.aliresearch.com/blog/article/detail/id/20775.html

and co-creation meetings. Successfully reorganising internal business units to share generic resources can prepare ecosystem orchestrators to open well-platformed internal generic resources to external participants for ecosystem development. The macro-coordination and simultaneous strategising for both internal and external stakeholders became so important that Alibaba started to call internal and external communities "One Community" from specifically the second phase (Sina News, April 4, 2013). According to Ming Zeng, the "One Community" concept was proposed to facilitate synergies between internal and external orchestration. It covered two key areas: 1) internal organisational reform to a platformed architecture for adaptation and innovation efficiency where business units that control generic resources can be shared across and support business units that focus on independently developing applications or services, and 2) external ecosystem development by sharing generic internal resources and becoming an operational platform for external participants. While Alibaba mainly focuses on innovating and developing generic applications in the form of platforms, external participants are encouraged to develop non-generic platforms or complements for platforms for which Alibaba does not have capacities and knowledge. Alibaba also designed ecosystem-friendly KPIs and formed social enterprise governance mechanisms within the platformed organisation architecture to prevent tensions that hinder ecosystem sustainable growth. In this way, the organisation's architectural reconfiguring can support both internal innovation efficiency and external adoption for ecosystem sustainable growth.

To briefly summarise, through re-envisioning, internal piloting, and organisation architectural reconfiguring, Alibaba proactively developed internal momentum to support external orchestration, ecosystem vision, and ecosystem sustainable growth. Internal orchestration is considered an integral part of the overall ecosystem orchestration arena, requiring proactive macro-coordination by ecosystem orchestrators for alignment with external orchestration. This also requires a systematic and long-term analysis of internal activities beyond internal cost-benefit analysis in the short run to architecturally facilitate large-scale internal experimentations, absorb emergent demands and support external ecosystem adoption.

Second, insights from Alibaba's case also complement existing research on ecosystem adoption activities through *platform spawning, the generality principle, prioritised customising and demonstrating, and synchronising*. While it has been well acknowledged that adoption activities can be encouraged by pecuniary strategies such as pricing and subsidies and non-

pecuniary strategies such as providing APIs, controlling access, designing rules of interactions, leveraging intrinsic motivations and offering complementary services (Boudreau & Hagiu, 2009; Cusumano et al., 2019), my analysis highlights the strategy of *platform spawning*. These strategies studied by existing research focus on minimising costs and reducing complexity and uncertainty to facilitate adoption, while Alibaba's platform spawning approach complements them by paying particular attention to the synergies among platforms to incentivise adoption. This approach was particularly salient during the second ecosystem-empowering phase, characterised by primarily consumption-side ecosystem synergies with limited participant heterogeneity. By focusing on developing platforms where one side already has wide adoption and Alibaba has "*strong control*" (A14 I interviewed) through existing platforms, Alibaba was able to gain the participation of other sides relatively easily in new platforms that provide complementary services to existing platforms. In addition, focusing on expanding through the platform model instead of the ownership model enabled Alibaba to scale fast with a relatively light investment. As illustrated in the case, Alibaba has leveraged this principle in the consumption and provision sides, particularly in the second phase of ecosystem empowering. Critical platforms have been spawned not only for niched e-commerce markets and consumption-side services but also for the provision side where third-party complementors were orchestrated to provide services for sellers. As I illustrated in the case analysis, Alibaba spawned niched e-commerce platforms such as Tmall and Juhuasuan in the second phase by leveraging control of its large user base in existing platforms. This developed synergies where existing platforms can facilitate the adoption of new platforms and at the same time the new platforms, as they are complementary to the existing ones, can increase the adoption of the existing platforms. In other words, buyers' willingness to join the Alibaba ecosystem increases as more niche e-commerce platforms are developed. On the consumption side, similar synergies across platforms are also exhibited to promote ecosystem adoption. In my case analysis, Alibaba spawned platforms on the consumption side for consumers' various needs in life, such as search engine, entertainment, news, navigation, travel, and ticket purchase. The more consumption-side platforms are set up, the wider coverage of Alibaba ecosystem services, and the more likely one may adopt the Alibaba ecosystem. Data collected across platforms can improve data-driven learning and data network effects through which customised services can be provided with increased accuracy and thus attract more ecosystem adoption. While niche and consumption-side platform spawning have been discussed extensively in existing literature, the provision-side

platform spawning extends existing research which focuses on consumption-side platforms and complementary services, e.g., Apple App Store or video games that orchestrates complementary services for individual consumers (Parker & Van Alstyne, 2005; Shankar & Bayus, 2003), by proposing the platform synergies across the provision side to promote ecosystem adoption. In my case analysis, Alibaba spawned platforms for the provision-side participants by expanding upstream and downstream of the value chain to support third-party complements, e.g., marketing, finance, logistics and organisational operation. Sellers can join the Alibaba ecosystem to gain access to a wide range of third-party complementors for services such as advertising, shipping and obtaining financial loans. In doing this, Alibaba facilitated platforming or horizontalising vertical value chains to shift to a value network structure (Stabell & Fjeldstad, 1998) through which operational efficiency could be enhanced through direct, efficient and effective interactions and ecosystem adoption increased from sellers and third-party complementors. Data-driven learning and data network effects were also developed in this process and facilitated further ecosystem adoption. Moreover, in the third phase, Alibaba further spawned platforms in the manufacturing stage of the value chain through the IIoT platforms, leading to further enhanced operational efficiency among sellers, component providers and complementors and increased ecosystem adoption. And, breaking through the consumer-provider divide, Alibaba further expanded its services to other organisations such as governments, NGOs, and public organisations by providing infrastructural platform services. Picking critical platforms to spawn was essential in converting indirect ecosystem participants to direct ones, especially in the infrastructure-empowering phase where comprehensive services were provided by the Alibaba ecosystem, covering buy, sell, pay, deliver, travel, social, live and work, and social activities such as poverty relief, environmental protection, and job creation. In this way, synergies among platforms inside the ecosystem can accumulate rapidly to attract adoption to existing and new platforms. Besides complementarities across platforms after the spawning, new types of synergies in the form of data-driven learning and data network effects also started to play a crucial role in promoting ecosystem adoption. The key takeaway here is that Alibaba's platform spawning approach complements existing cost-reduction-focused approaches for single platforms by highlighting the synergy-focused approach in encouraging adoption in multiple platforms in the long run.

While the platform spawning approach emphasises the benefits of developing lightweight platforms to encourage ecosystem adoption, the principle of *generality* Alibaba leveraged further

points out the best areas to enter for maximal synergies, value creation and value capture, especially when it comes to the provision-side ecosystem. This finding also adds to previous work arguing that factors other than network sizes, such as adopter heterogeneity, composition, structure and preference strength, affect the performance of complementors and positive feedback loops (Afuah, 2013; Panico & Cennamo, 2022). It also provides some nuances to the call for more studies on motivations behind ecosystem orchestrators' entry into complementors' markets (Zhu, 2019). Specifically, generality can be leveraged as a critical principle to choose which areas to focus on developing platforms and associated services for the ecosystem orchestrator so as to attract a wide range of participants, maximise ecosystem synergies, and sustain ecosystem growth. The ecosystem change of Alibaba can be viewed as a process of going down the digital stacks – from front-end transactional platforms to generic digital infrastructural services that enable front-end platforms and businesses across industries. One of the key drivers is the shifting to generic offerings - developing digital infrastructure that empowers all participants. The lower the stack is, the more generic the digital offerings are, the less specific resources orchestrators need to possess, the wider the participant adoption is, and the more ecosystem synergies can be co-created and captured in the long run. This principle was leveraged in the second phase when Alibaba picked emerged demands that were generic to spawn for both the consumption and provision sides to incentivise wide adoption. As one informant summarised, "*Alibaba provides basic products, such as rice and white steamed buns, so you won't be hungry. These places (service providers) are cakes, snacks, side dishes, and snacks. What Alibaba provides is standardised and universal.*" (A6 I interviewed). It became even more important when Alibaba tried to expand to the provision-side manufacturing ecosystem in the third phase. Expanding to the provision side required a high level of industry-specific elements which Alibaba lacked compared with traditional industry players. Therefore, Alibaba chose to focus on the most shared and generic areas, such as data and cloud digital infrastructural services, to attract participants' adoption across industries and cultivate ecosystem synergies on the provision side. One informant summarised the importance of generality in promoting the provision-side ecosystem adoption: "*The key for the IIoT platform is that you must evolve into massive openness for a wide range of participants. To achieve that, the most important thing to focus on is the level of generality, which means that the offerings can be used not only by yourself but also by others… I think this is the core difference between the consumer Internet and IIoT platform – the level of generality. Most IIoT apps are customised*

initially, unlike the consumption-side ones which can be applied to others after one person uses them. In the industrial Internet system, there is a curve between general and special use. At first, it is customised and participant-specific, but it will be increasingly general in the future. In other words, when we talk about the cloud, the bottom layer of cloud computing is IaaS, then PaaS, and then SaaS. In terms of its generality, IaaS is the most general, because whether you are engaged in steel, petrochemical or high metallurgy, your data to be stored are all 0-1 codes, you have to calculate and engage in computing and storage. It is the same, there is no difference, the data is no different in the IaaS layer. Specialisation starts when you get to the PaaS layer, because it contains a large number of core algorithms. The algorithm itself can be further divided and layered, so when it comes to the SaaS layer, you will face different problems for different participants in different industries, such as the machinery industry, the automobile industry, the food industry, and each of your R&D and production supply chains. What value does the difference in generality bring? The value it brings is that the global IaaS market is an oligopoly market. The higher the layer, the more fragmented the market becomes." (A2 I interviewed). The implementation of the generality principle comes with a firm commitment from ecosystem orchestrators to maintain the role of generic platform providers instead of coming into participants' markets. Alibaba proactively communicated externally about such a clear task boundary to prevent friction. Existing research has discussed the coopetition relationships between ecosystem orchestrators and participants, suggesting that ecosystem orchestrators sometimes compete with participants for their own competitive advantages (Zhu & Liu, 2018). We can see this, for example, in Amazon's case, where Amazon was sued in 2010 for monopoly by developing its own private label with lower costs using sellers' data, such as which products are popular. Amazon entered sellers' successful product markets because the profits Amazon was able to seize in the short run outweighed the negative impact on sellers' trust and commitment to the ecosystem. However, the long-term impact of having a blurred task boundary is that trust from participants may deteriorate and thus reduce their commitment and the synergies they can cultivate together. Alibaba, on the contrary, has in many cases emphasised the clear boundary of tasks regarding its role as a generic platform provider. For instance, an Alibaba executive summarised this principle in an Alibaba conference, "*Alibaba focuses on developing infrastructural skills to be integrated by others. Alibaba does not do SaaS, let everyone do better SaaS…Every ecosystem partner has its own specialities and unique advantages. After Alibaba clears the task boundary, we can each determine*

the direction of focus." By "*adhering to partner first*" and following the principles of "*open and altruistic*", Alibaba "*takes a step back*" and "*encourages partners to lead the walk for success*". Jack Ma also emphasised this in his letter from CEO in 2014: "*Alibaba's mission makes it impossible for us to become an empire-like business. We believe that only by creating an open, collaborative and prosperous ecosystem that enables its constituents to fully participate can we truly help our small business and consumer customers. As stewards of this ecosystem, we spend our focus, effort, time and energy on initiatives that will benefit the greater good of the ecosystem and its various participants. We can only be successful if our customers and business partners are successful.*" From the participant's perspective, one informant also illustrated the difference between Alibaba and Amazon, "*The difference is whether their mentality is open enough. For Alibaba, Alibaba knows that it is impossible for Ali to do all the business. If Ali kills all the businesses [participants], he himself will die, and he will have no value in existence*." (P31 I interviewed)

When Alibaba did enter participants' markets, its entry normally served one key purpose – growing the ecosystem. This confirms prior observations of the strategic activities used by ecosystem orchestrators to grow ecosystems, e.g., entering complementary markets while promoting third-party complementary innovations (Cennamo, 2018; Cusumano et al., 2019; Foerderer et al., 2019; Gawer & Henderson, 2007). To grow the ecosystem but prevent creating trust-related frictions, my analysis of the Alibaba case extends prior discussions by highlighting how orchestrators must carefully choose which markets to enter with what partners for feasibility testing and demonstration. This *prioritised demonstrating and customising* become significantly critical when pushing for adoption in the provision-side ecosystem, as the generality is lower on the provision side than on the consumption side. When generality is high, for example, on the consumption side, generative changes through positive feedback loops across relatively homogenous participants are easily developed by ecosystem orchestrators through for example subsidies and APIs. However, when generality is low, such as the provision side with ample industry-specific and risk-averse elements, generative changes must be cultivated by first doing customisation with heavy involvements of orchestrators and then building platforms for generativity across participants. This means that network effects are hard to kick off across participants when participant heterogeneity is high, generality across participants is low, and risk aversion is high. One service that works for one participant may not be applied directly without

adaptation to other participants. Each adoption needs a customised service at the beginning. Consequently, as one informant summarised, "*when you talk about this platform in the ToB industry, you must not understand that you develop a platform and then others will automatically pay for it as the consumption side. This is not acceptable. ToB is a customised service for products. Each large company will spend about 500,000 to 1 million to cooperate with you [ecosystem orchestrators], if they just buy an account without having anyone from Alibaba to help customise, it is not possible [to get them on board].*" (A9 I interviewed) During customisation, when resources are limited, there needs to be prioritisation in picking which participants to start the process. Therefore, customisation requires carefully selecting early adopters to co-develop services and products so as to demonstrate and scale to other participants and markets. In the case analysis, I highlight various factors to consider when choosing early adopters, such as willingness level, whether supported by business leaders, resources one owns, size, market position, types of industries, and risk tolerance. These factors ultimately impact scalability after successful customisation and demonstration, meaning the degree to scale to other participants quickly with little mistrust and modification. For example, one informant emphasised the importance of choosing the process rather than discrete industries because "*process industries involve processes that after you do it successfully in this company today, it can be used in similar companies in the future*" (A9 I interviewed). He also pointed out the role played by industry size – "*This process is done in every industry, such as cement, for example, there are more than 1,800 production lines across the country. If I do a good job in one production line, I can apply to other production lines of the cement industry*". Early adopters could also benefit from participating in the early stage, as illustrated by one informant: "*It is different in resource investment at the beginning than at the mature stage. When everyone is not sure about this thing at the beginning, you can put more of your own ideas into it. I can influence Ali's direction more. When this thing is very mature, think about who would be willing to listen to your stuff?*" (P32 I interviewed). Ecosystem orchestrators need to ensure that they "*really know*" early provision-side adopters and "*have frequent and deep interactions*" to neutralise the risks. After successful customisation and demonstration, services co-developed with early adopters normally in the form of algorithms can be shared across participants from similar or other industries through which such algorithms can be improved. As summarised by an informant, "*The algorithm we came out with for the rubber company can be shared with other rubber or similar companies who face the same production issues or processes.*

The more companies use this algorithm, the better the algorithm becomes. This is the network effect on the provision side. It's a batch copy model." (A9 I interviewed) Consequently, my analysis shows that, when participant specificity is high and risk tolerance is low, ecosystem adoption needs customisation first to demonstrate success before scaling to other participants for generative changes.

While existing research primarily conducts strategic analysis within a single platform or offering for ecosystem adoption (Cobben et al., 2022), my analysis highlights how ecosystem orchestrators must leverage *synchronisation* to promote ecosystem adoption of interdependent components. This means that instead of focusing on one component at a time to push for adoption, synchronisation requires the operation of two or more interdependent things simultaneously for adoption and ecosystem-wide synergies. This is particularly crucial for the provision side IIoT ecosystems. Industry and region heterogeneity decides a lack of winner-take-all platforms in the short run and the prevalence of industry-specific and region-specific platforms and associated complementary offerings (Piller et al., 2021). Because interoperability among interrelated and co-evolved components is critical to allow data and information to flow effectively and efficiently to improve operational efficiency, the development and adoption of different platforms and offerings simultaneously form crucial components for the whole ecosystem to realise synergies. Moreover, depending on the technological, resource, and mental readiness of different participants in different industries or regions, the areas they choose to adopt first may be different. One cannot push one platform or offering to all participants but to match them with different participants to fit their circumstances and needs. These different offering-participant alignments are simultaneously proceeded to gradually work towards the fully-connected platform ecosystems across industries. As my analysis of the third phase of the Alibaba ecosystem shows, when pushing for participant adoption, ecosystem orchestrators need to consider synchronisation across architectural layers, participants, industries, geographical locations and levels of applications. The interdependency among these areas can be seen through 1) reciprocal dependence and compatibility among digital infrastructural layers in the sense that failure to synchronise these layered activities may result in a breakdown of the ecosystem, 2) different types of participants in different industries or regions possess different advantages in adopting different ecosystem services thus needs to simultaneously reach out to a wide range of participants to together enact the full range of interdependent ecosystem services, and 3) successful adoption with suitable early adopters in one area can be

leveraged to attract other participants and other areas. These embedded interdependencies thus require ecosystem orchestrators to enact synchronisation to promote participants' adoption.

To briefly summarise, existing research on ecosystem adoption activities can be extended by the case of Alibaba through platform spawning, the generality principle, prioritised customising and demonstrating, and synchronising. Platform spawning works mainly well in the consumption-side ecosystem while the last three become saliently important when it comes to provision-side ecosystem expansion.

Third, the Alibaba case also surprises ecosystem orchestration literature with the significant and expansive role *institutional activities* play in ecosystem orchestration. The institutional perspective in ecosystem orchestration has been scantly explored in existing literature, although the embeddedness of organisations, individuals and collective arrangements are well recognised by, for example, sociologists (Spencer, 1890; Weber, 1968), economists (North, 1991), political scientists (Ostrom, 1990), and management scholars (DiMaggio & Powell, 1983; Scott, 1995). Within these classic works, institutions, although constraining behaviours to some degree, have been studied as important strategic vehicles actors can leverage to achieve competitive advantage (Garud, Hardy, & Maguire, 2007; Lawrence, 1999). Emphasising the human agency, these social engineering processes can be strategically leveraged to not only construct legitimacy but also overthrow existing institutions and create new ones using various institutional works (Lawrence & Suddaby, 2006). Institutions are important in any collective arrangement, especially ecosystems. This is partly because ecosystems represent a new organising logic that needs sensemaking and sense-giving and partly because ecosystems rely heavily on non-contractual and non-hierarchical approaches to induce and govern ecosystem participants for mutual and collective performances. Particularly, institutional arrangements play an important role in emerging economies, characterised by rapid institutional changes (Hoskisson, Eden, Lau, & Wright, 2000; Marquis & Raynard, 2015). Extant ecosystem studies are dominant in promoting ecosystem adoption through pricing and governance strategies to overcome the chicken-and-egg dilemma in developed economies (Jacobides et al., 2018; Kretschmer et al., 2022). Strategies that target sociocultural conditions are limited with some exceptions: 1) some market institutions to induce the adoption of standards and ecosystems, such as industry voluntary standards bodies, open standards organisations, and property rights (Boudreau, 2010; Katz & Shapiro, 1994; Khanagha et al., 2022), 2) some institutional works such as developing new practices, managing external

tensions and legitimacy work to facilitate the transition from a traditional supply chain logic to a platform logic (Gawer & Phillips, 2013), 3) institutionalisation of common behaviours and norms to improve ecosystem coherency and resource exchange and integration (Lusch & Nambisan, 2015; Wareham et al., 2014), and 4) cognitive and sociopolitical legitimacy building for new platform business models (Garud, Kumaraswamy, Roberts, & Xu, 2022). Findings from Alibaba's case confirm some of these observations. For example, in a variety of conferences and external communications, Alibaba persistently engaged in sense giving how the future looks like, such as new technologies and associated applications, new worldviews, new assumptions, and new mental frameworks, to promote the legitimacy of new e-commerce and ecosystem models. However, these institutional works in extant studies are largely limited in their efforts to develop new institutions and the extent of institutionalisation for an ecosystem logic as ecosystems move beyond being novel and evolve to a mature stage in non-western economies. Some works have started to explore institutional orchestration comprehensively at the emergence stage to address the liability of newness (Autio & Thomas, 2016; Garud et al., 2022; Thomas et al., 2022), but these findings can find it hard to apply to mature phases when ecosystem models become well-known and increased resources and power of orchestrators allow them to influence and re-create institutionalised arrangements (Aldrich & Fiol, 1994). Specifically, insights from Alibaba extend the existing ecosystem literature by *expanding the range of institutional activities* to move beyond initial legitimacy building to include active strategic choice institutional strategies to alter existing and develop and diffuse new institutions (Marquis & Raynard, 2015; Micelotta, Lounsbury, & Greenwood, 2017; Oliver, 1991). Institutional strategies Alibaba used involved a wide range of channels, including setting up knowledge diffusion institutions such as universities, training programs, research centres and competitions, setting up or collaborating with media channels, launching foundations, institutionalising shopping festivals, organising cross-industry conferences, setting up forums and communities, and even developing a new commercial civilisation. The scale and efforts of these institutional works were massive, playing a critical and integral part in Alibaba's orchestration endeavour to achieve ecosystem visions, expand ecosystem adoption, and support ecosystem sustainable growth. With ample resources and legitimacy gained along the way, Alibaba's goal of these institutional works moved beyond conquering the liability of newness to actively re-create and even export new institutional arrangements with participants to facilitate new knowledge diffusion, reduce monopoly concerns, and support domestic and global expansion.

The new commercial civilisation Alibaba proposed, for instance, is characterised by fundamentally shaping, re-creating and redefining the division of labour, the division of surplus, the specification of roles and responsibilities, organisational forms, value systems, informal rules of the game, and formal legal frameworks. It was embedded in Alibaba's vision in 2010 – "*to promote new commercial civilisation that is open, transparent, sharing and responsible*". On top of domestic institutional re-creation, Alibaba's case also highlights the global diffusion of new institutions to facilitate ecosystem expansion, especially in the third infrastructure-empowering phase. The values proposed by the new commercial civilisation, such as inclusivity, sustainability, and non-zero-sum business thinking, were emphasised in global events and interactions to facilitate ecosystem expansion.

In actively altering and re-creating the institutional environment, Alibaba emphasised *win-win tactics* where existing institutional constituents can join forces and benefit in co-creating new norms and values. Instead of classic active strategic tactics that focus on exerting power over pressure sources through co-opt, influence, and controlling (Oliver, 1991), my analysis reveals the win-win tactics that concentrate on bringing benefits for both institutional changers and pressure sources to enact institutional changes. As my analysis of the case shows, this win-win focus has been mentioned on multiple occasions by Alibaba towards not only government officials but also incumbents and rivals. Rather than relying on power dynamics to push for re-creating institutions, Alibaba spent tremendous energy in finding win-win scenarios and opportunities to let pressure sources willingly join forces in co-creating. Through such win-win tactics, Alibaba's case also complements existing research that focuses on communicating directly from orchestrators by highlighting *leveraging the voices of ecosystem participants* for institutional re-creation. This type of external leverage has shown up numerous times in my fieldwork. Jack Ma explained this in his interview with President Clinton in 2015, "*People need examples. When they see, well the others my neighbours made money online selling things, my neighbours buy many interesting things online. People start to learn. People start to buy mobile phones. We cannot make mobile factories sell phones to them, only when they know the mobile phone really works, we help them change their lives, they start to buy mobile phones.*" These successful examples have been widely promoted, distributed, and highlighted through the voice of ecosystem participants in a wide range of channels, such as conferences, white papers, training programs, and daily interactions with participants, to pave the way for new institutions. When Alibaba alone articulates and pushes the

new institutional arrangements, people may question its motive and the plan's feasibility and certainty. However, when numerous participants voice their support by showcasing their success, the new rules of the game and interaction structures tend to be much more believable and achievable. One participant explained his rationale for joining Alibaba as an early adopter, "*For us, I will help Alibaba with a lot of experiments. We often say that we help implement Ali's vision"* (P38 I interviewed).

To summarise, these expansive institutional activities by Alibaba and participants together actively supported the institutional re-creation and facilitated ecosystem expansion. Overall, insights from Alibaba confirm the need to expand our attention to move beyond pricing and governance strategies to consider strategies that systematically shape sociocultural conditions to support ecosystem sustainable growth. This thesis presents the first step in comprehensively leveraging the institutional approach in refining ecosystem theories.

5.5 Conclusion

In this chapter, I explored ecosystem synergies, change, and orchestration through the case of the Alibaba ecosystem. Based on my data analysis, I have divided Alibaba's ecosystem change into three phases: 1) platform empowering (1999-2006), 2) ecosystem empowering (2007-2014), and 3) infrastructure empowering (2015-2020). Within each phase, 1) macro-micro activities triggered and supported new ecosystem vision and synergies, 2) strategic actions of ecosystem orchestrator and emergent actions of participants co-evolved through aligned architectural, adoption, internal, and institutional orchestration activities, and 3) micro-macro activities led to cascading changes and bottlenecks which exerted constraints and pushed for a reconstruction of ecosystem architecture and vision to organise actions in the next phase. My analysis of the Alibaba ecosystem extends the prior discussion on ecosystem synergies, change, and orchestration in various ways. In the following chapter, based on the discussion of this chapter, I elaborate on the implications for theories and practice in general.

6 DISCUSSIONS

"Act always as if the future of the universe depended on what you did, while laughing at yourself for thinking that whatever you do makes any difference ... It is this serious playfulness, this combination of concern and humility, that makes it possible to be both engaged and carefree at the same time."

Csikszentmihalhi (1997: 133)

"Philosophy's brightest future is through closer encounters between Asian and Western thought."

Shusterman (2004: 13)

In this chapter, I discuss the implications of this thesis for scholars, practitioners, and policymakers. Implications for research cover theoretical contributions in five areas of ecosystem literature and some contributions for other related theories. Implications for practice involve findings that are valuable for ecosystem orchestrators as well as ecosystem participants. Implications for policymakers discuss insights that contribute to ecosystem regulation. This chapter ends with a discussion of limitations and future research directions.

6.1 Implications for Research

The theoretical and empirical investigations in this thesis contribute to ecosystem research in five areas. The ***first*** is an integral and updated conceptualisation of ***ecosystem synergies***. This new understanding helps scholars better understand my first research question – *What synergies do ecosystems provide?* It is theoretically grounded and empirically refined. The insights from existing ecosystem theories were classified into five themes using purpose as the main distinguishing criterion, and interrelations and assumptions were specified for synthesis. Empirically, unexpected anomalies, such as IIoT and smart government, unveiled nuances of ecosystem synergies and led to theory extensions. By synthesising the old and incorporating the new, this new ecosystem synergies framework suggests that ecosystem synergies at the core comprise three distinctive but interrelated components: 1) stack and integrate generic resources for efficiency and optimisation, 2) empower generative changes for variety and evolvability, and 3) govern tensions for sustainable growth. Together, these three components convey the unique synergies of ecosystems that differ from those of alternative collective organisations and explain

the value co-creation mechanisms that attract external participation. Understanding ecosystem synergies in this way is advantageous because it liberates ecosystems from consumer-provider analytical focus to incorporate multi-stakeholders for ever-expanding and accumulative potentials of collective value co-creation in ecosystems.

The ***second*** contribution addresses my research question of "*How do* ***ecosystems change*** *and specifically grow sustainably*?" My analysis provided herein offers new insights about ecosystem change by 1) ordering extant literature through a typology framework that facilitates scholars to self-identify and leverage combinations to develop novel ideas, 2) reconceptualising ecosystem change through a duality view of intentionality and emergence, and 3) developing a phasic model of ecosystem sustainable growth. This new understanding challenges and extends prior discussions on their dominant dualism view, focus on partial drivers, and taken-for-granted lifecycle model. By focusing on longitudinal analysis, my study of ecosystem changes complements existing research that overly focuses on variance analysis and highlights ecosystems' evolving and dynamic characteristics.

The ***third*** main contribution relates to my third research question – *how are* ***ecosystems orchestrated***? My case analysis in this thesis demonstrates how attention to time, width and systematisation can help advance research on mechanisms through which ecosystems are orchestrated. Ecosystem orchestration involves systematic coordination of technological, adoption, internal, and institutional activities, and it is driven by long-term visions and adjusted by the re-visioning process to steer collective behaviours towards ideal futures and ecosystem sustainable growth. My findings contribute to existing research by 1) highlighting the long-term vision-driven and re-envisioning approach and 2) unveiling a systematic orchestration approach that maximises mutually enabling relationships of four activities, including architectural, internal, adoption, and institutional orchestration. My analysis highlights internal orchestration's important role (re-envisioning, piloting, and organisation architectural reconfiguring), the synergy and system principles leveraged in designing the adoption activities, and the expanding arena of institutional activities.

The ***fourth*** contribution lies in the conceptualisation of ***ecosystem sustainable growth***. By theorising empirical events unfolding over 21 years, the thesis provides insights into the conditions for ecosystems to grow sustainably: 1) incorporating the environmental and societal sustainability elements and value creation for multi-stakeholders in the ecosystem business model, 2) leveraging

both intentional and emergent actions, and 3) rethinking the traditional concept of competitive strategy to a more inclusive and long-term understanding of rivalry dynamics.

Addressing my three research questions enabled me to rethink ***ecosystem conceptualisation***. This is the ***fifth*** contribution. Instead of the dominant view of designed collective arrangements, I propose to rethink ecosystems as empowering engines that emerge and grow sustainably with the help of participants and empower participants in their own ways. By taking multi-stakeholder synergies, the duality view of intentionality and emergence, sustainable growth, layered network instead of customer-provider logic and interpretative approach seriously, ecosystems as empowering engines can enable a wide range of users to be better selves according to their needs and, through empowering, can co-develop future direction of ecosystem development for ecosystem sustainable growth, i.e., an increasing pie with an increasing portion of participant-specific value for each. My discussion suggests scholars pay greater attention to and contribute towards emerging ecosystems literature that takes an active, inclusive, and fluid approach.

Alibaba ecosystem serves as an ideal case to study the above research questions. Alibaba has been experiencing sustainable growth since its launch in 1999 and aims to last at least 102 years, presenting a perfect setting to deeply understand ecosystem change and sustainable growth in a relatively long period. Being the first ecosystem player that spans its services in both the consumption and provision sides and across digital layers, it also presents the unique opportunity to comprehensively study ecosystem synergies and orchestration strategies. Importantly, the empirically identified key events, synergies and orchestration strategies do not in any way provide full coverage of the activities that occurred at Alibaba. Instead, they were salient empirically and theoretically. Consequently, they should be considered eminent empirical examples and analytical delimitations to understand ecosystem synergies, change, and orchestration. In the following, I elaborate on the significance of findings from this thesis with more granularity.

Ecosystem synergies

What synergies do ecosystems provide? Although the importance of ecosystem synergies has been firmly recognised in practice and theory (Cobben et al., 2022; Granstrand & Holgersson, 2020; McIntyre & Srinivasan, 2017), existing studies are fragmented and compartmentalised, where overlapping concepts and inconsistent assumptions inhibit cross-fertilisation and generalised application (Gioia & Pitre, 1990). Moreover, new phenomena such as the IIoT have

posed challenges to insights derived from extant theoretical frameworks (Alicke, Rachor, & Seyfert, 2016; Leminen et al., 2020; Pei Breivold, 2020). To address this need to synthesise the old and incorporate the new, I conducted a thematic review of concepts related to ecosystem synergies in Chapter 2 and an empirical case analysis of a leading ecosystem with novel synergies in Chapter 5. The iteration between theories and empirical findings gave me an updated and integrative understanding of ecosystem synergy types and mechanisms. In the previous chapter, I briefly discussed how my analysis of the Alibaba ecosystem extends the prior discussion on ecosystem synergies in section 5.4. In this chapter, I develop a new ecosystem synergies framework by synthesising nuances from my case analysis with existing studies.

I define ecosystem synergies as *the combined ecosystem-level effect that is greater than the sum of separate effects*. The assumption embedded in this concept is that the ecosystem organisational form allows ecosystem orchestrators and other participants to create value that is greater than the total value realised by each working separately. There is this ecosystem clue that makes a cluster of actors work together through which synergistic effects emerge. The extra value from these collective efforts represents the magic of ecosystem synergies, the motivation for forming ecosystems, and the features that make ecosystems unique. At the core, I suggest ecosystem synergies comprise three distinctive but interrelated components: 1) stack and integrate generic resources for efficiency and optimisation, 2) empower generative changes for variety and evolvability, and 3) govern tensions for sustainable growth. See Figure 6.1 for the graphical illustration of the new ecosystem synergies framework.

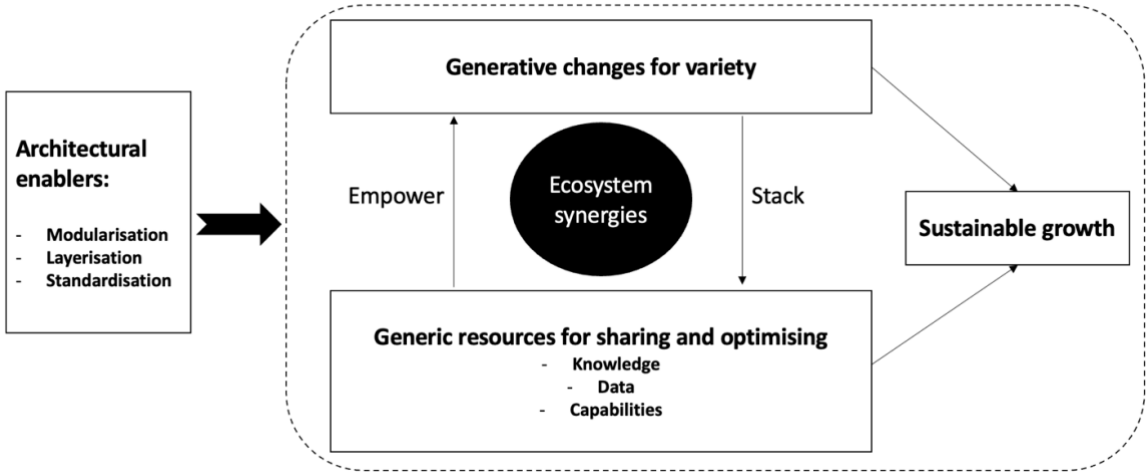


Figure 6.1 - A new ecosystem synergies framework

This view of ecosystem synergies postulates the following:

- Ecosystem synergies are enabled by architectural elements, including modularisation, layerisation, and standardisation.
- The ultimate purpose of ecosystem synergies is to obtain sustainable growth.
- To achieve sustainable growth, ecosystems need to balance tensions arising from two mutually enabling ecosystem synergies 1) stack and integrate generic resources for sharing and optimising and 2) empower generative changes for variety. While generative changes increase the variety of resources to stack, shared and optimised generic resources can empower generative changes by enhancing efficiency and supporting generative changes to focus on specialised innovations.

First, ecosystem synergies are enabled by architectural design elements, including modularisation, layerisation, and standardisation (Gawer & Cusumano, 2014). Modularisation suggests the decomposition of distinct but interrelated parts in a shared architecture so that flexible recombination with a high level of autonomy can happen and updates in one part have little impact on other parts or the ecosystem (Baldwin & Clark, 2000; Jacobides et al., 2018; Schilling & Steensma, 2001). Besides modularisation, layerisation is also vital in increasing flexibility and reducing complexity. While modularisation decomposes parts, layerisation separates layers. Instead of the sequential separation of a chain in one design hierarchy, the logic of layerisation is to divide the value configuration into multiple layers or stacks with functional differences (Gao & Iyer, 2006). The layered architecture, afforded by digital characteristics such as reprogrammability and data homogenisation (Yoo et al., 2010), allows each product-agnostic layer to possess or update its unique design principles with minimum impact on other layers. This separation of tasks between layers lets participants in each layer develop specialisation and dependence on others for complementary offerings. However, separating tasks between parts and layers alone is insufficient for flexibility. Standardisation is needed to ensure communication and compatibility between parts and layers and the participation of a wide range of actors (network effects) (Farrell & Saloner, 1985; Shapiro & Varian, 1999). Standardisation includes not only standardised interfaces but also standardised rules (Boudreau & Hagiu, 2009). This alignment around standard architectural design and engagement rules among interdependent parts and layers drive non-contractual coordination mechanisms necessary for ecosystem synergies to emerge.

Second, ecosystem synergies can aim for many purposes, but sustainable growth is the ultimate ecosystem-level goal in this framework. If properly governed and continuously adjusted, the ecosystem organisational form has the advantage over other alternatives, such as supply chains and vertically integrated business groups, for nurturing sustainable growth. The advantage is most salient when external environments, such as consumer needs and technological trajectories, change rapidly and dynamically with little uncertainty. It is achieved by leveraging unique architectural design principles and non-hierarchical governance to create an ever-expanding pie for increasing participants to contribute and benefit from according to their own needs while maintaining ecosystem stability and coherency through a stable and improvable platform core. This openness, adaptability, scalability and coherency make ecosystems flexible and expand *"like water*" (Alibaba supET white paper 2019), resulting in the extra value (an increased portion of a growing pie) for each ecosystem participant that is bigger than what they can achieve separately. To grow together, participants can obtain autonomy for their creativity, customised needs and improved performance by giving up control for certain areas needed for ecosystem stability.

Third, to achieve sustainable growth, synergies for coherency and variety are important, and tensions between these two must be governed. Coherency is emphasised by synergies of integrating generic resources for sharing in agreed architecture, channels, and rules, providing efficiency and optimisation. Variety manifests in synergies of allowing generative changes via the network, cost, reputation and complementarities mechanisms, allowing ecosystems to adapt to fast-changing demands. When an ecosystem works on integrating generic resources in shared platforms, including knowledge, data, and capabilities, it relieves participants' pressure of negotiating and developing standardised architecture and rules. A standardised architecture, shared storage places for generic modules, and agreed coordination rules provide an ecosystem with stability and coherency, enabling flexible recombination and enhancing the operational efficiency of utilising generic resources. Hardware products/services are less compatible than software technologies and thus may require more effort to convince potential participants to shared platforms (Church & Gandal, 1992). At the same time, this integration empowers variety by allowing participants to focus on developing their specialised areas. Positive feedback loops and complementarities discussed in existing literature reflect the mechanisms in generative changes for variety. By incorporating variety, ecosystems can become adaptive to changes, be able to conquer inertia and conduct renewals. By stacking generic resources, ecosystems can enhance

resource utilisation efficiency and optimise resource allocation, empowering generative changes. Both are necessary for the synergy of sustainable growth. As ecosystems develop, shared resources thicken and generative changes expand, creating more opportunities for ecosystem synergies.

This new ecosystem synergies framework contributes to ecosystem research in the following ways. To start with, this framework presents an integrative analysis of ecosystems' synergies, which helps reveal ecosystems' unique advantages compared to alternative organisational forms. By using purpose as the main criterion to distinguish existing frameworks, I identify their analytical focus for integration, facilitating cross-fertilisation among different disciplines which normally possess different ontological assumptions (Mayer & Sparrowe, 2013). This new framework not only distils the kernels of and integrates various existing frameworks but also refines and complements them by incorporating new phenomena. It is comprehensive, up-to-date, and easy to use for analysing various ecosystems.

