The Formation Process towards Conglomeration of Digital Ecosystems: A Hybrid Organizing Perspective

Wenchi Ying
School of Economics and Management
Beihang University
Beijing, China
Email: yingwenchi@buaa.edu.cn

Suling Jia
School of Economics and Management
Beihang University
Beijing, China
Email: jiasuling@buaa.edu.cn

Abstract

Although many enterprises have been pursuing an ecosystem strategy to facilitate larger and more diverse ecosystems in recent years, there are few successful examples of conglomeration of digital ecosystems through leveraging IT/IS capabilities to align and combine diverse ecosystems. Hybrid organizing is a sound guiding theory that we adopt to examine the nature of formation process of the conglomeration. We construct a theoretical lens aligning hybridization approaches with forms of ecosystems through an organization design based on IT/IS capabilities. Guided by this lens, we conduct an in-depth case study of a successful company in China. This study reveals a process model which consists of dismissing, separating, and cumulating phases. Our findings contribute to existing body of literature, in the field of digital ecosystems and hybrid organizing. Core firms of ecosystems can use the model to design and develop digital ecosystems with rational deliberation and planning.

Keywords Digital ecosystems, Hybrid organizing, IT/IS capabilities, Process model, Case study

1   Introduction

Digital Ecosystems are new models of value co-creation, capture and distribution (Adner, 2017; Ghazawneh and Henfridsson, 2013; SelAdner et al., 2013), deriving from digital disruption opportunities for destroying long-successful business models and reorganizing traditional types of ecosystems (Weill and Woerner, 2015). Digital technologies enable ecosystems to entirely remove the limitations of geographic proximity and provide tools for cross-system collaboration (Boley and Chang, 2007). Many of the companies are seeking to transform through operating in increasingly digital ecosystems where they can know more about and solve customer's needs (Weill and Woerner, 2015). By virtue of strategic significance and challenges, structuring digital ecosystems has attracted considerable attention from researchers. This research stream has provided companies with invaluable insights, especially on how to leverage IT/IS capabilities (Wade and Hulland, 2004) to rebuild business ecosystems (Iansiti and Levien, 2004a), technology ecosystems (Wareham et al., 2014) or other types of ecosystems (Thomas and Autio, 2012). However, practices on extension and combination of diverse ecosystems can still fail dramatically. A common characteristic often shared by these practices is that the core firms fail to address digital boundary-compatibility challenges in order for alignment and combination of elements from diverse ecosystems (Thomas and Autio, 2012). Several studies reveal the reasons why companies implement the alignment and combination of diverse ecosystems in the digital era. For example, Adner (2017) notes that ecosystem strategy affects value co-creation, capture and distribution within and across digital ecosystems, which means the core firm aligns elements not only within a single ecosystem but also across diverse ecosystems. Yoo et al. (2008) find that digital fusion transforms ecosystems, combining along with technological innovations that transform the business landscape. Thus, we define the form of alignment and combination above as *conglomeration of digital ecosystems*, like a conglomerate with different types of businesses and organizations. Obviously, many firms aspiring to be long-successful in the future, including the emerging and the traditional, are pursuing an ecosystem strategy based on IT/IS capabilities to facilitate larger and more diverse ecosystems, and conglomeration of ecosystems.

However, the "how" question (i.e. "*How do core firms implement conglomeration of digital ecosystems?*") has yet to be explored because there has been a lack of consideration of *the formation process for conglomeration*. Although alignment and combination provide the foundational concepts for explaining the phenomena of digital ecosystems (Adner, 2017; Henningsson and Hedman, 2014), we should adopt a much more precise theoretical perspective for examining "how". Battilana and Lee (2014) use the term "hybrid organizing" to describe how diverse types of organizations, whose structures are not always compatible, are aligned and combined. In this paper, we adopt the hybrid organizing perspective to explore how the core firm achieves conglomeration of digital ecosystems, where the typologies of hybridization approaches reflect the dynamic nature of different phases of conglomeration and different forms of ecosystems. Meanwhile, the IT/IS capability-enabled organization designs provide actual strategies for hybridization actions. Guided by this theoretical lens, we conducted an in-depth case study by analysing the successful formation process of hybridizing digital business ecosystems and technology ecosystems in Red Collar Group (RCG), a role model of smart manufacturing in China. Therefore, we derive our research question: *how does the core firm adopt hybrid-organizing approaches to conglomerate digital ecosystems step by step?*

