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How digital platform leaders can foster dynamic capabilities through innovation processes: the case of taobao

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ABSTRACT

Although enterprises can promote dynamic capabilities by managing their innovation processes, the specific innovation processes and ways to encourage such capabilities have been under-researched. This exploratory research illuminates the relationship between dynamic capabilities and innovation processes through a case study of the largest Chinese e-commerce platform, Taobao, a vast and complex digital platform with various actors and interactions with numerous related platforms. Based on previous research, interviews with ten management personnel at Alibaba from April 2019 to August 2021, and secondary data, we found six innovation processes specific to this digital platform. Furthermore, we found that each of these innovation processes relates to specific dynamic capabilities and, therefore, a platform leader can improve its dynamic capabilities by organising its innovation processes in the digital platform ecosystem. The presented findings show important implications for strategic management and information systems by connecting dynamic capabilities and innovation management theories. In particular, our findings enable us to describe how the innovation processes management induces strong dynamic capabilities, such as environmental scanning and sensing capability, innovation capability, and integrative capability.

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Dynamic capabilities; digital platform leaders; innovation processes; platform ecosystem

Introduction

Digital platforms (DPs) are multi-sided platforms that enable interactions between two or more groups of surrounding customers and complementors online (Boudreau and Hagiu 2009). With the popularity of smartphones and the rapid development of Internet infrastructure, the DP business has drawn substantial attention. The emergence of a DP that handles various content and products on the Internet has significantly influenced the traditional business environment. DPs rely on supply-side and demand-side participants to improve transactional efficiency through direct and indirect network effects to create substantial economic benefits (Lee, Song, and Yang 2016).

In the digital age, DP innovation is an essential topic in the field of information systems. A comprehensive definition of DP innovation involves two aspects. The first is the importance of innovation by complementors (e.g. Taobao and China Post) and users (e.g. buyers on Taobao). Complementors are the actors that directly provide products or services to complement the core value of a DP leader. The value of platform ecosystems depends on developing complementary products and services (Hilbolling et al. 2021). The quality of complements affects the value of the platform (McIntyre et al. 2021) because the unconstrained growth of low-quality innovations can drive away users

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and 'kill' a platform (Wareham, Fox, and Cano Giner 2014). Users are the actors that utilise the platform's products and services. More users are also actively participating in company-sponsored innovation activities on digital platforms (e.g. online user innovation communities) by posting and commenting about new ideas for improving and developing the companies' products and services (Ogink and Dong 2019; Naik, Fritzsche, and Moeslein 2021). Thus, complementors' qualified and innovative products, as well as users' involvement, are essential. The second aspect is the importance of designing and redesigning the platform ecosystem to allow innovation by a DP leader (e.g. eBay, Amazon, and Alibaba). A good design may attract both complementors and users. Because the value of DPs depends on both direct and indirect network effects (Lee, Song, and Yang 2016), more complementors attract more users. However, leaders should design layered architecture (Yoo, Henfridsson, and Lyytinen 2010) and governance (Tiwana, Konsynski, and Venkatraman 2013) across the platform ecosystem. Layered architecture involves a device, network, service, and content layer (Yoo, Henfridsson, and Lyytinen 2010). The design of technical architecture can provide a high-quality user experience and convenient product development environment for complementors. Leaders can also set regulations and incentives for governance to avoid low-quality complementary products in the ecosystem (Tiwana, Konsynski, and Venkatraman 2013) and promote complementary innovation.

Moreover, the design and redesign of platform ecosystem architecture and governance by DP leaders can orchestrate different types of complementors. The orchestration capacity can link complementors to promote innovation across the platform ecosystem. Helfat and Raubitschek (2018) discussed such a capacity from the viewpoint of dynamic capabilities (DCs), which is an extension of the resource-based view (Helfat and Peteraf 2003). Most strategic management researchers agree that DCs are the fundamental capabilities that help enterprises to gain a competitive advantage in highly dynamic environments by reconfiguring their resources and capabilities (Teece, Pisano, and Shuen 1997; Winter 2003; Teece 2007).