Moreover, by viewing ecosystems and associated synergies through a platformed network logic and context- and participant-specific value logic, this framework expands the value-creating potentials of ecosystems, allowing for more open and inclusive participation and scalable growth. Instead of the mental constraints set out by the chain-based logic and provider-consumer division, this perspective allows the expansion of ecosystem value propositions for a wide range of participants. Ecosystems coordinate interrelated actors across industry boundaries through standardised rules and social mechanisms that possess little hierarchical, sequential and contractual interactions, allowing actors to join according to their volition and to satisfy their idiosyncratic needs. Product sellers in the Alibaba ecosystem obtain not just transaction efficiency but also operation efficiency, digital transformation, and optimisation of processes through for example IIoT. Buyers do not passively accept offers from sellers in the Alibaba ecosystem; instead, they come for optimised value propositions on all areas of their life depending on their needs, such as travel booking, searching, socialising, and health. Not only sellers and buyers but a wide range of participants can also join shared platforms in Alibaba ecosystems in a plug-and-play format to obtain their own optimised value propositions with a high level of autonomy. In the third phase of Alibaba's evolution, direct users moved beyond buyers and sellers to include complementors, governments, NGOs, start-ups, media, and education and research organisations. This means that ecosystems are no longer constrained by a sequential chain-based logic and shift to a real-time network logic that is more inclusive. Instead of a stable linear value chain that guides component

assembly for final products with limited input from consumers, value networks become the core logic where all participants are connected via networks without linearity and resources are integrated via shared platforms to obtain optimised results for all in real-time. This network- and platform-oriented way of understanding ecosystem synergies is more inclusive and versatile than the chain-oriented one. Moving one step further, indirect participants are also crucial in nurturing ecosystem synergies. For example, in the case of Alibaba, although global investors and employees did not directly use the platform ecosystem in the first phase, they nonetheless provided their services, resources and legitimacy to share among ecosystem participants. From the foreign investors' point of view, they may view the Alibaba ecosystem as a channel to optimise their returns on investment by contributing legitimacy and capital, which Alibaba uses to attract direct users. Therefore, if we take a broad perspective, ecosystems can be viewed as a plaza to integrate various resources and actors for collective value co-creation where each actor is motivated by their unique agenda and contributes their specialised services. In this way, ecosystems become more open, dynamic, and malleable than existing studies suggest, incorporating new phenomena such as IIoT, smart government and smart city.

This framework can serve as a basic building block that can be used across levels of analysis. When it comes to the cross-industry or national ecosystem level, the integration of generic resources can include capabilities such as Cloud computing and security, the knowledge that is industry-agnostic, and data across industries, and the generative changes can be from the industry, organisational, and individual levels. Regarding the industry level, the integration of generic resources can include industry-specific and organisation-agnostic capabilities, knowledge, and data, and the generative changes can be from the organisational and individual levels. At the organisational level, generic resources can include firm-specific capabilities, knowledge, and data, and the generative changes can be from the organisational and individual levels. The difference is the type of shared resources and the level of generality. Because generic resources can be shared using standardised interfaces, the model can be nested as ecosystems develop. This means that the more generic the resources are, the more likely they reside in the lower layer, which supports the generative changes of less-generic platforms and resources. For example, capabilities such as Cloud computing and security are industry-, organisation-, and individual-agnostic, making them the most generic resources. Therefore, Cloud-related resources typically serve as the lowest order where other levels reside on. This also means that the sharing potentials of Cloud-related resources

are the most for the broadest participants, making it the most likely to reach the efficiency gain from economies of scale and scope. Depending on the level of analysis one focuses on, this framework can be leveraged to analyse comprehensively different mechanisms of ecosystem synergies.

Comprehensively understanding ecosystem synergies is a critical first step in comprehending ecosystem magic. It explains the unique advantage ecosystem organisation form has over other collective arrangements such as business groups, value chains and strategic alliances. It also offers the motivations for non-command-and-control participants to join ecosystems for value co-creation voluntarily. The following ecosystem change and orchestration frameworks also build on the integrative understanding of ecosystem synergies. Ecosystems change to accommodate and support increasingly diverse and accumulative ecosystem synergies for sustainable growth. Ecosystems are orchestrated to prepare, buttress and maximise ecosystem synergies, while synergies among different ecosystem components offer strategies for ecosystem orchestration for sustainable growth. In the following, I elaborate on my analysis of ecosystem change and orchestration that stem from the ecosystem synergies framework.

Ecosystem change

How do ecosystems change? To answer this research question, I conducted a thematic review and refined the literature-based model through the case study of the Alibaba ecosystem. My findings make the following contributions: 1) categorising existing research on ecosystem change into five interrelated but distinctive themes, 2) proposing a duality relationship between intentionality and emergence of ecosystem change to extend the dominant dualism perspective in existing research, and 3) suggesting a new framework of ecosystem change that extends the old, incorporates the new and shows a phasic model for ecosystem sustainable growth.

First, through the thematic review, I categorise received literature about ecosystem change into five themes: evolution, cyclicity, teleology, conflict, and complexity. Each theme has its unique analytical focus and logic in drivers, nature, and the path of ecosystem change. By proposing a typology framework of ecosystem change, I order extant literature and thus enable scholars to identify their analytical themes and consider leveraging combinations of themes to develop novel ideas. As a relatively new research field, ecosystem research has experienced and is still in the process of rapid propagation. Scholars coming along very often do not explicitly expound their analytical focus and tend to automatically accept and carry certain assumptions from

previous studies. Therefore, their contributions may be restricted to one or two perspectives. Given its newness and pluralism, it is important to have synthesis research to classify and root studies in associated intellectual heritages, facilitate enrichment across perspectives and provide a coherent understanding of drivers and processes of ecosystem change. Innovative theoretical development and integral theoretical understanding tend to come from the interplay of different perspectives, as one perspective alone can provide a rather partial understanding of the phenomenon. Specifying how different perspectives and associated intellectual heritages relate to each other through the 2x2 typology framework offers the potential for scholars to develop more comprehensive theories with more powerful explanatory abilities.

Second, In contrast to the dominant dualism perspective on the emergence and intentionality of ecosystem change, my analysis suggests a duality perspective of ecosystem change where duality is defined as "*fundamentally interdependent-contradictory but also mutually enabling*" (Farjoun, 2010: 202). The five themes from received studies implicitly assume that ecosystems are either strategically engineered by orchestrators according to their prediction of future changes (teleology) or determined by ecosystem lifecycles (cyclicity), or emergent as a result of natural selection (evolution), tensions (conflict), or complex interactions (complexity). Consequently, they consider intention and emergence separately and contingently because they are contradictory and incompatible. For example, the contingency perspective would argue that intentional plans for ecosystem change work effectively in a stable environment while emergent structure and processes may be required for a rapidly changing environment. On the contrary, according to the duality logic, ecosystem change results from both emergent and strategic actions, disregarding the contingencies. This means that instead of pure environmental determinism or an action-oriented approach, intentionality and emergence exist simultaneously and are complementary and mutually enabling in driving sustainable ecosystem growth. Although contradictory, one cannot exist without the other because strategic actions feed off emergent actions, and emergent actions gain significance from strategic actions. Although some ecosystem outcomes result from a designed ecosystem phasic vision, emergent actions also play an essential part in re-tuning the vision and contributing to the direction of the next ecosystem phase. Similarly, although some ecosystem outcomes happened unintentionally, strategic actions still steer and support such outcomes.

The dominance of the dualism view may be a reason that existing empirical studies on ecosystem change focus mainly on the emergence stage, leading to a partial understanding of forces driving ecosystem change in the long run (Dattée et al., 2018; Palmié, Miehé, Oghazi, Parida, & Wincent, 2022; Pushpananthan & Elmquist, 2022; Thomas et al., 2022). In other words, extant research mainly explored nascent ecosystems instead of matured ones that span more than 20 years, so it is still unclear how ecosystems evolve after emergence (Hannah & Eisenhardt, 2018; Khanagha et al., 2022). Without putting the emergence stage in a broader time span, activities that drive change may be perceived as purely planned with linear causal relationships between actions and results or purely emergent without any predictability. Therefore, one way to understand the divergence between intentional and emergent is that timescale matters. In addition, ecosystem boundaries may play a role in such divergence. This is to say that the motive and significance of each action may change as one analyses within different ecosystem boundaries. My analysis of the Alibaba ecosystem in this thesis provides a comprehensive understanding of ecosystem change by taking up a timespan of almost three decades and covering all ecosystem components or sub-ecosystems. The results highlight the delayed significance of actions and the escalated impact of individual interactions across ecosystem components. Therefore, expanding the ecosystem boundary to include all components may help to take on the duality instead of dualism perspective.

Third, the categorisation and the duality perspective reveal that each theme of ecosystem change provides important insights in specific areas but has limited explanatory power in certain situations when applied alone. The *evolution* perspective provides important insights into natural selection, competition, and co-evolutionary dynamics in driving ecosystem change. However, it alone provides limited explanatory power regarding endogenously developed drivers, such as strategic actions and bottlenecks, and unintended system outcomes developed through micro-level interactions. The *teleology* perspective emphasises the strategic engineering of ecosystem change while treating uncertainty as external shocks where orchestrators can predict and adapt proactively. However, the planning and linear implementation path can be challenged by high uncertainty, lack of visibility in predicting, and constrained agency. The *conflict* theme provides important insights into ecosystem governance to address the "paradox of change" by balancing stability and evolvability. However, viewing ecosystems as tensions between individual and collective takes limited account of external drivers such as competition and system-level unintended outcomes. Given the lack of a causal relationship between individual actions and system outputs, the

complexity perspective suggests pure emergent ecosystem change. However, it has limited explanatory power for some elements of strategic agency that lead to predictable outcomes. The *cyclicity* theme highlights the necessity of designing strategies according to a cycle of birth-growth-maturity-decline/renewal. However, although some institutional works follow mostly the lifecycle logic, not all ecosystems go through the same cycle with forces of inertia.

To comprehensively understand the dynamics of ecosystem change and incorporate findings of the Alibaba ecosystem, significant potentials exist in synthesising the above five themes and adopting a duality assumption between emergent and intentional ecosystem change for ecosystem sustainable growth. The empirical case of the Alibaba ecosystem reveals a new model of ecosystem change that sits in the middle of these five themes. See Figure 6.2 below to illustrate its position in the 2x2 matrix.

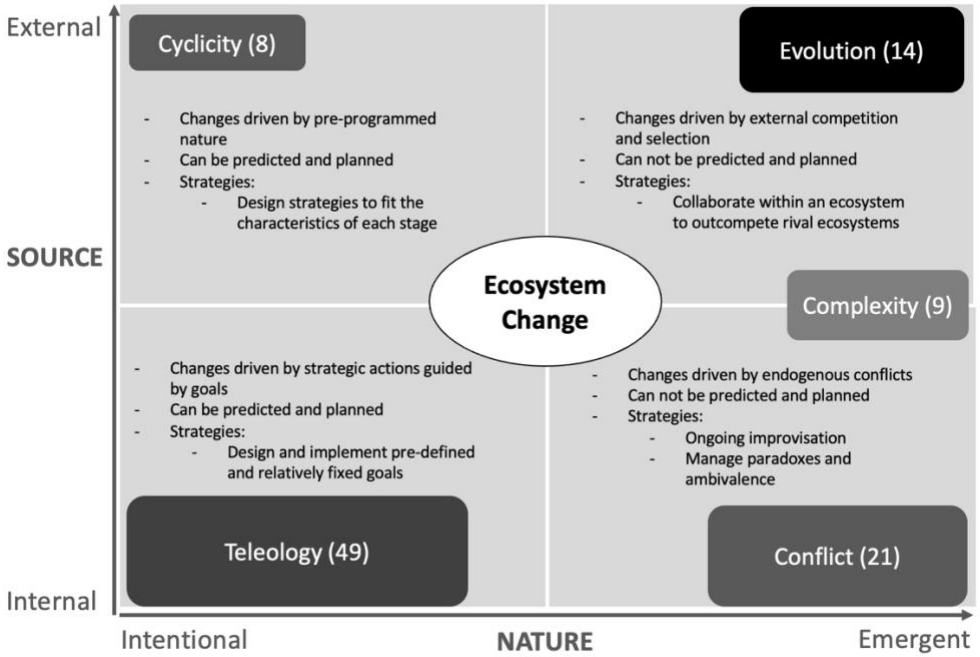


Figure 6.2 - Ecosystem change's position in the 2x2 matrix

Locating in the middle of the 2x2 matrix and incorporating elements from all five themes, ecosystem change results from contradictory but mutually enabling intentional and emergent actions and is driven by internal and external factors. Internal factors include 1) strategic actions, 2) managing tensions embedded in ecosystem synergies, and 3) internal needs to address emerged architectural bottlenecks. External factors include 1) competition, 2) external shocks such as technological upgrades, 3) the pre-programmed nature of the lifecycle, and 4) new external needs.

Specifically, ecosystem change goes through phases led by an overall mission that is stable and abstract and phasic visions that are temporary and updated. See Figure 6.3 below for the graphical illustration of the framework of ecosystem change. At the beginning of each phase, endogenous and new macro factors trigger and support micro-level behaviours to act on new opportunities. This is illustrated as processes 1 in the figure. Micro-level activities can be divided into two mutually-enabling actions: those taken by ecosystem orchestrators illustrated as 2 and those that emerged from participants displayed as 3. Ecosystem orchestrators strategically orchestrate ecosystem participants to achieve ecosystem mission and re-tune ecosystem phasic vision by incorporating emerging actions from participants. Their actions and interactions in the form of ecosystem synergies lead to unexpected ecosystem-level changes, when reaching a tipping point, engendering existing ecosystem vision and architecture constraining. This is marked as processes 4 in the figure. When new triggering and supporting macro factors come, a new phase of ecosystem change is enacted to restart the process. In this framework, intentional and emergent actions are mutually enabling. Ecosystem orchestrators thus possess the agency to shape ecosystems, but at the same time their strategic actions are emerged out of the unpredictable actions of others, linking to the ecosystem change research about the duality relationship between emergence and intentionality.

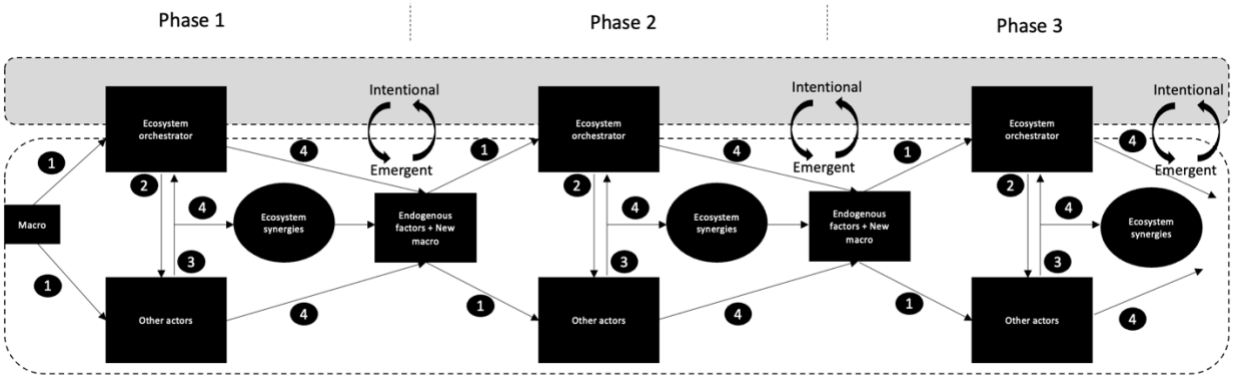


Figure 6.3 - A new framework of ecosystem change

This framework of ecosystem change incorporates some elements from all five themes. *First*, some elements of the *evolution* theme are incorporated into this framework as actions of others by acknowledging the important role competition plays in driving ecosystem change. Resonating with the natural selection process through which the fittest survives, this framework considers the co-evolution of all ecosystems and rival ecosystems' moves that push for better or more unique performance. The area that differs from the evolution theme in this framework is the

relational view on competition, treating competitors more than just absolute rivals but also situational and time-dependent ecosystem participants (Chen & Miller, 2011). This means that competing ecosystems are interdependent and mutually influenced and, depending on the context and time, can serve as rivals and win-win partners to "*raise all boats*" (Chen & Miller, 2011: 761). In other words, emergent competitors' moves can influence ecosystem change by weeding out maladaptive variations but can also provide "*non-zero-sum*" opportunities to improve performance and the environment for all.

Second, this framework also incorporates elements of the *teleology* theme by highlighting the strategic actions of ecosystem orchestrators and their adaptive moves to external shocks in driving ecosystem change. However, strategic engineering matters differently in this framework than in the existing teleology perspective. The intentional elements directed by ecosystem orchestrators involve little about predicting and planning for each participant's fixed value propositions, roles, responsibilities, and benefits beforehand. Instead, because of high uncertainty and low visibility, the engineering role played by ecosystem orchestrators involves meta-capabilities such as re-envisioning, incorporating emergent activities, restructuring ecosystem architecture, pushing for ecosystem phasic change, and steering collective efforts for ecosystem synergies and sustainable growth. The key takeaway from the teleology theme is the strong agency of ecosystem orchestrators in steering the direction of ecosystem change while simultaneously empowering participants and incorporating emerging changes. Although ecosystem orchestrators cannot fully predict and determine the long-term outcomes, they can nevertheless assume some agency in designing ecosystem phasic visions as the best guess to guide phasic development while re-tuning visions by incorporating emergent actions.

Third, the framework also incorporates some elements of the conflict theme by acknowledging the driving force of tensions endogenously generated in ecosystems. Specifically, resonating with the paradox of change, ecosystem change can be driven by tensions between variety and coherency. Interactions between ecosystem orchestrators and participants involve delicate and dynamic balancing to allow benefits of diversity and coherency to both flourish during ecosystem change. In this framework, these tensions are incorporated in pushing for ecosystem synergies. My findings of the Alibaba ecosystem also suggest that addressing the paradox of change can lead to internal bottlenecks when technological upgrades for stability and scalability

cannot match the speed of service increase for evolvability and adaptability. These internal bottlenecks can then drive ecosystem change.

Fourth, this framework reflects elements of the *complexity* theme, especially in mechanism 4 - micro-level actions and interactions lead to unexpected ecosystem-level changes when reaching a tipping point, engendering existing ecosystem vision and architecture constraining. In line with nonlinear feedback systems and emergent order (Stacey, 1995), ecosystem change between phases is unpredictable and emerges from complex interactions between micro-level participants. It is not possible for ecosystem orchestrators to design shared intentions throughout ecosystem development where outcomes are determined because of the emergent actions of others and positive feedback loops in ecosystem synergies. There is no equilibrium state to reach, and chaos is constant throughout ecosystem development. Although strategic actions can propose ecosystem visions as best guesses by assembling all available information, orchestrators are unsure about the future. Orchestrators constantly welcome new opportunities and roles proposed by participants and afforded by new technologies by refining initial visions. Recognising the non-linear feedback loops embedded in ecosystem synergies, ecosystem orchestrators focus on nurturing and unleashing such feedback loops while ensuring stability and coherency instead of controlling the long-term direction.

Fifth, some elements of *cyclicity* are reflected in this framework but not in the default birth-growth-maturity-decline/renewal model. Ecosystem change can go through phases, each built on top of the previous one. Each phase has its own ecosystem vision and organisational logic, guiding the orchestration strategies and ecosystem synergies in that phase. The maturity phase may not come after growth, and the decline/renewal phase may not come after maturity. Each phase can be a growth stage according to its unique growth driver and logic. As illustrated in the previous section, maturity and decline/renewal stages can be countered through three mechanisms through which growth can be sustainable with little change-inhibiting inertia, including ecosystem synergies accumulation, proactive re-envisioning, and bottleneck-driven architectural restructuring. Having said this, however, I can see the logic of cycles also in the framework but in a different way. In this framework, ecosystem change goes through phases, and each phase has its growth logic and goes through a cycle of 1) macro-micro processes – 2) micro-level actions and interactions – 3) micro-macro processes. This cycle starts with triggering and supporting macro factors on micro behaviours, continues with micro-level strategic and emergent actions and

interactions guided by an ecosystem phasic vision, and leads to unexpected macro-level ecosystem expansion and constraining ecosystem bottlenecks. Combined with a new round of triggering and supporting macro-level factors, these micro-macro changes restart a new ecosystem phase.

To summarise, by extending the old perspectives and incorporating new phenomena, this new framework suggests that ecosystem change results from mutually enabling intentional and emergent activities, is driven by both internal and external factors and goes through phases with re-tuned visions and restructured ecosystem architecture for sustainable ecosystem growth.

Ecosystem orchestration

How are ecosystems orchestrated? My research shows how attention to time, width and systematisation can help advance research on mechanisms through which orchestration creates ecosystem sustainable growth. In the following, I elaborate on my definition of ecosystem orchestration and contributions to the literature.

I define ecosystem orchestration as *systematic actions directed by the ecosystem owner to steer participants' autonomous behaviours and guide internal organisation restructuring for mutual and collective sustainable growth in the long run*. This definition emphasises that ecosystem orchestration is systematic, influencing both external and internal participants, and aims for long-term sustainable ecosystem growth. It differs from existing research emphasising the collective innovation outputs engineered by ecosystem orchestrators for mainly self-interested motivation (Dhanaraj & Parkhe, 2006; Nambisan & Sawhney, 2011; Sjodin et al., 2022). As ecosystems are a result of intentional *and* emergent actions, the presence of a leading actor in an ecosystem, therefore, is necessary (Adner, 2017; Iansiti & Levien, 2004a). Specifically, my findings contribute to existing research by 1) highlighting the long-term vision-driven and re-envisioning orchestration to steer collective behaviours for long-term growth while incorporating emergent opportunities and 2) unveiling a systematic orchestration approach that maximises mutually enabling and co-evolutionary relationships of four orchestration activities. My definition of ecosystem orchestration expands orchestrators' mental map by suggesting they think across time and orchestration areas, taking seriously the system thinking, co-evolution, interdependencies, and social system design mechanisms.

First, existing research has studied the deliberate, purposeful and strategic orchestration activities, for example specifying value propositions, identifying actors, forming structure, and managing value creation and capture (Adner, 2017; Gawer & Cusumano, 2014; Jacobides et al.,

2018). Inherent in these studies is the powerful role ecosystem orchestrators play in predicting and managing ecosystem creation and evolutionary path (Altman et al., 2022) or following a stable vision set up at the beginning (Ansari et al., 2016; Gawer & Phillips, 2013). For example, Intel predicted a clear value proposition of the next-generation processor "*whose fundamental mission is to grow the overall market*" by "*getting new applications, find new users for the PC*" (Gawer & Henderson, 2007: 10). The pre-defined and clear value proposition of the Michelin's PAX run-flat tire "*was the promise that it would allow drivers with punctured tires to continue driving for 125 miles, at speeds of up to 55 miles per hour, before having to stop for repair*" (Adner, 2017: 44). However, my findings suggest that ecosystem orchestration does not come with such high clarity and predictability.

Existing research provides some means to explain the lack of predictability and specificity in ecosystem orchestration. For example, the S-D logic highlights the subjectivity of value propositions by reframing value propositions as "*perceived or anticipated, subjective experiences, of a (potential) beneficiary, rather than something that is designed and offered, much less promised, by one actor to another*" (Vargo, 2020: 310). This shift from an objective to a subjective or contextual approach explains why a clear and stable value proposition cannot be designed ex-ante to orchestrate adopters who perceive them differently. Therefore, the orchestration promotes resource exchange and integration for value co-creation without specifying value propositions beforehand. Another example is the pure emergent view which approaches from a different angle. They assume high uncertainty during ecosystem emergence and thus suggest "*(1) it is not possible to create a meaningful vision to simply enlist prospective stakeholders, and (2) ecosystem champions themselves do not have good enough visibility to inform them on how to position themselves adequately for eventual value appropriation once an ecosystem, whatever it may look like, is in place*" (Dattée et al., 2018: 467). Therefore, the orchestration approach involves a process of collective discovery and dynamic control (influencing, monitoring, and updating strategies) to ensure the appropriation of a disproportionate share of value co-created.

Combining the pure intentional and pure emergent approaches, insights from this study suggest another approach–- a duality of both. Following a duality relationship, ecosystem orchestration activities, specifically the vision, can be designed purposefully beforehand to attract, align and inform participants and, at the same time, to incorporate uncertainty and emergent changes as new opportunities arise. In other words, ecosystem visions not only guide but also

reflect emergent changes of ecosystems, similar to perceptual works such as images (Gioia & Thomas, 1996). Ecosystem visions are intentionally construed here as not only an input for emergent changes but also an output or product of emergent changes. They are recursive in the sense that they are both medium and outcome of changes. The mechanism that links these two seemingly contradictory approaches is re-envisioning. Jack Ma summarised it well, "*Nobody knows the future. You can only* ***create*** *the future.*" Such future creation is achieved through setting up long-term vision and conducting constant re-envisioning to reflect qualitative ecosystem changes and guide the next round of ecosystem growth. Although uncertainty is high at the beginning of ecosystem creation, a long-term vision still can and needs to be proposed to reduce uncertainty and convince and align potential participants. Here, proposing a compelling vision does not necessarily mean knowing exactly what the future looks like and how to get there. In other words, there is no "*assumed accuracy of the blueprint*" (Dattée et al., 2018: 469). The vision serves as a best guess, assumption, and the north star to guide strategy and process design, resource acquisition, and participant adoption. It specifies what the ideal future roughly looks like, brings focus to specific orchestrating activities by pointing out the future of industries and the economy in response to technological, social and economic changes, how the orchestrator is going to play a role in getting to the future, what the orchestrator aims to achieve, and the potential benefits to ecosystem participants. The vision has a long-term focus and is formed by orchestrators after they study the historical development patterns in technologies, scan successful local and international players, study the implications of the technologies' unique characteristics, and consider emergent changes. Although not coming with certainty, the vision is essential initially to attract participants and provide employees with a picture of what they are working towards and thus what they say when approaching potential participants to get them on board. Vision also needs to be set up with long-term and aspirational elements so that all activities conducted can be checked frequently to determine whether they benefit long-term and phenomenal growth and eventually lead to ecosystem sustainable growth. This means that ecosystems following a short-term and survival or create-and-then-sell-orientated vision will choose completely different strategies, processes, resources, participants, and governance. To prevent falling into such short-term and opportunity-driven orchestration while sacrificing long-term growth, having a long-term-oriented vision and working towards it is thus necessary. This means that ecosystem vision, although subject to

constant adjustment and phasic qualitative changes, is still vital in guiding ecosystem change and orchestration activities in each phase.

Because the initial vision is set up as a best guess, further iteration is necessary to ensure it is up to date. In other words, vision construction does not need to follow "*an almost linear plan*" and then focus on implementing "*the clearly envisioned future*" (Dattée et al., 2018: 468), nor does the vision have to be specific or fixed. As the best guess from information gathered by the orchestrator, the vision is set up as a starting direction and constantly revisited during the phase to test its validity by considering technological changes, new opportunities and emergent changes. Because different participants perceive the ecosystem differently and aim for different utility or value propositions, the vision does not need to specify the specific value propositions, which resonates with the subjective view on ecosystem value propositions (Vargo, 2020). Moreover, the vision does not include a specific governance structure that pre-designs participating actors, who contribute what and who gets what because of the constant re-tuning of the vision, participant heterogeneity and the dynamic adjustments of enabling strategies. When talking to different participants, ecosystem orchestrators consider participant heterogeneity to cater to their unique needs and resistance. This helps orchestrators co-design with participants about their specific value propositions, value creation and value capture mechanisms as interactions start. When standardisation is leveraged for engagement, piloting projects internally or with visionary early adopters helps test the initial governance structure and rules on value creation and capture before scaling. Because of the limitation in guessing, as new needs and opportunities emerged from participants, the ecosystem vision set up initially needs to be refined by incorporating these new micro and micro-macro changes to further guide future behaviours. Through revisioning, ecosystem vision serves as a result of these emergent changes and at the same time as a guide for the next round of ecosystem change. New visions amplify the already ongoing emergent changes and serve as "a new discursive template—a set of new interpretive codes—which enables a novel way of talking and acting" (Tsoukas & Chia, 2002: 579) where new emergent behaviours will further generate from.

Therefore, instead of pre-designing a one-size-fits-all ecosystem value proposition to offer to and align multilateral partners, ecosystem orchestrators need 1) an improvable vision of the future economic structure and relationships to provide inspiration and general guidance and 2) a

process of re-envisioning to incorporate to emergent opportunities with customised offerings for subjective value propositions of heterogeneous participants.

Second, besides leveraging long-term vision-driven and re-envisioning approaches to create and experiment with the future proactively, ecosystem orchestrators must also take a systematic approach to influence participants to co-create ecosystem synergies for proposed ecosystem visions. My analysis extends existing research by highlighting the discipline-agnostic and holistic shaping forces of four distinctive but interrelated activities that together form ecosystem orchestration strategies (see Figure 6.4 below for the graphical illustration). Together, these four areas of ecosystem orchestration activities join forces in alignment to support ecosystem sustainable growth. This approach requires a system and structural thinking capability where the co-evolution of multiple interdependent areas is considered and strategised. *Architectural orchestration* provides a coherent, stable, and scalable technological foundation to support internal organisation and restructuring, buttress rapid growth in ecosystem adoption, and push for new institutional arrangements. *Adoption orchestration* incentivises ecosystem participation while ensuring ecosystem safety and stability, through which technological architecture is pushed for updates, institutional orchestration can obtain exemplars and voices, and internal activities can be renewed with new opportunities. *Institutional activities* support architectural, adoption, and internal activities by orchestrating institutional arrangements within which ecosystems rival for resources and legitimacy. Finally, *internal orchestration* aligns with and supports the other three activities by setting up and adapting necessary internal structures and processes.

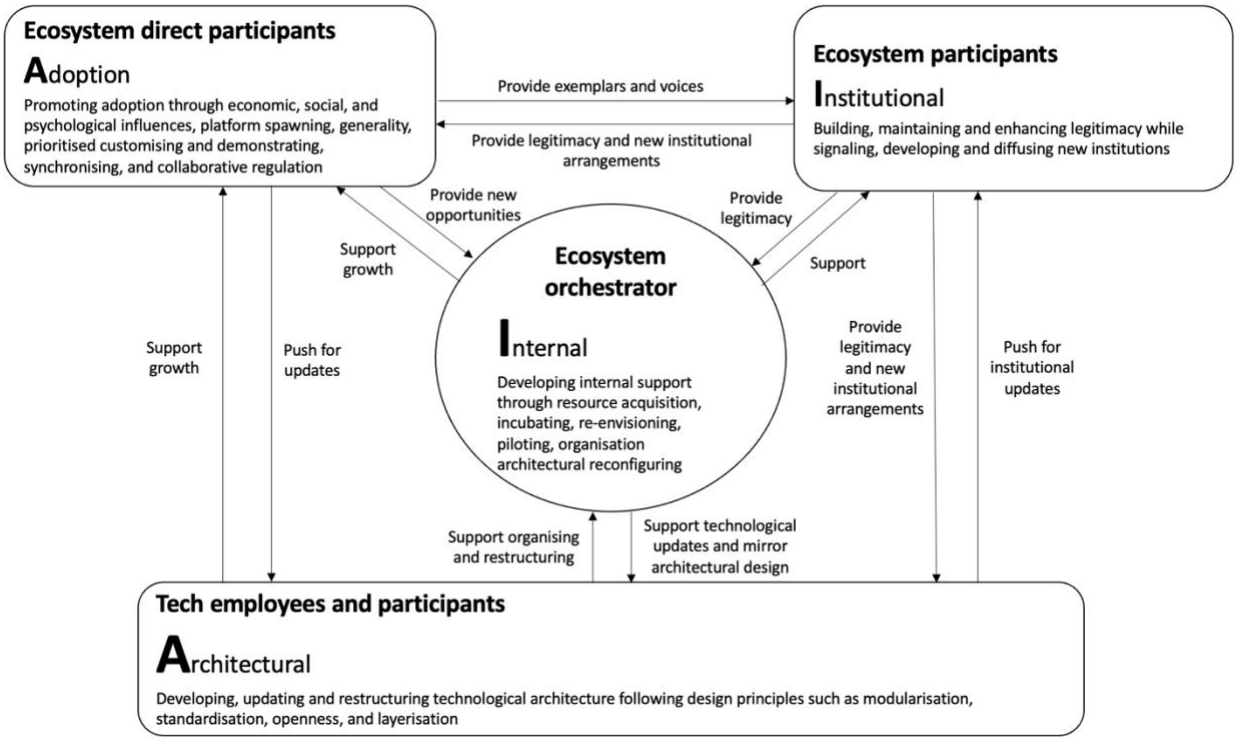


Figure 6.4 - A framework of ecosystem orchestration

Resonating with the existing technology management view (Baldwin & Woodard, 2009; Gawer & Cusumano, 2014; McIntyre & Srinivasan, 2017; Simon, 1962)*, architectural activities* follow engineering design principles such as modularisation, standardisation and layerisation to set a coherent, stable and scalable technological foundation for generative changes and ecosystem-wide integration. Mainly targeting the tech employees and participants, technological architectures address the structure of the ecosystem, the quantity of layers and platforms, how platforms are partitioned into modules, how modules are decoupled and recombined, the interfaces between platforms and modules, the interdependencies between modules and platforms, and how modules are allowed to be varied. For architectural orchestration activities to be effective, it is critical to ensure design principles are salient and communicated to all architecture builders and to adapt and restructure the architecture frequently following not only short-term cost-efficiency and stability but also long-term scalability principles. This means that sometimes focusing on scalability may bring suffering in short-term profits but is key to long-term ecosystem sustainable growth.

As a critical component of ecosystem orchestration, *internal activities* must be holistically strategised with other orchestration activities to foster ecosystem vision and sustainable growth. As discussed in the previous section 5.4, my analysis extends prior discussions by highlighting the

interconnections between internal and external orchestration activities, the proactive role internal activities can take, and the organisation architectural reconfiguring as an alternative approach to address ambidexterity. It seems natural for scholars to have attention mainly devoted to activities external to orchestrators as the ecosystem concept emerged initially to account for the limited consideration of the ecological elements one embeds in and the interdependency between organisations (Moore, 1993). However, the keystone role ecosystem orchestrators play in business ecosystems reminds us of their critical value and irreplicable functions (Iansiti & Levien, 2004a). Not only do ecosystem orchestrators have to cultivate their capabilities to orchestrate participants external to them for ecosystem synergies as emphasised by extant literature, but they also need to learn how to dynamically adjust internal processes and structures to actively support and shape business ecosystems, especially in rapidly changing environment and mature stage of ecosystem development when ecosystem orchestrators increase in size, resources available and influence. In my study, I identified three critical internal processes that needed to be set up for ecosystem orchestration: re-envisioning, piloting, and organisation architectural reconfiguring. *Re-envisioning* involves setting up 1) long-term vision-driven strategies and 2) processes or routines of revisiting and adjusting visions periodically to account for external changes. By looking forward to the "*best assumption*" of the ideal future, ecosystem orchestrators consider interdependencies and co-evolvement of different elements and attract a wide community of participants for united efforts. By incorporating changes in areas such as technology, competitive landscape, regulation, and participants' needs through a decentralised feedback-gathering process, visions can be re-tuned to point to new directions and sustain ecosystem competitive advantage. Contemplating long-term visions and short-term adjustable actions simultaneously is crucial to facilitating iterations, leading to gradually approaching improvable visions. Ecosystem orchestrators must set up internal structures and processes for re-envisioning to systematically support ecosystem sustainable growth in the long run. *Piloting* requires ecosystem orchestrators to proactively experiment and incubate innovations internally and, if successful, showcase and scale to external ecosystem participants. By setting up structures and processes such as internal competition and platform business units to deliberately conduct experimental pilots internally, new concepts and innovations can be tested, validated and demonstrated for external participants to adopt. *Organisation architectural reconfiguring* requires organisational processes of reconfiguring organisation architecture where resources and processes are embedded. By redesigning how

different resources and processes are interrelated using the platform principle, orchestrators can systematically transform organisational logic from a traditional bureaucracy manner to a platformed manner with autonomy, innovation and efficiency and without legacy constraints that come with component adjustment. Internal architectural reforms of business units to the platformed logic enable the decoupling of shared resources business units and application-specific business units, supporting internal large-scale agile experimentations as well as external ecosystem adoption. Ecosystem-friendly KPIs and identity shifts within this platformed architecture prevent tensions experienced by employees and thus orient them to work towards ecosystem sustainable growth. Note that internal orchestration possesses some similarities to the concept of dynamic capabilities, as internal orchestration requires the ability to sense market changes, seize new opportunities, and reconfigure internal assets (Eisenhardt & Martin, 2000; Teece, 2007; Teece, Pisano, & Shuen, 1997). However, there are differences in purpose and mechanisms. The goal of internal orchestration is more than sustaining competitive advantage as an organisation but supporting ecosystem sustainable growth from the perspective of an ecosystem. Because of the ecosystem orientation, internal orchestration must be macro-level coordinated with external orchestration activities to together foster collective ecosystem benefits. These internal orchestration mechanisms differ from external ones that rely on voluntary adoption as orchestrators can leverage some command-and-controls, shared platforms, and internal market resource allocation to push some strategic initiatives when piloting projects that are not ready or difficult for external adoption. Insights from my study showcase this congruence and supportive mechanisms between internal and external orchestration for ecosystem sustainable growth.

While technological architectures set a stable and coherent foundation in a technical sense and internal activities prepare ecosystem orchestrators to support ecosystem development by re-envisioning, piloting and architecturally restructuring, *adoption activities* focus on influencing participants' adoption in an economic, social, and behavioural manner according to their needs and characteristics. As illustrated in section 5.4, my study extends prior observations of pecuniary strategies such as pricing and subsidies and non-pecuniary strategies such as providing APIs, controlling access, designing rules of interactions, leveraging intrinsic motivations and offering complementary services (Boudreau & Hagiu, 2009; Cusumano et al., 2019) by highlighting strategy of platform spawning, the generality principle, prioritised customising and demonstrating, and synchronising. These strategies emphasise the two important principles in designing adoption

activities: synergy and system orientation. Synergy orientation means that incentivising adoption can be oriented by how the new activities can develop synergies with existing ones. System orientation suggests considering the interrelationships between different activities. Existing adoption activities focus on cost- and complexity-reduction approaches such as providing boundary resources and immediate pecuniary benefits or entering complementary markets to grow the ecosystem. Synergy- and system orientation approaches shift the focus from short-term cost-benefit analysis around one interaction to long-term synergistic efforts around a system of interactions. These principles can be seen in all four strategies my study highlights. Platform spawning strategy to encourage adoption reflects orchestrators' consideration of synergistic supports and ecosystem synergies among different platforms. It involves spawning platforms on not only the consumption side but also the provision side. Existing platforms can support new platforms' adoption by offering existing networks, and all platforms can benefit from combined ecosystem synergies such as data-network effects and complementarities. Generality reflects the synergistic consideration when it comes to the number and variety of resources that can be stacked and shared to improve efficiency and optimisation. The more generic the new entry area is, the more potential for ecosystem synergies and the more ecosystem adoption. Prioritised demonstrating and synchronising evokes momentum-building dynamics through successful micro actions in a system to synchronise collective behaviours in ecosystem adoption. These all convey that ecosystem adoption strategies can be designed by considering the synergistic system dynamics, extending prior discussions on short-term cost and complexity reduction around one ecosystem component (a platform or a product).