This study proposes a three-phase process model on conglomeration of digital ecosystems. In each phase, the model unveils a kind of hybridization mechanism, consisting of a set of IT/IS capabilities and IT/IS capability-enabled organization design, and illustrates a distinctive form of ecosystems. Thus, this study makes both important theoretical and practical contributions. First, by examining the hybridization process of conglomeration of digital ecosystems, this study contributes not only to the digital ecosystems literature but also to that of hybrid organizing. Second, the core firm may use the findings to implement conglomeration of digital ecosystems and maintain health of the evolving ecosystems, and by doing so, increase the success rate of the construction of digital ecosystems.

2   Literature review

2.1   Business ecosystem, technology ecosystem and digital ecosystems

Ecosystem is defined as an alignment structure comprising a multilateral set of stakeholders that need to interact in order for a focal value proposition to materialize (Adner, 2017). Business ecosystem (Iansiti and Levien, 2004a; Moore, 1993) emphasizes efficiency and flexibility as key sources of value (Thomas and Autio, 2012), where value is co-created through thriving in scale and scope economies.

Its locus of coordination is the core firm (Iansiti and Levien, 2004b) whose centrality is established on the basis of control over the dominant technological architecture, or product characteristics, or brand that structures value in the ecosystem (Teece, 2007). Meanwhile, technology ecosystem, that is, industry ecosystem (Wareham et al., 2014), emphasizes innovation and externality benefits as the primary sources of value through thriving in variety of products (Thomas and Autio, 2012). Technology ecosystem is often described as a product platform defined by core components and products made by the platform owner (Wareham et al., 2014), with complementary products and services made by autonomous complementors (Teece 2007) in the periphery, and its locus of coordination being the technology platform (Thomas and Autio, 2012). Obviously, there are diverse ecosystem models with differing value logics and locus of coordination which reveal the conceptual boundaries of ecosystems (Thomas and Autio, 2012).

Digital Ecosystems derive from digital disruption opportunities (Weill and Woerner, 2015) and being characterized by the digital fusion relations between business and industrial technology regarding different resources (SelAdner et al., 2013) and IT/IS capabilities (Tan et al., 2015; Wade and Hulland 2004). The fusion transforms digital ecosystems along with technological innovations that transform the business landscape (Yoo et al., 2008). Thus, digital ecosystems are defined as a collective of stakeholders that are inter-linked by a common interest in the prosperity of IT/IS capabilities, and a demand-driven, domain-cluster, dynamically interactive environment (Boley and Chang, 2007) where they can know more about and solve customers' life or business needs, with products and services from their companies, from complementors, and sometimes from competitors (Weill and Woerner, 2015), within and across ecosystems (Adner, 2017). Based on IT/IS capabilities, e.g. core firm's abilities to mobilise and deploy IT/IS architecture or platforms in order to integrate internal and external resources (Tan et al., 2015; Wade and Hulland 2004), digital ecosystems may entirely remove the limitations of geographic proximity and can provide tools for cross-system collaboration (Boley and Chang, 2007). Therefore, the core firm should adopt suitable strategy to approach the alignment of stakeholders and secure their collective activities to contribute to the whole ecosystem (Adner, 2017).

Obviously, digital ecosystems align resources not only within a single ecosystem but also across multiple and diverse ecosystems. Thus, it is significant for the core firm to address digital boundary-compatibility challenges (Battilana and Lee, 2014; Ghazawneh and Henfridsson, 2013) in order for combination of diverse organizations (Huang et al., 2017). We conceptualize the alignment and combination related to digital ecosystems as *conglomeration of digital ecosystems* on which few researchers focused, and *hybrid organizing* is a suitable theoretical perspective.