Teece (2018b) noted the importance of strong DCs in a changing environment. Enterprises have been shown to be able to promote DCs by managing their innovation processes (e.g. Drnevich and Kriauciunas 2011). Liu, Wang, and Gao (2020) also noted that the coexistence of three boundary-spanning capabilities (resource sharing, cross-network bridging, and digitalisation transformation) is critical for the digital innovation process, using the Haier company, which is not a DP, as an example. Although this work was instrumental for explaining digital innovation, specific innovation processes and ways to encourage DCs on DPs have been under-researched. Indeed, previous research has three main limitations: (1) the theoretical frameworks of DCs merely propose a tentative idea that requires further empirical research, (2) few studies have demonstrated innovation processes in DPs, and (3) it remains unclear how DCs relate to the innovation process. Further, most research has focused on the manufacturing industry and other traditional industries; little research has shown how DCs relate to innovation processes by DPs.

To bridge this gap in the body of knowledge, this exploratory research illuminates the innovation processes of DPs and verifies how DCs relate to innovation. By investigating the largest Chinese e-commerce platform, Taobao, we establish connections between theories from the DCs' viewpoint and innovation management, thereby expanding the theoretical framework of Helfat and Raubitschek (2018). While the literature on DP ecosystems has primarily emphasised the dyadic relationship between DP leaders and complementors (Hilbolling et al. 2021), our findings indicate the importance of the triadic relationship between the leader, complementors, and users in DP innovation processes. Furthermore, the features of DPs make the innovation process a complex technical and social undertaking (Nambisan et al. 2017). Most research on DP innovation processes has focused on their technical, functional, and economic aspects and overlooked how these processes unfold over time (Eaton et al. 2015; Makkonen and Komulainen 2018; Klein et al. 2020). Our research, therefore, provides social and technical perspectives by examining the relationship between DCs and innovation processes.

Theoretical background

Leadership in DPs

Gawer and Cusumano (2014) defined two types of platforms: company-specific (internal) and industry-wide (external) platforms. The former platforms comprise a company's assets that can efficiently develop and produce a stream of derivative products. The latter type is an innovative business ecosystem that provides products, services, and technologies for external innovators to develop their complementary products, technologies, and services. Most industry-wide platforms are two-sided or multi-sided platforms with two or more interdependent complementor or customer groups that provide network benefits to each other. These platforms embody a design that defines certain features, such as the architecture of the offered services, enabling infrastructure and a set of rules that govern the platform (Ihlström Eriksson et al. 2016). DPs, which are industry-wide and multi-sided, provide interfaces with and among two or more groups of economic actors on different 'sides' of the platform, including complementary assets (Helfat and Raubitschek 2018).

DPs can be defined as meta-organizations (Gawer 2014) that enrol users through a participatory economic culture that coordinates network effects and mobilises the software code and analytics to create multi-sided markets online (Peticca-Harris, deGama, and Ravishankar 2020). The network effect is direct when the platform's value relies on the number of users from the same group; in contrast, the effect is indirect if the platform's value is based on the number of users from a different group (de Reuver, Sørensen, and Basole 2018).

DP leaders (Gawer and Cusumano 2002; Helfat and Raubitschek 2018) and keystone enterprises (Iansiti and Levien 2004) are the owners of platforms that should design a comfortable business environment for complementors and coordinate their relationships. A DP cannot create value through an individual enterprise; rather, value is added by involving other complementors and users such as Amazon and Google. The more complementors and users on the platform, the more valuable the platform is to the owner and users because of the growing access to users' networks and, often, an increasing set of complementary innovations (Gawer and Cusumano 2014). It is thus vital to design a platform ecosystem for various actors in addition to businesses (Teece 2017; Teece 2018a; Helfat and Raubitschek 2018).

Ordinary capabilities and DCs

DP leaders need the capability to orchestrate users and complementors in the ecosystem. However, while business models and ecosystems design make up the output of the enterprise's *ordinary capabilities*, the orchestration, refinement, and transformation of business models and platform ecosystems depend on *DCs* (Teece 2018b; Helfat and Raubitschek 2018). Ordinary capabilities focus on how enterprises can earn money in the short term (Winter 2003; Drnevich and Kriauciunas 2011). They raise performance by enhancing existing products or services, business processes, and customer relationships (Brush and Artz 1999). Three categories of ordinary capabilities—administration, operations, and governance (Teece 2014)—are embedded in skilled personnel, facilities, routines, and administrative coordination. Ordinary capabilities are thus strong when the enterprise performs best practices in a stable environment.