As a part of ecosystem orchestration, *institutional activities* play an essential role in driving ecosystem sustainable growth. While architectural activities orchestrate ecosystem participants using technical vehicles following digital design principles and adoption activities focus on economic, social, and behavioural influencing tactics, institutional activities support sustainable ecosystem growth by shaping and re-creating the institutional landscape within which ecosystems build legitimacy, reduce monopoly concerns and develop new institutional arrangements (Lawrence, 1999). Although they take longer than other activities, re-creating institutional arrangements produces the most long-lasting results as they work on changing taken-for-granted norms and values. Ecosystems co-evolve rapidly with actors and institutions, demanding significant institutional transformation or reproduction to support new ecosystem vision and actors'

changing demands. As institutional works at this phase represented a relatively straightforward goal – building and maintaining legitimacy, strategic actions took on a dominant role (DiMaggio, 1988; Lawrence & Suddaby, 2006). Moreover, the cyclicity perspective helps plan institutional activities as different stages typically face different legitimacy challenges. My study shows that institutional works leveraged by ecosystem orchestrators can be more expansive than extant research covers, moving beyond reactively responding to contextual demands and conquering the liability of newness embedded in new ventures, emerging ecosystem logics and new technologies. A complete picture is that institutional works can involve proactively transforming and re-creating institutional settings to support the ecosystem's growth into a designed future, especially in the mature stage. Moreover, new institutional arrangements can be diffused globally to areas with distant institutional arrangements (Lawrence & Suddaby, 2006) to support global expansion. By expanding the institutional arena, my study extends existing studies that have a narrow analytical focus and restricted orchestration vehicles. The content of this new institutional arrangement results from digitalisation, where the advancement of digital technologies transforms the development and organisation logic of economies, society and culture. Unlike neoliberalism and neoclassical economics that assume competition, self-interest and short-term shareholder gains (Colombo, 2022), this new institutional setting is characterised by a new value system that promotes altruism, cooperation, win-win, inclusivity, sustainability, openness, transparency, sharing, and responsibility. According to the research about self-fulfilling prophecies or the "Pygmalion effect", the expectations deriving from the value systems impact and nourish the associated behaviours (Rosenthal & Jacobson, 1968). In other words, expect altruism, cooperation, win-wins, inclusivity, sustainability, openness, transparency, sharing, and responsibility, create behaviours associated with them. This new institutional setting promotes these behaviours that support ecosystems to realise ecosystem synergies and empower participants. For example, openness and sharing are needed to support data sharing, platform interoperability and collaborative regulation. Transparency is important for information and feedback to flow freely so as to build credible trust mechanisms online. Cooperation, altruism, and win-wins are necessary as every organisation and platform relies on each other for value cocreation in layered digital infrastructure instead of siloed leadership through competitive rivalry. Sustainability and inclusivity are key to considering the business, individuals, society, and environment as interdependent elements of a complex living ecosystem so as to ensure ecosystem sustainable

growth and the embeddedness of civil responsibility in business models. These new cultural norms and values are essential in maximising ecosystem synergies, supporting sustainable growth, and empowering ecosystem participants. Lastly, it is important to note that emerging economies may display more institutional influences than developed economies as they are undergoing rapid institutional changes (Hoskisson et al., 2000). Therefore, context may play a key role in determining institutional strategies' role in ecosystem orchestration.

In sum, when the long-term vision-driven and re-envisioning approach is considered with systematic orchestration of multiple interdependent areas, ecosystem orchestrators need to possess both system orchestration capability and the capability of thinking in both the long term and short term. In other words, the mental map of ecosystem orchestrators needs to span across time and orchestration areas. It is a multi-dimensional orchestration – a dimension of time and a dimension of orchestration areas. Spanning across time is important because ecosystem orchestration needs both long-term visions to guide short-term verifications and short-term iteration to incorporate changes and adjust long-term vision. By conducting both long-term and short-term thinking, ecosystem orchestrators can leverage social system design principles to create the future based on their vision of the ideal system (Banathy, 1996). Indeed, as Jack Ma mentioned, "*Nobody knows the future. You can only create the future*". The future needs to be set up at the beginning as a starting point to guide short-term behaviours but is under constant re-envisioning to incorporate emergent changes, presenting both direction and flexibility to ensure long-term ecosystem sustainable growth. Spanning across areas is also crucial because successful ecosystem orchestration for sustainable growth relies on the alignment of multiple interdependent orchestration areas. The wide orchestration arena spans technological, organisational, external influences, and institutional re-creation; each plays a critical role in realising ecosystem synergies and supporting sustainable growth. Failure to orchestrate any of these four may risk experiencing system bottlenecks or growth constraints.

Ecosystem sustainable growth

Insights from my study also shed light on understanding sustainable ecosystem growth by 1) expanding existing studies by considering the sustainability elements and value creation for multi-stakeholders, 2) highlighting the leverage of both intentional and emergent actions, and 3) proposing a rethink of the traditional concept of competitive strategy to a more inclusive and long-term understanding of rivalry dynamics for ecosystem sustainable growth.

In this thesis, supported by the case study, I define ecosystem sustainable growth relatively broadly, including not only economical (as "*sustained profitable growth*" (Teece, 2007: 1335)) but also social and environmental values suggested by the United Nations' Brundtland Report (Lacoste, 2016), the Triple Bottom Line Framework (Elkington, 2004) and the stakeholder theory (Dmytriyev, Freeman, & Hörisch, 2021; Freeman, 1984). Not all three aspects are emphasised equally in every phase of ecosystem growth, e.g., the economic pressure to stay alive is paramount in the emergence phase. In the case of Alibaba, it focused on economic growth in the first phase and shifted to systematically support economic, environmental, and social dimensions in the following phases. The systematisation manifests in embedding environmental and social benefits in Alibaba's business model, according to its first CSR report in 2007. Existing ecosystem research has discussed goals such as ecosystem orchestrator competitive advantage (Moore, 1993), "*sustained profitable growth*" (Teece, 2007: 1335), the materialisation of a focal value proposition (only on customers) (Adner, 2017), ecosystem survival and health (Iansiti & Levien, 2004b), and value creation and extraction (Dhanaraj & Parkhe, 2006; Jacobides et al., 2018). Although academically grounded and well-received, these goals discussed by existing research can be expanded by considering the sustainability elements and value creation for multi-stakeholders that may not be the direct ecosystem participants (Cobben et al., 2022). Including all stakeholders' interests in orchestrating ecosystem sustainable growth resonates with this thesis's multi-stakeholder conceptualisation of ecosystem synergies. It also resonates with the recent account of the sustainable business model that incorporates multi-stakeholder interests into value creation (Bocken, Short, Rana, & Evans, 2013; Freudenreich, Lüdeke-Freund, & Schaltegger, 2020; Schaltegger, Hansen, & Lüdeke-Freund, 2016), the movement in redefining the purpose of the corporation from the shareholder primacy to stakeholder terms (Harrison, Phillips, & Freeman, 2020), and normative inquiry philosophically of "*how we ought to act in light of why, weighing various considerations, that is the right, just, or good course of action*" (Margolis & Walsh, 2003: 291). The logic of considering all stakeholders' interests and embedding them in the business model is that "*by contributing to ecological and social value creation, business models can create competitive advantages while contributing to the sustainable development of markets and society*" (Freudenreich et al., 2020: 5). In other words, ecosystems can obtain sustained competitive advantage and grow sustainably if all stakeholders are at least not worse off when interacting with the ecosystem, as illustrated by Jack Ma in his letter from CEO in 2017: "*We have conviction that*

the ultimate mission of a great company is to solve the problems of society. Only by contributing real value to society can a company build a sustainable business."

My research shows that, to achieve sustainable growth, ecosystem orchestrators must leverage both intentional and emergent actions. While intentional actions come mainly from the ecosystem orchestrator, emergent actions can stem from a wide range of stakeholders. For the diversity of generative changes to realise its full potential and strength, a certain degree of autonomy is needed in ecosystem orchestration, as emergent innovation arises from spontaneous participants instead of planning by the orchestrator. At the same time, for the coherency to enhance efficiency for all, a certain degree of influencing is required in ecosystem orchestration, as only the ecosystem orchestrator has the resources and capabilities for ecosystem-wide stacking and integration. Therefore, ecosystem orchestrators focus on influencing participants' autonomous behaviours with limited management to allow sustainable growth for the ecosystem and participants. Resonating with the minimum structure principle for improvisation in the product innovation theory (Brown & Eisenhardt, 1997), tacit rules and abstract visions in ecosystems provide guidance and boundaries while leaving room for emergent roles and benefits (Kamoche & Cunha, 2001). This means that when rules and visions are not explicitly specified, new offerings and interpretations are able to have the legitimacy to emerge and diffuse. Alibaba's case suggests a relatively stable ecosystem mission and temporary ecosystem phasic vision as useful abstract visions to guide sustainable growth. Ecosystem missions guide ecosystems to create the future, and ecosystem phasic visions are set up to steer collective efforts but updated periodically to address bottlenecks, respond to external changes, consider emergent activities, and rejuvenate ecosystem growth. Given low predictivity, ecosystem vision is defined with minimum specificity and vast space for innovative interpretations. The mission for Alibaba that remains stable and simple throughout the journey is "*to make it easy to do business anywhere*", providing steers and guidance for general direction while opening varied routes to achieve such a mission. It plays a vital role in helping articulate the meaning of existence, solidifying decision-making principles, getting buy-in from a wide range of participants for collective benefits, and steering the direction orchestrators set. At the same time, it is abstract enough to allow room for flexibility regarding what that mission looks like and how to achieve it. Following this grant mission, ecosystem phasic visions may change flexibly as ecosystems evolve to account for unpredictable and emergent actions. This ecosystem phasic vision is temporary, as it has to be renewed when ecosystem

bottlenecks from emergent activities start to inhibit growth. As illustrated by Zeng (2018b): "*More than a static vision, the firm needs a visioning process. As time passes, its vision has to be checked against reality and updated*." (p. 145). At the same time, it also has to be checked with the ecosystem mission to ensure it is in line with the created meaning and principles. These abstract missions and visions are an alternative mechanism to traditional contractual manner to foster emergent and strategic behaviours, collective value creation, and orchestrator's value capture (Altman et al., 2022). The minimum structure allows ecosystems to accommodate both strategic and emergent activities and have good from both sides.

Moreover, value creation and capture must be carefully considered to cultivate ecosystem sustainable growth. When value creation is not appropriately motivated, then ecosystems cannot grow. When value capture is not fairly allocated or ecosystem orchestrators extract too much value, ecosystems cannot grow. Iansiti and Levien (2004a) highlight the importance of maintaining healthy development for all ecosystem participants so as to be sustainable: "*The system thrives when everyone is healthy. At the same time, the system becomes unsustainable if significant assets get hurt or if significant segments of the system are out of balance.*" (p. 25) They highlight the concept of shared fate for sustainable business performance and ecosystem health - "*Because collective effects are crucial to firm performance, sustainability is a function of the health of the whole ecosystem, not just of individual firm's capabilities*" (Iansiti & Levien, 2004a: 222). My analysis of Alibaba's focus on growing ecosystems sustainably highlights the altruistic and collective mentality but does not completely rule out non-altruistic behaviours that Alibaba may have conducted. My point is that, in general or on average, Alibaba's strategic actions follow the vision of growing the ecosystem for the collective benefit rather than purely focusing on their own profits and performance. Value creation results from both emergent and strategic actions to collectively develop a bigger pie, while value capture mainly addresses orchestrators' strategic actions to capture a portion of the bigger pie sustainably. The former requires structural flexibility that attracts and promotes emergent changes and the latter needs fair allocation mechanisms. Instead of viewing value capture as the contradictory force that is in conflict with the collective value creation, as illustrated by John and Ross (2021)'s finding that "*the lead firm may capture more value with a bigger share of a smaller pie than a smaller share of the biggest pie*" and "*the interest of the lead firm in maximizing its value capture and the interest of the ecosystem as such in maximizing total value created may be misaligned*" (p. 32), my research proposes alternative

thinking – the same or a bigger portion of a bigger pie sustainably, in which the interest of the ecosystem orchestrator in maximising value capture is in line with the interest of the ecosystem in maximising total value created in a dynamic and long-term manner. As Jack Ma illustrated in 2015, "*what ordinary companies think of is to earn the 5 yuan that can be seen in the customer's pocket, while Alibaba's pursuit is to help customers turn 5 yuan into 50 yuan, and then take out the 5 yuan Alibaba deserves.*" and in 2010 with an eBay executive (rival), "*our challenge is to keep innovating to make the market bigger and create more opportunities. We're not talking about a zero-sum game, but how to use our abilities to make the cake bigger*." Several of my informants also discussed the concepts of co-creating for a bigger pie embedded in the ecosystem concept and Alibaba's fair value capture after value creation mindset, e.g., "*I am adding value, I am not taking it out of your original plate, I am creating another plate for you*" (A9 I interviewed). In this alternative thinking, ecosystem orchestrators are sometimes willing to sacrifice their short-term value capture to foster a larger pie for the whole ecosystem and thus capture more value in the long run for themselves and all participants. This process is dynamic and constantly adjusted along the way. A typical example is the dynamic enabling orchestration Alibaba used to develop the complements markets in the second phase. Aiming for sustainable growth for complementors and orchestrators, Alibaba sometimes had to develop complements itself first to cultivate a new market and then give it up to newly emerged complementors. In other words, Alibaba has to dynamically balance the role of building the ecosystem infrastructure and helping set up the market and support new complementors (Zeng, 2015). This mentality of delaying fair value capture until the pie has been enlarged for all participants supports sustainable value creation, value capture, and thus ecosystem sustainable growth.

This is in contrast to existing studies in ecosystem competition, e.g., "*Platform owners sometimes enter complementors' product spaces and compete against them… Amazon is more likely to target successful product spaces*." (Zhu & Liu, 2018: 2618), and "*The platform owner might then act as an unusually effective regulator of the ecosystem as a whole; however, its goals might be distorted towards capturing profits rather than just increasing value in the ecosystem."* (Boudreau & Hagiu, 2009: 184) The difference between Amazon and Alibaba can be observed through their revenue models: Amazon charges commission fees on product sales, while Alibaba makes most of its profits from premium services and advertising. By acting mainly as an empowerment party focusing on enlarging the pie and capturing fair value, Alibaba does not

participate in product sales and does not have inventory to manage, thus reducing the sourcing risk as well as the friction from distrusting participants. This reconceptualisation suggests a loose coupling between rational economic decision-making and short-term profiting behaviours. In particular, specific connections between rational economic decision-making and short-term profiting behaviours are the foundation of coopetitive relationships between ecosystem orchestrators and some participants, such as sellers and complementors in the Amazon ecosystem. The case of Alibaba suggests otherwise. Ecosystem participants can work towards long-term sustainable growth where a bigger pie can be created for a bigger portion for everyone. The choices for long-term profiting behaviours are also rational economic decisions in certain contexts.

Consequently, while recognising the importance of existing theories, I suggest a rethink of the traditional concept of competitive strategy to a more inclusive and long-term understanding of rivalry dynamics. Different from the evolution perspective that treats rival ecosystems as threats to survival, ecosystem orchestration can take an inclusive approach that treats competitors and themselves as interdependent and even mutually enabling. Rivals can support the ecosystem's sustainable growth in numerous ways, e.g., pointing out promising new areas, providing motivation to innovate, fine-tuning unique competitive advantage, offering legitimacy, co-developing the market for a bigger pie, and creating win-win collaborations. This inclusive view of competition resonates with relational competition, which suggests that the aims of interactions are not only for value appropriation and advantage but also for "*lifting all boats*" (Chen & Miller, 2015: 761). It is also consistent with the stakeholder theory (Freeman, 1999) - "*the goal is not to damage or beat a rival but to do well by contributing to and creating value for many players, even one's rivals: for example, by contributing helpful standards, open source-designs, or infrastructure*" (Chen & Miller, 2015: 761). This bigger pie mentality for ecosystem sustainable growth also resonates with Iansiti and Levien (2004a)'s work: "*a deeper philosophical shift is needed. The emergent philosophy should emphasize that individual firms will live and die by the health of their ecosystems, and should thus take these fundamental considerations deeply into account when making business decisions*" (p. 223). Most importantly, in line with the institutional updates discussed above, as the increasingly important phenomena - IIoT ecosystems – require mutually dependent co-existence and are lack "winner-take-all" paradigm (Piller et al., 2021), relational competition plays and will play a far more important role than rivalry competition does or will do in explaining and predicting patterns in the foreseeable future.

Ecosystem conceptualisation

What are ecosystems? Insights about ecosystem synergies, change, orchestration, and sustainable growth together extend prior conceptualisation of ecosystems. We tend to think ecosystems are designed and used as collective arrangement vehicles: 1) for survival as a business ecosystem with a shared fate (Iansiti & Levien, 2004b; Moore, 1993), 2) to jointly produce a focal value proposition to a specific group of end-user using an innovation ecosystem as a structure to align (Adner, 2006; Chen, Yi, Li, & Tong, 2022b; Hannah & Eisenhardt, 2018; Kapoor, 2018; Uzunca et al., 2022), 3) to survive and outcompete rivals (Gawer & Cusumano, 2002; Kretschmer et al., 2022; Parker, Van Alstyne, & Jiang, 2017), and 4) to govern tensions for equilibrium in technology/digital ecosystem strategy (Wareham et al., 2014; Zittrain, 2008). In this thesis, through iterations between theories and new phenomena, I propose a reconceptualisation of ecosystems as *empowering engines* by taking multi-stakeholder synergies, the duality view of intentionality and emergence, sustainable growth, layered network instead of customer-provider logic and interpretative approach seriously. In other words, acknowledging the important insights of viewing ecosystems as "*ecology of competition*" (Moore, 1993), "*strategy*" (Iansiti & Levien, 2004b), "*structure*" (Adner, 2017), or "*meta-organization*" (Kretschmer et al., 2022), this thesis instead invites a rethink of ecosystems as *empowering engines* that emerge and grow with the help of participants and empower participants in their own ways sustainably.

While a collective arrangement strategy can be used to produce focal offerings for a certain type of end users and outcompete other ecosystems, an empowering engine can enable a wide range of users to be better selves according to their needs and, through empowering, can co-develop future direction of ecosystem development for ecosystem sustainable growth, i.e., an increasing pie with an increasing portion of participant-specific value for each. My discussion suggests scholars pay greater attention to and contribute towards emerging ecosystems literature that takes an active, inclusive, and fluid approach.

Much of ecosystem research takes on a rationalistic approach to study the value ecosystems provide for each participant using concepts such as "*focal value proposition*" (Adner, 2006: 98). Such pre-defined and fixed value proposition is used to align participants and together satisfy the needs of a pre-defined group of end-users. The final value is thus seen as comprising two separate entities: end-users and ecosystems. My study and empirical findings reveal an interpretative approach that is inclusive and context-specific (Weber, 1968). This means that ecosystem value

for each participant depends on their experiences of ecosystems, their contexts and specific needs. In other words, resonating with the service-dominant logic (Chandler & Vargo, 2011), value is context-dependent and participant-dependent. There are potentially different interpretations of ecosystem value for the same type of participants. Instead of separating end-users from ecosystems, ecosystem value for each participant and the ecosystem are interrelated through the interpretation of participants. It is the participants' ways of interpreting ecosystem value according to their experiences and needs that form and organise their resources to participate in ecosystems.

I suggest that ecosystems do not need to have only one focal value proposition formulated ex-ante for one specific type of end-user and then convened to all participants for alignment and collective offerings. Instead, ecosystems can have multiple synergistic value profiles, and each participant can be satisfied and continue to be satisfied according to their specific needs. While ecosystems are predominantly viewed as organisational arrangements that force upon related participants for collective offerings, the conceptualisation arises from my empirical suggests otherwise. Instead of forcing upon participants, ecosystems emerge from the needs of participants and simultaneously empower participants for their own specialities. There can be central orchestrators, but their roles are about listening to, reliably satisfying and empowering emerging needs so as to design and predict specific destinations for all to work towards. Ecosystems are not exogenous tools out there to be enacted on related participants; instead, they have life growing inside sustainably nutritionalised by emerging demands and nutritionalising participants involved.

Because of ecosystems' evolving feature, there is hardly any ecosystem boundaries. Ecosystems are by nature boundless. This requires an open-minded approach that is seldom emphasised in received literature (Shipilov & Gawer, 2020). Although early scholars such as Iansiti and Levien (2004b) have mentioned the boundary-crossing characteristic, their primary focus on industry boundaries limits their insights. The boundary-expanding nature of ecosystems goes beyond the boundaries of industries and crosses the boundaries of competitors and public sectors. Competitive ecosystems are also part of one's ecosystem. Public organisations can also be direct users and contributors to ecosystem growth. Ecosystems do not need to only focus on one type of product, nor do ecosystems have to ignore dynamics inside ecosystem orchestrators. This also implies a dynamic value network logic instead of a sequential and inert chain-based logic that is bounded by industry schema (Li & Whalley, 2002). This dynamic value network logic is afforded by digital technology advancements, which increasingly horizontalise tightly coupled

vertical value chains by digital shared architectures that connect participants through standardised interfaces and rules (Leminen, Rajahonka, Westerlund, & Wendelin, 2018; Vial, 2019). New phenomena such as the IIoT suggest that traditional providers can join ecosystems for the value of enhancing operational efficiency by distributed cloud computing, data-driven learning and other ecosystem services instead of only for the collective offerings of final products for customers in the sequential chains. Smart governments also suggest value profiles such as operational efficiency and smart regulation where ecosystems provide. Communities and the environment can also benefit from ecosystems through social and ecological values. The boundless nature enables ecosystems to assemble a wide range of generic resources for sharing, quickly adapt to changing needs and internal bottlenecks, and thus grow sustainably.

Furthermore, the metaphor of an empowering engine does not have to be fixed on the role of each participant (Ekman, Raggio, & Thompson, 2016). Individual consumers can join ecosystems to obtain or provide value, and so can all other participants. When providers join ecosystems to obtain value or resources, individual consumers and other firms can be value or resource providers to help enhance their operational efficiency, innovation, and scalability. The rather fluid roles between consumers and providers of resources for each ecosystem participant show the limitation of anchoring a focal offer in existing ecosystem definitions. Ecosystems' focal offers can be different things for different participants. What one participant contributes to ecosystems' generic resources may be raw materials for the critical value of other participants. Ecosystem orchestrators cannot predict all. Ecosystems as empowering engines are built on shared generic resources where all participants contribute to allowing flexible recombination of resources each needs. When orchestrators talk to one type of participant, they can frame ecosystems as the empowering engine for their specific needs.

Ecosystems conceptualised as empowering engines consider multi-sided platforms such as Alibaba as an ecosystem, challenging Jacobides et al. (2018)'s framework, which proposes otherwise. The reason that multi-sided platforms are considered ecosystems is partly because there are nongeneric complementarities and other synergies where group-level coordination is needed and partly because of the generation of value for participants that is more than transaction efficiency. Combining buyers and sellers without a digital platform developed by an ecosystem orchestrator produces less value than connecting multiple sides with a central digital platform developed by an ecosystem orchestrator. As illustrated by my case analysis, synergies in the

Alibaba ecosystem that require ecosystem-level coordination include not only nongeneric complementarities but also positive feedback loops, the efficiency of innovation, production, and operation, optimisation in resource mobilisation, and sustainable growth. Rather than a limited focus on a single criterion, such as nongeneric complementarities for a focal offering, the criteria of my conceptualisation are broader - the generation of ecosystem synergies through mutually enabling relationships between generic resources and generative changes for sustainable growth that empowers all participants in their own way.

Other theories

This invitation to rethink ecosystem synergies, change, orchestration, sustainable growth and conceptualisation, however, is no less relevant for mainstream studies of other collective arrangements than it is for ecosystem research. I elaborate on five potential areas of contribution in the following as examples.

First, based on my discussions in this thesis, classic collective arrangements in management studies, such as joint ventures, alliances, networks, consortia, mergers and acquisitions, and trade associations (Barringer & Harrison, 2000; Feldman & Hernandez, 2022), can be seen to differ from ecosystems because of their lack of systematic synergistic potentials and architectural design for sustainable growth (Shipilov & Gawer, 2020). These differences, however, do not exclude classic collective arrangements to co-exist or even transition to ecosystems.

Second, this thesis also sheds light on the governance theories of control and collaboration (Sundaramurthy & Lewis, 2003). Extant research discusses the paradoxical tensions between control and collaboration and proposes several self-correcting cycles to prevent overemphasising one approach, including embracing trust and conflict, promoting diversity and shared understanding, and external interventions. Findings from this thesis propose new ways to embrace both control and collaboration through, for example, technical architectural design and institutional works. By expanding the possible vehicles, governance theorists can explore the complementary and reinforcing role played by other approaches to facilitate adaptation and sustainable growth.

Third, my model of ecosystem change resembles the "bathtub" framework by Coleman (1986) which describes the macro-micro-macro dynamics in social theory. Coleman (1986) highlights a promising research area – micro to macro mechanisms that have been under-researched by social theorists. My model attempts to fill this gap by emphasising the role of vision-driven collective action and feedback loops that lead to system-level changes. Existing research

has studied three types of configurations of resources and interests that lead to "*markets, authority systems, and systems of norms*" (Coleman, 1986: 1326). My study of ecosystem change shows that micro-level individuals' actions, interactions and collective vision triggered by macro-level factors can lead to system-level change and sustainable growth. The relations among individual actors that lead to different macro-level changes do not need to be purely transactional and independent, purely hierarchical and authoritative, or constrained by social norms. In ecosystems supported by platforms, individual participants follow standardised rules and digital interfaces with limited contractual or hierarchical exchanges, which lead to system-level changes.

Fourth, research on ecosystem orchestration also complements the literature on asset orchestration, network orchestration, and open- and closed-system orchestration by pointing out the uniqueness of ecosystem orchestration. Instead of controlling through for example command-and-control and contractual relationships in ***asset orchestration*** and ***network orchestration*** for self-interested competitive advantage (Dhanaraj & Parkhe, 2006; Nambisan & Sawhney, 2011; Teece, 2007), ecosystem orchestration is unique because it emphasises *influencing* participants' *autonomous* behaviours with constrained ownership and authority for mutual and collective sustainable growth. The use of *influence* and *autonomy* here resonates with the dynamics of ecosystem change, allowing the emergent actions to work with the intentional engineer. Instead of being mainly oriented by self-interested value creation and capture through assets and networks, ecosystem orchestration is oriented toward long-term and collective value creation and capture based on participants' needs. However, instead of purely "*pro-social, other-oriented*" (Giudici, Reinmoeller, & Ravasi, 2018: 1371) of ***open-system orchestration*** such as incubators, ecosystem orchestration also considers value capture for ecosystem orchestrator in the form of an enlarging portion in an enlarging pie. Therefore, my view on ecosystem orchestration lies between the closed-system and open-system orchestration approaches (Giudici et al., 2018). My findings also highlight how ecosystem orchestration differs from closed- and open-system orchestration by highlighting the architectural-driven coordination and ecosystem-wide integration for efficiency, diversity, mass coordination and ecosystem sustainable growth. This leverage of architectural design principles and tensions, combined with the in-between self-interested and pro-social, set ecosystem orchestration apart from asset orchestration, network orchestration, and closed- and open-system orchestration.

Fifth, the re-envisioning and systematic approach in ecosystem orchestration discussed in this thesis also sheds light on the strategy literature by providing a new understanding of combining planned and emergent perspectives of strategy formation (Mintzberg & Waters, 1985; Sull, 2007). Confirming prior discussion in strategy literature that "*purely determined strategies are probably as rare as purely planned ones*" (Mintzberg & Waters, 1985: 268), ecosystem strategy formation combines both ends. In re-envisioning ecosystem strategies, orchestrators leverage both intentional directing of design visions and adaptive incorporating of emergent changes. Strategic learning happens more than when orchestrators learn from their experiences of organising as suggested by existing literature (Mintzberg & Waters, 1985), but also when orchestrators think systematically about how emergent changes can develop synergies with previous strategies in forming new strategies. This system logic shows a unique characteristic of ecosystem strategy formation as digitalisation brings modular, standardised, layered and de-coupled architecture that makes ecosystem strategies possess high interdependency and easy to build on to maximise ecosystem synergies. Different from patterns proposed by prior research where planned strategies tend to come after the entrepreneurial stage of an organisation (Mintzberg & Waters, 1985), the re-envisioning and systematic approach can happen on an ongoing basis from the ecosystem emergence by setting up the organisational structure and process to set up visions and learn from external changes consistently. The sustained strategic learning is thus supported by the process strategy in which the process of strategising is deliberately designed in orchestrators to allow adaptation to external changes.

Ecosystem and philosophy

While getting increasingly familiar with ecosystem research, I observed the implicit separation of ecosystem research and its philosophical underpinnings in extant studies. This separation conceals the relatedness and common grounds between them, making them incomprehensible to each other. Generally speaking, social science can be based on three main epistemological stances: realism or positivism, interpretivism, and pragmaticism, each with its view of reality and logic of and approach to knowledge creation (Astley & Van de Ven, 1983; Benton & Craib, 2011; Burrell & Morgan, 1979). Much of the ecosystem research bears the realistic tradition, treating ecosystems as something objectively out there to be observed, studied, examined and then generalised (Gioia & Pitre, 1990; Morgan & Smircich, 1980). Accordingly, there seems to be an objective truth of ecosystem definition, goals and structures. Such objectivity

pays scant attention to the subjectivity of human perceptions or the evolving characteristics of problems ecosystems are designed to fix (Cobben et al., 2022). Once the truth is discovered and abstracted, it becomes a theory that can be applied to various contexts.

Contrarily, my analysis of ecosystem studies suggests a strong imprint of pragmatic and interpretative paradigms (Goldkuhl, 2012; Mead, 1930), approaching ecosystem understanding and orchestration as a specific problem-solving and design process. Unlike the realistic epistemology that assumes an objective reality to guide behaviours across contexts, pragmaticism suggests designing an ideal understanding based on problem-solving experimentation in specific situations (Romme, 2003; Simon, 1996). Social systems differ from natural and engineered systems in that "*Natural and engineered systems cannot be other than what they are. Human activity systems, on the other hand, are manifested through the perceptions of human beings who are free to attribute a variety of meanings to what they perceive. There will never be a single (testable) account of human activity systems, only a set of possible accounts, all valid according to particular Weltanschauungen*." (Checkland, 1981: 14). Because of the openness in interpretation, social system design can be understood as a "*future-creating, collective human activity*", where "*people in social systems engage in design in order to devise and implement systems based on their vision of what those systems should be*" (Banathy, 1996: 1). This means that the definition and functions of ecosystems are designed to evolve so as to solve different problems in specific situations as problems emerge. There is no fixed or objective understanding of ecosystems that apply to all contexts and bear the test of time. When new problems emerge and new perceptions of the ideal design take on a central stage, our understanding of ecosystems changes accordingly. Although this epistemological discussion addresses the knowledge creation process, it also talks to and has implications for the practical understanding of ecosystems and the associated orchestration. Like scholars, practitioners also face the task of creating knowledge about ecosystems to guide ecosystem orchestration. Therefore, epistemological understanding is deeply embedded in practical ecosystem development, survival and success. A key process is the initial design of an ideal ecosystem. An interpretative approach is necessary to design an ideal understanding as different participants of ecosystems perceive ecosystem value and problems differently (Goldkuhl, 2012). This ideal understanding or vision is proposed as a hypothesis to solve predicted problems and guide current behaviours to achieve such vision. As new problems emerge and external circumstances change qualitatively, a new ideal or vision is proposed by re-

envisioning and incorporating diverse perspectives to guide behaviours. It is a trial-and-error process through which one's understanding of the ideal ecosystems and associated orchestration activities change. In this way, it is not that the objective understanding of ecosystems is to be generalised and applied to different contexts, but the pragmatic process of ecosystem design and experimentation that can provide insights into various contexts to obtain their emergent understanding of ecosystems to solve their unique problems. Jeff Zhang, the Chief Technology Officer, described this pragmatic and interpretative approach perfectly, "*Your first day as an open-source person is the same as our first day as a Taobao person, and as an Alibaba platform person. No one can figure out what the business model is. Because many times today, for example, I did A, and I did B. Originally, I imagined that C could not receive the money, but finally received the money from D. In fact, the process of this development is very uncertain, as long as you start from doing a good tool, and then to the product, and then to the ecosystem, there are countless possibilities in the ecosystem, we Alibaba today did not think that our advertising is a very big business model, I believe Facebook did not think that the day he built Facebook. I definitely didn't expect him to rely on advertising to accomplish this. He must have solved some core problems. Therefore, in terms of business models, I think there is a lot of diversity*." (2017 Alibaba Yunqi the Computing Conference in Hangzhou).

Consequently, while recognising the insightful findings of existing studies, I propose a process approach of ecosystem research where ecosystems are treated as a process rather than a state (Pettigrew, 1992; Van de Ven, 1992). The processual approach suggests that ecosystems are not static but dynamic; they occur rather than exist. This means that, instead of an objective and stable truth of ecosystems out there to be discovered, ecosystems are socially constructed, contextual, path-dependent, open-ended, and fluid. Ecosystems and associated visions are framed and declared by ecosystem orchestrators to stem change but in the process of doing so they are generated by it. Echoing Giddens (1979)'s structuration theory, the agency of ecosystem orchestrators emerges from the context they embed and at the same time shape it. Therefore, agency needs to be understood as the duality of being produced and producing. Similarly, contextual factors need to be comprehended as the duality of being shaped and shaping. To study ecosystems, therefore, scholars cannot afford to get away from considering the multilevel contextual influences, the historical sequence of events, and the holistic understanding of causal relationships (Pettigrew, 1992). Thus ecosystems are both an outcome of micro-level actions but

also socially constructed vehicles to stabilise reality and unite collective behaviours to predictable goals (Tsoukas & Chia, 2002).

6.2 Implications for Practice

The thesis matters for practitioners because a comprehensive understanding of ecosystem synergies, sustainable growth, and orchestration can help organisations grasp key forces driving ecosystem success and devise effective strategies to achieve ecosystem leadership sustainably. Note that although insights generated from the successful ecosystem case in this thesis are inspiring, one needs to be firstly aware of their boundary conditions before contemplating the application to their case. The implications from this thesis can provide practitioners ideas of how one can play an ecosystem game systematically in an institutional setting like China, but it would be difficult to apply to situations for example 1) when ecosystem orchestrators have different aspirations, e.g., remaining small, 2) when institutional settings are different, e.g., different countries and political systems, and 3) when resources available for organisations are different. After getting this boundary condition conveyed, I then illustrate some practical implications for suitable would-be ecosystem orchestrators and associated ecosystem participants below.

Ecosystem orchestrators must be aware of different types of ecosystem synergies that can be cultivated, considering time and inputs from participants. Ecosystem orchestrators do not need to achieve all these synergies initially but must be conscious of how different synergies can be accumulated to form more impactful synergies as time passes. One key strategy is to design modular and layered platform architecture that allows abstracting and stacking generic resources to share and empowers participants by enhancing operational efficiency and specialised innovations. It is important to note that ecosystem synergies' ultimate goal is long-term sustainable growth which requires a dynamic balancing act between supporting stability and evolvability. The potential of ecosystem synergies can be expanded by shifting away from the chain-based logic and provider-consumer division and moving towards the logic of value networks. In the platform-based value networks, all participants are connected via networks without linearity and resources are integrated via shared platforms to obtain optimised results for all in real-time. In this way, ecosystem synergies can be more inclusive, providing benefits to and attracting a wider range of participants for value co-creation than existing practices suggest. Specifically, existing ecosystem orchestrators can start broadening synergistic offerings from the consumption side to developing those that involve more sides. For example, for the provision side participants, leveraging this

ecosystem synergies framework, ecosystem orchestrators can develop shared platforms with generic resources to empower providers and third-party complementors who develop services for providers. In the case of the Apple ecosystem, as illustrated in Chapter 2, provision-side participants are component suppliers of the iPhone's core functions, consumption-side participants are buyers of the iPhone and associated services, and complementors are actors that provide complementary services such as applications in Appstore and music in iTunes. Apple currently focuses on developing consumption-side ecosystem synergies where provision-side participants and complementors are orchestrated to provide services to consumption-side participants. To expand the potential of ecosystem synergies, Apple can work on thickening the shared platforms and broaden the generic resources by developing shared IIoT platforms to enhance operational efficiency for component suppliers, attract third-party complementors to develop services for these suppliers, and provide data-driven insights to optimise their operations. By doing this, consumption-side and provision-side participants can also jointly connect to shared platforms to enhance supply-demand matching and large-scale data-driven mass customisation of iPhones. Later on the road, Apple can extend to other types of participants such as governments, NGOs, and public organisations by leveraging its existing control of certain resources to develop generic platforms through which their operational efficiency can be enhanced. Moving beyond the organisational level, industry and regional resource allocation and operational efficiency can also be enhanced by developing shared platforms for ecosystem synergies. In this way, ecosystem orchestrators can maximise ecosystem synergies when developing the ecosystem model.

The interpretative approach to understanding ecosystem synergies and value for each participant also has major implications for ecosystem orchestrators. The most basic area relates to how to identify and describe ecosystem synergies and value for participants as a starting point to attract participants. This finding provides a major shift from orchestrator-driven fixed value propositions to participants' rapidly changing perceptions of ecosystem value. Taking participants' unique circumstances and needs into consideration enables ecosystem orchestrators to identify and describe more fully the ecosystem synergies and value for each participant, thus designing more effective strategies to attract a wide range of ecosystem participation. Although ecosystems are guided by an abstract mission and phasic vision, ecosystem orchestrators can frame ecosystem synergies and values differently when they talk to participants so that orchestrators can emphasise the specific value each participant cares about. For example, ecosystems can be framed as enabling

personalisation and gain of a sense of belonging for individual participants; for service providers, ecosystems can be framed as an enabler for digital transformation to increase profits and resilience; for governments, ecosystems can be framed as an engine for economic growth, job creation, and government's regulation and operational efficiency.

Ecosystem orchestrators need to be sensitive to perceive subtle micro and micro-macro changes and be open-minded about the contribution of participants' emerging needs in driving ecosystem change for sustainable growth. Ecosystems are not pre-engineered by ecosystem orchestrators or emerged without any intentionality. Instead, ecosystem changes result from mutually enabling interactions of emerging and strategic actions. Without satisfying participants' needs for the bigger pie all work towards, they will not be able to get on board in the long run and may even destroy the trust of ecosystems for other participants. Release parts of the control in the direction of ecosystem growth allows generative changes to realise their potential. What is more, ecosystem orchestrators must not take the life-cycle model for granted when predicting ecosystems' evolutionary path where maturity and decline tend to follow the growth phase due to inertia and lock-ins. Ecosystem orchestrators can proactively rejuvenate ecosystem growth before maturity by actively accumulating ecosystem synergies, re-envisioning and conducting architectural restructuring. Although ecosystem architectural reforms take more considerable resource commitment and involve higher risks than addressing ecosystem component bottlenecks, the returns are high. Ecosystem orchestrators can take the courage to engage in architectural restructuring by leveraging a sequential, piloting and long-term approach to systematically alter the architectural design for long-term ecosystem growth. Re-envisioning also needs the special attention of ecosystem orchestrators to guide the growth of each phase following a fixed mission and improvable visions.

To grow the ecosystem sustainably, ecosystem orchestrators need to expand the range of orchestration activities by systematically conducting architectural, adoption, internal and institutional activities with alignment. Specifically, orchestrators need to 1) design technological architecture following design principles such as modularisation, standardisation and layerisation to support rapid user growth, scalability and security, 2) set up and adapt necessary internal structures and processes through re-envisioning, piloting and organisation architectural restructuring to support internal agile innovation, organisational adaptation as well as external adoption, 3) leverage pecuniary and non-pecuniary strategies to influencing participants' adoption

in an economic, social, and behavioural manner using system-thinking, and 4) develop, re-create and diffuse institutional arrangement to support ecosystem legitimacy and expansion. Although ecosystem orchestrators cannot predict specific ecosystem value propositions with specificity and certainty given the lack of clarity in the future, ecosystem development can still be guided by long-term visions with constant re-envisioning to incorporate emergent changes. Specifically, ecosystem orchestrators need to set up structures and processes internally for re-envisioning, piloting, and organisation architectural reconfiguring to support internal adaptation and external ecosystem adoption. Besides established pecuniary and non-pecuniary strategies, adoption activities can also rely on platform spawning, the generality principle, prioritised customising and demonstrating, and synchronising by using the system and synergy principle. Institutional activities can also be expanded to re-create the necessary culture, norms and values that support ecosystem expansion. While the ecosystem organisational form possesses many advantages, businesses considering developing ecosystems must be aware that ecosystems need a commitment of considerable resources at the beginning and tend to take a long time to reap profits, especially when it comes to being purely platform providers.