2.2   Hybrid organizing towards digital ecosystems

A hybrid organization is defined as the combination of multiple organizational structures (Battilana and Lee, 2014; Jay, 2013). Elements of different organizational structures are not always compatible (Greenwood et al., 2011). Such incompatibility may lead to tensions inside hybrids when they have to combine mutually conflicted processes or practices demanded by different organization forms in the hybrid work context (Tracey et al., 2011). Recent studies propose that combining organizational forms is central to organizational innovation and, in particular, the creation of new forms (Tracey et al., 2011), such as digital ecosystems combining diverse ecosystems.

Hybrid organizations' innovativeness, however, brings about unique challenges (Battilana and Lee, 2014), because structural elements of multiple forms such as diverse ecosystems are not often compatible (Greenwood et al., 2011; Thomas and Autio, 2012). As structure follows strategy (Chandler, 1962), the organizations have to adopt suitable strategies to address the internal and external tensions (Greenwood, et al., 2011) that these challenges for structures lead to. Thus, Battilana and Lee (2014) collected *four strategic approaches of hybrid organizing* from existing research: (1) Dismissing refers to explicitly rejecting elements or demands of at least one organizational form; (2) Separating refers to compartmentalizing elements or claims from different organizational forms; (3) Cumulating refers to retaining and linking disparate elements of different organizational forms and (4) Creative refers to forging a new distinctive institutional order. Furthermore, Battilana and Lee (2014) proposed *a conceptual set of organization designs* to align activities with strategies (Chandler, 1962), and such hybrid organizing features of the design include: (1) incentives and control systems that the core firm uses to teach and reinforce the behaviours and values desired in stakeholders; (2) organization structure between multiple forms as the tensions need to be experienced and resolved and (3) governance relating to maintaining core accountability for managing risks. Meanwhile, Battilana and Lee (2014) mentioned that hybrids are prone to ecosystems' goal updating and evolve toward higher level forms (Adner, 2017), and organizations could develop activities related to hybridization approaches through a process of "selective synthesis" (Chen et al., 2014). Obviously, hybrid

organization design is a key area of the organizational process through which organization leaders formally translate strategic approaches into actions step by step.

Despite fruitful hybrid-organizing research on social enterprises (Battilana and Lee, 2014), microfinance organizations (Battilana and Dorado, 2010), social housing (Binder, 2007), medical education (Dunn and Jones, 2010), and online-offline organizations (Huang et al., 2017), few researchers have focused on the emerging field of digital ecosystems, which is a typical phenomenon involving the hybridization of multiple and diverse organizations within or across ecosystems, where the core firm has to conduct a set of hybrid-organizing designs based on IT/IS capabilities. Simultaneously, the process of hybridization is an important domain that has received limited attention from scholars (Battilana and Lee, 2014). From there, we derive our research question: *how does the core firm adopt hybrid-organizing approaches to conglomerate digital ecosystems?*

3   Research methodology

The case research method is particularly appropriate for this study for several reasons. First, the research question is based on "how" and is thus better answered through inductive methods (Pan et al., 2011; Walsham, 1995). Second, since the study aims to build a new theoretical model, the case study is more effective because of its strength in exploring new conceptual arguments (Siggelkow, 2007). Third, the case study method is suitable for a process-based analysis (Gummesson, 2000).

For the purpose of case selection, three criteria were identified. First, the organization should proactively establish its digital ecosystems so that the theoretical phenomenon is significant. Second, the sample organization should be reasonably large and sufficiently complex in terms of its innovative activities to allow for ecosystem structures and strategies to be studied. Third, top management should be willing to support a detailed case study so that rich insight can be gained.

RCG is particularly appropriate for our purpose, because it is an outstanding example in the field of digital enablement in China. RCG successfully developed a digital platform and leveraged it to establish digital ecosystems combining business and industrial technology ecosystems. In addition, top management granted us sufficient access.

3.1   Data collection

Data was collected in two steps. Research access was first negotiated and granted in August 2015. Before onsite data collection and interviews, we systematically collected secondary data from newspapers, magazines, the Internet, and industry seminars. Meanwhile, we selected and confirmed the theoretical lens (Pan et al., 2011) that we would employ in the study and read both the classic and current literature. The collection of secondary data, the adoption of digital ecosystem concepts and the hybrid-organizing perspective guided us for subsequent on-site data collection and analysis.