In contrast, DCs are placed above ordinary capabilities (Zollo and Winter 2002; Breznik and Hisrich 2014). They are the long-term organisational routines that change a firm's existing resources and capabilities (Eisenhardt and Martin 2000; Helfat 1997; Winter 2003). Further, DCs exist at different levels. First-order DCs extend, modify, and change ordinary capabilities (Collis 1994; Winter 2003; Dosi, Nelson, and Winter 2000), especially when those are ineffective and disconnected from their profit mechanisms in a changing environment (Drnevich and Kriauciunas 2011). First-order DCs tend to develop new products and services, implement new business processes, create new customer relationships, and change business methods. However, when first-order DCs are insufficient,

especially in rapidly changing environments, an enterprise must adopt a new approach to develop second-order DCs (Karimi and Walter 2015). These are the highest-level capabilities on which top management should focus (Teece 2018b). Researchers agree that DCs are most valuable in dynamic environments (Drnevich and Kriauciunas 2011; Breznik and Hisrich 2014). For example, Teece, Pisano, and Shuen (1997) suggested that enterprises need DCs to configure and reconfigure internal and external competencies to adapt to continually changing environments.

DCs and innovation

DCs are an essential component of an innovation strategy for enterprises to gain a competitive advantage (e.g. Helfat et al. 2007; Ota, Hazama, and Samson 2013); they also affect firms' meta-routines (Nelson and Winter 1982; Helfat and Raubitschek 2018). Hence, DCs directly or indirectly influence enterprises' performance and innovation. Teece (2007) noted that DCs have the capacity to sense opportunities and threats, seise opportunities, and reconfigure organisational assets. However, it is unclear whether this theory applies to DPs in the digital economy.

DCs in the digital age are distinct from those of traditional manufacturers and service providers. Helfat and Raubitschek (2018) listed three types of DCs for DP leaders: innovation capability, environmental scanning and sensing capability, and integrative capability. Innovation capability is the capability needed for enterprises to form software development routines with different levels of expertise and product sequencing (Helfat and Raubitschek 2000). It is not a stand-alone capability; it links with other DCs (Parashar and Singh 2005). What Helfat and Raubitschek refer to as 'environmental scanning and sensing capability' is similar to what Teece (2007) called 'sensing capabilities.' As agents of enterprises, managers scan the external environment to find the latest technologies and new business models to identify opportunities and threats. Finally, integrative capability, the coordination and orchestration of resources inside and outside the platform ecosystem, is arguably more vital and unique than the former two types for DP leaders (Helfat and Raubitschek 2018).

Furthermore, digital technology differs from earlier technologies because of such features as reprogrammability, the homogenisation of data, and self-referentiality (Yoo, Henfridsson, and Lyytinen 2010). DP innovation leads to a new version of the product (e.g. applications and websites) and a changing interaction between actors by designing a new business model or attracting new actors. The new interaction between actors may then cause new experiences for buyers and benefits across the ecosystem (Helfat and Raubitschek 2018).

Methodology

We adopted a single case study suitable for analyzing a unique case (Creswell and Poth 2016), namely, a Chinese DP. As a research method, a single case study lacks generalizability. However, the rich data of a single case study can help build theory, and this method is suitable for addressing the how and why research questions (Yin 1994). Trott (2008) also demonstrated that a case study can illuminate the innovation process and provide an 'intimate connection with empirical reality that permits the development of a testable, relevant, and valid theory' (Eisenhardt 1989, 532). We used interview data to examine innovation processes in DPs and both secondary and interview data to determine the relationship between innovation processes and DCs. We adopted the Corbin and Strauss (1990) approach, which focuses on providing propositions rather than test propositions (Glaser and Strauss 1967), to explore the relationship between innovation processes and DCs. Alibaba Group, the research case selected for this project, is an enormous global IT company and a typical example of a digital platform leader. However, not many global digital platform leaders have grown from a venture company to a global leader like Alibaba (e.g. Google, Apple, Amazon, Meta, and Tencent). Additionally, dynamic capability and innovation processes need to be considered from a long-term perspective to determine their relationship. Thus, a single case study based on the Alibaba Group is vital. From this company, we obtained interview data from

ten employees along with more than 500 pieces of secondary data such as online news, photos, and books. Although this is a single case analysis, it is essential for presenting a hypothesis of generality and beneficial for other IT companies to enhance DCs and improve innovation processes as this kind of digital platform leader has since it is difficult to find similar companies.