Participant heterogeneity is a crucial element to consider when designing ecosystem orchestration strategies. Participants have different value profiles and needs, thus requiring different influencing strategies. For example, to orchestrate businesses for network effects on the IIoT platform, ecosystem orchestrators need to reconsider the strategies used for individuals as businesses possess different challenges, needs, and risk-taking propensities. Heterogeneity also can be observed in the level of standardisation in the device one uses. Compared with businesses that use different machines, individuals use relatively easy-to-standardised devices such as phones and laptops. Unlike orchestrating for a consumption-side ecosystem where generative changes are promoted rapidly for winner-take-all competitive advantage, provision-side ecosystem synergies are orchestrated by promoting customisation and efficiency first and then generative changes. Due to low risk tolerance, high data sensitivity and costs, and low standardisation, provision-side ecosystems tend to rely on the process of experimentation, demonstration, and scale serves as a critical orchestration rhythm to synchronise collective efforts (King & de Rond, 2011). Ecosystem orchestration following this principle needs to prioritise profiling sides and participants to understand their specific characteristics before applying orchestration strategies.

Ecosystem sustainable growth can be developed by embedding environmental and social benefits in orchestrators' business models and leveraging both intentional and emergent actions by proposing missions and visions with minimum specificity. Ecosystem orchestrators' key role is to design rules to promote active resource exchange for optimised value extraction of each participant while maintaining ecosystem stability and coherency. Ecosystem orchestrators that enter participants' areas to beat them to death or extract too much value from collectively generated value will risk losing participants' trust, the potential synergies and sustainable growth for all. Indeed, if properly governed, ecosystems can act as empowering engines that emerge and grow with the help of participants and empower participants in their own ways sustainably.

This thesis also has implications for ecosystem participants. Viewing ecosystems as empowering engines for participants' needs, participants can be liberated to value their own needs and actively co-create value with ecosystem orchestrators or other participants. Participants can have an active impact in steering the direction of ecosystem growth through for example proposing new ideas, providing feedback on others' contributions, and helping regulate illegal behaviours. To facilitate resource exchange, participants need to be sure about their needs and exert signals to the ecosystem to attract potential collaborators. Furthermore, ecosystem participants need to be aware of the intention of ecosystem orchestrators when they are in the process of selecting ecosystems to join. Participants need to avoid joining forces with orchestrators that focus on extracting as much value as possible for their own individual performance.

6.3 Implications for Policy

The thesis also matters for policymakers because a more comprehensive and informed understanding of ecosystem synergies, ecosystem sustainable growth, and ecosystem orchestration strategies could help policymakers interpret the forces driving ecosystem change and success and thus help them devise and implement more appropriate regulations.

The holistic analysis of ecosystem synergies reveals how different ecosystem synergies play out in ecosystems' competitive advantages. This has important implications for the increasing debates among policymakers about the break-up of giant ecosystems into small firms, arguing that large ecosystems enjoy unfair monopoly advantages (Busch, Graef, Hofmann, & Gawer, 2021; Cennamo & Sokol, 2021; Cusumano, Gawer, & Yoffie, 2021; Jacobides, Bruncko, & Langen, 2020). Ecosystems, if governed properly, provide significant empowering benefits to participants

and societies. This thesis provides some balancing arguments in current antitrust economics that emphasise monopolistic behaviours' threat.

Furthermore, the increasing role government and regulators play in ecosystem growth and governance also provides important implications for policymakers. As ecosystems increasingly engage in infrastructural empowering, governments move beyond mere regulators to direct users of ecosystems by enjoying enhanced operational and regulatory efficiency. Regulators may lose these potentials by completely curtailing the growing size of ecosystems. The key, according to the findings of this thesis, is to obtain a dynamic balance as well as the government's appropriate degree and types of involvement in ecosystems and the allocation of roles between government and ecosystem orchestrators in developing digital infrastructures. Existing research has a scant discussion of this transition and the dynamic balancing role of policymakers, signalling promising areas for future research.

6.4 Limitations and Future Research

To facilitate future examinations, I suggest the following research areas (see Table 6.1 below for the summary).

Table 6.1 - Future research agenda

Themes	Potential research questions
Ecosystem synergies	
Ecosystem dissonance	*What are the unexpected negative consequences of ecosystems?* *How are different ecosystem dissonances generated?* *How do ecosystem dissonance and ecosystem synergies interact?*
Sequence	*What is the sequence of different types of ecosystem synergies?*
Ecosystem change	
Degree of change	*Does the degree of change matter? And if yes, how much?* *What types of ecosystems with what types of drivers change radically, and what are the outcomes? Do different types of change require different strategies?*
Comparison	*How is ecosystem change different from social, institutional, industry, and organisational change?* *Are strategies employed for social, institutional, industry, and organisational change applicable to ecosystem change?*
Capabilities	*What capabilities are necessary for successful ecosystem change?*
Sustainable growth	*What characteristics of ecosystem change lead to sustainable growth?* *How to balance value creation and capture for ecosystem sustainable growth?*
Digital agency	*Will digitalisation drive a new pattern of ecosystem change?*
Ecosystem orchestration	
Internal orchestration	*What are other types of internal orchestration strategies?* *How is internal orchestration co-evolve with ecosystems?*
Institutional orchestration	*What are other types of institutional orchestration strategies?*
IIoT orchestration	*What are the unique orchestration strategies of IIoT ecosystems? What are the challenges for scaling IIoT ecosystems?*
Smart city orchestration	*What are the unique orchestration strategies of smart city ecosystems?*

Sustainability-oriented orchestration	*What are different sustainability-oriented orchestration strategies?*
Digital infrastructure	*What are the unique orchestration strategies of digital infrastructure?*
Methodology	
Qualitative studies	*In-person interactions and observations in the fieldwork for ethnography studies*
Quantitative studies	*Proposing and testing propositions*
Transferability	
Other emerging and developing country contexts	*Are there consistent findings across different emerging and developing country contexts?* *Are there consistent findings across different non-western country contexts?*
Developed country context	*How are developed country ecosystems orchestrated and changed?* *What different types of ecosystem synergies do ecosystems in developed countries have?*
Comparative studies	*Compare case studies of successful and unsuccessful ecosystems* *Compare ecosystem cases from developed and non-developed countries* *Compare ecosystem cases from Western and non-western countries*

Regarding *ecosystem synergies*, my research focuses on the benefits of ecosystems. Rhetoric about the benefits is prevalent but so are concerns about the negatives and hardships of ecosystems working in practice. A study conducted by the BCG Henderson Institute suggested that "*fewer than 15% of the 57 ecosystems investigated were sustainable in the long run*" (Pidun, Reeves, & Schüssler, 2019: 9). Consequently, future research can look at the negative effects and their relationships with the positive ones to further our understanding of successful and sustainable ecosystems. Generating more benefits also means generating more negative consequences (John & Ross, 2021). For example, consumers may enjoy the convenience of interacting with friends through message apps and learning new trends in social media. However, the same benefits may also bring negative consequences, such as mental illness and anxiety about interacting with people in person (Keles, McCrae, & Grealish, 2020). Other negative complementarities may include fraudulent or nonethical behaviours, congestion, over-competition, and environmental pollution (John & Ross, 2021). This means that although ecosystem orchestrators may come with good intentions for the ecosystem vision, the results may involve unexpected negative consequences. Secondly, the review and empirical analysis show that ecosystems possess different combinations of synergies at different phases. Some ecosystem synergies can only happen after others. For example, data network effects only initiate after other positive feedback loops (such as two-sided markets and reputation systems) take off because data-driven synergies tend to take a long time to realise and do not provide immediate utility. Future research can further explore the sequence of different ecosystem synergies and the conditions under which specific synergies can be built faster or technologically and institutionally unfeasible.

Regarding *ecosystem change*, my finding explains the drivers and nature of change. Future research can look at whether the degree of change matters and, if yes, how much and in what conditions. These questions have limited exploration in extant ecosystem literature. For example, what types of ecosystems change radically with what types of drivers, and what are the outcomes? Do different types of change require different strategies? Moreover, by bringing out the intellectual heritages of ecosystem change at different levels, including organisation, industry, institution and society, more work can be done to borrow insights from these intellectual heritages to study ecosystem change. For example, ecosystem change literature can learn from social change literature – the three classic strategies to enable social change: power-coercive, empirical-rational, and normative-reeducative (Bennis, Benne, & Chin, 1961; Chin & Benne, 1969). Lastly, new digital technologies such as blockchain have the potential to replace roles conducted by humans using software protocols. By "*incorporating counterbalancing incentives in the code*" (p. 6), blockchain technologies can deal with the agency issues embedded in human agents (Hsieh, Vergne, Anderson, Lakhani, & Reitzig, 2018). What is more, applications of artificial intelligence (AI) such as facial recognition, non-human chatbots and autonomous driving have also started to bring out digital agency in ecosystem evolution in the way of continuously optimising resource allocation smartly (Jacobides, Brusoni, & Candelon, 2021; Rinta-Kahila, Penttinen, & Lyytinen, 2021). Through data-driven insights generated by deep learning and AI, ecosystems with the equipment of digital technologies can evolve in the direction of smart and continuous optimisation without much human intervention. The digital agency possesses more emergent and generative elements in ecosystem evolution than social systems, so will digitalisation drive a new theme different from the dynamic model of ecosystem change?

Regarding *ecosystem orchestration*, this thesis serves as the first step in exploring the crucial roles played by internal orchestration for sustainable ecosystem growth. While substantial research has been on ecosystem synergies generated through external engagement, there is considerable open space for ecosystem synergies considering internal orchestration. Similarly, because extant research on ecosystem orchestration only lightly addresses some internal activities for platforms (Cusumano & Gawer, 2002; Gawer & Phillips, 2013), there are still substantial opportunities to explore capabilities and co-evolutionary activities internal organisations need to be equipped for sustainable ecosystem growth. When it comes to the institutional approach, my thesis empirically supports the importance of institutional strategies in ecosystem orchestration.

Future research can explore unnoticed institutional strategies in institutional literature to shed more light on their role in ecosystem orchestration. With regard to the IIoT ecosystem orchestration, my research in this thesis points out the important differences between provision-side and consumption-side ecosystem orchestration. While I highlighted key technological, social, and institutional barriers through the Alibaba IIoT ecosystem case study, there is still considerable room to explore other industry-specific challenges in scaling IIoT ecosystems. Therefore, future research can further study this topic in different industries. My research also serves as a first step to exploring sustainability-oriented ecosystem orchestration. Future research can look further into different orchestration strategies for sustainable ecosystem growth by leveraging theories such as sustainability-oriented innovations (Oskam, Bossink, & de Man, 2021). Future research can also look into the boundary conditions for these ecosystem strategies, i.e., what types of individual-level, organisation-level, and institution-level conditions are necessary for these ecosystem strategies to work. The empirical context of my case in this thesis may present unique conditions that facilitate these orchestration strategies. For example, businesses in emerging economies tend to leverage internal markets as substitutes for under-developed external markets for effective resource allocation (Guillen, 2000). Note also that ecosystem orchestration here mainly applies to the business context with one hub firm who orchestrates, meaning that ecosystem orchestration in public sector contexts such as smart city or city data ecosystem orchestration may need a multi-orchestrator instead of a single-orchestrator approach (Gupta, Panagiotopoulos, & Bowen, 2020; Linde, Sjödin, Parida, & Wincent, 2021). Future research can explore the differences in ecosystem orchestration strategies in the public sector. Lastly, existing research on ecosystem orchestration has a limited discussion about digital infrastructure orchestration, which becomes increasingly important as digital technologies become more widely available. Digital infrastructures "*provide the necessary computing and networking resources*" where digital platforms and innovations emerge (Constantinides et al., 2018: 382). As digital infrastructure has a layered architecture (Yoo et al., 2010), examples of digital infrastructures can come from all layers, such as data centres and digital gadgets from the device layer, cables and network standards from the network layer, The Internet (Hanseth & Lyytinen, 2009) and applications at the service layer, and big data in various forms from the contents layer. Current research mainly focuses on strategies of application ecosystems such as Apple, Facebook and Google to maintain ecosystem leadership, and orchestration has not touched upon the general infrastructure (Cusumano, 2022). The findings are

limited as they treat institutions and infrastructure as a given or assumed exogenous (Tilson et al., 2010). Although this assumption often works, empirical findings from this thesis prove that infrastructure can be strategically orchestrated, created and shaped by ecosystem participants. This thesis provides the first attempt to bridge the literature of infrastructural orchestration and ecosystem orchestration using empirical cases. Similar to the finding of industry architecture reengineering, size does matter in infrastructural orchestrating, as changing digital architecture requires significant resources and power (Pisano & Teece, 2007). Given the inertia of co-specialised investment, architecture orchestration faces significant resistance. Therefore, how to find the right sector matters as well. Digital infrastructure orchestration serves as a promising future research direction.

Regarding *methodology* (Langley, 1999), my findings are limited by the amount of data I could access and influenced by my own interpretation. I greatly appreciate Professor Li from Tsinghua University and all the informants who have assisted me with my thesis. Their knowledge and discussions with me have made this thesis possible. Given the interruption of Covid-19, my research project was cut short, but I managed to conduct innovative data gathering remotely. The acceleration of remote working technologies during Covid-19 has made many conferences and materials available online, which I was lucky to access. Future research could have more in-person interactions and observations in the fieldwork for ethnography studies that take a more extended period of time for a more comprehensive analysis. More attention could also be paid in future studies towards the challenges of doing qualitative research in intercultural contexts by highlighting the important role played by power, language and identity (Cohen, Ravishankar, Symon, & Cassell, 2012; Easterby-Smith & Malina, 1999). Besides more detailed qualitative research, quantitative research can also help propose testable hypotheses and test the findings from this thesis.

Regarding *transferability*, the empirical setting focuses on Chinese contexts, which present challenges for direct application to other settings, but also provide opportunities for mutual understanding and indigenous Chinese management research (Leung, 2012; Li, Leung, Chen, & Luo, 2012). Compared with most English-speaking contexts, Chinese contexts possess different assumptions, e.g., the concept of man (Hahn & Waterhouse, 1972), and different thinking habits, e.g., system-thinking mode (Peng & Nisbett, 1999). Moreover, as a female Chinese scholar, I am influenced by my personal beliefs when analysing the data because reflexivity involves (Alvesson

et al., 2008) and my psychological characteristics differ from those of Western scholars (Masuda & Nisbett, 2001; Peng & Nisbett, 1999). Although challenges exist, my thesis provides an opportunity for Western scholars and practitioners to understand the cultural background of Chinese businesses and for Chinese practices to connect with Western management theories, hopefully assisting in mutual understanding and sympathy. Moreover, I believe the framework has a high level of transferability in that the case of Alibaba can be seen as a representation of a larger set of ecosystems influenced by collectivism and the aim to achieve sustainable growth. Given the limited reflexive research conducted in non-western contexts, future research can take an open-minded approach regarding assumptions, norms, and beliefs regarding how non-western ecosystems operate. Given "*the political-, interest- and value-laden nature of social enquiry*" (Alvesson & Kärreman, 2011: 6), future research needs to take the courage to be reflexive when researching non-western contexts (Tsui, 2009). Risks of lost in translation (Van Nes, Abma, Jonsson, & Deeg, 2010) and the power of language in manoeuvring particular accounts (Berger & Luckmann, 1967) suggest that having scholars with native language speaking capabilities in research projects play an essential role in honest and interesting interpretations, resonating the call for more indigenous Chinese management research (Fang, 2010; Leung, 2012; Meyer, 2006) and ecosystem research in international contexts (Altman et al., 2022). Comparative studies can also be carried forward to explore the differences between developed and non-developed country ecosystems, western and non-western country ecosystems, and successful and non-successful ecosystems. Specifically, by exploring similar ecosystem phenomena across contexts and revealing commonalities across cultures, a more robust theory of ecosystems can be developed backed by empirical regularities than by isolated cases (Tsang, 2009).

It is my goal for this thesis to catalyse discussions about ecosystems. I do not claim absolute truth but promote dialogues as interpretative and pragmatic epistemology suggests. I am aware that different readers might interpret my work differently. Scholars from an economics background might see my framework as a romanticised imagination at large, thereby resisting the discussions altogether. Management, strategy or organisation scholars may question the accuracy of my work, arguing that it rests upon an ideal world where public relations materials are treated as what organisations really believe and act upon. Information systems scholars might propose a bigger role of digital agency and technological determinism. Positivist scholars might resist the production of my work altogether because they say that my subjectivity has messed around the

objective reality that is out there to be discovered and doubt the transferability of the results. Either way, how they interact with my work will ultimately assess the goal I set for this mental framework.

7 CONCLUDING REMARKS

This thesis has examined ecosystem synergies, change, and orchestration. The theoretical and empirical investigations contribute to ecosystem research in five areas. The first is an integral and updated conceptualisation of ecosystem synergies that comprise three distinctive but interrelated components. The second is a phasic model of ecosystem sustainable growth with a duality relationship between emergence and intentionality. The third demonstrates how attention to time, width and systematisation can help advance research on ecosystem orchestration. The fourth lies in the conceptualisation of ecosystem sustainable growth. The fifth is a rethink of ecosystems as empowering engines that emerge and grow sustainably with the help of participants and empower participants in their own ways. Implications for practice, policy and future research have been discussed. I hope this thesis will stimulate future research on ecosystems.

8 APPENDICES

8.1 Appendix 1 – Literature Reviews

Table 8.1 - List of ecosystem change papers selected for analysis

Paper	Journal	Main Theme
Aarikka-Stenroos and Ritala (2017)	Industrial Marketing Management	Evolution
Adner (2006)	Harvard Business Review	Teleology
Adner (2017)	Journal of Management	Teleology
Adner and Kapoor (2010)	Strategic Management Journal	Teleology
Alaimo, Kallinikos, and Valderrama (2020)	Journal of Information Technology	Teleology
Altman et al. (2022)	Academy of Management Annals	Teleology
Ansari et al. (2016)	Strategic Management Journal	Evolution
Beltagui, Rosli, and Candi (2020)	Research Policy	Evolution
Benitez et al. (2020)	International Journal of Production Economics	Cyclicity
Boudreau (2010)	Management Science	Conflict
Cenamor and Frishammar (2021)	Research Policy	Conflict
Cennamo et al. (2020)	Academy of Management Discoveries	Conflict
Cennamo and Santaló (2019)	Organization Science	Conflict
Chesbrough, Kim, and Agogino (2014)	California Management Review	Teleology & Cyclicity
Clough and Wu (2022)	Academy of Management Review	Teleology
Constantinides et al. (2018)	Information Systems Research	Conflict
Dattée et al. (2018)	Academy of Management Journal	Complexity
Fang, Wu, and Clough (2021)	Strategic Management Journal	Teleology
Foerderer et al. (2019)	Information Systems Journal	Conflict
Frandsen, Raja, and Neufang (2022)	Industrial Marketing Management	Evolution
Gómez-Uranga et al. (2014)	Technovation	Evolution
Ganco et al. (2020)	Academy of Management Review	Teleology
Garnsey and Leong (2008)	Industry and Innovation	Evolution
Garud et al. (2022)	Strategic Management Journal	Teleology
Gawer and Cusumano (2014)	Journal of Product Innovation Management	Teleology
Gawer and Cusumano (2008)	MIT Sloan Management Review	Teleology
Gawer (2020)	Long Range Planning	Cyclicity
Gregory et al. (2021)	Academy of Management Review	Teleology
Hagiu and Wright (2019)	Management Science	Conflict
Hanelt, Bohnsack, Marz, and Antunes Marante (2020)	Journal of Management Studies	Complexity
Hannah and Eisenhardt (2018)	Strategic Management Journal	Evolution
Helfat and Raubitschek (2018)	Research Policy	Teleology
Henfridsson and Bygstad (2013)	MIS Quarterly	Complexity
Holgersson et al. (2022)	California Management Review	Conflict
Holgersson, Granstrand, and Bogers (2018)	Long Range Planning	Teleology

Iansiti and Levien (2004b)	Harvard Business Review	Evolution
Iyer et al. (2006)	California Management Review	Evolution
Jacobides et al. (2018)	Strategic Management Journal	Teleology
Jha et al. (2016)	MIS Quarterly	Teleology
John and Ross (2021)	Academy of Management Review	Conflict
Jones, Leiponen, and Vasudeva (2021)	Strategic Management Journal	Conflict
Jovanovic et al. (2021)	Technovation	Evolution
Kamalaldin et al. (2021)	Technovation	Teleology
Kapoor and Lee (2013)	Strategic Management Journal	Teleology
Karhu, Gustafsson, and Lyytinen (2018)	Information Systems Research	Conflict
Khanagha et al. (2022)	Strategic Management Journal	Teleology
Kolloch and Dellermann (2018)	Technological Forecasting and Social Change	Conflict
Kretschmer et al. (2022)	Strategic Management Journal	Teleology
Leong et al. (2016)	MIS Quarterly	Cyclicity
Leten, Vanhaverbeke, Roijakkers, Clerix, and Van Helleputte (2013)	California Management Review	Teleology
Li (2009)	Technovation	Teleology
Linde, Sjödin, Parida, and Wincent (2021)	Technological Forecasting and Social Change	Teleology
Lindgren et al. (2015)	Journal of Information Technology	Conflict
Lingens, Böger, and Gassmann (2021)	California Management Review	Teleology
Lingens, Miehé, and Gassmann (2021)	Long Range Planning	Teleology
Logue and Grimes (2022)	Strategic Management Journal	Teleology
Luo (2018)	Technological Forecasting and Social Change	Teleology
Majchrzak, Malhotra, and Zaggl (2021)	Academy of Management Discoveries	Complexity
Mantovani and Ruiz-Aliseda (2016)	Management Science	Conflict
Masucci et al. (2020)	Research Policy	Teleology
Meynhardt, Chandler, and Strathoff (2016)	Journal of Business Research	Complexity
Miller and Toh (2022)	Strategic Management Journal	Teleology
Moore (1993)	Harvard Business Review	Evolution & Cyclicity
Nambisan and Sawhney (2011)	Academy of Management Perspectives	Teleology
Nambisan and Baron (2013)	Entrepreneurship Theory and Practice	Conflict
Nenonen and Storbacka (2020)	Industrial Marketing Management	Teleology
O'Mahony and Karp (2020)	Strategic Management Journal	Teleology
Oh et al. (2016)	Technovation	Teleology
Overholm (2015)	Technovation	Teleology
Palmié et al. (2022)	Technological Forecasting and Social Change	Teleology
Palmié, Wincent, Parida, and Caglar (2020)	Technological Forecasting and Social Change	Evolution & Cyclicity
Panico and Cennamo (2022)	Strategic Management Journal	Conflict
Parker and Van Alstyne (2018)	Management Science	Conflict
Pushpananthan and Elmquist (2022)	Technovation	Teleology
Randhawa, West, Skellern, and Josserand (2021)	California Management Review	Teleology
Rietveld, Ploog, and Nieborg (2020)	Academy of Management Discoveries	Teleology
Ritala and Almpanopoulou (2017)	Technovation	Complexity
Sandberg et al. (2020)	MIS Quarterly	Complexity

Schmeiss et al. (2019)	California Management Review	Conflict
Shankar and Bayus (2003)	Strategic Management Journal	Teleology
Shi et al. (2021)	Journal of Management	Teleology
Shipilov and Gawer (2020)	Academy of Management Annals	Teleology
Snell and Morris (2021)	Academy of Management Perspectives	Complexity
Snihur, Thomas, and Burgelman (2018)	Journal of Management Studies	Teleology
Stonig et al. (2022)	Strategic Management Journal	Teleology
Teece et al. (1997)	Strategic Management Journal	Teleology
Thomas and Ritala (2021)	Journal of Management	Teleology
Thomas et al. (2022)	Technovation	Cyclicity
Tiwana (2015)	Information Systems Research	Evolution
Tiwana et al. (2010)	Information Systems Research	Conflict
Tsujimoto et al. (2017)	Technological Forecasting and Social Change	Complexity
Vargo (2009)	Journal of Business & Industrial Marketing	Teleology
Wareham et al. (2014)	Organization Science	Conflict
Williamson and De Meyer (2012)	California Management Review	Teleology
Xu et al. (2021)	Journal of Business Research	Evolution
Zhang et al. (2022)	Strategic Management Journal	Teleology
Zhu and Liu (2018)	Strategic Management Journal	Conflict

8.2 Appendix 2 – Research Data

Table 8.2 - Data sources

Data type	Data Sources	Details	Data Analysis
Primary Data	Interviews	The first round of exploratory interviews conducted during the Tsinghua-Alibaba New Business Xuetang with Alibaba and programme participants in June 2019 The second round of interviews conducted during the internship in the Alibaba Research Centre with Alibaba and provision-side participants from November 2019 to January 2020. Also interviewed managers in a competitor of Alibaba in IIoT in December 2019 The third round of interviews conducted telephonically in March 2020 Interviews of Alibaba executives published in news articles by the business press, online blogs, and books (e.g., McKinsey Quarterly, WSJ, Business Ecosystems in China) and conducted by journalists in news programmes (e.g., Bloomberg, CNBC, FT, tech.qq.com, Sina)	Interviews were transcribed and analysed for first- and second-order constructs.
	Participant observations	**2018** Attended the workshop on the e-commerce industry in the new era hosted by Tsinghua University and the China Electronic Commerce Association Attended the internal meeting on the topic of startup incubation between one of Alibaba's key competitors and Microsoft Visited DiDi's headquarter in Beijing (Alibaba is one of DiDi's stakeholders) in July 2018 Visited Beijing Zhongguancun (China Silicon Valley) **2019** Helped with interviews for admission to Tsinghua-Alibaba New Business Xuetang (Digital Transformation Training programme for industry leaders) Attended the Tsinghua-Alibaba New Business Xuetang Training Session 3 in Beijing (with CEOs from 52 industry leaders) Interned at Alibaba Research Centre Attended Alibaba Taobao Village International Forum Attended Alibaba's visit to two provision-side participants on Alibaba's ecosystems Attended Alibaba One Business Conference Attended Alibaba's visit to one IIoT platform Attended Alibaba Research Centre's internal centre meeting **2020** Attended the New Economy Think Tank Summit Attended the Digital Business workshop 2020 annual conference Toured the Alibaba Hangzhou Headquarter	Participant observations allowed observation of actions directly through meetings and discussions, informal conversations, and an in-depth understanding of the field.

Secondary Data	News and articles	Articles and comments/commentaries published in the business/trade press and online blogs between 1999 and 2020, accessed from databases (Factiva) and through extensive Google searches; Chinese language websites such as Baidu, Caijing, Sina, and Sohu are searched and reviewed	Chronological analysis to determine how the Alibaba platform ecosystem evolved, the types of participants, triggers of new platforms, and the value propositions of each platform. Quotations from reports were coded for first- and second-order constructs.
	Presentation files	Alibaba's presentation slides to provision-side participants and conferences	
	Video recording from meetings, webinars, and others	Alibaba's annual Yunqi conferences from 2015 to 2020, Alibaba conferences I attended during my internship, Alibaba Cloud webinars, Alibaba's training in Hundun University, and other conferences Alibaba presented	
	Alibaba's websites, milestones, news hub, and blogs	Alibaba's own news hub Alizila, Alibaba Group's primary websites, Alibaba Cloud websites, Alibaba Cloud Blogs, and Alibaba Twitter and Weibo accounts (457 files)	
	Alibaba's SEC filings, press releases and published reports	Alibaba's annual reports, IPO prospectus, 10-Q reports and 10-K reports between 2007 to 2022; Alibaba's press releases from 2000-2022 and CEO letters; Industry reports and analysts' reports related to Alibaba accessed through the Thomson One database and the Stock.US website; News releases and reports published by industry associations (e.g., Alliance of Industrial Internet, e-commerce, China International E-Commerce Association) (7 files)	
	White papers from Alibaba	White papers issued by Alibaba Research Centre and Alibaba Cloud	
	Wikipedia, Baidu Baike, Sougou Baike	Narratives and criticisms from free online encyclopedias in English and Chinese, including Wikipedia (English and Chinese), Baidu Baike (Chinese), and Sougou Baike (Chinese) to ensure objective understanding (only extract data with citations)	
	Academic studies on Alibaba	37 Academic articles on Alibaba downloaded through keyword searches on Google Scholar	
	Case studies on Alibaba	42 Harvard Business Review case studies related to Alibaba	
	Books about Alibaba	More than 20 books about Alibaba (written by Alibaba employees or others in English or Chinese). Detailed analysed 11 books in Atlas.ti including Zeng (2018), Clark (2016), Erisman (2015), Greeven (2018), Tse (2015), Jian (2016), Xiaopeng (2019), Yang (2018), Xiaopeng (2018), Zhong (2017), and Liu & Martha (2009)	

Table 8.3 - Provision-side participants descriptive data

	Year launched	**Number of employees**	**Collaboration initiation time**	**Industry**	**Private vs public**	**Collaboration type**
Provider 1	2003	>2,000	2016	Cosmetics	Private	New Retail
Provider 2	1990	>10,000	2018	Furniture	Public	New Retail
Provider 3	2006	>9,000	2017	Snacks	Public	A100
Provider 4	1979	>50,000	2019	Apparel	Public	A100
Provider 5	1994	>10,000	2019	Washing products	Private	A100
Provider 6	1987	>4,000	2019	Chemical	Public	IIoT
Provider 7	1987	>700	2019	Titanium	Public	IIoT
Provider 8	1990	>2,000	2019	Copper	Public	IIoT
Provider 9	1993	>20,000	2019	Steel	Public	IIoT

Table 8.4 - Informants data

Informant number	Informant code	Ecosystem role	Informant title	Number of interviews	Hours interviewed (Approximately)
1	A1	Ecosystem orchestrator	Vice President	2	2
2	A2	Ecosystem orchestrator	Vice Dean	5	6
3	A3	Ecosystem orchestrator	Vice President	2	3
4	A4	Ecosystem orchestrator	Senior strategy expert	3	4
5	A5	Ecosystem orchestrator	Cloud analyst	2	3
6	A6	Ecosystem orchestrator	Senior strategist	2	3
7	A7	Ecosystem orchestrator	Senior strategist	5	6
8	A8	Ecosystem orchestrator	Staff	1	1
9	A9	Ecosystem orchestrator	Cloud director	2	2
10	A10	Ecosystem orchestrator	IIoT architect	3	3
11	A11	Ecosystem orchestrator	IIoT project manager	2	4
12	A12	Ecosystem orchestrator	Data Middleware manager	2	2
13	A13	Ecosystem orchestrator	Senior strategist	3	4
14	A14	Ecosystem orchestrator	Senior strategist	2	2
15	A15	Ecosystem orchestrator	Senior strategist	1	2
16	A16	Ecosystem orchestrator	Strategist	2	1
17	A17	Ecosystem orchestrator	Senior strategist	2	2
18	A18	Ecosystem orchestrator	Cloud Smart manager	2	2
19	A19	Ecosystem orchestrator	Vice Dean	1	2
20	A20	Ecosystem orchestrator	Sales for DingTalk	1	1
21	A21	Ecosystem orchestrator	Sales for Middleware	1	1
22	A22	Ecosystem orchestrator	Vice President	1	2
23	A23	Ecosystem orchestrator	Ex-Chief of Staff	1	1
24	A24	Ecosystem orchestrator	Senior strategist	2	2
25	A25	Ecosystem orchestrator	Staff for Taobao University	1	1
26	A26	Ecosystem orchestrator	Project manager Taobao village	1	1
27	P11	Provider 1	President	3	3
28	P12	Provider 1	Vice President	1	1
29	P13	Provider 1	President assistant	1	1
30	P21	Provider 2	President	1	1
31	P22	Provider 2	Division manager	1	1
32	P31	Provider 3	President	1	2
33	P32	Provider 3	Vice President	1	2

34	P33	Provider 3	Supply chain manager	1	2
35	P34	Provider 3	Manager	1	2
36	P35	Provider 3	E-commerce platforms manager	1	2
37	P36	Provider 3	Brand manager	1	2
38	P37	Provider 3	IT manager	1	2
39	P38	Provider 3	Store manager	1	1
40	P39	Provider 3	Vice President	1	1
41	P41	Provider 4	Vice President	1	2
42	P42	Provider 4	IT manager	1	2
43	P43	Provider 4	Store manager	1	1
44	P51	Provider 5	HR manager	1	1
45	P52	Provider 5	CEO	1	1
46	P53	Provider 5	Vice President	1	1
47	P54	Provider 5	President	1	1
48	P55	Provider 5	Marketing manager	1	1
49	P56	Provider 5	SCO	1	1
50	P57	Provider 5	Chief strategy officer	1	1
51	P58	Provider 5	Business unit manager	1	1
52	P61	Provider 6	CEO	1	2
53	P71	Provider 7	CEO	1	1
54	P81	Provider 8	CEO	1	1
55	P91	Provider 9	CEO	1	1
56	J1	IIoT joint firm	CEO	1	1
57	G1	Government 1	Mayor	1	1
58	G2	Government 2	Vice Mayor	1	2
59	G3	Government 3	Secretary of Data Resources	1	1
60	G4	Government 4	Director of provincial IIoT department	1	2
61	R11	Rival 1	IIoT manager	1	2
62	R12	Rival 1	IT manager	1	1
63	R21	Rival 2	Vice president	2	3
			Total	**92**	**117**

Table 8.5 - The list of interview questions

Types of ecosystem participants	**Interview questions**
The ecosystem orchestrator - Alibaba	How did Alibaba start? What is Alibaba's vision, and how does Alibaba aim to achieve that? How did Alibaba evolve from a simple website to the digital economy specified in the annual report? What are Alibaba's strategies to expand the platform ecosystem? What are the triggers of each change and each new initiative? What are the benefits for Alibaba to collaborate with provision-side participants? What type of provision-side participants does Alibaba choose to collaborate with? What can Alibaba contribute to the provision-side participants? How did Alibaba get provision-side participants on board?
Provision-side participants	What made you want to collaborate with Alibaba? How did the collaboration start? What do you expect to get by collaborating with Alibaba? Could you share with me the details of your collaboration with Alibaba? Do you have any concerns? How did the collaboration evolve?

8.3 Appendix 3 – Case Narratives

Events leading to launch. When Jack Ma turned 30 in 1994, he quit his English teaching role in a college to set up his own translation agency company, Haibo. His intention at that time was to "*be a better teacher*" by "*spending some time in actual practice*", and his plan after that was "*coming back to the school to teach, with a better understanding of what I was doing"* (Shiying & Avery, 2009: 17). This significant but tiny shift, combined with the expansion of students of traders and businesspeople in Hangzhou while he taught night classes part-time, led to some critical unintended changes that Jack Ma did not plan. One consequence was the popularity of his English-speaking skills in Hangzhou, which unintentionally attracted the Hangzhou municipal government, which later signed him to solve an international dispute in America. This incident did not result from Jack Ma's intention but led him to encounter the Internet. Before 1995, Jack Ma planned to be a better teacher, but after 1995, Jack Ma's goal was "*to go out in the world and meet up with the internet*" (Shiying & Avery, 2009: 21). Joined force with some key entrepreneurship lessons Jack Ma learnt in Haibo, these interactions with Americans and the Internet escalated into some major changes in Jack Ma and the initial business after 1995. Instead of planning to return to be a better teacher, Jack Ma decided to start another company called China Yellow Page by collaborating with the Americans he befriended during that business trip. The mission was to "*pull together information on Chinese enterprises, put it on a Web site, and broadcast their products to the world*" (Shiying & Avery, 2009: 23). Little did the Hangzhou municipal government know the consequences of that assignment, nor did Jack Ma, the Americans, the businesspeople students, the internet inventors and marketers, and everyone in the process. The trip was described by Jack Ma as "*was really like a classic American-style Hollywood film. I was taken hostage by a kind of Mafia, so that [when I escaped] I just left my suitcase behind - it's still back there somewhere*" (Shiying & Avery, 2009: 18). After the trip to America, Jack Ma gathered 24 friends who are all students at the night school he taught for a meeting through which Jack Ma convinced them to work on this idea together. From 1995 to 1997, Jack Ma focused on getting businesses on the Internet through the China Yellow Page. By the end of 1997, Jack Ma left the China Yellow Page, given the conflicts with Hangzhou Telecom which owned most of the shares. From 1998 to 1999, Jack Ma worked on developing trade websites for the government in Beijing as the head of an information technology company, a Ministry of Foreign Economic Relations and Trade (MOFERT) department. In December 1998, Jack Ma and some of his team launched the

first online marketplace operated as a bulletin board service (BBS) to help businesses post trading information. Again, Jack Ma left in 1999 as he realised the government, due to its complex, slow, and cautious approach, was not the right place to ride the high tide of the Internet. His loyal employees who had followed him from Hangzhou to Beijing quit after hearing Jack Ma's plan, and together went back to Hangzhou with him to embark on the journey of Alibaba. Although these three failures, i.e., Haibo, China Yellow Page and Beijing government job, made Jack Ma heartbroken, he learnt a great deal of lessons about entrepreneurship, working with the Chinese government, and how to create websites.

Alibaba digital economy. To achieve the mission of "*to make it easy to do business anywhere*", Alibaba developed its digital economy. Alibaba defines its digital economy in the 2019 Alibaba Annual Financial Statement: **"***A digital economy has developed around our platforms and businesses that consists of consumers, merchants, brands, retailers, third-party service providers, strategic alliance partners and other businesses. At the nexus of this digital economy are our technology platform, our marketplace rules and the role we play in connecting these participants to make it possible for them to discover, engage and transact with each other and manage their businesses anytime and anywhere. Much of our effort, time and energy is spent on initiatives that are for the greater good of the digital economy and on balancing the interests of its participants. We feel a strong responsibility for the continued development of the digital economy and we take ownership in this development. Accordingly, we refer to this as "our digital economy". Our digital economy has strong self-reinforcing network effects benefitting its various participants, who are in turn invested in our digital economy's growth and success."* (p. 62)

The Alibaba digital economy operates around four businesses: "*core commerce, cloud computing, digital media and entertainment, and innovation initiatives*" (Alibaba Annual Report 2019). What is more, as an unconsolidated related party, Ant Financial offers financial services and payment to participants of the Alibaba ecosystem. Combined with Ant Financial, these four businesses provide the technological infrastructure and marketing reach to assist businesses with digital transformation to interact with their customers and operate more efficiently.

Core commerce. Alibaba's core commerce ecosystem comprises six sub-ecosystems: retail commerce, wholesale commerce, branding and monetisation platforms, commerce technologies and services, logistics services, and consumer services. Each sub-ecosystem connects with one another and provides data inputs and outputs to and from each other. As the largest retail commerce

business in the world, Alibaba operates Taobao and Tmall marketplaces. Taobao is the largest online shopping platform with a large growing community. Tmall spun off from Taobao and served as China's largest e-commerce platform for brands and retailers. Retail commerce also operates cross-border, including Lazada, AliExpress, Tmall Global and Tmall World. Lazada is the leading e-commerce platform across Southeast Asia. AliExpress is a global marketplace where consumers from around the world can buy directly from manufacturers and distributors from China and around the world. Tmall Global is the platform to help the Chinese to buy international brands and products. Tmall World allows overseas Chinese to buy products from China. In 2019, 66% of Alibaba's revenue came from the retail commerce business in China. The revenue is mainly from merchants and is primarily performance-based marketing services comprising customer management, commission, and other revenue. Customer management revenue consists of P4P marketing services and display marketing services. The commission is based on a percentage of the transaction value generated by Tmall and certain other platforms. Another revenue is mainly from the New Retail initiatives and direct sale businesses from Freshippo, Intime, Tmall Global and Tmall Mart. Alibaba wholesale commerce consists of 1688.com and Lingshoutong. 1688.com is the largest wholesale platform in 2018 by revenue. It connects wholesale buyers and sellers in China. Listing on 1688.com is free. Sellers may purchase additional services. Lingshoutong connects FMCG brand manufacturers and distributors directly with mom-and-pop stores in China. Lingshoutong provides digital supply chain services to FMCG brands and their distributors and improves their distribution efficiency by digitalising offline distribution data through setting up POS systems at mom-and-pop stores. Alibaba branding and monetisation platforms include Alimama and marketing for brands. Alimama is Alibaba's monetisation platform which matches the demands of businesses with the media resources on Alibaba's platforms and third-party properties, enabling it to monetise its core commerce and digital media and entertainment businesses. Marketing for brands refers to the Uni Marketing approach that helps businesses build robust relationships with consumers throughout their lifecycles, drawing on Alibaba's big data capabilities. Alibaba commerce technologies and services consist of a core operations control panel, big data support and engagement platform, and knowledge graph. The core operations control panel allows businesses to conduct core operations through a unified interface. Big data support and engagement platform is part of the New Retail initiatives to improve offline retail operations through consolidating online and offline data using cloud-based insights platform and

analytics services. Alibaba logistics services are operated under the Cainiao Network. Cainiao Network establishes and operates a global fulfilment network together with logistics partners. It offers domestic and international one-stop-shop logistics services and supply chain management solutions, addressing various logistics needs of merchants and consumers at scale. Cainiao Network utilises data and technology to digitalise the entire logistics process and empower logistics partners, thereby improving efficiency across the logistics value chain. As of March 2019, Cainiao Network has collaborated with 15 express courier partners. Cainiao also established a fulfilment network connected by Cainiao Network's proprietary logistics data platform. Alibaba consumer services consist of Ele.me, Koubei, and Fliggy. Ele.me is an on-demand delivery and local service platform in China. It allows customers to order meals, snacks, and beverages online through apps such as Ele.me, Taobao, Alipay, and Koubei. It also serves other Alibaba businesses, such as New Retail initiatives and Alibaba Health, where customers can leverage the networks to deliver food and pharmaceutical products. Koubei is one of the largest restaurant and local service guide platforms that provide local restaurants and service providers with data-driven marketing and other digital operational services. Ele.me and Koubei are managed under one team to expand Alibaba's offerings from shopping to other services. Fliggy is an online travel platform in China that provides reservation services for airline tickets, train tickets, and others. Fliggy enhances user experience through data technology where partner hotels can identify users with good credit and provide them with express check-out or other services.