On-site data collection was then conducted at RCG's headquarters and its factories, through telephone interviews, and from October 2015 to June 2016. We applied the top-down interview method (Pan et al., 2011), interviewing a total of 25 informants (see Table 1), including the founder, executive vice director, marketing director, CIO, senior manager, mid-level manager, and external partners, among others of RCG and KuteSmart (its subsidary). Each interview lasted approximately 50–120 min, and the questions were customized to the informants. Each digitally recorded interview was then transcribed. The transcripts and the secondary data allowed for triangulation, which enabled greater substantiation of the constructs and hypotheses (Eisenhardt 1989).

Position / departments	The number of interviewees	Duration of the interview (per person)
RCG's founder	1	60 min
RCG's executive vice president	1	90 min
RCG's marketing director	1	120 min
RCG's CIO	1	70 min
Senior manager of KuteSmart (RCG's subsidiary)	4	60-90 min
Mid-level managers in logistics, R&D, CAD tech, IE, sales departments in RCG's headquarters and KuteSmart	14	50-70 min

Representatives of peer manufacturers as RCG's partners	3	60-90 min

Table 1. List of Interview

3.2 Data analysis

To organize the large volume of data, we focused on two themes: the form of digital ecosystems structured around RCG and its digital platform, and IT/IS capability-enabled organization design related to hybridization approaches for aligning and combining internal and external organizations. The exhibition of hybridization approaches could facilitate RCG's strategies and activities for conglomerating digital ecosystems, which is important to the understanding of digital ecosystems' practices and theories (Dyer et al., 1991). Focusing on the two sets of constructs – hybrid-organizing approach with organization design and IT/IS capabilities, and form of digital ecosystems – in Figure 1, we identified RCG's three important phases for conglomeration of digital ecosystems: the dismissing phase, the separating phase, and the cumulating phase. Correspondingly, we conceptualized three structures of digital ecosystems by imagining ecosystems as a concert, and thereby outlined three digital ecosystem forms established by RCG: digitally solo ecosystem, digitally divisi ecosystems, and digitally tutti ecosystems. (See Table 2)

Data analysis was performed concurrently with data collection to take advantage of the flexibility that the case study research methodology affords (Eisenhardt, 1989). Based on the emerging data, to facilitate the examination of the form of digital ecosystems in different phases, we introduced relevant constructs of organization design within the phases: incentives and control systems, organization structure, and governance. The theoretical model was then validated and revised accordingly. The data analysis followed an iterative process among the empirical data, the relevant literature, and the emerging model until theoretical saturation was achieved (Pan et al., 2011).

4   Case description

Red Collar Group (RCG) is an apparel manufacturer, founded in 1995 and headquartered in Qingdao, Shandong, China. With around 3,000 employees and annual revenue of over 300 million USD, the company now is a major producer of a high-grade, personalized-customization series of suits, complementary apparels, and accessories in the global market.

RCG had been engaging in its suit-manufacturing business through taking bulk orders from clients. Since 2002, RCG started its digitally transformative and innovative journey which took the company 10 years to acquire the competencies in digitally personalized-suit production. During this period, RCG created a novel digital platform and business model that is now well known as C2M (customer-to-manufactory) model. Based on the platform, RCG integrated customers, sales, suppliers, designers, and producers such as peer manufacturers, even including former competitors. Thereby, according to the customers' personalized needs, RCG provided customers with various kinds of apparel products including suits, trousers, shirts, coats, as well as wigs, bags, etc. By far, RCG have conglomerated digitally multi-win ecosystems. How did RCG achieve it?