Case selection: Taobao

The Alibaba Group launched Taobao in May 2003, and by 2018 it held approximately 60% of the market share of the e-commerce services sector in China. We chose Taobao as a case study for three reasons. First, it fits the theoretical question (Helfat and Raubitschek 2018) since it is a typical DP leader in the Chinese market. Moreover, secondary data on which to conduct the research are readily available. Second, since the e-commerce market environment in China is highly competitive and rapidly changing, it is helpful to observe and analyze how Alibaba Group fosters DCs to change internal and external competencies for adapting to the environment. Third, through constant innovation, Taobao has become a complex and entirely different DP from its initial state (e.g. building an online credit system). Thus, a longitudinal case study can analyze how the Alibaba Group manages innovation processes.

Figure 1 presents Taobao's platform ecosystem. Using the research by Wirtz et al. (2019), we can see that Taobao's actors in the ecosystem include Taobao, sellers, buyers, and complementors. All the actors inside the big circle frame belong to Taobao's digital platform ecosystem. However, Alibaba can directly control the resource flows within the dotted square frame and cannot directly control anything outside of it (sellers, logistics companies, and buyers). Therefore, transaction flow and information flow circulation within the dotted frame can allocate resources to the actors through data management and marketing services.

Sellers of all kinds, including individual vendors, distributors, and manufacturers, can open stores through an application process. They enter the trading platform, obtain transaction flows with buyers, and access the information flow in Alibaba's ecosystem. In addition, Alibaba further optimises and allocates resources within the ecosystem to enhance data management services, marketing services, and payment platforms. Alibaba is thus, the leader in controlling transaction and information flows in the ecosystem, and by collaborating with various complementary vendors and strengthening complementary relationships, transaction flow and information flow will also increase. This will further develop the entire ecosystem.

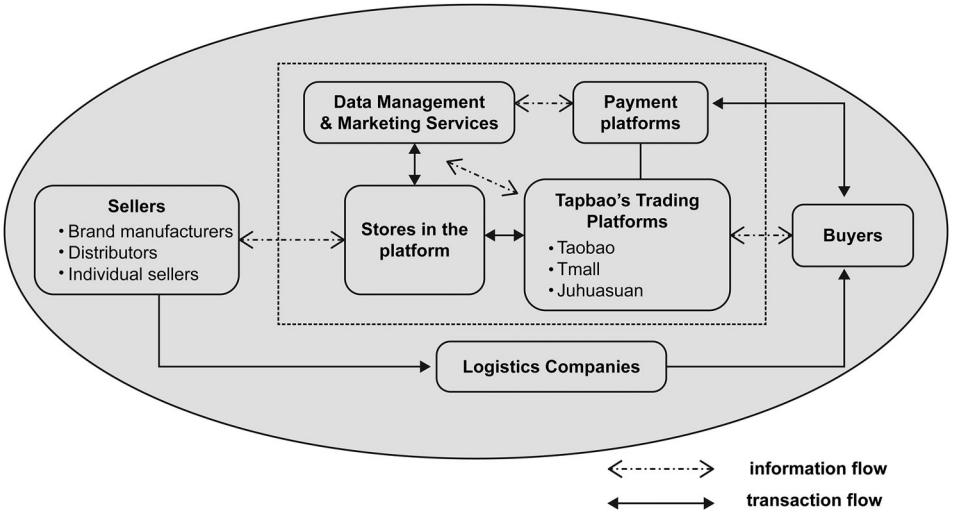

Figure 1. Taobao's digital platform ecosystem.

Data collection

This study collected data from two sources (i.e. interviews and secondary data), as the triangulation of multiple data raises research reliability and validity (Eisenhardt 1989). We first conducted in-depth semi-structured interviews with ten management personnel at Alibaba from April 2019 to August 2021, during which we asked respondents about the company's needs and competitor analyses, software and new product development processes, coordination of actors and business models, and innovation processes. With the respondents' permission, all the interviews were recorded (six on tape and four with field notes). On average, each interview lasted one and a half hours.

We interviewed two operations directors, two operations managers, one senior product manager, two product managers, two software engineers, and one software developer. Each participant had over five years of working experiences. We selected the interviewees from different departments for several reasons. Product managers understand the product and are familiar with other departments, and these respondents could thus answer questions related to the innovation capability and product's functional changes in innovation processes. Operations managers operate the entire platform ecosystem and have direct connections with users, sellers, and other complementors. They could thus confirm the integrative capability and Taobao's ecosystem changes in the innovation processes. Additionally, we asked operations directors about the company's scanning and sensing capability and strategy changes related to innovation. Software developers and engineers use advanced technology to develop and update Taobao's software. We therefore asked them questions related to innovation capability and technology changes in innovation processes.