Cloud computing. Alibaba Cloud is the third largest cloud in the world and the top in China. Alibaba provides customers with a complete list of services worldwide, including elastic computing, database, storage, network virtualisation services, large-scale computing, big data analytics, security, management and application services, IoT services and a machine learning platform. These offerings provide customers with IT infrastructure cost-efficiently and equip them with leading big data analytics capabilities, providing deep data insights by efficiently handling the complex computing tasks of hundreds of millions of data dimensions.

Digital media and entertainment. Alibaba's digital media and entertainment ecosystem comprises key distribution and content platforms. The key distribution platforms consist of Youku and UC Browser. Youku is China's third-largest online video platform, allowing users to search, share and view high-quality video content across multiple devices. Data gained from Alibaba's retail commerce and Alibaba's data technology allow Youku to deliver relevant digital media and

entertainment content to its users. Simultaneously, Youku helps drive customer loyalty to Alibaba's commerce business through complementary offerings to users. For example, membership in Alibaba's core commerce business can provide the opportunity to purchase a Youku membership at a preferential rate or to be rewarded with membership free of charge. Alibaba offers a wide range of digital media and entertainment content through production and acquisition. It self-produces content, jointly produces content with studios, acquires rights to display on Alibaba's platform, and offers an open platform for users to share content. Digital media and entertainment business revenue is mainly generated from customer management services and membership subscriptions.

Innovation initiatives. Alibaba has proposed three innovation initiatives: Amap, DingTalk, and Tmall Genie. Amap is the largest mobile digital map, navigation, and real-time traffic information provider by monthly active users in China as of March 2019. It operates as both B2B and B2C models. To customers, Amap provides data-enabled navigation services to end users. To businesses, Amap operates a large open platform in China that supports major mobile apps in China covering industries such as food delivery, ride-sharing and social networking. Moreover, Amap also provides digital map data, navigation software and real-time traffic data to international and domestic automobile manufacturers. It also supports powerful platform and infrastructure service providers in Alibaba's digital economy, including Alibaba retail commerce, Cainiao Network and Alipay. It generates revenue by charging a software service fee to enterprise customers. DingTalk is the largest business efficiency app in China by monthly active users as of March 2019. It serves businesses of all sizes through a digital working platform that provides unified communication services, intelligent mobile workspaces and network collaboration services. Its open platform also supports third-party software providers to develop apps or services for DingTalk. Tmall Genie is the No.1 smart speaker in China by shipments as of March 2019. It is the gateway to link customers with new experiences and services provided by the smart home appliances offered by Alibaba's digital economy participants in an interactive way. It generates revenue from product sales.

Niched e-commerce platforms. In 2008, Alibaba set up a group inside Taobao called Taobao Mall to explore the growing potential of the B2C marketplace and then, in 2011, reorganised Taobao. Hence, Tmall became a separate platform that connected branded sellers and Chinese consumers. To ensure wide coverage of branded sellers, Taobao Mall followed the

openness principle and obtained a commitment from leading Chinese B2C sites such as Intime (Yintai), Vancl, No. 1 Store (Yihaodian), Newegg, M18, Cool8 and Redbaby. These 38 leading B2C vertical sites set up a flagship store on the tmall.com platform so consumers can access "*the widest range of quality brands and authentic products in a single shopping destination*" (Alibaba Press Release, 2011). In 2010, Alibaba launched Juhuasuan, which facilitates transactions between Chinese consumers and sellers in a group selling fashion to save money for consumers. In the same year, Alibaba launched AliExpress online marketplace for consumers to buy directly from China. After this, Alibaba expanded coverage to global businesses and consumers to capture the growing demand in international B2C trades. In 2014, Alibaba set up Tmall Global, an extension of Alibaba Group's B2C Tmall business, which enabled overseas businesses to enter China's online retail market. By joining Tmall Global, businesses could get exposure to consumers on Taobao.com and Tmall.com from overseas without setting up physical operations in China, and Chinese consumers could get access to a wide range of global brands fulfilled from outside China. In 2016, Alibaba made a strategic investment in Lazada, the top e-commerce platform in Southeast Asia, and later increased investment in 2017 and 2018 to accelerate the plan to grow Lazada and deepen its integration into the Alibaba ecosystem. In 2018, Alibaba entered the Pakistan market by acquiring its leading e-commerce platform Daraz. In 2019, Alibaba acquired Kaola.com, a leading cross-border retail e-commerce platform that provides an extensive range of products in baby and maternal care, healthcare, beauty, and cosmetics. Besides online platforms, Alibaba also actively sets up or cooperates with offline stores, resonating with the New Retail strategy Alibaba proposed in 2015. The New Retail strategy emphasises the end of 'pure e-commerce time' and suggests integrating online, offline and logistics. Hence, customers are able to have more engaging, digital-connected, and omnichannel shopping experiences, and businesses can have more understanding of consumers and thus increase sales. In 2012, Alibaba started the experimentation by establishing Tmall Supermarket, which sells groceries, pantry items and other non-perishable fast-moving-consumer goods. Drawing on Alibaba's complete ecosystem advantage, including logistics, online payments, big data and cloud computing, Tmall supermarkets can allow consumers in more than 25 cities to have next-day delivery services in 2015. To get more offline stores on the platform, in 2015, Alibaba's platform Cainiao also started to build partnerships with local supermarkets and mom-and-pop stores, which act as pick-up and delivery locations called Cainiao Post. In 2016, Alibaba set up Freshippo, a chain of supermarkets where consumers can either order in the store

or online for delivery in under 30 minutes. Customised lists of products are recommended to consumers through a mobile app based on data analytics. Consumers can also have their groceries cooked to eat in the store. Besides developing physical stores themselves, Alibaba also actively acquires or conducts strategic investments in leading offline department stores and shopping malls, e.g., Intime, Suning, Sanjiang, and SunArt. For example, in 2014, Alibaba made a strategic investment in Intime to collaborate on online-to-offline (O2O) opportunities where Tmall gets access to Intime's offline product database to enable a broad selection of products for consumers and fast delivery through Intime's physical stores while Intime benefits from Alibaba's targeted promotion and convenient mobile payments for more sales. I summarise all e-commerce platforms in the Alibaba ecosystem (see Figure 8.1 in 8.4 Appendix 4 – Data Analysis).

Provision-side initiatives. Similar to the consumption side, provision-side platform ecosystems reside in a modular and layered digital infrastructure, with the lower layer providing infrastructural support to enable the upper layer to generate user-facing solutions. The Industrial Internet of Things refers specifically to internet-connected factories, sensors, and any connected devices that can be integrated into manufacturing. It is typically structured in four layers. The first layer is the Edge layer which is responsible for gathering data using digital objects such as machine tools and power stations. The second layer is the infrastructural as a service (IaaS) layer, which provides storage, computing, and distribution of data gathered from the Edge layer. The third layer is the platform as a service (PaaS) layer, which services like the operating system, similar to the Android operating system for mobile phones. As the core of the IIoT, it provides the necessary tools and rules to develop industrial software, transforming data collected into actual knowledge and action. The fourth layer is the software as a service (SaaS) layer, which resides in specific software developed by a wide range of participants. IIoT platforms generate value by increasing operational efficiencies. Using the four layers, IIoT platforms create a digital twin mirroring the physical presence by connecting machines, analytics, and people with edge devices. Beyond offering improved interfaces, the IIoT platform transforms the industry structure and enables new ways of creating and capturing value by collecting, exchanging, analysing, and monitoring data across departments, firms, and industries. Organisations can get a full and accurate view of the status of the operation, make predictive maintenance, improve safety, and make better decisions. Supplies can be driven by and customised to fit actual demand, thus improving inventory turnover. From a macro perspective, resource allocation efficiency is improved by connecting various firms

across industries in a shared platform. In the case of Alibaba, four key initiatives have been proposed to orchestrate provision-side participants for operational efficiency enhancement.

New Retail Initiatives. Alibaba introduced New Retail initiatives in 2016 to fundamentally transform retail operations. Alibaba states the New Retail initiatives in its 2019 Annual Report: "*We have introduced New Retail initiatives to innovate models for retail businesses and reengineer and transform the fundamentals of traditional retail operations. New Retail represents the convergence of online and offline retail by leveraging digitalized operating systems, in-store technology, supply chain systems, consumer insights and the mobile ecosystem to provide a seamless shopping experience for consumers. We believe the lack of real-time consumer insights is one of the key issues facing China's traditional retailers today. Through consumer insights and technology, our New Retail initiatives not only incubate new business models, but also focus on enabling traditional retailer partners to reinvigorate their businesses by digitalizing their operations and increasing their catchment area online and offline, thereby improving sales productivity. We are also empowering retailers with our new technology to significantly improve operating efficiency and allow them to react to consumer demands on a real-time basis.*

• Creating a New Shopping Experience through Innovative Supply Chain Management — Freshippo. Freshippo, known as "Hema" in Chinese, our proprietary grocery retail chain, exemplifies the creation of a new shopping experience through the convergence of online and offline activities by using retail stores to warehouse and fulfil online orders in addition to offering a rich and fun experience for customers who shop in-store. Its proprietary fulfilment system enables 30-minute delivery to customers living within a three-kilometre radius of a Freshippo store. Freshippo offers a mobile app that allows consumers to search for products and place orders while browsing in store. To improve consumer experience, Freshippo uses transaction data to personalize recommendations and geographic data to help plan the most efficient delivery routes. Freshippo is also shortening the sourcing process and increasing supply chain transparency and visibility through data technology. As of March 31, 2019, there were 135 self-operated Freshippo stores, primarily located in tier-one and tier-two cities.

• Transforming the Traditional Retail Model — Starbucks and Sun Art. Through our New Retail strategy, we are at the forefront of transforming the retail industry by digitalizing all aspects of store-based operations. For example, in fiscal year 2019, Alibaba Group and Starbucks Coffee Company jointly announced a comprehensive strategic New Retail partnership to enhance the way

customers enjoy their food and beverages. By the end of April 2019, we had enabled on-demand delivery of Starbucks offerings in more than 2,100 stores across 35 cities throughout China. We have also helped accelerate membership acquisition for its new Starbucks Reward program through the Alipay and Taobao apps. Furthermore, as of March 31, 2019, we have assisted Sun Art, the No. 1 hypermarket chain in China in 2018 by value of retail sales, according to Euromonitor International Ltd, with digitalizing approximately 470 stores. Our technology and know-how enable these stores to better manage their retail systems while allowing consumers to place orders through the Taobao app and secure delivery through our on-demand delivery platform, Ele.me. We invested in and formed a strategic alliance with Sun Art in November 2017.

We are also pursuing New Retail initiatives in product categories beyond daily consumption, such as electronics, home furnishings and FMCG, among others. Intime Department Store is a leading department store chain in China that intends to transform traditional retail models for fashion apparel and accessories. We and Suning are jointly testing and developing new ways for consumers to shop for and purchase consumer electronics. In the home furnishing sector, we have invested in Red Star Macalline Group Corporation Limited and Easyhome, each of which is a leading retail chain for home-improvement supplies and furniture in China." (p. 73)

Jack Ma predicted in 2016 that online and offline logistics must be combined. Offline enterprises must go online. Online enterprises must go offline. Online and offline plus modern logistics can be combined to create the New Retail. The new retail of online and offline integration has shown great potential and has become the trend and direction of future business development. The Alibaba ONE Business Conference on January 11th, 2019 also highlighted the success of the New Retail model. By digitisation of store operations, online and offline retail can be integrated. In the past two years, the New Retail development has been strong, with more than 1,200 brands upgrading their more than 200,000 offline physical stores to "smart stores" through digitalisation.

Alibaba A100 Program and ABOS. Alibaba launched the A100 strategic partnership program on January 11th, 2019, at the first Alibaba ONE Business Conference in Hangzhou, aiming to provide a comprehensive one-stop solution to help them accelerate their digital transformation. Members of the A100 program will build long-lasting relationships with Alibaba's various departments and platforms to create the best values for efficiency and sustainability in the digital age. The name A100 symbolises Alibaba's goal of increasing digital solutions for a large number of companies. The A100 program is based on the Alibaba Business Operating System (ABOS),

which was also displayed at the conference. The creation of ABOS represents the natural evolution of Alibaba from an e-commerce provider to a comprehensive global technology company. As Alibaba's business extends from pure e-commerce to digital entertainment and local services, its infrastructure has expanded to cloud-based sales, logistics, supply chain optimisation, payments, marketing, and many other ancillary services. With its powerful cloud computing capabilities, its infrastructure can handle massive data streams, providing insights and analysis tools to meet customers' needs better and assist them in expanding their business. The new retail is the key entry point for enterprises to access the ABOS.

Alibaba provides ABOS to companies of all sizes through the A100 program. Companies can select from a wide variety of service content based on their needs and optimise business operations. Alibaba created a cross-platform integrated customer service team specialised in following up on implementing A100 and cooperating with partners in the Group's ecosystem. Specifically, the ABOS empowers organisations' digital transformation through 11 elements: branding, products, sales, marketing, channels, manufacturing, services, finance, logistics, organisation, and IT. This A100 program was not set up within a day. Instead, it is an ultimate manifestation and accumulation of Alibaba's multiple years of strategic expansion since 1999. Instead of the combination of Amazon and eBay described by commentators during Alibaba's IPO in 2014, Alibaba has focused on redefining the concept of e-commerce, aiming to build an e-commerce infrastructure enterprise. With over 600 million monthly active users and nearly 30 business units specialising in enterprise services, the benefits for members to join the A100 program include operational efficiency enhancement, business growth generated by new avenues for sales and distribution, product innovation enabled by data-driven prediction to meet the lifestyle upgrade across China.

Alibaba stated in its 2019 Annual Financial Statement that ABOS was one of its key strategies: "*Our diverse commerce platforms and extensive consumer insights, combined with our cloud computing technologies, New Retail supply-chain management and sales and marketing systems form a critical foundation that facilitate digital transformation for businesses. We refer to this foundation as the Alibaba Business Operation System ("ABOS"). ABOS allows us to enable the participants in our digital economy with our proprietary capabilities and know-how. To date, we have already enabled the transformation of the business operations, technology infrastructure and organizational systems of many of our enterprise customers. The enterprises that have*

leveraged our ABOS have already benefited from integrated online and offline operations, effective customer engagement, acquisition and retention, speedy delivery, innovative utilization of retail space, enhanced operating efficiencies and new business models. ABOS currently serves a wide variety of businesses in our digital economy. We intend to make ABOS available to a broader range of enterprise customers in the future." (p. 64)

Strategic Investments and Acquisitions. As part of the New Retail initiative, Alibaba also leverages strategic investments and acquisitions to strengthen its digital economy and create synergies among its sub-ecosystems. Alibaba has the solid financial strength to explore and set up the new retail layout directly. From strategic investment in Sanjiang Shopping to the privatisation of the Intime business, from Freshippo to unmanned retail, Alibaba has been increasing the number of channels to explore new retail. According to media statistics, one year after the "New Retail" concept was proposed, Alibaba has added numerous pieces centred around the new retail strategy. Investment in supermarket chains and department stores was the main channel.

supET IIoT platform ecosystems. The New Retail and A100 initiatives are paving the way for the supET IIoT platform ecosystems. In 2018, Alibaba published a White Paper for the supET IoT platform ecosystems through the Alibaba Research Centre. From the beginning as an e-commerce website to launching sub-ecosystems covering finance, logistics, marketing and cloud, and engaging or acquiring traditional offline firms, Alibaba has been preparing for the IIoT platform ecosystems. However, that is just the beginning. Specifically, in 2009, Alibaba began to develop the Apsara operating system independently, and cloud computing began to enter Chinese manufacturers' eyes. In 2013, with the help of big data and algorithms, the Tao factory platform was established to successfully match tens of thousands of factories and customers, showing the new paradigm of C2M (consumer to manufacturers) manufacturing. In 2017, Alibaba Cloud Industrial Brain utilised smart technology that brought a 1% production yield improvement to GCL Solar. In 2018, the Alibaba Cloud Industrial IoT platform reached a cooperation agreement with nearly 200 partners to support the interconnection of up to 500 types of industrial devices. The Industrial Brain Open Platform was released the same year, opening up three industry knowledge maps, 19 business models, and more than 20 industry algorithm models. Code engineers can independently develop enterprise-specific industrial intelligence applications for the first time. These milestones seem to be unrelated and develop at their own pace. However, when these different storylines are stitched together, we vaguely see the prototype of an industrial Internet

platform with Chinese characteristics, from which we can find key elements to build a platform - connectivity, data, insight, and service.

It is against this background that, in April 2018, Alibaba Cloud took the lead in initiating the construction of a supET Industrial Internet platform or Industrial IoT platform with Zhejiang Zhongkong, Zhijiang Laboratories and others, aiming to build an inclusive, win-win, open and collaborative industrial Internet platform ecosystem and promote the integration of next-generation information technology and industry such as cloud computing, big data, Internet of Things, artificial intelligence, etc. for all walks of life. The company provides inclusive, one-stop digital, networked and intelligent services to promote the transformation and upgrading of China's manufacturing industry.

According to the White Paper, the IoT platform innovation was driven by three elements. 1) "1+N" platform framework – move from competition to symbiosis, 2) data intelligence - breaking through the consumer Internet and the industrial Internet, and 3) Industrial Brain – intelligent engine for Industrial Internet Platform. The first driver - Alibaba supET IoT platform ecosystem adopts the "1+N" framework. The "1+N" model combines leading industrial enterprises and various service providers to create a horizontal, cross-platform resource and capability-sharing platform to serve N industrial, regional and enterprise industrial Internet platforms. The supET "1+N" model includes explicitly three key functions:

First, ability-sharing middle platform. Alibaba's innovative organisation of "big middle platform, small front end" makes the frontline business more agile to better adapt to the more complex, faster and more challenging market environment in the 21st century. The "1" in supET not only plays the role of the middle platform in the ecology of the industrial Internet platform but also integrates product technology and data capabilities. Relying on the fundamental commonality provided by the central office, including data resource management, computational storage, machine learning platform, algorithm model and industrial mechanism model, the front-end N platforms can be lightly loaded without the need to spend much effort to make a repetitive basic capacity building. Instead, they can focus more on the polishing of customer service experiences, the development of business scenario applications, and the innovation of business models. At the same time, the industrial mechanism knowledge, micro-services and industry algorithms of N platforms can be continuously deposited into the middle platform. The middle platform can abstract it into more general algorithms and data models and increase its thickness and breadth

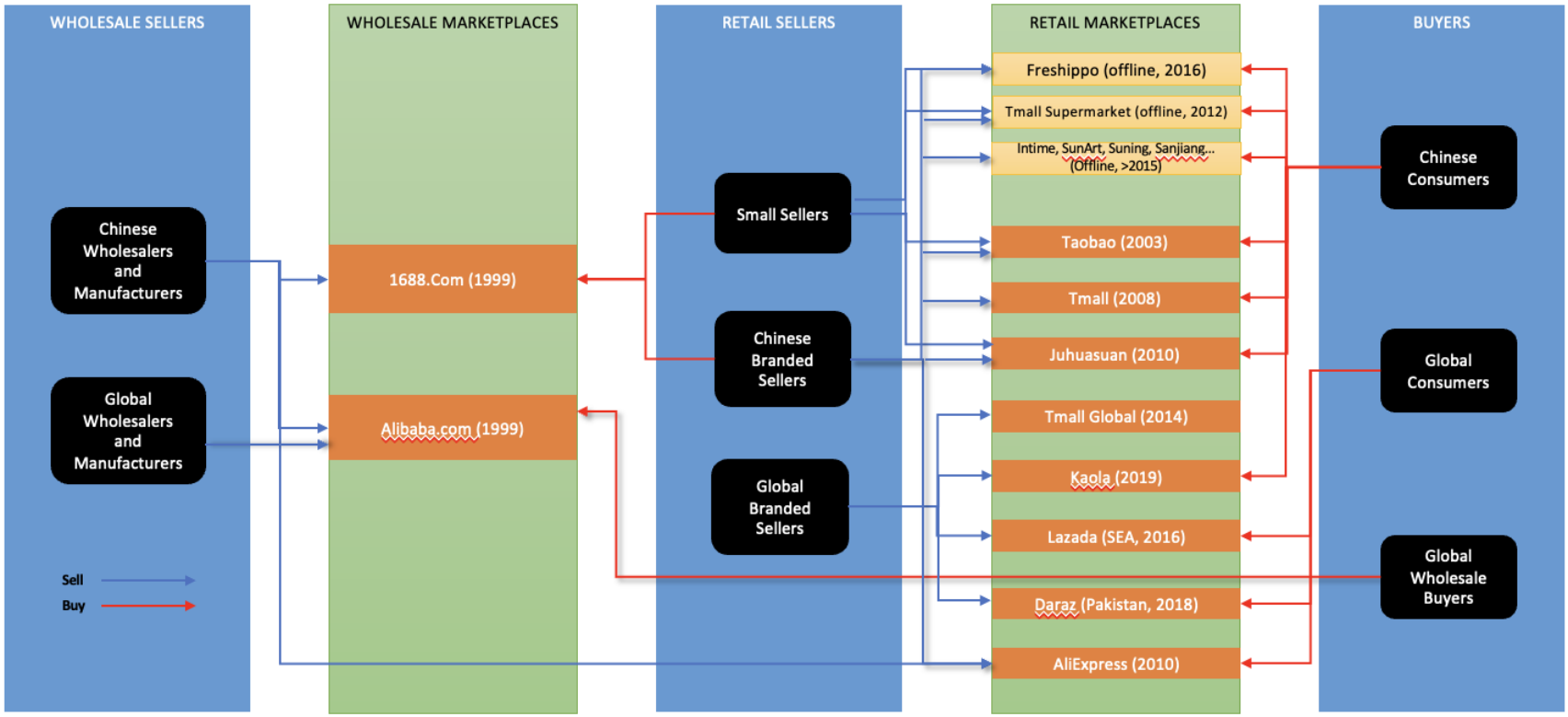
index. To better support the development and innovation of front-end platform business applications.

Second, knowledge routing platform. The essence of the platform is the sharing and flow of industrial knowledge, and supET plays the role of knowledge routing. Thanks to the platform's zero marginal cost and unlimited accessibility, the niche industry platform also has the opportunity to reach out to the vast market. At the same time, the mainstream mass industry platform can also transform into a small micro platform, reaching the majority of small and medium enterprises. Relying on the "1+N" model, N vertical industry platforms can overcome their market limitations and make their knowledge more SaaS, APP or micro-services to do more cross-platform distribution and trading, greatly enhancing knowledge. Commercialisation and liquidation capabilities; on the other hand, the front-end vertical platform relies on the supET platform to introduce more cross-border resources, combine experience and best practices, transform the knowledge of other platforms into their own, and upgrade and iterate the platform's capabilities.

Third, data plaza. The "1" of the supET platform can also effectively break the barriers of data barrier between platforms and promote data opening and sharing between platforms. As a national-level industrial Internet platform, supET can ensure that data is not abused and data privacy is not violated, effectively alleviating the data trust crisis between platforms. The application of the future blockchain will provide more insurance for platform security. The supET platform is like a public data plaza; the vertical platform can open data to each other in the square. Cross-sharing of data can double the value of data. By supplementing, comparing, or correlating the data of the new dimension with the existing data, the front-end platform can help the secondary development of the data and further discover new cognitive business scenarios and solutions.

The industrial brain needs the industrial Internet platform to create blood for it, and at the same time, it is the engine of platform development. Moving downwards, the industrial brain takes root in the horizontal cloud platform and gains robust data and computing power. At the same time, the algorithms and applications in the cloud can dynamically interact with the device and release control commands in real time. Moving upwards, the industrial brain platform serves the vertical industry platforms and 10,000 companies on the platform, providing a wealth of algorithms, models, and applications. Once multiple killer-level industrial intelligence applications can really solve the business pain points on the platform, it will bring massive traffic to the platform and promote the platform's active and prosperous.

8.4 Appendix 4 – Data Analysis



Developed by the author

Figure 8.1 - Niche platforms in the Alibaba ecosystem

8.4 Appendix 5 – Findings

Table 8.6 - Code structure – Phase 1

Phase 1 Platform empowering (1999-2006)		
Aggregate dimensions and second-order codes	**First-order codes**	**Representative data/quotes/excerpts**
Ecosystem future probes and synergies		
Ecosystem future probes	Ecosystem mission	*"The vision or mission was less important when the future was more predictable... Alibaba's mission, as I will describe in the next chapter, has basically remained constant throughout the life of the company: "to make it easy to do business everywhere". (Zeng, 2018b: 142-143)* *"Our mission in these 102 years is: to make it easy for our users to do business anywhere. We are devoted to serving small to medium-sized enterprises (SMEs)... This mission starts with creating trade opportunities to help SMEs survive and prosper." (Alibaba.com Annual Report 2007)*
	Ecosystem phasic vision – platform empowering	*"Alibaba.com's vision is to become the number one destination for buyers and sellers at small- and medium-sized enterprises (SME's) to find trade opportunities, promote their businesses and conduct transactions online" (Alibaba Press Release, December 19, 2000).* *"From the first day we started Alibaba, we had three main goals. We want Alibaba to be one of the top ten websites in the world. We want Alibaba to be a partner to all business people. And we want to build a company that lasts 80 years" (Erisman, 2015: 13).* *"Alibaba.com was founded in 1999 and it is our vision to sustain and grow our company for 102 years. Based on this vision, we were only eight years old when we became a public company in 2007." (Alibaba.com Annual Report 2007)* *"Lots of companies in Silicon Valley were built for sale, but Chinese firms are set up to pass on to future generations… To make it better, longer, and sustainable, we need to set up a vision for the future. Because only after you set a vision for the future, the future then can come. So when I first started Alibaba I mentioned that I wanted Alibaba to live for 80 years, but not every employee who came to interview believed it. But I believe it. I believe it will live for 80 years, so our actions are set up step by step to achieve that vision. Later we adjusted to 102 years… Businesses are different from politics in that businesses need a very clearly communicated vision to guide employees so as to prevent misunderstanding and multiple versions. We have to be clear about what we want and what we do. We found that there was a trend at that time that every company wanted to be a 100-year company but not no one took it seriously. So I wanted to have a clear and specific vision -102 years to cover three centuries - and I wanted to take this seriously. All 18 co-founders knew that if we did not last for 102 years then we were considered a failure no matter how successful we were at one time… This year we are only at our 17 years. 17 years is very short and it's very likely that we fail tomorrow then we are considered a failure. So live for 102 years is our clear vision. This creates a strong sense of crisis. A company that aims to live for 30 years is very different from one that aims to live for 102 years in terms of the way they think, the rhythm of its actions, and its company culture. So for every project we need to make sure that it is good for the company in 5 years, 10 years, 20 years, and long-term growth." (Jack Ma, speech at Hupan University, 2016)*
Ecosystem synergies	Support generative changes through two-sided network effects	*"Taobao's popularity was fueled by a "virtuous circle": More merchants and product listings meant more shoppers were attracted to the site, which meant more merchants and products, etc." (Clark, 2016: 72)* *"We believe if we can increase our customers, we will increase our revenue later and the process will take care of "itself" (The Wall Street Journal, 2008, Nov 12)* *"The evolution of Taobao was a classic exercise in building a platform through network externalities, catering to both buyers and sellers as the two sides of the market built off one another. More sellers brought more buyers, bigger sellers needed more services, and so on. In economics, the spillover effects of an action are called "externalities"." (Zeng, 2018b: 254-265)* *"Parallel to the growth of our marketplaces, we also placed strong emphasis on the development of the community on our website. The B2B e-commerce community is a powerful tool to keep our users abreast of industry information and increase the stickiness of our website. Last year, we continued to run various kinds of online and offline community events for buyers and sellers. Collaborating with top tradeshow organizers worldwide, we brought top tier tradeshow combined with e-commerce promotion opportunities to our members. We*

		formed our buyer service and development team in 2007 to facilitate a large number of renowned multi-national companies such as General Electric and Home Depot to source through Alibaba.com." (Alibaba.com Annual Report, 2007)
	Support generative changes through trust and reputation systems	*"TrustPass' most innovative feature is the use of an open Feedback Forum, a live online platform in which members with TrustPass can view and post comments on the quality and service levels of other members. In this open system, common in B2C models but a first for B2B models, members are rated on a series of performance variables…TrustPass is the businessperson's passport to trust online." (Alibaba Press Release, September 10, 2001)* *"He [Jack] was angry about downgrading in prominence a long-standing discussion forum set up for traders to chat with one another. Jack demanded David move it back the next day. David pushed back, saying that Alibaba needed to focus on transactions, not discussions, adding that the space on the home page was very valuable for advertisers. But Jack was emphatic: "We are a B2B marketplace. Nobody comes to trade every day. We are more important a community than our marketplace. The same for Taobao; nobody comes to shop every day. If you downgrade this forum you are focusing too much on profits. Switch it back to a non-revenue-generating entry point to the business community." (Clark, 2016:88)* *"Sellers often worked together, sometimes on official Taobao forums, but also in informal contexts off of the platform, learning from each other to overcome these hurdles to doing business." (Zeng, 2018b: 38)* *"We use Alibaba.com to grow our business and expand our markets. We even make a lot of friends through Alibaba.com… I'm proud of being a SME that is able to win business from well-known international companies through Alibaba.com." (Alibaba.com Annual Report, 2007)*
	Support generative changes through consumption-side complementarities	*"Alibaba.com (www.alibaba.com), the world's largest business-to-business marketplace for global trade, announced today that it has signed revenue-sharing deals with four leading global logistics providers to create an online quotation and e-contract platform for shipping and airfreight service. Atlantic Forwarding, Geodis, Panalpina and Schenker have signed separate agreements with Alibaba.com to participate in the platform, which will be accessed by Alibaba.com's members and hosted on the Alibaba.com marketplace… "Alibaba.com's ground-breaking quotation and e-contract system will offer our members world-class logistics services at competitive prices. This is a freight forwarding service that could not have existed before the Internet era and will bring time and cost savings to importers and exporters around the world."" (Alibaba Press Release, December 19, 2000)* *"As part of the TrustPass service, Alibaba is working with Asian Company Profiles Ltd, Huaxia Credit and Dun & Bradstreet to provide A&V service. A&V allows an Alibaba member with TrustPass to establish and demonstrate that 1) the member's company is a legal entity and 2) the member is a representative of the company. A&V is particularly valuable in online commerce where businesses operate in an otherwise anonymous environment. Without TrustPass, it is difficult for businesspeople to differentiate between quality partners and others who may be interested in securing proprietary product and company information with no real intention of closing a deal." (Alibaba Press Release, September 10, 2001)* *"Alibaba.com announced today the official launch of its Alipay online escrow system and the www.alipay.com website, which makes Alipay available to all businesses and individuals in China. The payment system provides buyers and sellers with a comprehensive solution that resolves the issue of trust in online transactions while providing an efficient platform for transacting online…To insure AliPay is China's safest way to trade online, Alibaba.com has partnered with four of China's largest national banks, including China Merchants Bank, China Construction Bank, Agricultural Bank of China, and the Industrial and Commercial Bank of China." (Alibaba Press Release, February 2, 2005)* *"The SME loan program we launched in the second half of 2007 in partnership with two major banks in China has been very well-received by our customers. In the current economic climate, our SME financing program is an invaluable resource because access to affordable capital is often critical to a SME's survival. Last year, we helped over 600 SMEs in Zhejiang province acquire more than RMB1 billion in loans from two partnering banks. In 2009, this program will be expanded to more major manufacturing and trading cities in China in partnership with more banks to offer much needed financing to SMEs." (Alibaba.com Annual Report 2008)*
	Stack generic resources for sharing and optimising	*"Thanks to Alibaba.com and its most important tool, the Internet, 1,000,000 corporate representatives from 202 countries and territories can easily meet and do business online." (Alibaba Press Release, 2001, December 27)* *"Atlantic Forwarding, Geodis, Panalpina and Schenker have signed separate agreements with Alibaba.com to participate in the platform, which will be accessed by Alibaba.com's members and hosted on the Alibaba.com marketplace." (Alibaba Press Release, December 19, 2000)*

		"My company has been using Alibaba.com to find new buyers and to promote our products around the world. This platform is a great tool to help me develop my business without travelling expenses and offers me the ability to find new partners as if I were exhibitors of a trade show." (Alibaba.com Annual Report 2007)
Macro-micro processes (emergent)		
Trigger	New technologies	*"Thanks to Alibaba.com and its most important tool, the Internet, 1,000,000 corporate representatives from 202 countries and territories can easily meet and do business online." (Alibaba's Press Release 2001)* *"Their website—Alibaba.com—was meant to allow these small businesses access to the riches that only the Internet could unlock." (Erisman, 2015: 12)*
	Infrastructural gap opportunities	*"In 1995, I traveled to America and saw the internet for the first time. When I searched for "China beer" on the internet, I found nothing. Seeing the lack of results, I decided to go back and start a company to bring the internet to China, and to bring China to the rest of the world. Back then, there was no online business in China. Now, the internet is everywhere." (Jack Ma, founder, quoted in Clark, 2016)* *"China provided fertile ground for this model to unfold because the country's business infrastructure was weak and undeveloped." (Ming, 2020: 19)*
	Macroeconomic cycle	*"Yet in the upside-down logic of the unfolding dot-com boom, losses were not only acceptable but worn as a badge of honor: the bigger the loss, the grander a firm's ambition. Venture capital (VC) firms were there to bridge the gap…Watching from the sidelines, Jack realized he would have to hustle if he was to ever catch the attention of VCs…" (Clark, 2016: 44)*
Support	Regulatory support	*"In March 1999, the government scrapped the installation fee for second phone lines and made it cheaper to surf online, too, cutting the average price from $70 per month in 1997 to only $9 by the end of 1999." (Clark, 2016: 45)* *"The key turning point for this generation was China's entry into the World Trade Organization in December 2001 and the opening of China's markets that followed. Almost all of China's leading Internet companies date from this period. Entrepreneurs who started out in the 2000s are typically more internationally minded than their predecessors, often drawing their inspiration from companies in other parts of the world." (Tse, 2015: 30)*
	Population scale advantages	*"When Jack created Alibaba in early 1999 China had only two million Internet users. But this would double in six months, then double again, reaching nine million by the end of the year. By the summer of 2000 there were 17 million online." (Clark, 2016: 44)*
	Geographical advantages	*"Hangzhou was far from the IT centers in Beijing and Shenzhen, and the cost of human talent was cheap." (Liu and Avery, 2009:50)*
Strategic and emergent actions of ecosystem orchestrators		
Develop architectural support	Adopt a monolithic architecture with simplicity	*"Buying a website is obviously more trouble-free than building a website, but their dream is not to make a small website, it is to make it bigger, it is not just to buy anyone, the website must have relatively low maintenance costs, and it must be able to expand easily with low secondary development costs. Then comes the second question: what kind of website to buy? The answer is: light and simple. So I bought a website with such a framework: LAMP (Linux+Apache+MySQL+PHP). This is still a very common website architecture model even now. Its advantages are: no need to compile, fast release, powerful PHP language, can do everything from page rendering to data access, and the technologies used are open source and free." (Zhao, 2013:13)* *"From 2006 to 2011, Taobao has changed from a monolithic architecture to micro-service distributed and open architecture." (Leifeng News, June 10, 2021)*
	Adapt the architecture incrementally to meet growing demands	*"At the end of 2003, MySQL could no longer hold up, and the technical alternative was very simple, which was to switch to Oracle. In addition to its large capacity, stability, security, and high performance, the reason for switching to Oracle is also due to talent. Oracle gives some titles to technical experts around the world. The highest level is called ACE. There are only more than 300 people in the world who have been given this title. At that time, there were only a dozen in the world, and there were 4 in Alibaba." (Zhao, 2013: 21)* *"At the beginning of 2004, the problem of SQL Relay could not be solved, and the database had to use Oracle, so where to start? Just change the development language. What language should I change to? Use Java. Java was the most mature website development language at that time. It had a relatively good enterprise development framework and was widely adopted by large-scale mainstream websites in the world. In addition, there are more talents with Java development experience, and the follow-up maintenance cost will be relatively low." (Zhao, 2013:30)*