4.1   Building the digital infrastructures to exploit an internal system of personalized-suit customization

Personalized suit production, as we know, is highly expensive and time consuming. For example, it takes 3-6 months' work to accomplish one set of suits, and a traditionally skilled production line can only complete 5 sets each day, while the customers have a very limited range of options. Since engaging in suit-manufacturing business, RCG spent over 8 years on acquiring the experience in customization. However, a critical issue arose, as RCG's founder explained,

> *Despite the experiences, the capacities of manual work and traditional production line were limited, so that we could not flexibly integrate the diverse stakeholders and related resources to reduce the complexity and costs of customization, or improve the efficiency and benefits for stakeholders. We had to look for a new technological alternative, and digital technology offered an answer.*

In 2002, RCG first adopted a specialized ERP system to redefine the operational process including 308 procedures and to modularize the personalized-suits production line. Then, RCG started to accumulate data of each order through the ERP system, and built the data warehouse for standardizing data collection, design pattern and data analysis of the next order. As a result, the designers, producers, and suppliers could cooperate online, and the efficiency and accuracy of RCG's supply chain and

production were greatly improved. For example, based on over 2 million records of orders so far, the time-consuming manual pattern making process was replaced by a series of data queries and analysis that can be automatically done within 5 minutes.

Subsequently, RCG developed an order placement system to take orders online in 2007, and gradually made it an e-commerce portal, including website and mobile application (an app for iOS or Android), where the customers were able to have a wide range of customization options for each procedure, upload their personal measurements, and place orders online. Simultaneously, customers could also go to RCG's offline stores for professional services which were supported by the e-commerce portal. Then, the production process of an order would be launched immediately. Actually, the customers participated in the design actions of customization by selecting fashion styles, shell fabrics, and product parameters autonomously.

Furthermore, RCG board simplified hierarchy and complexity of the organizational structure, in order to ensure efficiency of business process. After 10 years' endeavour, RCG established its own business system for personalized-suit customization, through building a series of digital infrastructures including ERP system, data warehouse, and e-commerce portal. As KuteSmart's CIO mentioned,

> *Relying on these information systems, we integrated resources and built our business ecosystem for customization. All the units can now collaborate to deliver a product within 7 days after the order placement and produce over 3,000 sets of personalized suits each day, while the overall costs are only 1.1 times of traditional mass production.*

4.2 Delivering digital solutions to explore new consulting services towards external stakeholders

RCG now becomes a role model of smart manufacturing in China. However, before 2013, RCG focused on building its own business ecosystem and did not advertise the model proactively. When many officials and experts visited RCG, they spoke highly of the significance of RCG's digital creation and business innovation, and strongly suggested that RCG should export the business model to contribute to other companies' digital transformation and upgrading. Meanwhile, as RCG's popularity increased, progressively more companies wanted to visit, learn, and emulate RCG's success, especially the peer manufacturers. As RCG's executive vice president remarked,

> *An opportunity was smiling at RCG, absolutely, RCG decided to smile back. However, the core issues are what our new business model is and what strategy we should adopt to ensure both the security of original business and the benefit of new business. Eventually, we determined to standardize information systems, and thereby to explore new services, but we needed to do that step by step in order to control the risks.*

Thus, RCG first integrate IT/IS infrastructures into a standardized platform, that is, C2M platform. Then, RCG set up KuteSmart, a new subsidiary, to develop and deliver new services for the manufacturing ends, while RCG's headquarter kept operating the personalized-suit business. KuteSmart, based on C2M platform, developed the digital solutions named as SDE (source data engineering of personalized-customization) which offered a set of methods and tools for digital transformation and upgrading. Thereby, KuteSmart delivered the solutions in the form of consulting services to peer manufacturers, instead of providing them with direct access to the C2M platform. KuteSmart's services included the following three parts: the training service was aimed at sharing the experiences and expertise of digitally personalized customization and to offer access to visiting RCG's factories; the design service referred to helping organizations to design blueprints, roadmaps, and technical solutions for the personalized-customization transformation of their products and factories; the implementation service referred to assisting organizations to implement the personalized-customization upgrading of their factories and even of sales models. This strategy enabled RCG to generate and separate new business from original business, and the indirect alignment of these two businesses underlay the future development. As one of KuteSmart's senior managers explained,

> *Although the SDE solutions were suitable for diverse manufacturing firms, we prioritized those whose products or services could complement RCG's personalized suits. The peer manufacturers even including former competitors could perceive and understand RCG's C2M business model and platform. Furthermore, RCG's future planning, which referred to sharing C2M platform for conglomerating the personalized-apparel business, provided them with the collaboration vision. Actually, while we were conducting the consulting services, we were incubating a resource pool of potential partners.*

The potential partners' products included various kinds of other apparels, add-ons, services, and suits different from RCG's. Once the candidates became official partners, C2M platform would contribute to their upgraded production lines and sales services directly, especially, the set of clothing patterns and over 2 million records of orders within the warehouse would be shared with them to process customers' personalized-apparel needs.