We collected news and photographs about the Taobao marketplace from Factiva, a business information and research tool that provides over 32,000 global sources (such as newspapers, journals, photos, etc.), by choosing keywords such as 'Taobao' from April 21, 2003, to December 31, 2016, resulting in 544 online news articles and 20 photographs. Further, we collected data from books, magazines, and the Alibaba Group's homepage to triangulate our data (Yin 1994).

Data coding

To explore the relationship between innovation processes and DCs, we separated the innovation processes into six stages (I. Scanning, II. Productization, III. Implementation, IV. Needs analysis, V. Strategy forming, and VI. Updating) from interviews and coded all the data using SQL NVivo (Release 1.3). We conducted three coding processes: open coding, axial coding, and selective coding (Corbin and Strauss 1990). We kept an open mind and highlighted data fragments of analytical sentences or themes for each innovation process to form an initial category (open coding). We then found the logical relationship between the initial categories to build the main category (axial coding). Finally, we systematically analyzed all the main categories to construct core categories for the theoretical constructs of DCs and found the relationship between innovation processes and DCs (selective coding). To enhance reliability, we discussed and reviewed the interpretation of the data, coding, and results, achieving total agreement from all the authors (Eisenhardt 1989). Table 1 presents the results of the analysis of Taobao's innovation processes.

Results and discussion

Innovation processes at Taobao

Using the six-stage innovation process in the manufacturing industry by Ota, Hazama, and Samson (2013)— scanning, idea generation, strategy formation, resource procurement, implementation, and value creation— Figure 2 illustrates the six innovation processes of Taobao (an Internet company) based on a synthesis of the interview data: I. Scanning, II. Productization, III. Implementation, IV. Needs analysis, V. Strategy forming, and VI. Updating. In the beginning, Alibaba scanned business

Table 1. Keywords, measurement variables, theoretical constructs, and coding number of each innovation process.

Innovation processes	Keywords/initial category	Measurement variables/main category	Theoretical constructs/core category	Coding no.
I. Scanning	Imitation, environment, market, online marketplace, Internet market, e-commerce market, Chinese market, competition, competitor, new competitor, local competitor, company policy, competitors' policy, fail	Analyze market, competitors, and environment; learn from failure	Scanning and sensing capability	49
II. Productization	Partner, partnership, investment, invest, employee, hiring, shareholder, strategy, software development, product	Integrate internal and external resources; new product development	Integrative capability, Innovation capability	53
III. Implementation	Release, advertisement, promotion, marketing, sellers, logistics, supply chain, delivery services, online shoppers	Integrate internal and external resources; attract and integrate actors	Integrative capability	98
IV. Needs analysis	Customer experiences, customer needs, customer feedback, stock, analyze, data, data-centric, big data, database, logistics data, integrate data, cloud computing, algorithm	Store the data; analyze the feedback and data; build the algorithm	Scanning and sensing capability	103
V. Strategy forming	Strategy, business decision, decision making, business model, upgrade business model, competition, tactics, transition, long-term development, speed, corporation, expand the market	Design and redesign the business models; design and redesign the business strategy	Integrative capability	102
VI. Update	Upgrade, technology upgrade, product, software upgrade, software, software development, *Zhong Tai*, agile	Build and rebuild the software development system; upgrade the technology	Innovation capability	79

models and technology in both the US and Chinese markets (I) and decided to imitate the planning and function of eBay's e-commerce business to develop Taobao (II). The results of I and II depended on the experience (whether successful or not) and the vision of the founder, Jack Ma. However, once Alibaba launched Taobao, it was recognised as being significantly different from its competitors. Next, Alibaba continuously orchestrated different actors' interactions to construct the platform ecosystem (III–VI). In summary, while I and II depend on the founder's experience and decision making to modify ordinary capabilities and grow DCs, the circulation from III–VI is the primary innovation process. Further, the continuous circulation of III–VI repeatedly upgrades first-order DCs to second-order DCs.