Develop internal support and adaptation	Acquire resources through visionary leaders and an altruistic culture	*"Employees may come second to customers for Jack, but an ability to motivate his team to overcome obstacles has been critical to Alibaba's success. Joe Tsai didn't hesitate in describing them to me as "disciples" when recalling his first impression in 1999 of Alibaba's earliest employees, some of whom had already followed Jack for years" (Clark, 2016: 18)* *"Most of Ali's employees' nicknames come from characters in Mr. Jin Yong's martial arts works. The use of the martial arts name subtly integrates the chivalrous spirit advocated by the new martial arts into the blood and marrow of employees, and becomes part of the inner temperament and sense of identity of Alibaba employees. "Heroes" have passed away, but the chivalrous spirit of "righteousness", "responsibility", and "words must be practiced" advocated by Mr. Jin Yong has become the spiritual pursuit of many readers who have read Jin Yong's works." (Sina Finance, September 5, 2019) – In line with my observations in Alibaba.* *"The other consequence is that successful businesspeople, having prospered within a framework of order created by officials, feel a deep obligation to give their business purpose. It cannot just be about making money for themselves. The notion that a business should have a wider purpose from the start explains the widespread lack of interest in the trappings of wealth among most of the country's richest businesspeople. It also explains the idealist streak that has so often surfaced in my conversations with these entrepreneurs. "Social responsibility is a part of this," says Alibaba's chief strategy officer, Zeng Ming. "Faced with these kinds of historic opportunities, Jack [Ma] thinks it's our responsibility to make use of them." (Tse, 2015: 32)*
	Promote internal incubation and updates for adaptation	*2001 – Redefine values to manage chaos – "Internal chaos was the price we were paying even as Jack boasted publicly, "Alibaba doesn't plan." New departments formed and disbanded so quickly that nobody had a good sense of who was doing what and who was in charge…These are the core values that everyone will be evaluated on. From now on, everyone will have a quarterly review and scorecard. 50 percent of your points will be based on your performance in reaching goals. The other 50 percent of your points will be based on how well you adhered to Alibaba's core values… And with these values, we will have a new system for hiring, evaluating, promoting, and firing staff" (Erisman, 2015:28)* *"…the Alibaba Group restructures its operations into two divisions: one B2B division, including the Alibaba.com websites, and one consumer division, including the Taobao, Alipay and Yahoo! China businesses." (Alibaba Press Release, 2006)* *"With growing pressure to develop a viable business model, the company launched a new initiative each day, trying to find a product idea that would generate revenues and cover the company's growing costs. We tried banner ads. Revenue-sharing partnerships. Website development for small businesses. We tried everything, but nothing stuck. It was a race for revenue." (Erisman, 2015:21)*
Incentivise platform adoption	Promote free models and subsidies to reduce adoption barriers	*"Since the first day of the establishment of Taobao.com, Jack Ma has given him (Taobao manager) the task of completely forgetting about the charges, expanding the concept of shopping through continuous investment, and popularizing the behaviour of online transactions." (Alibaba Press Release, October 20, 2005)* *"Different from eBay, Taobao allowed sellers to list products on its site commission-free… and provides sellers some free standard services for example setting up a Taobao store." (A6 I interviewed)*
	Provide value-added services to enhance adoption benefits	*"2000, October, Launched Gold Supplier membership to serve China exporters.2001, August, Launched International TrustPass membership to serve exporters outside China. 2002, March, Launched China TrustPass membership to serve SMEs engaging in domestic China trade. 2002, July, Launched keyword services on our international marketplace. 2003, November, Launched TradeManager instant messaging software to enable users to communicate in real time on our marketplaces. 2005, March, Launched keyword bidding service on our China marketplace.... As for Gold Supplier members, we started distributing a web-based business exporter CRM and order management solution designed by our sister company, proval, through our direct sales force in a few selected regions. The AliSoft solution has been well received by our Gold Supplier members, and we have generated additional commission revenue from this cross-selling activity." (Alibaba.com Annual Report 2007)* *"Taobao's growth has been based on four pillars - trust and safety, the AliPay payment system, search and an active marketplace." (Alibaba Press Release, May 10, 2006)* *"In its overall strategic planning, Alibaba Group has now established multiple important fronts to facilitate SMEs doing business online, such as offering platforms for international trade, domestic trade and retail trade, and providing business services related to trading, transaction financing, online marketing and management software... We believe this product enhancement was a win-win strategy for Alibaba.com and our customers. While it increased the satisfaction of both buyers and sellers through the highly sought after product features, it also accelerated sales conversion." (Alibaba.com Annual Report, 2007)*

	Solve trust issues and ensure safety to reduce adoption concerns	*"Yet Alibaba still encountered difficulties winning converts to the e-commerce cause. Some balked at the high costs of buying computers; others lacked personnel with a sufficient understanding of IT. An even bigger obstacle was a pervasive lack of trust. Suppliers worried that customers they had never met might never pay for their orders. Buyers overseas were concerned about fake or defective goods, or shipments that never arrived." (Clark, 2016: 55)* *"TrustPass' most innovative feature is the use of an open Feedback Forum, a live online platform in which members with TrustPass can view and post comments on the quality and service levels of other members. In this open system, common in B2C models but a first for B2B models, members are rated on a series of performance variables…TrustPass is the businessperson's passport to trust online." (Alibaba Press Release, September 10, 2001)* *"In the early 2000s, e-commerce and online shopping first gained popularity in China but there existed a problem in terms of the lack of trust between online sellers and shoppers who did not know each other, which was considered as the biggest hurdle of the industry. Accordingly, Alibaba invented Alipay to enable guaranteed transactions and thus increased the safety of online purchases…Alipay has solved the long-term trust issue in China's thriving online shopping industry, contributing to the explosive growth of Taobao.com in the following years... the robust growth of e-commerce cannot be achieved without the existence of a secure and efficient online payment system." (Lu, 2018: p. 14-15)*
Build legitimacy	Obtain credibility by aligning goals to support resource acquisition and adoption	*"In July 2000 we received a major boost when Forbes put Justin Doebele's story about Jack Ma on the cover of the magazine's "Best of the Web: B2B" edition. The coverage helped push Alibaba's global recognition to a new level and gave us the credibility we needed to attract businesses to the site." (Erisman, 2015: 21)* *"To support Goldman's newest portfolio company, Shirley Lin conducted a series of interviews with media in Hong Kong, even going on local television stations to spread the word about Alibaba." (Clark, 2016:53)* *"Xue Cunhe (SoftBank CEO) recalled in an interview with foreign media that there were four major companies in the B2B field in China at that time. In addition to Alibaba, there were 8848, MeetChina and Sparkice. The important reason for choosing Alibaba was the firm belief of Ma Yun and his team, especially 18 entrepreneurial partners… Softbank not only invested funds in Alibaba, but also gave Alibaba sufficient support in its later development. "There were also many ups and downs along the way, especially during the downturn of the Internet from 2001 to 2003. However, our investors accompanied the entire team of Ali to survive all the way." Xue Cunhe recalled." (Souhu News, November 8, 2007)*
	Share e-commerce knowledge and cultivate e-commerce talents	*"As a leading brand in China's e-commerce training, Ali University will continue to "share e-commerce knowledge, cultivate e-commerce talents, inherit the way of doing business, and spread new business civilization" in the future. For the mission, keep up with the development trend of the e-commerce industry, gain insight into the changes in the industry, be brave in innovation and actively explore, continuously optimise the curriculum system, integrate the resource advantages of Alibaba Group and the strength of excellent merchants, and continuously develop e-commerce for different levels, professions and regions, and training programs to cultivate outstanding e-commerce talents for the society." (Ali University website)*
Emergent actions of other actors		
Suggest new opportunities	Propose new roles	*"The first truly emergent role within the network was the Tao University lecturers. Because so many sellers were inexperienced, knowledgeable sellers were constantly on call with company leadership or platform newbies. Taobao's leadership realized that it needed a new business to properly train and thus support the development of Taobao University. Under this program, Taobao created a framework for experienced sellers to give teaching seminars to users, who would pay to attend in facilities provided by Taobao or through Taobao's online education platform created for the lectures." (Zeng, 2018b: 45)*
	Present new demands	*"As the website's members grew, companies in China began to use the site to connect with one another as well as to the outside world, prompting the launch of a Chinese-language marketplace for wholesalers in China seeking domestic trade leads." (Clark, 2016:54)* *""TrustPass is the businessperson's passport to trust online," said Jack Ma, CEO of Alibaba.com. "We asked our members what they wanted most in creating opportunities online and the answer was 'trust.' With TrustPass, we're pleased to announce a new era of trust in online B2B commerce for SME's." (Alibaba Press Release 2001)* *"Designed with input from Taobao users, Aliwangwang is an early example of the type of "consumer-driven innovation" that drives successful technology firms in China today, such as the role that cell phone vendor Xiaomi's fan club plays in suggesting new product feature." (Clark, 2016: 72)*

		"We soon realized that it wasn't enough for sellers to have a paid listing on Alibaba. Buyers needed to have some assurance that the person they were dealing with was legitimate. So we launched a service called TrustPass. The only way to be certified with TrustPass was for a company to go through a third-party authentication-and-verification process that demonstrated that in fact it was a legal business and the person was authorized to represent the company in trade dealings… It made China Supplier customers (TrustPass members), who paid for that status, appear more trustworthy. It made those members still clinging to their free accounts seem less trustworthy. After all, if they had such a good business, why weren't they willing to pay up a little to prove it (Erisman 2015: 29) *"Taobao's initial development was bumpy. Users had doubts about online transactions – sellers worried whether the money would be collected after sending the goods; buyers whether they would receive the goods after making payment – hence many transactions were conducted in the same city. A buyer in Hangzhou would post an order on Taobao and arrange to meet the seller at an agreed location to physically receive and pay for the goods. It was clear that the "no pay, no goods" mentality would hinder further development. Alipay, launched in 2004, offered a solution by providing an online payment facility and escrow services. Not only did it enable buyers and sellers to send/receive payments, but kept the payment in an escrow account (instead of transferring it from the buyer's account directly to seller's), thus providing the means to claim a refund if the goods/services were not received or failed to satisfy quality expectations." (INSEAD case study 1667, 2020)*
	Present pressure for differentiation	*"I started looking at the market and realized that, pretty soon, eBay was going to try to get aggressive with its business in China. They'd start with consumers, but over time they will start coming after Alibaba's wholesalers. Competition was inevitable. So I decided the only way we can slow them down is to launch a site to compete directly with their Chinese-language site"… "Jack's message to the team was to forget everything about eBay's business model in the United States. It was more important, he argued, to focus on Chinese consumers and develop what they needed rather than what had worked in the United States." (Erisman, 2015: 38)*
	Present win-win collaborations	*"Teaming up with Yahoo! will allow us to deliver an unmatched range of e-commerce services to businesses and consumers in China," said Jack Ma, chairman and chief executive officer of Alibaba.com. "With the addition of Yahoo! China to Alibaba.com's business, we're expanding our services to provide a leading search offering to China's Internet users. In China, Alibaba.com is winning in B2B, winning in C2C, winning in online payments and now we're going to win in search." (Alibaba Press Release, August 11, 2005)* *"The launch of the Alibaba.com Trade Show Partnership Program marks an industry turning point where, instead of regarding each other as competitors, trade show organizers and online marketplaces work together to grow both their businesses.. "In the last five years, it's become clear that trade show organizers and online marketplace operators do best when they focus on their businesses, rather than trying to compete," Erisman said. "The next five years will show that partnerships between the two will be the most powerful way to serve buyers and suppliers. Alibaba.com plans to lead this trend."." (Alibaba Press Release, February 21, 2006)* *"If you can't tolerate your opponents, you will be definitely beaten by your opponent… If you treat your opponents as enemies, you have already lost at the beginning of the game. If you hang your opponent as a target, and practice throwing darts at him every day, you are only able to fight this one enemy, not others… Competition is the greatest joy. When you compete with others, and find that it brings you more and more agony, there must be something wrong with your competition strategy." (Clark, 2016: 62)*
Micro-macro processes (emergent)		
Expand	Ecosystem synergies	*"Taobao's popularity was fueled by a "virtuous circle": More merchants and product listings meant more shoppers were attracted to the site, which meant more merchants and products, etc." (Clark, 2016: 72)* *"We believe if we can increase our customers, we will increase our revenue later and the process will take care of itself" (The Wall Street Journal, November 12, 2008)*
	Re-envision	*The introduction of Alipay will transform Alibaba from an "information exchange platform" to an "online trading platform". (Alibaba Press Release, February 10, 2006)* *"Since it was founded in 1999, Alibaba Group has grown to include the following core businesses: Alibaba.com, Alibaba Group's flagship company and the world's leading B2B e-commerce company; Taobao.com, China's largest consumer e-commerce company; Alipay.com, China's leading online payment service; Yahoo! Koubei, a company providing online classified listings for local services and search; and AliSoft.com, an Internet-based business management software company targeting SMEs in China." (Alibaba Press Release, May 17, 2009)* *"In the early years, Alibaba directed its efforts to becoming, in the company's words, "an e-commerce company serving China's small exporting companies." This objective led to the initial focus on Alibaba.com, which created a platform for Chinese manufacturers to sell*

		internationally. However, as the market continued to evolve, so did the company's vision. With the explosive growth of Chinese domestic consumption, Jack Ma saw the opportunity to expand our e-commerce offerings beyond China's export businesses to include Chinese consumers. The result was the launch of Taobao in 2003. However, Alibaba soon realized that Chinese consumers needed more than just a marketplace for buying and selling. They needed greater confidence in online shopping and assurance that their payments were safe. There were no credit cards in China at the time. Consequently, Taobao expanded its reach with Alipay in 2004, which became a runaway success and greatly sped up the penetration of e-commerce across the country." (Zeng, 2018b: 146) *"The strategy meeting held on September 28 to 30, 2007, was the most important one in Alibaba's history. First, Alibaba's performance was not very well… We were not sure where to head after Taobao's rapid growth… Taobao and AliPay were fighting really hard as to whether AliPay should be a separate platform or operate as a complementary service for e-commerce platforms. The Yahoo we acquired has not obtained any growth after about 2 years efforts and we haven't figured out AliSoft's future direction. The whole Alibaba group was very confused. The topic of that strategy meeting was to discuss where should Alibaba head in the next ten years and what strategies should Alibaba have. The result of the discussion was: fostering the development of an open, collaborative, and flourishing e-commerce ecosystem." (Souhu News, Ming Zeng's speech, December27 2017)* *"Alibaba exemplifies this revisioning approach. When the company started in 1999, the internet reached less than 1 percent of China's more than one billion citizens. While many observers expected penetration to grow, they couldn't predict the precise nature of that growth. In response to this uncertainty, Alibaba applied an experimental approach to our vision. Rather than treat our vision as a given, the company instead posited a vision, given the best working assumption about the future and using all available information. We remained transparent about this approach. As the market evolved and new realities emerged, management regularly and profoundly reevaluated its vision, checking its intuition against reality and modifying the company's goals as appropriate." (Zeng, 2018b: 145-146)*
Constrain	Performance bottleneck	*"Part of it is a cost issue; part of it is whether it can support Taobao's fast-growing business quickly and stably; another part is a key issue that directly determines whether the technology platform can support the continued development of the Taobao platform. That is to say, if you continue to follow the current architecture development, you will soon encounter the bottleneck of platform development, which will no longer be able to bring effective support to the development of Taobao business." (Zhong, 2017: 71)* *"The processing power of an Oracle is limited by the number of connection pools, so the data processing capacity is limited. In addition, its query speed is inversely proportional to its capacity. When the data volume reaches hundreds of millions and the query volume reaches hundreds of millions, it reaches its limit…The architecture of this centralized database makes the database become the bottleneck of the entire system and has become less and less adaptable to the huge demand for computing power from massive data." (Hua Chuang Security Report, 2019: 8)*
	Cost bottleneck	*"According to the scale and speed of business development, the cost of Oracle storage using high-end storage and minicomputers will be difficult to control, so cost reduction is inevitable." (Zhong, 2016: 95)* *"Alibaba's recent investments in cloud computing do not come from a desire to ape Amazon. They came from company leadership's realization in 2008 that IT expenses paid to companies like Cisco and Oracle would soon outstrip the company's entire revenue stream, not just its e-commerce businesses. To avoid being crippled by IT expenses, Alibaba decided to invest in its own cloud-computing capabilities." (Zeng, 2018b: 55)* *"Around 2008, the surge in users and the increasing amount of data generated by users, and the rapid development of Ali's business have caused the use of existing IT equipment to reach a bottleneck. Taobao and Alipay have a large number of high-end equipment such as IBM minicomputers and Oracle databases. These minicomputers are expensive, and the cost of database software signed with Oracle is also extremely high. Coupled with a large maintenance fee, Ali's technological development has entered a period of great pressure period." (TMT Post News, July 7, 2014)*

The data shown in this table only represent a subset of my analysis for illustrative purposes. The complete set is available from authors on request.

Table 8.Error! Unknown switch argument. - Code structure - Phase 2

Phase 2 Ecosystem empowering (2007-2014)		
Aggregate dimensions and second-order codes	**First-order codes**	**Representative data/quotes/excerpts**
Ecosystem future probes and synergies		
Ecosystem future probes	Ecosystem mission	*"Mission: To Make it Easy to Do Business Anywhere." (Alibaba.com Annual Report, 2008)* *"Our mission is to make it easy to do business anywhere." (Alibaba Annual Report, 2015)*
	Ecosystem phasic vision – ecosystem empowering	*"Since its launch in 2003, Taobao has grown into an ecosystem where over 1 million online merchants reach a growing online consumer population in China…The Taobao Ecosystem encompasses third-party service providers in payment, verification, logistics and is China's largest community of online merchants and consumers…With the combination of Taobao and Alimama we are adding strength to strength. There is a lot of synergy between the two businesses that can be unleashed. Sellers on Taobao can now gain added exposure to millions more consumers through Alimama's web publisher partners, while these publishers can tap new revenue sources from among Taobao's merchants. And the real winners of this combination will be Taobao's consumers, a bigger and better Taobao Ecosystem will attract more merchants and bring more choice for consumers." (Alibaba Press Release, September 4, 2008)* *"Alibaba Group has been a persistent champion of creating open and vibrant ecosystems, as openness is the inevitable way forward for the Internet industry," said Zeng Ming, Chief Strategy Officer of Alibaba Group. "In a future that will be increasingly driven by consumer demand, an open eco-chain is essential to enable innovation and specialization that can satisfy ever more sophisticated customer needs and expectations." "**Taobao Mall itself will not sell merchandise nor become a retailer**, and will continue to focus on its core competency as a B2C platform **that helps brands and retailers to grow and flourish**," said Zhang. "We are not weighted down by the low gross margin pressures of taking on our own inventory. Our platform business model enables us to re-invest our profits towards better customer experiences and support for merchants."" (Alibaba Press Release, September 19, 2011)* *"There was no way Taobao could provide all the services of offline retail by itself. Inspired by early successes such as the Wangpu storefront platform, which had led to the creation of many software service providers, Alibaba articulated a new strategy: fostering the development of an open, collaborative, and flourishing e-commerce ecosystem. The company positioned itself as a platform with the goal of developing the infrastructure to fully enable online commerce. With this step, Taobao entered a new stage of development, powered by the explosive growth of the collaborative business networks built on top of it. As the system grew in complexity, it had to develop data intelligence to improve coordination." (Zeng, 2018b: 41)* *"Building e-commerce infrastructure and cultivating an open, collaborative and prosperous e-commerce ecosystem is the core development strategy of Alibaba Group in the future. This strategy includes multiple levels such as business ecosystem and social ecosystem, and the concerns of stakeholders such as customers, partners, employees, shareholders, society, and the country have also been fully reflected in it." (Alibaba CSR Report 2007)* *"In 2009, Alibaba updated its vision: Alibaba aims to become the first data sharing platform, become the company with the highest happiness index, and live 102 years." (Ming Zeng, Hupan University 2nd class, 2016)*
Ecosystem synergies (new)	Support generative changes through indirect network effects	*"AliSoft is endowed with the mission of "letting the world have no unmanageable business", and its ecosystem strategy is manifested in promoting the service of software and achieving a win-win situation with multiple parties. For users, AliSoft advocates "sell as much as you use, try first and then buy". For software peers, AliSoft is committed to building a platform, providing an easy-to-use development environment and charging system for other software companies, and bringing tens of millions of SME users to its partners." (Alibaba CSR Report 2007)* *"Taobao will soon open its technology platform to independent software vendors (ISVs) to develop applications for Taobao's substantial user base, including advanced product display and special visual effect functionalities." (Alibaba Press Release, October 8, 2008)* *"Taobao, the largest online shopping destination in China, has launched the Taobao App Store and will invest RMB10 million (US$1.46 million1[1]) to foster promising independent software developers via the Taobao Open Platform (TOP) fund every year. The Taobao App Store (http://app.taobao.com) will offer solutions created by independent developers through TOP for Taobao merchants and consumers. The first batch of applications available in the store is the top 30 applications identified through the "Win at Taobao"*

	competition held by TOP…The Taobao App Store will offer products across a range of categories to meet the needs of all Taobao users, including tools for sellers and buyers; extensions for Taobao community sites; tools for product recommendation; and mobile phone applications. For Taobao sellers, the applications will aim to improve their business management and back-end operation functionality while buyers will be offered tools to improve their shopping experience. Software developers will be able to generate revenue from their applications through subscription fees, commissions or advertising, depending on the type of service offered and popularity of the product." (Alibaba Press Release, January 15, 2010) *"Third-party developers can opt to either develop cloud apps over their own servers or choose to use AliCloud's infrastructure and open platform services at a low cost and quickly develop their businesses. The cloud OS is the result of three years of development and uses AliCloud's self-developed distributed file system and virtual machine; the cloud OS is also fully compatible with Android-based applications." (Alibaba Press Release, July 28, 2011)* *"Alibaba Group, a global e-commerce leader and the largest e-commerce company in China, today announced the official launch of Alimama (www.alimama.com), an online advertising exchange which allows web publishers and advertisers to trade online advertising inventory…Since launching the beta version of the marketplace on August 10, Alimama has already signed up more than 150,000 small- and medium-sized web publishers and 135,000 personal blogs, covering more than 1 billion page views per day. The exchange has over one million registered users with an inventory of more than 380,000 advertisement positions available for purchase, with transactions for more than 20,000 advertisement positions occurring each day. Alimama continues to grow at a rapid rate, adding 4,000 small and medium sized websites and 10,000 personal blogs each day...Alimama's growth is expected to encourage the growth of the Alibaba Group's member companies which operate in distinct, but complementary areas of e-commerce." (Alibaba Press Release, November 20, 2007)*
Support generative changes through data-driven learning and data network effects	*"Taobao, the largest online retail destination in China, is launching an initiative to help small businesses harness the power of data-mining to make sound strategic growth decisions by offering for the first time access to its database of aggregate consumer transaction records. Taobao hopes that this new data sharing service, the most extensive of any e-commerce platform in the world, will empower its small business customers to gain additional insight into important aspects of their businesses such as inventory, product design and offerings." (Alibaba Press Release, March 31, 2010)* *"At the same time, the algorithms that calculate credit scores are themselves evolving in real time, thus improving the quality of decision making. MYbank's model is built on probabilistic reasoning. Rather than an exact theory of why certain traits will differentiate between good and bad borrowers. Algorithms improve their own predictive power through continuous iteration. If a seller with terrible credit pays back a loan right on time, or a seller with stellar credit catastrophically defaults, the algorithm clearly needs tweaking. The algorithms are built so that it is easy to digitally check their assumptions and make small but important changes. Which parameters should be added or removed? Which parameters connected to which kinds of user behavior should be given more weight? Most banks would take at least half a year to recalibrate their models." (Zeng, 2018b: 60)* *"The two companies have agreed to work together to deliver to consumers an online shopping experience connected to Intime's physical stores and membership system. For example, Alibaba's Tmall.com—China's leading online mall for quality, brand-name goods— will have access to Intime's offline inventory product database, enabling a broader product selection of international brands as well as fulfillment of online orders from Intime's physical stores. Harnessing Alibaba's experience in mobile Internet retail, customers will also be able to take advantage of more targeted promotions and membership benefits by connecting their smartphones via wi-fi and location-based technology in Intime stores. Customers will also be able to use virtual pre-paid cards in department stores and for mobile points of sale through the Alipay mobile wallet." (Alibaba Press Release, March 31, 2014)* *"Every export transaction involves a very long process and a large amount of data can be generated in each stage – from the signing of a deal to customs clearance, tax rebate application, and logistics. By providing small businesses with integrated export services, we can now be a part of their transaction processes and accumulate solid transaction data. Going forward, such real transaction-based data can serve as the credentials of export businesses on our platform," said Sophie Wu, Vice President of Alibaba Group and head of Alibaba.com." (Alibaba Press Release, May 13, 2014)* *"If companies selling coffee get on the ecosystem of Alibaba, then Alibaba will know who buys coffee at what time at what location. If companies selling snacks work with Alibaba, then Alibaba will know who likes what types of snacks and prefers to buy from which channel." (A7 I interviewed)*

Stack generic resources for sharing and optimising	*"By linking up merchants, third-party vendors and logistics partners in a standardized framework, we hope to create a more effective and economical distribution channel that will allow merchants to not only offer quality products but also differentiate themselves through quality point-to-point service to consumers in a crowded retail environment." (Alibaba Press Release, November 1, 2010)* *"Introducing cloud apps to mobile devices not only brings a whole new user experience, but also greater ease for third-party mobile software developers who will be able to use Internet technology such as HTML5 and JavaScript to reduce the complexity in the app development process…The cloud OS will feature cloud services including e-mail, Internet search, weather updates and mapping&GPS navigation tools. A distinguishing feature of the cloud OS is its support for web-based apps. These offer users an Internet-like experience and do not require the user to download or install application software on their mobile devices. Cloud OS users can seamlessly synchronize, store and back-up data such as contact information, call logs, text messages, notes and photos to AliCloud's remote data center, and can also access and update this data across all their PC and mobile devices. AliCloud will provide each cloud OS user with a total of 100 gigabytes of data storage initially, with plans to expand according to user needs." (Alibaba Press Release, July 28, 2011)* *"Taobao, the largest online retail destination in China, is launching an initiative to help small businesses harness the power of data-mining to make sound strategic growth decisions by offering for the first time access to its database of aggregate consumer transaction records. Taobao hopes that this new data sharing service, the most extensive of any e-commerce platform in the world, will empower its small business customers to gain additional insight into important aspects of their businesses such as inventory, product design and offerings…"We will be sharing raw aggregate data with customers and users as we believe they will find this information extremely valuable in terms of planning and business growth efforts," said Jonathan Lu, president and CEO of Taobao. "As a data-driven company, Taobao uses extensive data-mining to continuously improve the user experience on our platform. Today we want to share this valuable resource with everyone, particularly the small businesses on Taobao, to help people make smarter decisions in managing their businesses, which will also lead to greater job creation and economic growth." "With better data, consumers will be able to shop more intelligently while manufacturers will be able to better customize product offerings to suit consumer needs," says Zeng Ming, chief strategy officer of Alibaba Group. "As part of our commitment to ushering in an e-commerce-driven new business paradigm founded in openness, transparency, sharing and responsibility, we believe data like this is meant to be shared."" (Alibaba Press Release, March 31, 2010)* *"This direction is grounded in Taobao's principals of openness and sharing, and our goal is to create a framework for merchants and service provider partners that will allow each to optimize their own competitive advantage so as to establish a new B2C e-commerce ecosystem that will collectively serve the needs of Chinese consumers." (Alibaba Press Release, November 1, 2010)* *"We already see meaningful changes taking place today in the operations of our merchants' businesses. For example, every day, more than 6 million businesses currently use our merchant mobile app, called Qianniu, which helps them improve sales and marketing, as well as enhance overall management quality and efficiency." (Letter from CEO Jack Ma, 2016)*
Sustainable growth	*"In 2011, we will focus on stabilizing our existing businesses and accelerating the upgrade of our business model. After the strong customer growth in the past two years, we have reviewed the pace of our acquisition of new paying members. With our "Customer First" philosophy, we believe it is crucial for the quality of our service to keep up with our membership growth in order to ensure customer satisfaction and to improve the value we provide. We have decided in 2011 to place more emphasis on making our platform a safe and trusted place for e-commerce, enhancing our services to our existing paying members rather than accelerating member acquisition. We will enhance Gold Supplier and China TrustPass customer experience through service upgrades that we hope will result in a stable membership base and healthy, sustainable growth." (Alibaba.com Annual Report, 2010)* *"Our business continues to perform well, and our results reflect both the strength of our ecosystem and the strong foundation we have for sustainable growth." (Alibaba Press Release, November 4, 2014)* *"By 2007, the development of e-commerce itself was entering the stage of in-depth application. In the next few years, e-commerce will penetrate into a wider range of economic and social fields at an accelerated rate. Alibaba Group believes that the decentralizational efforts have become more and more difficult to promote e-commerce to a new level at present. In order to promote industrial progress, Alibaba Group will strive to implement an ecosystem development strategy in the future. The essence of this strategy is to focus on the business transformation in the next few decades, cooperate with the most extensive industrial and social forces, build and improve the e-commerce infrastructure, and jointly cultivate an open, collaborative and prosperous e-commerce ecosystem. In the process, the operating efficiency of the entire industrial chain will be improved, and Alibaba Group will also create sustainable value for all*

		ecosystem partners... Alibaba Group believes that corporate social responsibility should be inherent in the business model and integrated into the corporate development strategy. Only by making social responsibility the inner core gene of the enterprise can it have permanence and sustainability. It will be difficult to obtain the internal motivation for sustainable growth if it breaks away from the foundation of the enterprise, such as business model, development strategy and core value system, and constructs social responsibility, and it will be difficult to carry out in the long run." (Alibaba CSR Report 2007)
Macro-micro processes (emergent)		
Trigger	Ecosystem bottlenecks	*"Alibaba's recent investments in cloud computing do not come from a desire to ape Amazon. They came from company leadership's realization in 2008 that IT expenses paid to companies like Cisco and Oracle would soon outstrip the company's entire revenue stream, not just its e-commerce businesses. To avoid being crippled by IT expenses, Alibaba decided to invest in its own cloud-computing capability." (Zeng, 2018b: 55)* *"In the early years, many Taobao sellers had offline businesses and sourcing channels, but by 2008, many new merchants joined the platform in a rush for online gold. They faced the challenge of building their businesses completely from scratch, online. Taobao then had to bring into the online network the many functions of brick-and-mortar retail so that every seller could access them. As time went on, the Taobao marketplace even began to incubate new functional roles unknown to brick-and-mortar retailing. There was no way Taobao could provide all the services of offline retail by itself. Inspired by early successes such as the Wangpu storefront platform, which had led to the creation of many software service providers, Alibaba articulated a new strategy: fostering the development of an open, collaborative, and flourishing e-commerce ecosystem." (Zeng, 2018b: 40-41)*
Support	Regulatory support	*"Though personal financial services can be highly controlled by the government, in actuality it's a grey area in terms of regulatory intensity in China - and financial officials have been willing so far to allow Alibaba to continue running Yu'e Bao. This suggests they are happy with the effect competition is having in helping them move toward the government's long-stated goal of interest-rate liberalization." (Tse, 2015: 23)* *"On June 1, 2007, the National Development and Reform Commission and the Information Work Office of the State Council jointly issued the country's first "Eleventh Five-Year Plan for E-commerce Development". The "Plan" clearly puts forward the overall goal of the country's e-commerce development during the "Eleventh Five-Year Plan" period: by 2010, the coordinated development pattern of e-commerce development environment, support system, technical services and promotion and application will be basically formed, and the e-commerce service industry will become an important emerging industry, and the application level of e-commerce in various fields of national economic and social development has been greatly improved and remarkable results have been achieved." (National Development and Reform Commission website, 2007)* *"Speaking in 2015, Jerry Yang took stock of the China Internet market: "Maybe in the next ten years some American or Western brands will be successful in China. But in that 2000–2010 timeframe there just weren't any." (Clark, 2016: 86)* *"With continued support from the China Government, the SME sector, which is Alibaba.com's target customer segment, remains vibrant." (Alibaba.com Annual Report, 2007)*
	Macroeconomic cycle	*"The Chinese economy was growing at an unprecedented rate, topping 14 percent in 2007. Anticipation about the 2008 Olympic Games in Beijing set off a massive stock market rally at home. Western capital poured into China and the share prices of the country's leading Internet players took off. Baidu's stock trebled in 2007, valuing the company at over $13 billion. Tencent, with more than 740 million QQ instant messaging users and a growing games business, climbed to $13.5 billion. A new wave of China Internet companies prepared to go public." (Clark, 2016: 87)* *"Alibaba.com's IPO ushers in a new era of e-commerce development and we look forward to pioneering an e-commerce ecosystem that benefits businesses in China and around the world." (Alibaba Press Release, November 6, 2007)*
	Increased internet access and broadband penetration	*"The rapid growth in Internet access and broadband penetration has also facilitated the growth of our business. In 2007, growth of the Internet market in China continued. According to China Internet Network Information Center, the number of Internet users in China grew by 53% to reach 210 million in 2007, and China's broadband Internet users also increased significantly by 80% to reach 163 million, representing a broadband penetration of 78%. This, together with China's buoyant economy and growing SME sector, generated strong demand for e-commerce activities." (Alibaba.com Annual Report, 2007)*
Strategic and emergent actions of ecosystem orchestrators		

Restructure architectural design	Shift to a micro-service distributed and open architecture to solve performance bottlenecks	*"From 2006 to 2011, Taobao has changed from a monolithic architecture to micro-service distributed and open architecture." (Leifeng News, June 10th, 2021)* *More detailed processes have been summarised from the book Zhao 2016.* *"During the year, we continued to upgrade and enhance our technology platform through infrastructure enhancement and innovation. We established a new data center in Hong Kong to further improve our website recoverability and business continuity. In addition, we invested in our core network infrastructure and significantly strengthened our network capacity to ensure scalability for future business growth. Our technology platform was upgraded with several innovative features, including advanced machine-learning technology and image-based search that improve user experience. Our architecture has also been improved with enhanced scalability and reduced hardware cost." (Alibaba.com Annual Report 2008)* *"If we disassemble the changes in Alibaba Cloud-native practice in the past fifteen years, it must be inseparable from this logic: self-research, self-use, and open the cloud to the public. The first stage: From 2006 to 2011, Taobao Mall switched from a centralised architecture to a microservice distributed architecture, focusing on solving the problems of high availability and stability. The second stage: From 2011 to 2015, we began to invest in containers to solve the problems of cost and operation and maintenance efficiency. The third stage: from 2015 to 2019, promote the comprehensive commercialization of product technology and fully embrace cloud-native standards. The fourth stage: from 2019 to the present, from supporting the full cloud migration of the double 11 core system to supporting the full cloud nativization of the core system." (Interview of Alibaba Cloud-native application platform manager, Leifeng News, 2021, June 10)* *"APIs, a set of tools that allow different software systems to "talk" and coordinate with one another online, have been central to Taobao's development. As the platform grew from a forum where buyers and sellers could meet and sell goods to become China's dominant e-commerce website, merchants on the site needed more and more support from third-party developers. New software had to be broadly interoperable with all other software on the platform to be of any value. So in 2009, Taobao began developing APIs for use by independent software suppliers. Today, merchants on Taobao subscribe to more than 100 software modules, on average, and the live data services they enable drastically decrease the merchants' cost of doing business. Getting the technical infrastructure right is just the beginning. It took tremendous effort for us to build a common standard so that data could be used and interpreted in the same way across all of Alibaba's business units." (Zeng, 2018a: 94)*
	Take off IOE, embrace open source and develop own core technology system to solve cost bottlenecks	*"At present, Alibaba is promoting "Take off IOE" and is evolving from "commercial software" to "open-source software", and then to "independent technology + cloud computing"." (Wang, 2016: 22)* *"Alibaba Cloud was established in October 2009 with the goal of building the first platform for Internet data sharing and becoming a data-centric cloud computing service company." (51CTO, December 27, 2012)* *"The technologies that power Alibaba Cloud grew out of our own need to operate at the massive scale and to address the complexity of our China businesses, including related payments and logistics elements." (Alibaba Annual Report, 2022)* *"As a company that exports technology, Alibaba Cloud needs to be on the same "aircraft" as our customers, not just "build aircraft" or watch "aircrafts" flying in the air. The most important thing for the cloudification of the Alibaba economy is to make us and our customers on the same "aircraft"." (Wang, 2016)*
	Develop the Data Middle Platform to enhance data management and utilization efficiency	*"Alibaba's data volume is beyond the universe, and because of the complexity and diversification of business scenarios, Alibaba faces even more complex problems than Google and Facebook. Most of the time, Alibaba is trudging through no-man's land. Each set of functions and logic, each set of architecture and system is closely related to business and scenarios. This black hole is expanding so fast that most of the time, there are pain points that stimulate the architecture upgrade." (Preface by Zeng in the book <Alibaba Big Data Practice> 2017)* *"In Alibaba before 2014, our computing resources were scattered everywhere, and our data indicators often conflicted with each other. Most of our data applications were developed vertically from the data source upwards and spent a lot of resources. This situation cannot sustainably promote business digitization and data servitization. As a result, Alibaba's data-intensive collaboration started from a business perspective rather than a purely technical perspective to build an intelligent big data system that is both "accurate" and "fast". During the period, while pursuing technological improvement, we established three major systems of OneData, OneEntit and OneService, and developed products such as Dataphin dedicated to intelligent data construction and management, and Quick BI*

		for efficient data analysis and presentation, and cultivated a large number of Big data talents with unique Ali characteristics. Cloud Data Middle Platform came naturally." (Deng, 2018; III) *"The Data Middle Platform was originally a solution proposed by Alibaba based on its own rapidly growing data processing and usage needs, and it was tested internally in Alibaba in the early stage, incubated and applied, and then pushed to the external market after the model matured." (Technology Service Standard for Data Middle Office Delivery Report, 2022)*
Conduct internal consolidation and systematic updates	Enact Shared Service Division, One Company strategy, Decouple, and leadership rotation to enhance internal synergies	*"Jack Ma, Alibaba Group's Chairman and Chief Executive Officer, said, "With the combination of Taobao and Alimama we are adding strength to strength. There is a lot of synergy between the two businesses that can be unleashed. Sellers on Taobao can now gain added exposure to millions more consumers through Alimama's web publisher partners, while these publishers can tap new revenue sources from among Taobao's merchants. And the real winners of this combination will be Taobao's consumers, a bigger and better Taobao Ecosystem will attract more merchants and bring more choice for consumers."" (Alibaba Press Release, September 4, 2008)* *"In 2009, the Shared Business Division came into being. The main members came from the previous Taobao technical team. In terms of organisational structure, it became a separate division with the same level as Taobao and Tmall. In this way, the (Alibaba) Group hopes to better allow the technical team to support both Taobao and Tmall's businesses, and at the same time sort out and precipitate the two sets of e-commerce businesses, precipitate the common and general business functions of the two platforms into one platform, share the business division, avoid duplication of construction and maintenance of some functions, and make more rational use of technical resources." (Zhong, 2017: 19)* *More detailed processes have been summarised by me from the book Zhong 2017 in Chinese and Hua Chuang Security Report 2019 triangulated with primary data such as interviews and observations.* *"In June 2011 at Yongfu Temple, Alibaba announced that Taobao would be "dismantled into three parts", and then began intensive strategic and organisational adjustments of "not being an empire, but becoming an ecosystem"." (Sina Finance, Four Strategic Turning Points Affecting Alibaba's Historical Trend, March 30, 2020)* *"From January 1, 2013, Alibaba will officially adjust the organisational structure and rebuild the company's ecosystem. A core word is to "Decouple"." (Huxiu News, December 17, 2012)* *"In June 2012, to promote the "One Company" concept, Alibaba privatized Alibaba.com, which had been listed on the Hong Kong Stock Exchange since November 2007. Alibaba.com consisted mainly of the organisation's B2B businesses. Alibaba claimed that it had plans to restructure and make all of its businesses public." (Ho Park and Zhao, 2016; 7)* *"On the afternoon of March 9, 2012, Alibaba Group announced today that in order to strengthen the synergy of various businesses, organisation and talent flow of the group, more than 20 middle and senior management cadres in the organisation department of the group will be rotated." (Hexun News, 2012 March 9)* *"We firmly believe that by strengthening our management team's international exposure, encouraging these senior managers to continuously learn and to enhance their skills and knowledge, and placing them in different positions within Alibaba Group, Alibaba Group will be able to groom world-class business leaders for its long-term sustainable development, as well as to build further synergies among our member companies." (Alibaba.com Annual Report, 2007)*
	Set up the Horse Racing process to systemise internal incubation	*"In 2010, Lu Zhaoxi, who was the president of Taobao at the time (now the CEO of AliGroup), proposed the idea of Taobao's internal entrepreneurship—horse racing. It was her fourth year in 2013. During this period, products and businesses such as Taobao iPhone main client interface, "I want to send express", and "Taobao classmates" were incubated. Horse racing itself has also moved from Taobao to the group, becoming a unified innovative brand within Ali, carrying the innovative culture, and has made its own practice in the exploration of new organisational forms." (BenchMarking News, February 20, 2017)* *"To ensure that governance initiatives are in place for the smooth running of the internal orchestration and ecosystem orchestration…. Inside the company, Alibaba has made various beneficial attempts in terms of governance model, organisational model, and innovation model, such as the "partnership system", "building a sharing platform", and exploring the innovative mechanism of "horse racing", etc." (Future Platform Organisation Research Report by AliResearch and BCG, September, 2016)* *"In the years that followed, Alibaba Group incubated several affiliate companies… Tmall: In 2008, Tmall was separated from the rest of Taobao as a site for the big brands and retailers. Its sellers pay a commission, normally ranging from 0.4 to 5.0 percent, for premium service. AliExpress: This international e-commerce site, launched in 2010, connects Chinese sellers with the rest of the world. Cainiao Network: Alibaba launched this smart logistics platform in 2012. Ant Financial: In 2014, Alibaba launched Ant Financial Services.*