4.3 Leveraging the digital platform to conglomerate the internal and external stakeholder

As a potential partner was judged competent for RCG's standardized requirements, including the categories of complementary apparel products, customized production quality, and business trust and commitments, RCG would grant the partner access to RCG's C2M platform through technical interfaces, especially access to the big-data warehouse. Meanwhile, the selected partners also needed to share their own resources with RCG on the platform. For example, the partners use the analysis service for clothing-pattern design through paying for the license of data warehouse usage, while they should guide their customers to place orders through RCG's e-commerce portal so that the new customers could be shared with RCG and other partners. All of this depended on how RCG could leverage C2M platform to support partners, who contribute to the development and prosperity of RCG's business. As RCG's marketing director illustrated,

> *A peer manufacturer, whose products were also a series of suits, was a competitor of RCG. KuteSmart assisted the company not only to upgrade the production line but also to redesign our value proposition as personalize-suits customization for college graduates. Therefore, the new products filled the market niche and complemented RCG's products, while RCG's e-commerce portal enabled the company to capture customers consisting of millennials. Simultaneously, the number of procedures for the new production was much less than RCG's 308 procedures, such that C2M platform could easily support design and production directly.*

Given the goal for conglomerating internal and external stakeholders, RCG's board determined that KuteSmart was responsible for both internal and external personalized-customization businesses, and KuteSmart needed to benefit not only the manufacturing-end partners, but also the client-end customers. Thus, the customers had rich personalized options of apparel products, while appropriate products or product portfolios from diverse manufacturers were automatically recommended to customers according to the analysis on the data of customers' profiles and purchasing behaviours. As RCG's marketing director explained,

> *As a customer, you can find diverse categories of apparel products provided by RCG and its partners, such as suits, trousers, coats, shirts, as well as accessories, wigs, and bags. At the same time, when you choose one kind of product or if you had bought some products before, the system would tell you what you might want next, and which could enhance your own dressing style.*

So far, RCG has been leveraging C2M platform to extend the ongoing business model. Based on the huge resources in both the manufacturing-end and the client-end, RCG is developing the entrepreneurial-end, especially, towards creative SMEs and independent designers who will contribute to highly personalized apparels. As Ms. Xiaoqian Guo, one of KuteSmart's senior managers, illustrated, "*Ladies dress and wedding dress are coming soon!*"

5   Discussion

Our study reveals the framework (see Figure 1) and a process model of conglomerating digital ecosystems for new value creation, capture, and distribution. The purpose of this study is to generate insights that can advance both research and practice in the fields of e-business and digital enablement.

5.1   Formation process of conglomeration of digital ecosystem

In relation to our research question, the case evidence was analysed through three phases. As shown in Table 2, the analysis reveals that the constructs of each phase are marked by the presence of hybrid-organizing phase (be defined by the hybridization approaches, e.g. dismissing, separating, and cumulating (Battilana and Lee, 2014)) and a form of digital ecosystems (to be conceptualized as the playing forms of concert, e.g. solo, divisi and tutti (Erickson, 1999)).