Innovation processes for promoting DCs

Table 2 summarises the innovation process, critical events, DCs, and promotion of those DCs. Teece (2018b) defined strong DCs as strong (relative to competitors) in all relevant areas of sensing, seising,

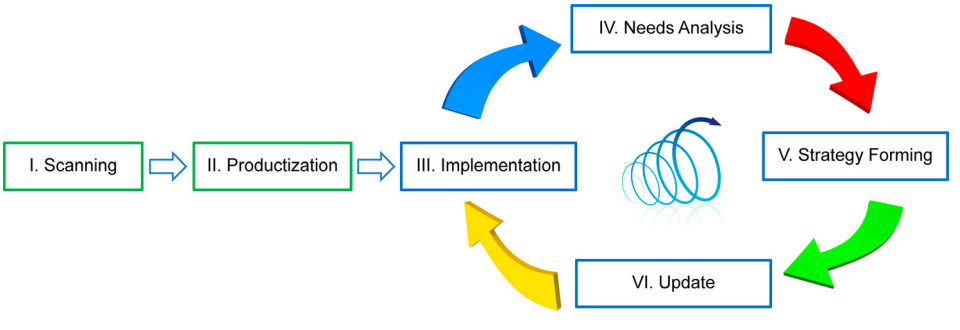

Figure 2. Innovation processes at Taobao.

and transforming. In the context of the DCs of DP leaders, this can mean strong in sensing and seising, innovation, and integrative capabilities. An enterprise with strong DCs can orchestrate resources to innovate and thus respond to a changing market (Teece 2018b). Based on the interviews and secondary data, we found that the Alibaba Group did not initially gain strong DCs but rather developed them by organising its innovation processes.

Process I shows that Jack Ma, as an agent of the organisation, scanned and sensed the business environment in China. He learned about the Chinese market from his earlier business failures from 1995 to 1999. He noticed that the Internet was not well known among Chinese customers and that its potential should be promoted in the Chinese market. When the Alibaba Group was incepted, it formed ordinary capabilities related to basic administration, operations, and governance skills. However, competition in e-commerce was intense, forcing the Group to build first-order DCs. In the scanning process, it imitated eBay's features but modified eBay's business model to fit the Chinese market. For example, Taobao did not charge transaction fees but rather earned profits from advertising. This change was based on local needs and helped it gain competitive advantages. Thus, the Alibaba Group applied the scanning and sensing capability by managing Process I.

Table 2. Relationship between the DCs and each innovation process.

Innovation process	Events	DCs	Promotion of DCs
I. Scanning	Alibaba observed and analyzed eBay, other competitors, and the Chinese market. It imitated the format of eBay's website, but it charged sellers zero transaction fees.	Scanning and sensing capability (*first-order*)	Observe and imitate competitors. Utilise founder's failure experiences.
II. Productization	Alibaba collected investments and human resources to develop the website of Taobao.	Integrative capability (*first-order*); innovation capability (*first-order*)	Integrate internal and external resources. Understand the failure experiences of raising funds. Develop new product.
III. Implementation	(1) The target customer was unclear at the beginning. Alibaba advertised on websites to differentiate itself from large companies. (2) Alibaba tried to solve credit and communication problems between sellers and buyers in the Chinese market. (3) Medium-sized and large enterprises were the main targets. (4) Alibaba stored the data and developed cloud computing technology.	Integrative capability (*second-order*)	Attract and increase new types of actors to change its platform ecosystem. Understand the experiences of ecosystem management.
IV. Needs analysis	(1) Alibaba analyzed failure experiences, knowledge, and intuition of the founder himself. (2) The analysis was based on the reaction of the market. (3) Alibaba built the data categories, stored the data, and analyzed big data.	Scanning and sensing capability (*second-order*)	Analyze the data on customers and the market from the founder's intuition and using big data technologies.
V. Strategy forming	(1) A strategy was built to differentiate it from eBay. (2) Alibaba established a Tmall platform and connected to Taobao to meet customers' needs. (3) Alibaba launched a Double 11 (annual shopping holiday) marketing strategy.	Integrative capability (*second-order*)	Design and redesign the business model of Taobao.
VI. Update	(1) Develop a communication tool called WangWang and a payment tool called Alipay. (2) Construct a B2B e-commerce platform called Tmall, which connects to the Taobao C2C platform. (3) Build and utilise Alibaba cloud computing technology.	Innovation capability (*second-order*)	Build and rebuild new product development patterns.

Proposition 1. By managing the innovation process of scanning through analyzing the market, competitors, and environment as well as learning from successes and failures, DP leaders promote the scanning and sensing capability.