	This company now lends to consumers and small businesses across China. Web-celeb companies: 2014 saw the first wave of web celebrities starting their own companies." (Zeng, 2018b: 21) *"Just as Welch did not dictate an overall theme or strategy for GE, Ma preferred not to set one agenda from Alibaba's corporate center, but rather to have each subsidiary set its own strategy. Much like Welch's famed "#1 or #2" objective for each of this businesses, Alibaba's governance inspired its subsidiaries to be the leaders of their respective industries. Ma explained, "Business unit presidents must have the freedom to do what is right for their business. I want business units to compete with each other…and focus on being the best in their businesses." (Wulf, April 26, 2010, HBS case study Alibaba Group)*
Develop ecosystem-friendly KPIs and social enterprise governance mechanisms	*"In 2010, Ma Yun (Jack Ma) a new set of KPIs: "Shopping is Taobao, Small business is Alibaba, Payment is Alipay, and computing is AliCloud". Why? Previously, the KPIs were "Taobao is shopping, Alibaba is for small businesses, Alipay is an online payment tool, and AliCloud is for computing". He reversed it to mean that you must become the basic knowledge of this industry. The future shopping experience is defined by Taobao, and the computing standard is defined by AliCloud. When you think of payment, you only think of Alipay, which is actually a very high KPI. These four sentences belong to each business unit manager, and each of them has to think about how to achieve it. It used to be a dessert, but now it is the mainstream. You need to recognize it and make breakthroughs in the mainstream." (Ming Zeng, Hupan University 2nd class, 2016)* *"In 2012, Ma Yun (Jack Ma) proposed KPI "Double Millions", which is completely different from the previous idea. One million sellers need to earn more than one million a year in three years - this is completely consistent with the principle of ecosystems". (Ming Zeng, Hupan University 2nd class, 2016)* *"Ali faced three key issues at that time (2010): The first is the transformation and upgrading of Taobao and B2B; the second is the healthy development of Taobao's ecosystem; the third is the mechanism and organisational building for complex environments and large economic volumes…The idea of the second question is to find out the indicators that can reflect the ecosystem health. For a long time, Taobao has been operating in an atmosphere where GMV orientation is strong, and at the same time power is delegated to Xiao Er [shop assistants]. Then after the search upgrade, search gradually became the main path of traffic. At this time, the product that adapts to the environment is naturally to break through Taobao's traffic leverage with low-priced hot items. The proliferation of low-priced explosive products has further led to the homogeneity of products, making it difficult for small sellers to survive, not to mention a series of problems such as fake products, speculation, and professional bad reviews. Ma Yun has been thinking about this for at least a year. Throughout 2011, he emphasized to the Taobao team that KPIs are the realization of ideals, not the indicators of performance. At the beginning of 2012, he proposed "Double Millions", that is, within three years, there must be 1 million sellers on Taobao with an annual turnover of more than 1 million yuan. Soon the Taobao team realized that it was necessary to optimize the search-based traffic path, and to help and support small sellers. So Taobao has been mentioning "SNSization of traffic" and "small and beautiful" in the past two years, including the "Wudang Daddy" case mentioned by Liang Ning later, with the background of the "Double Million". (Sina Finance, Four Strategic Turning Points Affecting Alibaba's Historical Trend, March 30, 2020)* *"The third issue is to use social governance methods to operate social enterprises. At that time, Ali experienced a series of syndromes of large platform companies, including merchant relations, rule-making, clean governance, frequent structural adjustments and personnel evaluations for job rotations, executive efficiency and innovation vitality, etc. Ma Yun gradually realized that Ali is actually a social enterprise, and the best way to learn to "operate a company well with the thinking of managing society" is to learn from advanced social institutions, especially the government. For example, learn from the Singapore government's experience in macroeconomic regulation, and use the principle of "civil society" to make up for the shortcomings of the Taobao ecosystem market mechanism, so there will be a series of measures to "return rights and empower" merchants. At the same time, similar ideas are also applied to improve the corporate governance system, not only learning from the partner system of McKinsey and Goldman Sachs, but also absorbing the experience of the Senate system in ancient Rome and the Philadelphia Constitutional Convention in the partner system, forming a partnership system. The prototype of the partner responsible person and cultural inheritance + strategic decision-making committee responsible for top-level strategic design + strategy executive committee responsible for implementation has been formed. The tasks of each layer are clear, which can not only expand the scope of discussion and participation, but also moderately isolate the side effects of large-scale personnel changes." (Sina Finance, Four Strategic Turning Points Affecting Alibaba's Historical Trend, March 30, 2020)*

Promote ecosystem adoption	Leverage dynamic enabling to develop new markets and enhance platform adoption	*"You can basically position them as supplements although it doesn't sound good. Alibaba provides basic products, such as rice and white steamed buns, so you won't be hungry. These places (service providers) are cakes, snacks, side dishes, and snacks. What Alibaba provides is standardised and universal, put into a more pleasant way to say that these service providers do things that Alibaba can't do and can't do well. These service providers at the same time can't provide stability and reliability (like Alibaba does) because you have to provide services at tens of millions and 100 million levels.. From a strategic perspective, even if it is an ideal or something, it is also a way to make the cake bigger together…Because the time cost and opportunity cost of these people are invested, they are familiar with this set of things. If you ask them to learn other ecosystems, they will struggle after learning Alibaba's.." (A6 I interviewed)* *"It remains our firm belief that the welfare of our company is deeply intertwined with the welfare of our customers – only if e-commerce can successfully help our SME customers triumph against the hardships will Alibaba.com emerge triumphant as well." (Alibaba.com Annual Report, 2008)* *"Despite such strong beliefs, however, there were still many occasions when our people wanted to be in control, to do things on their own, and in the process ended up competing against our partners. When such things happen, partners start to doubt whether they can make money on your platform, and this may hamper ecosystem momentum. For example, we once introduced standard software for store design, hoping to provide a helpful service and make some extra money. However, it soon became apparent that our solution could not meet the diverse needs of millions of power sellers, and at the same time, it also impacted the business of service providers who made their living through sales of store design services. Later, we decided to offer a very simple basic module for free and left the added-value market to our partners." (Zeng, 2015: 28)* *"To achieve flexibility, you cannot plan any network meticulously. It must develop according to the actors that enter and the consumers it serves. In practice, this means that participants' roles initially need to remain fuzzily defined. This unformed state might sacrifice some efficiency, but it allows for emergent forms of collaboration with new functions and capabilities. When roles do solidify, the platform can "recognize" them by giving them official support and a status within the network. In practice, a player's role is recognized when official avenues allow it to generate income." (Zeng, 2018b: 45)*
	Spawn platforms to increase ecosystem adoption and enhance data gathering	*"Ali has a way of thinking - the core of its value creation is to form one platform after another. There are some things that are born to be platforms, but some things are not, but he still builds them as platforms. For example, the logistics business is not a platform by nature… Ali thought clearly from the first day that he wanted to build a platform. He built a platform to connect all logistics companies. What Cainiao does is to link. If you go to my Cainiao platform to ship, then I will pass your order through my distribution system to various logistics companies, and it is still a platform. What he has to do is to first establish a platform, and second to connect the two sides of the platform, at least one of which has strong control. For example, regarding the Cainiao platform, Ali has strong control over merchants through its e-commerce platforms and use its access to these merchants to get logistics companies onboard for the Cainiao platform." (A14 I interviewed)* *"In terms of logistics, Ali focuses on platform business and does not do self-operated logistics. Instead, it connects Retail Express and Cainiao Network to improve warehouse distribution efficiency and information tracking." (Hua Chuang Security Research on Alibaba, July 12, 2020)* *"As the basic technical support in Alibaba's strategic layout, Alibaba Cloud is not doing cloud computing itself, but building a platform to realise the commercial value of e-commerce. Connect the upstream and downstream of services, open up the ecosystem, and use cloud services to optimise user trading behavior. In addition, data mining of individual and corporate users helps Ali's external financial business to carry out product pricing and credit evaluation, so as to achieve the purpose of risk control." (Pingan Security Research on Alibaba, December 15, 2014)* *"What we build is the infrastructure for future commerce. We empower merchants engaged in buying and selling, rather than compete with merchants engaged in buying and selling. From this point of view, the so-called our 'competitors' are actually the objects of our empowerment and help in the future. To simply regard the companies engaged in e-commerce in today's market as Alibaba's competitors is to compare apples with apple trees, which is inappropriate for both parties." (Alibaba Letter to Shareholders from Executive Chairman Jack Ma, 2015 October 8)* *"Alibaba.com's business in the early years was driven by a focus on rapidly increasing the number of manufacturers, trading companies and wholesalers that pay a subscription fee to sell products on the company's marketplaces in order to maximize revenue growth.*

		Last year, the company implemented a major initiative toward improvements in the quality of the buyers' experience on the company's online marketplaces… Alibaba.com outlined this strategic shift….” (Alibaba Press Release, February 21, 2012) *“In the 15 years of ups and downs since its establishment, Alibaba has never forgotten its original intention, adhered to the mission of "making business easy to do in the world", insisted on serving small and medium-sized enterprises, insisted on developing platforms, and provided "water, electricity and coal" for Chinese e-commerce.” (Alibaba CSR Report, 2012-2013)* *“Ali enhances its own network effect by increasing network connection points. Ali's e-commerce network mainly connects goods and services, and there is still a lot of room for improvement in terms of attract attention and traffic retention. Ali is enriching traffic sources and commodity categories by increasing the points connected in the connection chain. The specific measures are first, to increase the connection points of international buyers through the layout of export cross-border e-commerce, and to increase the connection points of national sellers through the layout of import cross-border e-commerce; second, to increase the connection points of domestic networks by opening up vertical markets.” (Dongxing Securities Research, March 30, 2020)* *“Ali makes up for the lack of network effects to enrich its own ecosystem. First, in terms of social networking, the traffic and stickiness naturally generated by social network effects are greater than those of e-commerce. DingTalk is Ali's sharp tool to improve the network effect of social tools (commercial social + campus social). DingTalk's future positioning is to help enterprises carry out digital transformation, and is helping ecosystem partners achieve rapid development. At the same time, DingTalk's application scenarios are in line with digital education, and the epidemic situation has given DingTalk wings to fly; second, in terms of content, the advantage of content-based companies such as Douyin and Kuaishou lies in the large number of connection chains (the platform algorithm accurately recommends content), low connection costs, higher user willingness to pay, and increasing user stickiness. A major means for the e-commerce network to make up for the lack of its own content attributes is to strengthen the content-based network effect through content e-commerce (live broadcast, short video) and other new tracks. From the perspective of "field", short video is becoming the most popular application among users. Content-based e-commerce includes content platform e-commerce and e-commerce platform content.” (Dongxing Securities Research, March 30, 2020)*
	Ensure fairness and protect rights through nine principles to reduce opportunistic behaviours	*“This ease of doing business must be facilitated by trust. We believe that trust is the basis for wealth and that trust is an important currency that makes our e-commerce platforms tick. All the work that we have done over the past 15 years underscores this belief.” (Alibaba Press Release, December 23, 2014)* *“Effectively combating the counterfeiting issue requires the active involvement from different government agencies and authorities, as the root of the counterfeit problem is offline. By collaborating with China's Public Security Bureau, the General Administration of Quality Supervision, China's State Intellectual Property Office and State Administration of Press, Publication, Radio, Film and Television and leveraging new tools such as the Internet and big data, Alibaba hopes that these measures will be impactful in combating fakes in the real world.” (Alibaba Press Release, December 23, 2014)* *“Wildlife trade monitoring network TRAFFIC and Alibaba Group today announced the signing of a strategic memorandum of understanding (MoU) to join forces to address the illegal wildlife trade that is devastating threatened and endangered species of wild plants and animals worldwide.” (Alibaba Press Release, October 14, 2014)* *“The Big Taobao Ecosystem Strategy aims to promote the concept of ”openness, synergy and prosperity“, and is committed to cooperating with various ecosystem partners on top of the basic services provided by Taobao, creating a variety of applications for a large number of consumers and businesses, to create a transparent, honest, fair and open business environment for the entire online shopping market, so as to facilitate and enrich the consumption of the public, improve the quality of life, and then promote the transparency and integrity of the offline market and even the production and circulation links.” (Platform Governance written by Network Planning Research Center, Alibaba Research Center and China E-Commerce Law Website, 2011)* *“We use data mining technology to analyse and track transactions of IPR-infringing products and identify hotspots for counterfeit distribution and sales.” (Alibaba Press Release, December 23, 2014)*
Maintain legitimacy and develop new institutions	Get buy-ins from incumbents and governments to reduce concerns and legitimate expansion	*“Besides appealing to small businesses, we hoped that the name [Ant] would also communicate our strategy: since each ant only eats a little, we were not threatening the traditional big lending business” (Zeng, 2018b: 58).* *“By sharing the integrity information of Alibaba members with banks, Alibaba provides two new types of financial services, network joint guarantee loans and friendship guarantee loans, which help banks provide short-term loans for small and medium-sized enterprises*

		to control risks, and at the same time allow enterprises to quickly obtain working capital and solve the urgent need, and achieve a win-win situation for the three parties." (Alibaba 2011 CSR Report) *"With continued support from the China Government, the SME sector, which is Alibaba.com's target customer segment, remains vibrant. The China SME sector is a growth engine for the national economy." (Alibaba.com Annual Report, 2007)* *"Alibaba.com (HKSE: 1688.HK), the global leader in B2B e-commerce, and Taobao, Asia's largest online retail marketplace, joined forces to host the first "Online Merchant Trade Fair," with support from the Guangdong Provincial and Guangzhou Municipal People's Governments. The aim of the event was to connect 30,000 high-ranking Taobao merchants directly to more than 400 formerly export-focused small and medium-size manufacturers as relationships forged here can help these manufacturers off-set the temporary decline in demand from international markets by introducing their goods to domestic consumers, and can provide Taobao's best sellers with new sources of high-quality goods." (Alibaba Press Release, May 17, 2009)* *"Wang Jian's contribution to Zhejiang is indeed a bit big (not to mention Ma Yun). Whether it is helping the provincial government to deepen its understanding of the information economy, or hosting the Yunqi Conference, promoting the construction of a "Data Powerful Province", or even holding the International Island Tourism Conference, Wang Jian has made a contribution…Now, the Internet has become a new gene of Zhejiang's economy, "Zhejiang on the Cloud" and "Data-Powered Province" are steadily advancing, and the information economy cantered on the Internet has become a new highlight and new driving force for Zhejiang's economic development. I believe that in the near future, Zhejiang will surely become one of the most dynamic regions in China and even in the world" (Wang, 2016: 6)*
	Develop a new civilisation with a wider range of participants to support expansion and knowledge diffusion	*"New Commercial Civilisation is a new state of human progress achieved under the conditions of the Internet, led by e-commerce, and realised through changes in economic, social and cultural development methods. The changes in productivity, production relations and production methods triggered by the information technology revolution will eventually promote the formation of new economic, social and cultural civilization paradigms and progressive states on this basis." (New Commercial Civilisation Report, 2010.* *"To address the growing need for information about the fast-moving e-commerce industry, Alibaba Group has launched Alizila, a web-based news organization to provide Alibaba users with a source of timely, trustworthy stories, videos and information about Alibaba Group products and services as well as international online trade." (Alibaba Press Release, September 9, 2010)* *"In 2011, we established the Alibaba Foundation, a private charity fund that primarily focuses on supporting environmental protection in China. The Alibaba Foundation has funded and spearheaded projects to help protect drinking water sources in China, allow the public to contribute to and monitor air quality on Amap app and research international environmental policies for local survey and legislative purposes." (Alibaba Annual Report, 2017)* *"On October 31, 2008, Alibaba Business School was launched. Alibaba Business School adheres to the concept of "openness, innovation, and excellence" and takes it as its mission to cultivate business elites and high-end entrepreneurial cadres with "international vision, practical ability, and innovative spirit", and strives to establish an "entrepreneur university." (Baidu Baike)* *"Effectively combating the counterfeiting issue requires the active involvement from different government agencies and authorities, as the root of the counterfeit problem is offline. By collaborating with China's Public Security Bureau, the General Administration of Quality Supervision, China's State Intellectual Property Office and State Administration of Press, Publication, Radio, Film and Television and leveraging new tools such as the Internet and big data, Alibaba hopes that these measures will be impactful in combating fakes in the real world." (Alibaba Press Release, December 23, 2014)*
Emergent actions of other actors		
Suggest new opportunities	Present new demands	*"According to forward-looking research data, the total number of domestic group-buying users at the end of 2011 was nearly 65 million, 2.45 times that of 2010. In response to the market, Alibaba established the Juhuasuan group buying platform." (Hua Chuang Security Report, 2019: 11)* *"In the early years, many Taobao sellers had offline businesses and sourcing channels, but by 2008, many new merchants joined the platform in a rush for online gold. They faced the challenge of building their businesses completely from scratch, online. Taobao then had to bring into the online network the many functions of brick-and-mortar retail so that every seller could access them." (Zeng, 2018b: 40-41)* *"When customers demanded better quality, Alibaba launched Tmall to sell established brands such as Nike Inc. and Gap Inc… But Alibaba executives worried that the site would be a turnoff for big, brand-name companies because they wouldn't want to be associated with*

		tiny, unknown sellers. Mr. Ma sent a team of about 30 engineers back to his old apartment to develop a site that would win over the big names." (The Wall Street Journal, April 15, 2014) *"Over the past decade, Alibaba.com managed to thrive by helping SMEs around the world capture business opportunities and go global. Nevertheless, given the rapid development of Internet technologies and the changing economic situation in recent years, the simple use of the Internet to resolve the unequal access to information can no longer satisfy the e-commerce development needs of SMEs…there is indeed an urgent need for comprehensive adjustments in the business of Alibaba.com, and nothing other than upgrades and reforms will allow us to satisfy our customers and adapt to future developments for the longer term." (Alibaba.com Annual Report, 2011)* *"Company leadership was constantly talking with sellers about how to make business easier. It was not uncommon to have a half a dozen sellers in the small Taobao offices at Hangzhou a couple of afternoons a week discussing what new tools might be useful. For example, the earliest sellers on Taobao used to print out each order as it was received to begin fulfillment, as they did for their offline business. When you have ten or even dozens of orders a day, this is a workable solution. But sellers faced a farcical yet very real problem from getting hundreds or even thousands of orders a day: their office printers overheated, some of them even catching on fire. It became apparent that to streamline the fulfillment process, sellers had to move more of their offline activities online so that they could better coordinate and optimize—and avoid fires. Without this pressure to improve the entire fulfillment workflow, up to and including logistics, the Cainiao Network—the logistics platform catalyzed by the 2012 delivery debacle—might not have emerged." (Zeng, 2018: 64)*
	Propose new roles	*"Web celebrities emerged in late 2014 and surprised us at Taobao. With no offline presence or big advertising budgets, these somehow-magnetic people nevertheless displayed an impressive ability to bring in sales and drive conversion." (Zeng, 2018b: 33)* *"A wholly owned subsidiary of Alibaba Group, Alimama has emerged from its 100-day beta period as China's largest online advertising exchange platform and well positioned to help small- and medium-sized web publishers monetize the estimated 80% of web site traffic which goes unmonetized in China." (Alibaba Press Release, November 20, 2007)*
	Present pressure for differentiation	*"In 2007, Baidu announced that it would introduce its own e-commerce platform called Youa to compete with Taobao. Baidu's chief executive, Robin Li, said at the time that search engines were the foundation of online shopping and that about half of Chinese online shoppers would conduct a general Web search before looking for goods on websites such as Taobao. Taobao responded by blocking Baidu from searching goods on its website." (The Wall Street Journal, October 13, 2010)* *"Alibaba Group Holding Ltd. unit Alibaba Cloud Computing is developing an operating system for mobile phones that it aims to release in the third quarter, a person familiar with the matter said Monday, as a range of companies battle to provide the core software used on smartphones... Alibaba's move comes as top Chinese search provider Baidu Inc. has hinted it could also be developing a mobile operating system." (The Wall Street Journal, July 5, 2011)* *Many potential investors are closely following Alibaba's battle to woo China's 500 million smartphone users. Online chat services are emerging as a major force in e-commerce, but the mobile-messaging business is dominated by Tencent's WeChat, which has 355 million monthly active users. Ma and Tsai gathered a team of young engineers and asked what Alibaba could buy to boost its mobile presence, according to Mr. Tsai. One engineer mentioned Momo, spreading quickly among young mobile users. Mr. Ma noted that Weibo has lots of users on mobile. Mr. Ma isn't reluctant to use the force of his personality. He cajoled and pressured Alibaba employees last fall to increase the use of the company's Laiwang chat app. "Everyone can help build up Laiwang. Don't tell me you can't," Mr. Ma wrote in a memo." (The Wall Street Journal, April 15, 2014)*
	Present win-win collaborations	*"Taobao, a subsidiary of Alibaba Group, and Wasu Media Internet Limited, a subsidiary of Wasu Digital Television Media Group, have jointly launched today a digital products platform and interactive digital television shopping to meet the growing needs of Chinese consumers for convenient and high quality shopping experiences. Taohua.com (www.taohua.com) will be China's first comprehensive digital products platform offering single-stop sharing and purchase of video, e-books, music and other digital entertainment and educational products." (Alibaba Press Release, June 29, 2010)* *"By sharing the integrity information of Alibaba members with banks, Alibaba provides two new types of financial services, network joint guarantee loans and friendship guarantee loans, which help banks provide short-term loans for small and medium-sized enterprises to control risks, and at the same time allow enterprises to quickly obtain working capital and solve the urgent need, and achieve a win-win situation for the three parties." (Alibaba 2011 CSR Report)*

		"To encourage competition, Ma assigned each of Alibaba's subsidiaries its own board of directors and executive team, including a president, a CFO and operating managers. Tsai illustrated some of the resulting competition, "Alipay's primary objective is to be a leader in payment processing which requires it to develop its own client base of online merchants. However, these clients could be other e-commerce websites that compete directly with Taobao. For example, Joyo.com is a client of Alipay, yet is a subsidiary of Amazon, a company that competes with Taobao." (Wulf, April 26, 2010, HBS case study Alibaba Group)
Micro-macro processes (emergent)		
Expand	Ecosystem synergies	*""Alibaba has played the scale game really, really well," says Paul McKenzie, an analyst at Hong Kong brokerage firm CLSA in Hong Kong. "They created a virtuous circle of more merchants attracting more shoppers, which in turn brings in more merchants."" (The Wall Street Journal, April 15, 2014)* *"The move highlights the comprehensive integration of Alibaba and UCWeb following Alibaba's investment in UCWeb in 2009 and 2013, and will enables deeper synergies between the companies by marrying Alibaba's strengths in e-commerce, cloud computing and big data technology and UCWeb's leading market position and technology in mobile." (Alibaba Press Release, June 11, 2014)* *"Web celebrities emerged in late 2014 and surprised us at Taobao. With no offline presence or big advertising budgets, these somehow-magnetic people nevertheless displayed an impressive ability to bring in sales and drive conversions." (Zeng, 2018b: 33)*
	Re-envision	*"Alibaba Group is a global e-commerce leader and the largest e-commerce company in China. Since it was founded in 1999, Alibaba Group has grown to include the following core businesses: Alibaba.com, Alibaba Group's flagship company and the world's leading B2B e-commerce company; Taobao.com, China's largest consumer e-commerce company; Alipay.com, China's leading online payment service; Yahoo! Koubei, a company providing online classified listings for local services and search; and Alisoft.com, an Internet-based business management software company targeting SMEs in China." (Alibaba Press Release, May 17, 2009)* *"In addition to opening up the platform for retailers and brand owners alike, Taobao Mall will work with a range of third-party e-commerce service providers and logistics service providers to create a quality retail infrastructure for the online B2C sector in China." (Alibaba Press Release, September 19, 2011)* *"Alibaba.com's business in the early years was driven by a focus on rapidly increasing the number of manufacturers, trading companies and wholesalers that pay a subscription fee to sell products on the company's marketplaces in order to maximize revenue growth. Last year, the company implemented a major initiative toward improvements in the quality of the buyers' experience on the company's online marketplaces. As a result, the pace of adding paying customers has been slowed down." (Alibaba Press Release, February 21, 2012)* *"Founded in 1999, the company is committed to developing a technology-driven commerce ecosystem for the benefit of consumers, merchants and service providers." (Alibaba Press Release, March 26, 2014)* *"Alibaba Group's mission is to make it easy to do business anywhere… provides the fundamental technology infrastructure and marketing reach to help businesses leverage the power of the Internet to establish an online presence and conduct commerce with hundreds of millions of consumers and other businesses" (Alibaba Press Release, May 12, 2014).* *"In 2008, Alibaba identified its strategy for the next ten years as "fostering the development of an open, collaborative, and flourishing e-commerce ecosystem." But it wasn't until the last few years that we started realizing that in responding to the changes in the external environment, the organization itself had to evolve. We didn't know enough about what the future would look like a few years out to plan for it. Alibaba needed to constantly adjust and readjust to the environment in real time, without traditional management getting in the way." (Zeng, 2018b: 139)*
Constrain	Performance bottleneck	*"Alibaba was born as an Internet company which is good at ToC businesses. Compared with born ToB businesses such as Huawei, Alibaba does not have the advantage because Alibaba does not have experience working in businesses or governments nor does it have the industry knowledge. Traditional ToB businesses have accumulated so many years of experience and networks with businesses and governments. Businesses and governments do not trust Alibaba." (A10 I interviewed)* *"The consumer Internet is asset-light, while the industrial Internet is asset-heavy. This does not depend on your stock. For example, Douyin, you don't need stock, you have capital and a good idea. But the Industrial Internet is heavy on assets. It needs to rely heavily on assets, this why it is Predix and Siemens instead of others that started the IIoT. It should be because it needs a lot of assets, including intellectual assets." (A2 I interviewed)*

	"The characteristics of manufacturing industries, regions, industrial chains, and industrial clusters determine that the development of China's industrial Internet platforms will be diversified, rather than monopolising most of the platform resources by a few oligopoly." (Alibaba supET White Paper 2019).
Scalability bottleneck	*"Fifteen years have passed since cloud computing has been industrialised to the present. However, the way a large number of applications use the cloud is still stagnant in the traditional IDC era: virtual machines replace the original physical machines: use files to save application data, a large number of built-in third-party technology components, cloud applications that have not undergone architectural transformation (such as microservice transformation), traditional application packaging and publishing methods, etc. There is no absolute right or wrong about how to use these technologies, but in the cloud era, the powerful capabilities of the cloud cannot be fully utilised, the higher availability and scalability cannot be obtained from the cloud technology, and the release and operation and maintenance efficiency cannot be improved by using the cloud which is a very regrettable thing…All these questions point to a common point, that is, the era of cloud requires a new technical architecture to help enterprise applications make better use of the advantages of cloud computing, fully release the technical dividends of cloud computing, and make business more agile and cost-effective and scalable. And these are exactly the technical points that the cloud native architecture focuses on." (The Cloud-native Architecture White Paper by Alibaba Cloud, 2020)*
	"Alibaba has been exploring the overall solution for the development and governance of distributed applications for more than ten years, and the exploration process has been continuously tested and incubated through harsh scenarios such as Double 11, and a single Java language has been used to create a complete set of technologies. Even so, it is still not easy to deal with the scale of distributed applications, which is reflected in the lack of top-level design and systemic deficiencies, coupled with the lack of attention to the user experience of technical products, which ultimately leads to high operation and maintenance costs and technical thresholds. In the face of these pains, the concept of cloud native gradually surfaced clearly. While Cloud Native advocates that technical products can still provide a certain quality of service in the most demanding scenarios and reflect good elasticity, it also emphasises that technical products themselves should have good ease of use, and provide for future enterprises that need multi-cloud and hybrid clouds. The IT infrastructure provides support (i.e., assists in the portability of distributed applications). The concept of cloud native not only fits well with the pains that Alibaba Group needs to solve in terms of technological development, but also caters to Alibaba's original intention of taking cloud computing as a group strategy and making cloud computing benefit the society. In this context, Alibaba has made a comprehensive cloud-native decision. Service Mesh, as one of the key technologies in the cloud-native concept, is of course included." (Alibaba Economy Cloud-Native Practice Report, 2019)

The data shown in this table only represent a subset of my analysis for illustrative purposes. The complete set is available from authors on request.

Table 8.8 - Code structure - Phase 3

Phase 3 Infrastructure empowering (2015-2020)		
Aggregate dimensions and second-order codes	**First-order codes**	**Representative data/quotes/excerpts**
Ecosystem future probes and synergies		
Ecosystem future probes	Ecosystem mission	*"Alibaba Group's mission is to make it easy to do business anywhere." (Alibaba Press Release, January 8, 2015)* *"Alibaba Group's mission is to make it easy to do business anywhere." (Alibaba Press Release, November 12, 2020)*
	Ecosystem phasic vision – infrastructure empowering	*"Alibaba's positioning is to start a business revolution. What we build is the infrastructure for future commerce. We empower merchants engaged in buying and selling, rather than compete with merchants engaged in buying and selling. From this point of view, the so-called our 'competitors' are actually the objects of our empowerment and help in the future. To simply regard the companies engaged in e-commerce in today's market as Alibaba's competitors is to compare apples with apple trees, which is inappropriate for both parties." (Alibaba Letter to Shareholders from Executive Chairman Jack Ma, 2015 October 8)* *"We are fully committed to creating the infrastructure for commerce in an inclusive economy because Alibaba is led by our ideals and vision." (Alibaba Letter to Shareholders from Executive Chairman Jack Ma, 2017 October 17)* *"The "platform" will play the role of "public service", providing the whole society with ubiquitous, on-demand, extremely rich, and extremely low-cost business services, and the "platform" will become an important business infrastructure in the information society. Based on the integration of the platform, more and more services such as credit, authentication, payment and modern logistics are integrated on the online business service platform, further improving the service level of the entire service ecosystem." (2016 Alibaba Business Service Ecosystem White Paper: 41)* *"As one of the world's largest technology companies with a mission focused on serving small business, we must contribute to the sustainable development of a healthy world economy…We are fully committed to creating the infrastructure for commerce in an inclusive economy because Alibaba is led by our ideals and vision…By 2036, we envision that Alibaba's infrastructure will support commerce activity with a combined transaction value that will rank as the world's fifth-largest economy. We aim to be a platform that will enable the creation of 100 million jobs, serve two billion consumers and support 10 million profitable small businesses. While Alibaba will serve as an advocate, driver and platform, the economy supported by Alibaba's commerce infrastructure will be far bigger than Alibaba the company. Through this "Alibaba economy," we hope to enable consumers and businesses to buy globally, sell globally, pay globally, deliver globally and travel globally. We want to enable more developing countries, small businesses and young people to share the benefits of globalization and free trade, and to share the innovation and opportunities that accompany technological advancement." (Alibaba 2017 Chairman letter to Shareholders 2017 October 17)* *"After 20 years of development, Alibaba has transformed from an e-commerce company to the basic infrastructure for the digital economy with an ecosystem that encompasses digital commerce, financial technology, intelligent logistics, cloud computing and big data. With many partners and service providers across the digital economy serving both consumers and enterprises, we have created and stimulated new consumption patterns and at the same time helped enterprises across industries to accomplish their digital transformation. We hope to help tens of thousands of small businesses to blossom, as well as supporting the development of new unicorns and companies on their way to becoming giants." (Alibaba HK Prospectus 2019)* *"This co-creation ability is very important in Ali, and everyone should train this in the job in Ali. Get to know others' shortcomings and their weak spots, then you go to help them, empower them and make them successful, in fact, every business line is like this. Without this, you cannot work in Alibaba." (A1 I interviewed)* *"We empower our customers with the fundamental infrastructure for commerce and new technology, so that they can build businesses and create value that can be shared among our digital economy participants." (Alibaba Website accessed 2020)*
Ecosystem synergies (new)	Support generative changes through network effects among organisations, industries, and regions	*"The industrial Internet platform is not a simple technology superposition, but a huge "organic life", including data collectors, software developers, system integrators, big data experts, and manufacturing companies. No organisation can survive independently. Only active interaction, collaboration, infection and empowerment between organisations can form a network effect…Relying on a platform-based operation mode, the Industrial Internet Platform shares manufacturing capabilities and resources across industries,*

	regions, and fields, and gives full play to the network effect of the platform to achieve collaboration across the entire value chain, including R&D, production, supply chain, and services. and accurate connection of resources…Relying on the basic common capabilities provided by the middle platform, including data resource management, computing storage, machine learning platform, algorithm model, and industrial mechanism model, the front-line N platforms can go into battle without spending a lot of energy on repetitive basic capacity building , but can focus more on the polishing of customer service experience, the development of business scenario applications, and the innovation of business models…Relying on the "1+N" model, N vertical industry platforms can go beyond their own market limitations, and use their knowledge to do more cross-platform distribution and transactions in the form of SaaS, APP or micro-services, greatly improving knowledge commercialization and liquidity." (Alibaba supET White Paper 2019). *"…Open up the upstream and downstream supply chain and sales chain, and accelerate the construction of an upstream and downstream entire industrial chain system supported by big data, networked sharing, and intelligent collaboration. Businesses will rely more on the Industrial Internet Platform to realise online design, online R&D, online production, online users, online services, and online consumption, as well as direct links between internal and external businesses. At that time, the overall data intelligence will improve the overall operating efficiency of the organisation, the interaction between all links will be promoted in a network manner, all business decisions will be based on user insights, all production activities can be flexible, and all products and services can meet the needs of "individuals"…More vertical industry leaders are benefiting from the transformation of the complexity and knowledge asymmetry of their industries into their own competitive advantages. On the one hand, businesses open up the knowledge, experience, resources, and data assets accumulated over the years to upstream and downstream businesses or cross-industry users in a digital, cloud-based, and platform-based manner, allowing knowledge and data assets to be monetarised in a large-scale manner. On the other hand, through the construction of a cross-platform and cross-industry ecosystem, a greater dimension of intersection and collaboration will be formed to create new business models and new formats, such as industrial e-commerce platforms, supply chain finance, mobile travel services, and industrial big data trading platforms." (Alibaba New Generation Industrial Internet Platform Model and Success Practices White Paper 2020)* *"The algorithm we came out with for the rubber company can be shared with other rubber or similar companies who face the same production issues or processes. The more companies use this algorithm, the better the algorithm becomes. This is the network effect on the provision side. It's a batch copy model." (A9 I interviewed)*
Stack generic resources in layered digital infrastructure for sharing and optimising	*"The "1+N" model combines leading industrial enterprises and various service providers to create a horizontal, cross-platform resource and capability-sharing platform to serve N industrial, regional and enterprise industrial Internet platforms. The supET "1+N" model includes explicitly three key functions. First, ability-sharing middle platform. Second, knowledge routing platform. Third, data plaza…The "1" in supET not only plays the role of middle office in the industrial Internet platform ecosystem, but also is responsible for integrating product technology and data capabilities. Relying on the middle platform to provide data resource management, computing storage, machine learning platform, algorithm…the industrial mechanism knowledge, microservices and industry algorithms of N platforms can be continuously deposited in the middle platform, and the middle platform can abstract them into more general algorithms and data models, so that the thickness and breadth of itself can be increased exponentially to better support the development and innovation of front-end platform business applications" (Alibaba supET White Paper 2019)* *"The new commercial civilization of Alibaba's overall layout is Ali's transformation. Ali's transition from traffic transactions to the upper end of the supply chain, from consumption to provision side, is the entire end-to-end digitalization. Ali OS is to break through the entire chain and start it all over again. Folding and replaying, this is to improve efficiency, on the other hand, it is to reorganize these industries and make them different things, reorganise the organisation, reorganise the values, and use digitisation to fiddle with it. This is the core of Ali's new business civilization essentials." (A1's talk in an Alibaba internal meeting)* *"The construction of Alibaba's data public layer from April 2014 to November 2015 and the implementation of Alibaba's big data capability empowerment social strategy in September 2016 are two key qualitative changes in Alibaba's big data field. The first qualitative change confirmed the data middle platform and data middle platform team on Alibaba Cloud, and the second qualitative change confirmed the social empowerment strategy of the data middle platform business model on Alibaba Cloud." (Deng, 2018: V)*

		""Data is the core of New Manufacturing and harnessing data insights is key to capturing new opportunities in the shift in consumer preference for personalized rather than mass-produced goods. New Manufacturing transforms traditional manufacturers with data-driven intelligence and technology to move towards a more agile model of production based on real-time demand." said Alain Wu, CEO of Xunxi Digital Technology Company, Alibaba Group. "This allows traditional manufacturers to improve profitability and reduce inventory levels while still being able to meet these personalization needs."" *(Alibaba Press Release, September 16, 2020)*
	Sustainable growth	*"Our business continues to perform well, and our results reflect the strength of our ecosystem and the strong foundation we have for sustainable growth." (Alibaba Press Release, January 29, 2015)* *"The key to the development of the regional industrial Internet platform lies in two sustainability - the sustainability of user value and the sustainability of cost efficiency… Each party in the ecosystem chain needs to rely on other parties to succeed and jointly promote the prosperity of the ecosystem." (Alibaba New Generation Industrial Internet Platform Model and Success Practices White Paper 2020)* *"While GMV is a proxy for scale, our focus on quality and sustainable growth means how we measure success is no longer dependent on a simplistic view of GMV growth. This is because we now deliver multiple value propositions to the organisations that take advantage of our marketing platform and commerce infrastructure services. In other words, Alibaba today is much more than a sales and distribution channel." (Joe Tsai, Alizila Executive Blog Post, 2016, March 21)* *"Launched in 2016, the biennial conference is an important representation of Alibaba Group's commitment to encouraging inclusive, universal and sustainable growth for businesses and communities alike – all for the greater benefit of people." (Alibaba Press Release, September 5, 2018)* *"Alibaba Group's mission is to make it easy to do business anywhere and the company aims to achieve sustainable growth for 102 years." (Alibaba Press Release, 2018, September 10 – Alibaba Press Release, June 19, 2019)* *"With the collective pursuit of a clear vision, our various businesses will work together to generate synergies that drive long-term sustainable growth." (Alibaba ESG Report 2018)* In the ESG Report, Alibaba defines sustainability *"as focusing on long-term value creation that drives sustainable profits"* and suggests that *"The pursuit of sustainability requires that we do the right thing when our business impacts the environment and society, and we need a system of governance to ensure that we are always choosing the right ethical path." (p. 5)*
Macro-micro processes (emergent)		
Trigger	Ecosystem bottlenecks	*"Alibaba was born as an Internet company which is good at ToC businesses. Compared with born ToB businesses such as Huawei, Alibaba does not have the advantage because Alibaba does not have experience working in businesses or governments nor does it have the industry knowledge. Traditional ToB businesses have accumulated so many years of experience and networks with businesses and governments. Businesses and governments do not trust Alibaba." (A10 I interviewed)* *"Alibaba has been exploring the overall solution for the development and governance of distributed applications for more than ten years, and the exploration process has been continuously tested and incubated through harsh scenarios such as Double 11, and a single Java language has been used to create a complete set of technologies. Even so, it is still not easy to deal with the scale of distributed applications, which is reflected in the lack of top-level design and systemic deficiencies, coupled with the lack of attention to the user experience of technical products, which ultimately leads to high operation and maintenance costs and technical thresholds. In the face of these pains, the concept of cloud native gradually surfaced clearly. While Cloud Native advocates that technical products can still provide a certain quality of service in the most demanding scenarios and reflect good elasticity, it also emphasises that technical products themselves should have good ease of use, and provide for future enterprises that need multi-cloud and hybrid clouds. The IT infrastructure provides support (i.e., assists in the portability of distributed applications). The concept of cloud native not only fits well with the pains that Alibaba Group needs to solve in terms of technological development, but also caters to Alibaba's original intention of taking cloud computing as a group strategy and making cloud computing benefit the society. In this context, Alibaba has made a comprehensive cloud-native decision. Service Mesh, as one of the key technologies in the cloud-native concept, is of course included." (Alibaba Economy Cloud-Native Practice Report, 2019)*
Support	Regulatory support	*"In 2015, China's government launched the 'Internet Plus' policy to encourage innovation and employ Internet and digital technology in traditional industries to achieve industry transformation and improve overall efficiency. The 'Mass Entrepreneurship and*