Phases	1: The *dismissing* phase	2: The *separating* phase	3: The *cumulating* phase
IT/IS Capabilities for Hybridization	*Inside-in IT/IS capabilities*: Internal IT/IS infrastructures and IT/IS-business partnership management focusing on a niche market in order to acquire unique core competencies for an isolated ecosystem.	*Inside-out IT/IS capability*: IT/IS platform-based solution development and implementation of skills in response to potential opportunities of ecosystems growth and in protection of internal core competencies.	*Outside-in IT/IS capabilities*: Shared IT/IS platform and accessible standards in support of hybrid ecosystems' relationship management and collective response to diverse needs of market.
Organization Design for Hybridization	Building core competencies for value creation and distribution; Isolation of core firm's business ecosystem through denying access of external ecosystems*;* Business exploitation through stabilizing focal value proposition of business ecosystem	Delivering appropriate competencies for potential value capture; Compartmentalization of core firm's business ecosystem and potential technology ecosystems; Business exploration through nurturing ambidexterity to operate two types of ecosystems	Leveraging core competencies for value co-creation, co-capture, and distribution; aggregation of core firm's business ecosystem and selected technology ecosystems; Business conglomeration through coordinating joint value proposition of digital ecosystems
Form of Digital Ecosystems	1: Digitally Solo Ecosystem	2: Digitally Divisi Ecosystems	3: Digitally Tutti Ecosystems

Table 2. A Process Model of Hybrid Organizing for Conglomeration of Digital Ecosystems

Moreover, each conceptual alignment of the hybridization approach with the form of digital ecosystems is developed through IT/IS capability-enabled organization design. Specifically, the design of each phase derives from the current value proposition based on corresponding IT/IS capabilities and previously established form of digital ecosystems, and thereby the core firm operates the core competencies (Prahalad and Hamel, 2006) rooted in IT/IS capabilities (Wade and Hulland, 2004) to shape the new form of digital ecosystems by the design. Meanwhile, three capabilities are developed for guiding the organization design in the three phases, respectively. The core competencies are created to teach and reinforce the value proposition through IT/IS capability-enabled incentives and control systems. The core firm, based on value propositions, structures the organizational boundaries of ecosystems and maintains joint accountabilities to govern risks.

5.2   The dismissing phase for digitally solo ecosystem

In the digital era, the core firm first needs to develop *inside-in IT/IS capabilities* which guide the identification of its own value proposition. Extending prior taxonomies (Tan et al, 2015; Wade and Hulland, 2004) and in the field of digital ecosystems, *inside-in IT/IS capabilities* are defined as internally-oriented, related to focusing on a niche market in order to acquire unique core competencies, for example, the exclusive IT/IS infrastructures and internally-oriented IT/IS-business partnership management are developed as incentives and control systems, which enable the core firm to integrate resources for exploiting its own focal products, distinctive production mode, and efficient business model, while the core firm denies access to other organizations that are not suitable for the internally-oriented value proposition. Namely, the core firm adopts the *dismissing approach* of hybridization to establish a single and isolated business ecosystem. Simultaneously, the corresponding accountabilities of the core firm and its board are clarified as stabilizing the efficiency and flexibility related to value proposition. Like someone playing alone in a concert, this is defined as the *solo* (Erickson, 1999); obviously, the business ecosystem plays solo in the industrial symbiosis environments (Walls and Paquin, 2015), and we name the form as *digitally solo ecosystem*.

5.3 The separating phase for digitally divisi ecosystems

After the core competencies became mature and the market brand was well recognized, the core firm commenced developing *inside-out IT/IS capabilities* (Tan et al, 2015; Wade and Hulland, 2004) to link its value proposition with other organizations outside of the solo ecosystem. In the field of digital ecosystems, *inside-out IT/IS capabilities* are redefined as internal, in response to external potential opportunities for ecosystem expansion, and in protection of existing core competencies. Thus, the IT/IS infrastructures are integrated into a standardized platform, and thereby IT/IS platform-based solution and implementation skills, separated from the core competencies, are developed as services, which not only incentivise the participation of other organizations, but also control the risk of new business, simultaneously. The core firm delivers the services to other organizations whose products and competencies are identified or explored as potential complements around the digital platform and the focal products, instead of providing other organizations with access to the digital platform and sharing the core competencies directly. Namely, the core firm adopts the *separating approach* of hybridization to establish externally potential technology ecosystems and to compartmentalize the boundaries between the two types of ecosystems. Simultaneously, the corresponding accountabilities of the core firm and its board are clarified as nurturing ambidexterity (Raisch and Birkinshaw, 2008) for operating two types of ecosystems. Like different people playing two or more separate sections in a concert, this is defined as the *divisi* (Erickson, 1999). Obviously, the business ecosystem and technology ecosystems play divisi in the industrial symbiosis environments (Walls and Paquin, 2015), and we name the form as *digitally divisi ecosystems*.