Process II shows that the Alibaba Group generated investments and developed human resources to enhance its website and built and rebuilt procurement patterns. It also promoted the capability to integrate internal and external resources based on failure experiences such as employee turnover problems (internal resources) and obtained financial investment from Silicon Valley and local banks (external resources). Finally, Alibaba procured investment from Softbank and hired university students as software engineers to develop new products (Taobao). Thus, Alibaba managed the circulation of innovation processes to promote platform innovation and foster strong DCs.

Proposition 2. DP leaders adopt innovation capability and integrative capability based on how they manage the innovation process of productization by integrating internal and external resources.

Process III shows that the Alibaba Group tried to attract new types of actors to the platform ecosystem of Taobao by building and rebuilding marketing patterns to attract different types of complementors. Initially, complementors only included individual sellers; however, small- and medium-sized enterprises, large enterprises, logistics companies, training institutions, and manufacturers soon joined Taobao. This led to different interactions among the actors in the ecosystem and provided an efficient service for buyers. Hence, Alibaba built and rebuilt the platform ecosystem to manage the innovation process, especially in relation to integrative capability, and applied it based on the success and failure of attracting and coordinating actors in the platform ecosystem.

Proposition 3. DP leaders promote integrative capability based on how they manage the innovation process of implementation by integrating internal and external resources as well as the different types of complementors and users.

Process IV shows that the Alibaba Group continuously carried out competitor and market analyses. The way in which customers' needs were analyzed changed profoundly from decision making by the founder based on his experience, market reactions, and market analysis to decision making using big data algorithms. This innovation process relates to the scanning and sensing capability, which it could foster through the construction and reconstruction of the ability to process data.

Proposition 4. DP leaders promote the scanning and sensing capability through managing the innovation process of needs analysis by analyzing customers' feedback.

Process V shows that the Alibaba Group built and rebuilt its business models by changing its strategy. New business models on the DP, such as the combination of C2C, B2C, and B2B business and the so-called double eleven shopping festival (11.11), transformed the ecosystem of Taobao. After the implementation of the 11.11 marketing strategy wherein goods worth US $38.4 billion were delivered and sold in the first 24 h in 2012, shipping networks were thrown into chaos nationwide. As a result, Alibaba could not handle its shipments, its warehouses were overflowing, and roads were clogged with transport trucks. However, our interview data showed that Alibaba established supply chain systems and improved them every year. This process relates to integrative capability, which must be fostered to design and redesign the business model to support complementors in the ecosystem.

Proposition 5. DP leaders promote integrative capability through managing the innovation process of strategy forming by designing and redesigning business models and strategies.

Process VI shows that the Alibaba Group built and rebuilt its software product development. First, no fixed production routine for updating the Taobao software existed. However, it constructed an agile software development model to implement production. Such models focus on involving customers, maintaining product quality, incorporating changing and emerging requirements, and encouraging self-managed teams (Hoda, Noble, and Marshall 2012). This production pattern connected the departments at Taobao and raised the efficiency of product development. In 2015, the concept of *Zhong Tai* (中台, a middle platform connecting the front end and back end) appeared at Alibaba. *Zhong Tai* allowed it to accumulate and share product development between business units across the organisation. This changed the product development pattern of Taobao and

fostered innovation capability. This innovation process thus relates to innovation capability, which should be fostered to build and rebuild a new product development pattern.

Proposition 6. DP leaders promote innovation capability through managing the update process by rebuilding software development and upgrading technology.

Discussion

Ota, Hazama, and Samson (2013) stated that manufacturing companies have six processes and that their continuous cycle drives innovation. However, there are substantial differences in the innovation processes of a manufacturing enterprise and those of a DP leader. DP innovation combines digital components in a layered modular architecture of software, hardware, networks, contents, and services (Yoo, Henfridsson, and Lyytinen 2010). This study thus modifies Ota, Hazama, and Samson's (2013) framework to construct a DP innovation process model. Our results reveal that DP innovation processes include two stages: before and after the product launch (Figure 2).

The Alibaba Group imitated eBay's e-commerce business to develop Taobao, and there was no originality before the product launch. Instead, it leveraged digital technology's reprogrammability, homogenisation of data, and self-referential processes (Yoo, Henfridsson, and Lyytinen 2010) to innovate after the product was launched. In these processes, Taobao's innovation involved interactions among the platform leader, complementors, and users (Hilbolling et al. 2021). Taobao collected data from users and complementors along with suggestions for designing and redesigning its platform ecosystem.