		Innovation' policy was launched as a national strategy to encourage people to start their own businesses and to innovate their current business." (Greeven, 2018: 26)
	Thriving VC market	*"In 2015 China's VC environment was thriving and promising with over 3,000 investors injecting over 17 billion USD in the market. Although there was a downturn in 2012 and 2013, especially due to the limited exit options once domestic IPOs were prohibited for over a year, the momentum picked up drastically in 2014 thanks to the booming of the Internet industry. In 2015 the Internet industry absorbed 31% of all VC investments." (Greeven, 2018: 26-27)*
	New technologies	*The 2016 Alibaba Business Service Ecosystem White Paper has summarised six main digital advancements that trigger the new ecosystem vision, including Cloud-computing, Big Data, the Internet of Things, Mobile Internet, Machine Learning, and Virtual Reality.*
	Booming middle class	*"Strong growth in the size and diversity of China's middle class will create new market opportunities for both domestic and international companies. In all, the strong growth of consumer demand is creating a positive push to the demand for higher quality, more and diverse products and services." (Greeven, 2018: 29)*
Strategic and emergent actions of ecosystem orchestrators		
Restructure architectural design	Shift to the cloud-native architecture to enhance efficiency and scalability	*"Cloud-native architecture is a set of architectural principles and design patterns based on cloud-native technology, which aims to maximise the stripping of non-business codes in cloud applications, so that cloud facilities can take over a large number of original non-functional features in applications (such as elasticity, resilience, security, observability, grayscale, etc.), so that the business is no longer troubled by non-functional business interruption, and has the characteristics of light weight, agility, and high automation…Compared with the traditional architecture, the cloud-native architecture has taken a big step forward, stripping a large number of non-functional features (not all, such as ease of use) from the business codes into IaaS and PaaS. In this way, the technical focus of business code developers is reduced, and the non-functional capabilities of applications are improved through the professionalism of cloud vendors." (The Cloud-native Architecture White Paper by Alibaba Cloud, 2020)* *"If an enterprise wants to use cloud-native technologies or products under the traditional working methods in the past, it needs to spend a lot of energy researching some open source projects, do O&M and management by itself, and also need to consider issues such as integration and stability guarantees. To build a cloud-native platform. Today, in order to make it easier for enterprises and developers to use cloud-native technologies and products, and to better accept the concept of cloud-native, Alibaba Cloud has done a lot of work to help domestic enterprises understand and use cloud-native. On the one hand, we are actively promoting the use of cloud-native technology internally. Alibaba has a very rich and large-scale usage scenario, through which cloud-native technology can be fully polished. On the other hand, Alibaba Cloud already has the most abundant Cloud native product family, the most comprehensive cloud native open source contribution, the largest cloud-native application practice, to empower the largest cloud native customer base." (Alibaba Cloud-native Large-scale Application Landing Guide 2020)* *"If we disassemble the changes in Alibaba Cloud-native practice in the past fifteen years, it must be inseparable from this logic: self-research, self-use, and open the cloud to the public. The first stage: From 2006 to 2011, Taobao Mall switched from a centralised architecture to a microservice distributed architecture, focusing on solving the problems of high availability and stability. The second stage: From 2011 to 2015, we began to invest in containers to solve the problems of cost and operation and maintenance efficiency. The third stage: from 2015 to 2019, promote the comprehensive commercialization of product technology and fully embrace cloud-native standards. The fourth stage: from 2019 to the present, from supporting the full cloud migration of the double 11 core system to supporting the full cloud nativization of the core system." (Interview of Alibaba Cloud-native application platform manager, Leifeng News, 2021, June 10)(Wang, 2016)*
	Adopt the "thick generic platforms and thin front-end applications" framework to enhance reutilization, efficiency, and scalability	*"The middle platform, in short, is the platform under the business applications. It extracts the common needs of each business line and builds it into a componentised resource package, which is provided to the front-end business department in the form of an interface to minimise repeated wheel building…Today, this "thick platforms and thin applications" IT architecture has become the standard for more and more enterprise organisations in the Internet era." (Hua Chuang Securities Report, 2019)* *"A common technology platform and infrastructure where learning and experimentation can be tried, applied, and adjusted across the system is an essential first step. The common tech platform has become an important organizational principle at Alibaba. Over the last few years, through round after round of hard work, Alibaba has moved all the computing work of any of its businesses onto the*

		same cloud-computing infrastructure. This achievement not only saves millions in capital costs annually but also makes the support of new business launches much easier. Systems, software, and business know-how can now be readily shared. Another recent major project has been to consolidate all coding and development work across departments and acquired businesses onto the same platform." (Zeng, 2018b: 170) *"As a leading digital economy platform, how to use data to better serve the huge group of merchants and consumers is one of the most important missions of Alibaba. At the same time, Alibaba hopes to build the value of data into a new infrastructure, open to service providers in the whole industry, and cultivate a more prosperous business ecosystem". (Alibaba Business Service Ecosystem White Paper 2016)* *"Alibaba's "thick platforms and thin applications" architecture form. At present, more than 25 front-end business units of the Alibaba Group (such as Taobao, Tmall, Juhuasuan, Quah and other well-known businesses) are not independently built on the Alibaba Cloud platform. There is a "shared business department" among the front-end business on the back-end Alibaba Cloud technology platform, which has deposited the public and general business of Alibaba Group's front-end business into this department, including more than a dozen centres such as user centres, product centres, trading centres, and evaluations. The Shared Business Division is the true embodiment of the "thick platform", providing Alibaba's various front-end businesses with the most professional and stable business services in the corresponding service centre field." (Zhong 2017: 21)*
	Adopt the "1+N model" to enhance sharing and support industry-specific platforms	*"The "1+N" model combines leading industrial enterprises and various service providers to create a horizontal, cross-platform resource and capability sharing platform to serve N industrial, regional and enterprise-level industrial Internet platforms." (Alibaba supET White Paper, 2019)* *"Alibaba's positioning is more in the lower layer. We provide a platform of platforms, i.e., the 1+N model. We say that we are the 1. Instead of developing the industrial Internet platform for specific industries, we are to provide the technical infrastructure for these companies that are developing the industrial Internet platform, especially the digital technology infrastructure including cloud platforms and digital technologies necessary to develop Apps in PaaS and SaaS layers." (A2 I interviewed)* *"If the ToC side and the ToB side are merged together, and then the device data is collected, Alibaba may become the largest industrial Internet in the world." (A2 I interviewed)*
Enact platformed architectural reform	Launch the Middle Platform Strategy to enhance synergies and adaptation	*"In 2015, the Middle Platform Strategy was proposed to establish a Middle Platform business group, including the Search Division, Shared Business Services Platform, Data Technology and Product Department. Group CTO Zhang Jianfeng served as the president of the Middle Platform Business Group. The middle platform, in short, is the platform under the applications. It extracts the common needs of each business line and builds it into a componentised resource package, which is provided to the front-end business department in the form of an interface to minimise repeated wheel building." (Hua Chuang Securities Report, March 11, 2019)* *"Ali launched the Middle Platform Strategy in 2015 and established a Shared Service Centre. By depositing basic, general and public businesses and data across more than 20 core businesses on the Middle Platform in the form of services, it has realised efficient and convenient business and resource integration and large-scale reuse and real-time response between information systems and changing business needs." (Book "Reconstructing" 2019 by Xiaopeng An, the Vice Dean of Alibaba Research Center, p. 49)* *"The advantage of the Middle Platform is firstly the aggregation and integration of products. For example, Tmall, Taobao, and Ele.me do transaction systems to process bills without having to do each business separately. You can use this module directly from the "Middle Platform". Secondly, the emergence of the Middle Platform has greatly simplified Ali's system and provided flexibility for innovative businesses. "Today, if Alibaba wants to build a new Taobao overseas, it may only take 2-3 months, because products, stores, and membership services can be quickly reused."" (Citic Securities Report, September 14 2020)* *"Consolidating code is only the beginning. Ambitious organizations can directly embed many duties of traditional management into the infrastructure. HR management, resource allocation, project coordination, budgeting, and other aspects of financial management all become services provided by the platform. These services are accessible to people and units without direct oversight. The most significant of these is resource allocation - with the right rules in place, resource allocation becomes almost automatic. There is little arguing about a budget. If a prototype takes off in the market and needs more resources to scale up, the resources, both people and money, are provided largely automatically. As the firm builds the infrastructure and as more knowledge becomes widely accessible through APIs and other sharing tools, contributors in the firm's internal network see their ideas compete for resources in both internal and external networks." (Zeng, 2018b: 170-171)*

Streamline and integrate for coherence and synergies	*"Previously, LPPZ and Nestle had to deal with Alibaba's different businesses, including logistics, payment, cloud computing and instant messaging, but now they only need to connect with one team from Alibaba, which is responsible for organising a series of customised services. Jingjie of Alibaba said in an interview with foreign media: "This change has subverted the way our entire company operates."" (A5 I interviewed)* *"Alibaba Business Operating System (ABOS) is born out of this, that is, if you never develop the ABOS, you will fight alone. If you want to become a fist, you have to integrate and develop synergies with each other." (A5 I interviewed)* *"Ali now has a series of solutions. The solutions I talked about are just business consultants, data banks, and a bunch of seismographs. These things are highly fragmented. So you need to string these business units together today. Get up, string them together with a thread, then you also need to string them together in your product solutions. In the past, you used a fragmented solution to solve a problem, such as consumer operations, logistics, digital supply chain, etc., all of our solutions need to be connected and integrated according to a logic." (A2 I interviewed)* *"Alibaba is now offering the Alibaba Operating System to companies of all sizes through the A100 program, which lets them choose from an exhaustive menu of services to enhance their business operations. Alibaba will establish a cross-platform integrated client-serving team to supervise the implementation of A100 and will start with partners already in the company's ecosystem. The program will gradually expand to other brands looking to optimize their digital operations." (Alibaba Press Release, January 11, 2019)* *"The Alibaba Cloud Industrial Internet Platform provides an integrated solution of "cloud, network, edge and terminal" for the digital transformation of enterprises. The core elements of this overall solution can be summarised in one sentence, that is, "connection is the foundation, data is the core, and application is the key." First, the industrial Internet of Things service realises the integrated management of cloud, edge and terminal, and serves many industries such as textile and clothing, electronic manufacturing, and mechanical processing. Second, the intelligent service of industrial data realises the intelligent analysis and application of industrial data, and serves dozens of industries such as photovoltaic, rubber, chemical, electric power, etc.. Thirdly, industrial APP operation service is also a key task of the industrial Internet platform, which is to realise the Application of OT software and help software developers and system integrators realise one-stop industrial APP development, integration, hosting, operation and maintenance, etc. From traditional system integration to microservice integration to improve application reproducibility, and to redefine industrial software with microservices, it is necessary to restructure the traditional industrial software architecture and check the black box of knowledge. Then build structured industrial knowledge, build a microservice component library, and abstract and solidify the component library into an industrial app with characteristic scenarios. Up to now, the Alibaba Cloud Industrial Internet Platform has connected more than 1.3 million devices, deposited nearly 20,000 APPs, and provided more than 4,000 solutions, serving nearly 40,000 enterprises of various types, bringing lighter and easier-to-use industrial digital applications to more and more enterprises." (Alliance of Industrial Internet website, May 12, 2020)*
Incubate platforms as pilots to experiment and demonstrate innovations	*"Since 2015, the Middle Platform strategy has been implemented, and a unified data sharing platform has been created. After internal success, Alibaba Cloud IaaS data services have been exported to external participants." (Soochow Securities Report, August 17, 2019)* *"Hema was created as a completely new entity to be the pioneer of New Retail. In other words, Hema was created as the testing ground for aggressively innovative concepts. Hema was the very first attempt at Alibaba's strategic plan for digital transformation of offline retail… The first Hema store opened in January 2016, with minimal marketing and almost zero media presence. According to Hema's general manager, the company's initial expansion was extremely careful, even "stealthy." This was because Hema was the "pathfinder of New Retail"; in other words, there was a lot of trial and error of the overall concept. Several years on, many people still questioned Hema's model." (IMD Case Study - Hema: New Retail Comes to Grocery, 2019)* *"Alibaba LST was also incubated internally. Similar to the Freshippo, the idea was proposed by an internal employee. After approval, Alibaba then requested some requirements when piloting. After successful pilots, Alibaba then requested some KPIs in scaling." (A14 I interviewed)* *"How to enable small and medium-sized merchants to achieve small batches of high-frequency new products and fast rolling replenishment? Alibaba's new manufacturing platform - "Rhino Smart Manufacturing" has tested the waters, first cut into new manufacturing from the clothing industry, achieved "100 pieces minimum order, 7-day delivery", and realised "mass production of*

		customised clothing". As a pilot factory built by Ali, the focus of Rhino Smart Manufacturing is not about manufacturing, but about integrating the Internet capabilities with manufacturing." (tech.gmw.cn News, March 2, 2021) *"People need examples. When they see, well the others my neighbours made money online selling things, my neighbours buy many interesting things online. People start to learn. People start to buy mobile phones. We cannot make mobile factories sell phones to them, only when they know the mobile phone really works, we help them change their lives, they start to buy mobile phones." (Jack Ma, Interview with Bill Clinton, 2015)* *""We generated synergies across our businesses, demonstrating the power of the Alibaba digital economy, which will be further* ***showcased*** *during our upcoming 11.11 Global Shopping Festival. Under our New Retail strategy, we are realizing our vision to enable renewed growth for traditional retailers through digitizing their store-based operations, powered by Alibaba's technology and consumer insights.""* (Alibaba Press Release, November 2, 2018)
Foster infrastructural adoption	Neutralise risks to reduce mistrust and promote adoption	*"For new application products, we will invest first, and then rely on some subsidies from the government to start the project." (A11 I interviewed)* *"The concern they have may be that their core process data may be put on the cloud. He is worried that it may be lost or stolen, but in fact this problem does not exist or the probability of its existence is even smaller than offline storage, which is simpler. It's like putting your money in the bank!" (A4 I interviewed)* *"This thing requires a seat belt, you must have a seat belt on the high speed, we must have a seat belt when we are doing this reverse-control services." (A18 I interviewed)* *"As a national industrial Internet platform, supET can protect data from being abused and data privacy from being violated, effectively alleviating the data trust crisis between platforms. The application of blockchain in the future will provide an additional layer of insurance for platform security." (Alibaba supET White Paper, 2019)* *"Alibaba focuses on mastering the Cloud platform and associated technologies so ecosystem participants can integrate into Alibaba. Alibaba Cloud does not do SaaS itself but lets everyone do better SaaS. This means that Alibaba focuses on empowering participants in niched industries by providing Cloud services." (Jianfeng Zhang, Smart AliCloud President, 2019 AliCloud Conference in Beijing)*
	Leverage generality and interoperability to attract a wide range of adopters	*"What kind of value does the difference in generic across layers bring? The IaaS layer is going to be a global oligopoly market because every firm will need to store and compute data using only 0 and 1. The higher the layer, the lower level of generality, and the more fragmented the market will be." (A3 I interviewed)* *"If the ToC side and the ToB side are merged together, and then the device data is collected, Alibaba may become the largest industrial Internet in the world." (A2 I interviewed)* *"Comprehensive service platforms and industry service platforms should prohibit low-level competition, fully maintain and give play to their respective advantages, continue to move towards cooperation and even integration, and construct a new service model of "mutual platform"." (2016 Alibaba Business Service Ecosystem White Paper: 41)* *"At its core, Taobao created the infrastructure for the marketplace as a whole, and that infrastructure fostered powerful network effects. Infrastructure refers to the tools and mechanisms that undergird a business network, such as reputation systems, search functionality, virtual computing resources, or APIs. As such, infrastructure comprises the basic services needed by every participant in the platform's work environment. Because infrastructure often requires significant investment, it is akin to a public good in the terminology of economics, whose supply and maintenance exceeds the responsibilities of any single player. It is incumbent on the platform to create infrastructure for the marketplace that will enhance coordination, engendering network effects." (Zeng, 2018b: 47)* *"Alibaba focuses on mastering the Cloud platform and associated technologies so ecosystem participants can integrate into Alibaba. Alibaba Cloud does not do SaaS itself but lets everyone do better SaaS. This means that Alibaba focuses on empowering participants in niched industries by providing Cloud services." (Jianfeng Zhang, Smart AliCloud President, 2019 AliCloud Conference in Beijing)* *"The implementation of Alibaba's Middle Platform services is outsourced to third-party service providers. Alibaba itself does not do the services." (P31 I interviewed)*

	"In the future, our highly compatible and standards-based platform will allow SaaS partners to onboard easily and thrive." (Alibaba Press Release, March 21, 2019) *"The AliOSThings operating system supports a variety of industrial protocol standards and security protection mechanisms to ensure that the connected machines on the platform can perform secure data transmission." (Alibaba Industrial Internet Platform White Paper, 2020)* *"In the Qihuotong solution, Alibaba provides merchants with a set of standard interfaces called "Qimen" to reduce the complexity of connecting heterogeneous systems. Qimen provides a complete standard interface for merchants and service providers. After merchants are transformed, they can realise multi-functional coverage scenarios." (Alibaba Business Service Ecosystem White Paper 2016)*
Synchronise activities across boundaries for simultaneous adoption and synergies	*"If the thinking of users and the ecosystem participants does not change, and if the Internet cannot be truly embraced, then the cloud is meaningless. Only when users and the entire ecosystem participants embrace the Internet will the value of cloud computing be truly realized." (Wang, 2016: 20)* *"At the edge level, we are all software things, and hardware things are all partners. At the IAAS layer, Ali is selling cloud services. The PAAS layer is very abstract, and there is no standard answer. We have a data platform, a business platform, and an AI platform. We understand them as PAAS. These three are currently partial project-based services. That is, if my customers have needs, I will go there to provide you with some advice. In the future, we will transform it into a platform, which can be copied. In the case of a platform, some things are standardised, and there is no need for customised services. Now it is project-based, selling products and solutions. In the future, we hope to make common elements become larger. For the SAAS layer, we provide a platform like Taobao, a third-party app, and you can choose what you need at that time. We receive a portion of the commission, which is ISVs. The industrial app is mainly for partners." (A2 I interviewed)* *"It is a rich and three-dimensional one with four aspects. It has to be done slowly in the four aspects such as equipment level and production line level." (A18 I interviewed)* *"In the process of serving enterprises, three industrial Internet platform models based on Alibaba Cloud have been gradually explored. Mode 1, an enterprise-level industrial Internet platform, works together with ecosystem partners to provide enterprises with "one-stop" services for digital transformation; Mode 2, an industry-level industrial Internet platform, empowers ecosystem partners, integrates industry resources, and creates an industry-level platform to achieve industry-leading scale empowerment; Mode 3, the regional industrial Internet platform lands on the regional platform, according to the characteristics of the regional industry, integrates industrial resources to help the development of the platform for enterprises in the region, and accelerates the application of enterprises on the platform." (Alliance of Industrial Internet Report 2020)* *"IIoT platform can be achieved and utilised in four levels: First, the equipment level. To connect all equipment and optimise its performance. Second, production line level. To connect machines and staff along a production line and optimise the performance of this production line. Third, firm level. To link all modules including product design, inventory management, production, and order management, helping firms to have the ability to optimise corporate decisions. Fourth, industrial district level. To collect data from multiple companies at the park level to optimise and manage." (A2 presentation during my field visit)* *"By constructing a cross-platform and cross-industry ecosystem, it will form a greater degree of intersection and collaboration, and create new business models and new formats, such as industrial e-commerce platforms, supply chain finance, mobile travel services, and big data trading platforms." (Alibaba supET White Paper, 2019)*
Prioritised demonstration and customisation to showcase successful pilots and concepts in vertical fields	*"Many companies need a process. Before he can see the local partner companies get on the cloud, he does not believe it, Also, the cloud, he said that unless you take me to have a look at the computer room, it is really like I can only believe that once I take a look at your base station and your server. It is just to use the power of example to do things." (J1 I interviewed)* – The power of exemplar demonstration has also been highlighted in many other informants, white papers, and my participant observations. *"The first is that we have some projects in the early stage through the demonstration model. In the early stage, Ali will invest first to dispel his concerns. We will invest in new application products first, and then rely on some subsidies from the government to first implement the project." (A11 I interviewed)* *"In the beginning, Industrial Brain was positioned as a platform similar to Taobao, but the problem it faced was that there was no one to do what was on the platform. Some manufacturers in the industry may know some traditional methods, but how to truly combine*

	technology and data, in fact, few people can do it. Based on this situation, the outside world will also doubt whether we can accomplish this. Therefore, we have to personally make some demonstration model to convince everyone that this is a feasible route… In addition to the cement industry, in many industries such as the steel and chemical industry, Alibaba Cloud Industrial Brain builds the demonstration model to create industry benchmarks, thereby accelerating the implementation of other various subdivided vertical industries… The positioning of our industrial brain is not a closed application, but an open platform. We use the demonstration model to attract everyone to this open platform so that everyone can see the general direction and firmly believe that there are so many treasure troves of industry data in the huge industrial industry." (A18 I interviewed) *"In terms of empowering the industry, create domestic and foreign industry demonstration benchmark customers, so as to drive the industry to follow, realize the industry expansion model, establish industry demonstration model according to benchmark customers, and promote iterative optimisation and abstraction of the product matrix in the cloud data centre, so as to adapt to industries and customers" (Deng, 2018: 32)*
Leverage collaborative and digital regulation to reduce opportunistic behaviours	*"Maintaining the health of any ecosystem, online or offline, requires the contribution of all stakeholders involved. Brands, e-commerce platforms, and law enforcement personnel must work closely together for a healthy business and social environment... In order to better protect intellectual property rights, Platform Governance formed the "Anti-Counterfeiting Special Task Force" that actively works with local law enforcement agencies. By expanding the scope of offline cooperation, such as "Operation Cloud Sword" and the "Cloud Sword Alliance," and establishing channels for routine collaboration, Alibaba aims to help identify and eliminate bad actors at their offline manufacturing facilities. Currently, Platform Governance is working with the public security bureaus of thirteen provinces and cities – Zhejiang, Shandong, Beijing, Heilongjiang, Liaoning, Jiangsu, Shanghai, Jiangxi, Anhui, Guangdong, Hunan, Chongqing and Fujian… Strengthen Collaboration with International Trade Associations. Alibaba has been, and remains, committed to working closely with trade associations around the world through open and constructive dialogue and the exchange of ideas, to jointly fight the global war against fakes. In 2016, Alibaba engaged in in-depth dialogues and joint efforts with numerous organisations to explore ways to better protect intellectual property rights online, enhance accuracy and efficiency in enforcing IPR, and discuss common challenges that the industry is facing." (Alibaba Group Platform Governance Report 2017)* *"Interviewer: Last year, you made a big move to build a platform where rights holders co-construct. Can this also be seen as a new attempt to mobilise more people to participate in the anti-counterfeiting work? Junfang Zheng (Alibaba Chief Platform Regulator): The biggest difference between this co-construction platform and the previous ones is that we and the right holders, that is, the various brand parties, work on the same platform. It used to be that they complained, when we checked, and then took it off the shelves. Now right holders can set some screening conditions by themselves, such as price, such as keywords, and once a counterfeit is found, they can file a complaint with one click, which greatly reduces the time and cost of cracking down on counterfeiting. Doing so is tantamount to combining the right holder's expertise with our big data advantages." (China Quality News Website, April 12 2017)* *""Collaborative governance" is the most basic way of platform economic governance. It is necessary to build a governance mechanism that is decentralised and multi-stakeholders participate together. Introduce more participants, each with a division of labour and performing their own duties, from the perspective of management in the past to the perspective of governance and even collaborative governance." (Three Topics of Collaborative Governance of Platform Economy Report by Alibaba Research Center and Deloitte, October 2017)* *"For good people, we provide empowering tools to create a sense of business security for businesses; for bad people, we resolutely crack down, and for malicious behaviour, we firmly say no… On August 23, 2019, Alibaba officially released its first business environment governance product "Business Security". The "Business Security" supplementary order fully integrates various business environment protection capabilities such as the prevention and control of malicious orders and product compliance testing that Ali has accumulated over the years, and also brings together government departments, Internet companies, merchants, and consumers, innovatively providing a set of solutions that use artificial intelligence technology to participate in platform governance and improve the platform's business environment… Merchants can not only enjoy the platform's active interception and prevention and control of malicious Internet behaviours such as malicious comments, malicious complaints, and malicious refunds, but also continuously cultivate the artificial intelligence model algorithm by feeding back information to the platform to promote "business*

		Security". The comprehensive evolution of the safety and risk control capabilities of Yingshangbao." (E-commerce Online Official website, December 31, 2019) *"Through continuous innovation, Alibaba has developed a comprehensive online rating system to regulate sellers. The system is powered by Alibaba's data processing engine and users are evaluated based on the following metrics – identity verification results, user credibility assessment, compliance with platform policies, penalty records, positive user behavior, collaboration efforts, and others. This rating system enables Alibaba to enforce its rules and policies in a more targeted manner against infringing merchants, hence optimising overall governance efficiency…In April 2016, Alibaba began a more concentrated effort to crack down on merchants attempting to mislead consumers into visiting their stores through abusive posting of branded keywords in the titles of product listings. Known within Alibaba as the "Haze Clearing Program," this initiative continuously uses big data algorithms to identify, block, and remove misleading uses of product identifying language. Listings identified by the initiative as subject to takedowns, lowered merchant credit ratings, and suspension of marketing activities." (Alibaba Group Platform Governance Report 2017)*
Enhance legitimacy and diffuse new institutions	Align with the government to reduce monopoly concerns and enhance legitimacy	*"The speaker is from the antitrust department. He was an antitrust government official before. We want to influence antitrust experts. He is the most influential in the antitrust field. Even if he doesn't work there anymore, he still has influence. He is a senior expert in the field of antitrust, and what he has to say will have an impact on the entire field of antitrust. For example, if he comes here, it will be beneficial to Alibaba under the circumstance that it is unnecessary to say too much. People have concern that Alibaba is very big and has a monopoly tendency, So through him, he said that Alibaba is not a monopoly and in fact, Alibaba is continuously innovating. He said it through his mouth (that's the key)." (A8 I interviewed)* *"New Retail will bring about a restructuring of the global supply chain and change the complexion of globalization from the domain of big companies to small businesses. The Chinese government's push for the "Belt and Road Initiative" presents a unique opportunity for Alibaba to grow our business internationally." (2017 Chairman Letter to Shareholders, Jack Ma, October 17, 2017)* *"In the last century, I call it IT time, IT is empowering yourself, and make yourself strong. In this century, I call it DT time. Data technology. DT is empowering others. When you empower others, you empower your future and yourself." (Jack Ma, 2015 CGI Annual Meeting, October 1, 2015)* *"What we build is the infrastructure for future commerce. We empower merchants engaged in buying and selling, rather than compete with merchants engaged in buying and selling. From this point of view, the so-called our 'competitors' are actually the objects of our empowerment and help in the future. To simply regard the companies engaged in e-commerce in today's market as Alibaba's competitors is to compare apples with apple trees, which is inappropriate for both parties." (Alibaba Letter to Shareholders from Executive Chairman Jack Ma, 2015 October 8)* *"China's "One Belt, One Road" strategy aims to establish a community of interests, destiny and responsibility with countries along the route with political mutual trust, economic integration and cultural tolerance, demonstrating China's peaceful will and strong strength. The Electronic World Trade Platform Initiative (eWTP) proposed by Alibaba is just a private exploration of the "Belt and Road" strategy. In 2016, Alibaba Group initiated the establishment of eWTP, which was widely recognized by the international community and was written into the communique of the G20 Hangzhou Summit as an important policy recommendation." (Alibaba Group SCR Report 2017/2018)*
	Leverage training, conferences, and white papers to systematically diffuse new institutions	*"Alibaba's positioning is to start a business revolution. What we build is the infrastructure for future commerce." (Alibaba Letter to Shareholders from Executive Chairman Jack Ma, 2015 October 8)* *"Alibaba Group Holding Limited (NYSE: BABA) announced today that it has entered into a definite agreement to acquire the South China Morning Post (SCMP) and other media assets of SCMP Group Limited (SEHK: 0583)." (Alibaba Press Release, December 11, 2015)* *"This "New Commercial Civilisation" represented the strategic shift of Alibaba from relying on the commercialization of network traffic to moving to the upstream of the supply chain and digitally transforming both the consumption side and the provision side in every stage of the value chain." (A1 I interviewed)* *"Everyone should have the opportunity to make the world better. The purpose of the Xin philanthropy conference is to inspire the young generation to give back and to support the development of philanthropy in China. It's not enough to have good will, we also need the talent, the planning and the execution to make a sustainable impact in China and in the world… Alibaba believes that companies*

		and entrepreneurs can make the greatest positive impact by keeping social purpose at the heart of the business model" (Alibaba Press Release, July 9, 2016) *"Alibaba Group's commitment to encouraging inclusive, universal and sustainable growth for businesses and communities alike – all for the greater benefit of people…Contributing to important causes such as rural education, youth engagement, environmental sustainability and women's empowerment." (Alibaba Press Release, September 5, 2018)* *"Alibaba Group announced today the establishment of an e-hub under the Electronic World Trade Platform (eWTP) initiative together with the Malaysia Digital Economy Corporation (MDEC), the country's digital economy development agency, and other parties… These include the establishment of an e-fulfilment hub near the Kuala Lumpur International Airport, a one-stop online cross-border trading services platform, cooperation in e-payment and financing, and development of e-talent training that will fit into Malaysia's roadmap of transformation into a digital economy…The parties will establish training programs to help incubate startups and develop skillsets in individuals in support of Malaysia's digital economy development." (Alibaba Press Release, March 22, 2017)*
Emergent actions of other actors		
Suggest new opportunities	Present new demands	*"Alibaba has a proven track record in smart city development which this newly announced collaboration will seek to build on. One example is the Hangzhou City Brain, which was launched in October 2016 based on artificial intelligence and deep learning and reduces traffic congestion by sending out instant traffic alerts and route suggestions to users by real-time prediction of traffic movement. This transportation management system, piloted in Hangzhou's Xiaoshan District, has increased traffic speed by as much as 11%." (Alibaba Press Release, August 4, 2017)* *"As part of its stated national agenda, the Malaysian Government wishes to create a fulfilment and logistics centre for global marketplaces, increase internet economy-related innovation and boost inward investment. This aligns closely with the commitment of the eWTP and given the strong historical trade ties between China and Malaysia, makes it a natural match for a DFTZ powered by Alibaba Group." (Alibaba Press Release, March 22, 2017)* *"Companies like Big-E, Ruhan, Red Collar, and Shangpin don't just emerge haphazardly or in isolation. They leverage platform capabilities painstakingly built on Taobao and the vital resources gathered there, namely, the many in dependent service providers detailed in chapter 2. At the same time, these firms enable the growth of platforms like Taobao. New players always grow together with the platforms and with the platform partners the players rely on for various support functions. In essence, brands, support functions, and the platform all grow together as an ecosystem." (Zeng, 2018b: 113)* *"When we came here [a participant's site], we wanted to do the city brain. The business application we chose at that time was transportation. However, when we arrived here, we saw that the participant's site has a population of 300,000. The traffic is basically not congested, so basically there is nothing to optimise. After a detailed exchange with the participant, we think this IIoT is more possible at this site." (A9 I Interviewed)*
	Propose new roles	*"Alibaba Group (NYSE:BABA), the world's largest retail commerce company, kicked off its first Olympic Games as a TOP partner today with the opening of its showcase – "The Olympic Games on the Cloud" – at the Gangneung Olympic Park…The opportunity for technology to positively influence, shape and reimagine the Olympic Games experience is tremendous and we haven't even scratched the surface yet," said Chris Tung, CMO of Alibaba Group. "Over the next ten years, Alibaba Cloud services will serve as the foundation of our efforts to drive the digital transformation of the Games, creating a more efficient and enjoyable experience for all audiences." (Alibaba Press Release, February 10, 2018)* *"With the advent of the big data era, not only will enterprises face the test of data security and data peak traffic, the government will face similar or even more severe issues. Based on the deep understanding of government informationalization, Alibaba constructs an open, sharing, flexible, highly efficient, secure and reliable government cloud infrastructure framework. Through close cooperation with integrators and ISVs of the government industry, Alibaba is capable of rendering full government cloud services, and able to provide government departments with sharing infrastructure resources, open data support platforms, rich smart government applications, 3D security safeguards, guaranteeing highly efficient operation and maintenance service" (Alibaba CSR 2014-2015 Report).* *"Today, Alibaba Group and the United Nations World Food Programme (WFP) announced the launch of "Hunger Map LIVE," a groundbreaking global hunger monitoring system that uses Artificial Intelligence (AI), machine learning and data analytics to*

	predict and track the magnitude and severity of hunger in over 90 countries in close to real-time." (Alibaba Press Release, September 26, 2019)
Force alternative opportunities	*"Alibaba focuses on mastering the Cloud platform and associated technologies so ecosystem participants can integrate into Alibaba. Alibaba Cloud does not do SaaS itself but lets everyone do better SaaS. This means that Alibaba focuses on empowering participants in niched industries by providing Cloud services." (Jianfeng Zhang, Smart AliCloud President, 2019 AliCloud Conference in Beijing)* *"What we build is the infrastructure for future commerce. We empower merchants engaged in buying and selling, rather than compete with merchants engaged in buying and selling. From this point of view, the so-called our 'competitors' are actually the objects of our empowerment and help in the future. To simply regard the companies engaged in e-commerce in today's market as Alibaba's competitors is to compare apples with apple trees, which is inappropriate for both parties." (Alibaba Letter to Shareholders from Executive Chairman Jack Ma, 2015 October 8)*
Present win-win collaborations	*"Alibaba Group Holding Limited (NYSE: BABA, "Alibaba") announced today that the company will invest approximately RMB5.45 billion for a 15% stake in Beijing Easyhome Furnishing Chain Store Group Co., Ltd ("Easyhome"), China's leading home improvement supplies and furniture chain operator. The strategic investment underscores Alibaba's commitment to furthering the New Retail strategy by taking it into new sectors and driving the seamless convergence of online and offline retail experience. The investment will combine the strengths of the world's largest e-commerce platform and the rich offline resources of Easyhome. Alibaba will apply its consumer insights, membership program, expertise in cloud and enterprise systems, as well as its logistics platform to support the digital transformation of Easyhome's 223 stores in 29 provinces, autonomous regions and municipalities across China. From home design to refurbishment projects, the two parties will provide customers with end to end home improvement solutions." (Alibaba Press Release, February 11, 2018)* *"Siemens and Alibaba Cloud, the cloud computing arm of Alibaba Group, signed a Memorandum of Understanding (MoU) today to partner to foster the industrial Internet of Things (IoT) in China. The two companies will leverage each other's technology and industry resources to build a unique IoT solution to support Industrie 4.0, China's manufacturing upgrade and transformation and other industrial Internet initiatives." (Alibaba Press Release, July 9, 2018)* *"One of the manufacturers, SAIC Motor Corp in China, said it would work with the Chinese e-commerce giant and invest US$161 million to develop cars that connected to the internet. At the same time, online car dealers at Tmall.com, Alibaba's global e-commerce platform, would use big data and cloud computing to match potential buyers and dealers, recommend cars to potential buyers and provide loans by analyzing data about the buyers' previous online purchasing histories." (ACRC Case Study, 2015, The Internet of Things (IoT): Shaping the Future of E-commerce)*

The data shown in this table only represent a subset of my analysis for illustrative purposes. The complete set is available from authors on request.

9 GLOSSARIES

Table 9.1 - Glossaries

Terms	*Definition*
Ecosystems	Ecosystems refer to an organisational form that is characterised by a community of heterogeneous, loosely connected, complementary and co-evolving actors that are coordinated for system-level value co-creation and mutual performance. Increasingly, ecosystems involve shared architectural elements such as platforms through which participants and activities are connected through standardised interfaces and rules. Some scholars may call them "meta-organisation" (Gulati, Puranam, & Tushman, 2012), networks and others.
Ecosystem orchestrator	The central actor of an ecosystem that is responsible for leading the ecosystem development. Examples of similar notions that have been used in existing literature are "ecosystem leader" (Moore, 1993), "keystone" (Iansiti & Levien, 2004a), "platform leader" or "platform owner" (Cusumano & Gawer, 2002), ecosystem "captain" or "manager" (Teece, 2018), "hub" (Dhanaraj & Parkhe, 2006; Iyer et al., 2006), architect, core, and focal actor (John & Ross, 2021).
(Ecosystem) participants	Organisations or individuals that participate in ecosystems by adopting ecosystem services and/or contributing to ecosystem development, including those that contribute directly and indirectly.
Consumption-side participants	Or Consumers. Some scholars may call it demand-side users (Panico & Cennamo, 2022). I define as organisations or individuals that use the core services that ecosystems strive to facilitate.
Provision-side participants	Or providers. Some scholars may call in supply-side users (Kapoor, 2018). I define as organisations or individuals that provide the core services that ecosystems strive to facilitate.
Complementors	Organisations or individuals that provide complementary services that support core services ecosystems strive to facilitate.
Ecosystem direct participants	Organisations or individuals that directly participate in ecosystems by adopting ecosystem services.
Ecosystem indirect participants	Organisations or individuals that indirectly participate in ecosystems by contributing to ecosystem development.
Ecosystem synergies	The combined ecosystem-level effect that is greater than the sum of separate effects
Ecosystem value propositions	"the promised benefit that the target of the effort is to receive, as opposed to what a firm is to deliver" (Adner, 2017: 43). An ecosystem value proposition is used to "create the (endogenous) boundary of the relevant ecosystem" (Adner, 2017: 43) and specify the common goal of ecosystem participants.
Ecosystem mission	An abstract and stable guidance that specifies the changes an ecosystem aims to make to the world
Ecosystem vision	A narrow and changeable guidance that specifies the direction an ecosystem aims to achieve and the strategic actions that are needed in the process
Architecture	An abstract notion that defines an ecosystem's overall structure, designs platforms and interfaces between participants, states roles and allocation of value co-created, and specifies rules that govern all (Baldwin, 2015; Tiwana et al., 2010).
Governance	Specifies the rules that support ecosystem sustainable growth by balancing evolvability and stability, autonomy and control, as well as value co-creation and value capture through mechanisms such as access, control, and incentives (Chen et al., 2022a; Schmeiss et al., 2019; Wareham et al., 2014) Ecosystem governance typically does not involve command-and-control hierarchical mechanisms but mainly influences and shapes participants' rather autonomic behaviours (Tiwana, 2014).
Interfaces	Design rules that specify how participants, modules, and the platform interact and exchange information (Tiwana et al., 2010)
Ecosystem organising logic	The rationale for designing and evolving ecosystem arrangements for strategic missions (Yoo et al., 2010)
IIoT	"A system comprising networked smart objects, cyber-physical assets, associated generic information technologies and optional cloud or edge computing platforms, which enable real-time, intelligent, and autonomous access, collection, analysis, communications, and exchange of process, product and/or service information, within the industrial environment, so as to optimise overall production value. This value may include improving product or service delivery, boosting productivity, reducing labour costs, reducing energy consumption, and reducing the build-to-order cycle." (Boyes et al., 2018: 3-4)
IaaS	The infrastructural as a service (IaaS) layer, coined by Oracle in 2012, provides storage, computing, network, and distribution of data gathered from the edge layer.
PaaS	The platform as a service (PaaS) layer, which services like the operating system similar to the Android operating system for mobile phones, is a category of cloud computing service that allows users to develop, test, run, and manage modular applications without configuring the infrastructure.
SaaS	The software as a service (SaaS) layer, which resides in specific software developed by a wide range of participants, refers to hosting software in the cloud without taking up on-premises resources.

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