5.4 The cumulating phase and digitally tutti ecosystem

As the joint opportunities become mature, the core firm should select externally appropriate organizations as formal partners around the joint value proposition, and develop *outside-in IT/IS capabilities* (Tan et al, 2015; Wade and Hulland, 2004) to link the partners directly. In the field of digital ecosystems, *outside-in IT/IS capabilities* are redefined as externally-oriented, in support of hybrid ecosystems' relationship management and collective response to the diverse or joint needs of the market. Thus, the shared IT/IS-platform and corresponding accessible standards are developed in order that the core firm can provide partners with access to the platform directly. On the platform, all the organizations can make full use of the core competencies of the platform and share customers with each other, while diverse styles of products can be jointly recommended to customers. Thus, the boundary spanning two types of ecosystems enables all stakeholders to co-capture, and co-create greater value. Namely, the core firm adopts the *cumulating approach* of hybridization to establish new digital ecosystems, which aggregate the original business ecosystem and emerging technology ecosystems. Simultaneously, the corresponding accountabilities of the core firm and its board are clarified as a coordinating joint value proposition for the conglomeration of digital ecosystems. As all the people playing together in a concert are defined as the *tutti* (Erickson, 1999), obviously, the business ecosystem and technology ecosystems play tutti in the industrial symbiosis environments (Walls and Paquin, 2015), and we name the form as *digitally tutti ecosystems*.

6 Theoretical and practical contribution

This study makes two important theoretical contributions. On the one hand, the study reveals the actual formation process of conglomeration of digital ecosystems. Previous researchers mainly focus on static elements and factors of the formation of digital ecosystems (Henningsson and Hedman, 2014; Yoo et al., 2008). However, few studies discuss the formation process, where digital ecosystems should align elements not only within a single ecosystem, but also across multiple and diverse ecosystems in dynamically interdependent environments (Adner, 2017; Boley and Chang, 2007). This study extends previous knowledge about the formation of digital ecosystems through a hybrid-organizing perspective, offers a three-phase process, and examines the dynamically logical designs and interactions.

On the other hand, this study also makes significant contributions to hybrid organizing literature. Previous researchers focus on social enterprise and other organizations instead of ecosystems (e.g. Battilana and Lee, 2014; etc.). However, digital ecosystems are typical forms, involving the hybridization of multiple and diverse organizations. The process of hybridization is an important domain that has received limited attention from scholars (Battilana and Lee, 2014), this study proposes a three-phase process of hybridization towards digital ecosystems, and indicates the dynamic linkages between different hybridization approaches, which remained static relationships before (Battilana and Lee, 2014). Simultaneously，this study reveals and conceptualizes three hybrid forms of digital ecosystems during the formation process. Furthermore, this study examines and enriches the

role of IT/IS capabilities in hybrid-organizing designs, which also contribute to research on IT/IS capabilities (Wade and Hulland, 2004).

This study also makes several practical contributions. Companies who want to build digital ecosystems have to confront the complexity of the dynamic environment, and they can use the framework and process model to develop their digital ecosystems step by step. Specifically, we further postulate that the core firm establishes digital ecosystems by IT/IS capability-enabled and hybrid-organizing design, rather than by emergence (Dong and Hussain, 2011). The design provides a rational perspective (Du and Pan, 2013) for the core firm to develop digital ecosystems and maintain the health of the evolving ecosystems.

7   Limitation and future research

This study must be considered in the light of its limitations, which also point to important directions for future research. First, we focused on the digital conglomeration of business and technology ecosystems, but not discussed other types of ecosystems such as innovation ecosystems or entrepreneurship ecosystems. Because RCG and other apparel companies continuously develop diversified ecosystems, we plan to study other types of ecosystems and further explore the mechanism behind their hybridization. Second, we studied the hybridization in the field of the mass personalized-customization industry, but not discussed other industries; however, digital strategies have been adopted by most industries, where the companies are creating, combining, and operating increasingly more types of digital ecosystems. We also plan to investigate and research these cases in the future.

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