While previous studies have discussed the relationships among ordinary capabilities, first-order DCs, and second-order DCs (e.g. Zollo and Winter 2002; Winter 2003; Breznik and Hisrich 2014), we focus on a DP leader to complement existing theories. Helfat and Raubitschek (2018) stated that DP leaders have three DCs. However, they did not explicitly state how these three DCs change from ordinary capabilities, how they evolve, or how they relate to innovation processes in a changing environment. We find that first-order and second-order DCs are applied in Processes I and II and Processes III–IV, respectively (see Figure 2). Jack Ma learned from past successes and failures to modify the firm's ordinary capabilities, especially in Processes I and II. In Processes III–VI, existing DCs became core rigidities (Leonard-Barton 1992; Gilbert 2005) in a highly competitive, changing, and unpredictable environment, especially in the face of challenges from competitors such as JD.com. The Alibaba Group modified those into second-order DCs, which are learning mechanisms that shape ordinary capabilities and first-order DCs (Zollo and Winter 2002). The continuous cycle of innovation in Processes III–VI encouraged learning across the platform ecosystem in line with the proposition by Leonard-Barton (1992) that second-order DCs should repeatedly update in a rapidly changing and unpredictable environment or otherwise, existing DCs could turn core competencies into core rigidities.

Conclusion

This study illuminates the innovation processes of DPs and the relationship between DCs and innovation processes through a case study of Taobao. Our rich data enable us to describe how the management of innovation processes induces strong DCs. This study thus contributes to research on DCs and innovation management in two main ways. First, we found six innovation processes specific to the DP ecosystem. Unlike traditional manufacturers, DP leaders conduct needs analysis after the product is launched, and strategy forming follows implementation and needs analysis. This difference allows them to modify and update the product in a faster and more flexible way. The main stages of innovation processes are III–VI. Alibaba orchestrates different actors' interactions for managing innovation through the continual circulation of these processes.

Second, each innovation process related to a DC and a platform leader can foster strong DCs by organising the digital ecosystem's innovation process. Our case study demonstrates that the platform leader did not initially have strong DCs and fostered their growth through the long-term

management of innovation processes. We observed that the scanning and productization processes are more likely to depend on the founder's experience of success and failure. In Taobao's case, Jack Ma learned from his experiences to modify the firm's ordinary capabilities and build first-order DCs. Moreover, the continual circulation from the launch process to the update process caused platform innovation through changes in the interactions among the actors in the ecosystem. In these processes, the Alibaba Group developed second-order DCs that created value.

This study has three main limitations. First, this is a qualitative study; quantitative studies to test our propositions could be conducted in the future. For instance, Senaratne, Wang, and Sarma (2021) provided four items (questionnaire) to measure the scanning and sensing capabilities and innovation capabilities for statistical analyses. Jun et al. (2021) also provided eight measurement items as proxy variables for integrative capabilities. These proxy variables of DCs could be used to test whether past experiences of innovation processes positively impact them. Second, the analysis is on a Chinese enterprise, and future research could conduct multiple case studies by comparing the DPs in different countries to test our framework. For instance, questionnaires could be developed as measurement tools of innovation processes and DCs on DPs for statistical analysis. Finally, it is an in-depth study on a single case, and limitations for external validity may exist. Taobao is a transaction platform, and our analysis could apply to the same type of DP. However, it may not apply to other types of DP such as innovation platforms (Intel and Apple). Transaction platforms emphasise the network effect between two groups of interdependent customers in multi-sided markets created by the platforms themselves, while innovation platforms focus on a purposefully designed technological foundation that can facilitate complementors with specialised expertise to develop complementary innovation outputs (Cusumano, Gawer, and Yoffie 2019).

We propose two directions for further study. The first is related to complementary enterprises' DCs in the ecosystem. They need the capacity to use the platform ecosystem's resources to gain competitive advantages. This capacity, which uses multiple platforms to survive and create value in a changing environment, thus differs from the dynamic IT capabilities discussed in previous research (Li and Chan 2019). Another research direction would be to test the relationship between DCs and innovation in a DP. Innovation involves incremental and radical innovation (Gilbert and Newbery 1982). It could therefore be worthwhile to examine which DCs influence incremental and radical innovation. For example, the uniqueness of integration capability may directly affect radical innovation.

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