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RESEARCH PAPER

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Platform Leadership: Managing Boundaries for the Network Growth of Digital Platforms

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Abstract

This study aims to generate a systematic understanding of how digital platform firms can attain platform leadership. We explore the question by casting a boundary management lens over the complex network of interactions on a digital platform. Firms are faced with various boundaries—boundaries of efficiency, competence, power, identity, and ties—and must carefully address tensions within diverse groups of actors with their own interests. We conducted an in-depth case study on China's largest online ticketing firm and established two contributions for attaining platform leadership. First, we conceptualized the development of a digital platform as a set of technology-based boundary management mechanisms (functional multiplexing, scope expansion, community curation, actor empowerment, and positional escalation) that includes a combination of boundary spanning, erecting, and reinforcing. Second, we uncovered the network dynamics of a digital platform by explicating the synergies and tensions of boundary management. Considering our novel findings, this study offers managerial and design guidelines for a digital platform by advocating an integrative view of boundary management. We present a multidimensional framework that includes five boundaries and four types of networks (dyadic, interconnected, intraconnected, and external) for future analysis of networks built on digital platforms.

Keywords: Digital Platform, Two-Sided Platform, Platform Leadership, Network Dynamics, Boundary Management, Case Study.

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1 Introduction

A digital platform (DP) is a technological entity that enables value creation by facilitating direct interactions between two or more groups of users (Edelman, 2015; Eisenmann, Parker, & Van Alstyne, 2011; Hagiu, 2009). Examples of DPs include an e-commerce site that connects sellers and buyers and a mobile ride-sharing application that links drivers and riders. Compared to a pipeline business—better known as the classic value chain model that creates value by controlling a linear series of activities along a vertical chain of command—platform businesses and DPs are designed with network-centric thinking based on horizontal collaborations among participating users (Basole, 2009; Van Alstyne, Parker, & Choudary, 2016; Weill & Woerner, 2015). Many traditional firms

offer services such as crowdsourcing or online communities via DPs, but some firms' very existence is dependent on owning and managing a DP. We refer to these latter firms as DP firms. These DP firms, such as Amazon, Alibaba, Facebook, Uber, and Airbnb, provide a digital foundation upon which diverse users can build complementary offerings to form a network of exchange. When such value-generating activities attract more users—a phenomenon known as the network effect—DP firms can dominate their markets by the size of their network (or the number of users connected by the DP) (Evans & Schmalensee, 2016; Gawer & Cusumano, 2008).

DP firms depend on constant growth in their networks to maintain their market position. Developing a network requires more than simply improving the efficiency of exchange between the firm and users; rather, it entails orchestrating resources owned by external actors for value creation (Van Alstyne et al., 2016). Accordingly, deployment of a DP fundamentally challenges the conventional notion of firm boundaries (Bharadwaj, El Sawy, Pavlou, & Venkatraman, 2013). The boundaries of a DP firm can no longer be viewed or managed simply as a demarcation of processes and activities, also known as the boundary of efficiency (Santos & Eisenhardt, 2005), thus warranting reexamination of boundaries that demarcate a firm according to the resources it owns and directly controls, which is understood as the boundary of competence (Santos & Eisenhardt, 2005). To add to this complexity, networks built on DPs are becoming increasingly fluid and permeable: along with the growth of digital connectivity, new actors are emerging and new relations are forming, while existing networks of relationships are reconfigured and the traditional distribution of power is shifting (Adner, 2017; Basole, 2009). As their DP connects an increasing number of actors forming an ever-growing complex network, DP firms determined to maintain and grow the network must manage new boundaries (and issues) within the DP, such as the boundary of power (relating to issues such as competing interests among actors, competing for power, and power shifts to new actors) and the boundary of identity (relating to issues such as reaching a consensus among actors regarding the changing roles of DP firms in facilitating exchanges). Considering the changes to boundaries and emergent boundary issues, we propose that adopting a boundary view will be helpful in understanding how DPs can be managed.

In addition to the diverse types of boundaries, DP firms must also consider network dynamics, including tensions among actors and the interaction effect between boundaries. Despite the existence of mutual interests, tensions are inevitable among the actors and can discourage continued participation (Van Alstyne et al., 2016). For example, whereas a seller on a DP may benefit indirectly from the critical mass of buyers building upon the participation of other sellers, an increase in the number of rivals can discourage further participation of the seller (Hagiu, 2014). Furthermore, reconfiguration of a boundary to produce a cooperative effect among actors can simultaneously generate conflict in other boundary relations (Barrett, Oborn, Orlikowski, & Yates, 2012). DP firms that focus too narrowly on one boundary may inadvertently trigger a minefield when other types of boundaries are affected (Santos & Eisenhardt, 2005). For example, the acquisition of Skype by eBay, which was executed with the intention to enlarge eBay's network of users by reducing communication costs between buyers and sellers (boundary of efficiency), backfired because many eBay users found voice communication potentially intrusive to the anonymity of online trading (the boundary of power) with which they were comfortable (Hagiu, 2009).

To ensure stability in growing a network, DP firms must provide platform leadership—that is, they must manage the positive network effect without undermining contemporary boundary issues, including competing interests and competing for power and power shifts, within the existing network of relationships (Adner, 2017; Basole, 2009), again implying that management of multiple boundaries is central to a DP firm's ability to manage the dynamics of growing its network. This paper therefore asks the question: *In the pursuit of platform leadership, how can digital platform firms manage the boundaries within their platforms?*

To answer this question, we conducted an in-depth case study of Damai, China's equivalent of Ticketmaster. Damai is the largest online ticketing platform in China and connects multiple external actors, including customers, agents, and suppliers. An initial understanding acquired from the gatekeeper (i.e., the VP-cum-CIO of the company) ensured the case's suitability for examining our research question. The frequent exchange of business opportunities and referrals between Damai and venue operators or suppliers, collaborations between Damai and its distribution agents to leverage each other's resources, and joint problem-solving, involving interactions beyond the sole boundary of efficiency, reflected an embedded network of relationships with multiple types of boundaries (Uzzi, 1996). In addition, the gatekeeper revealed part of the dilemma that Damai faced in engaging different actors, such as tensions between direct sales to customers and indirect sales through agents. Next, we review the DP and boundary management literature. We then provide details on the research method and case, followed by our analysis. Finally, we conclude this paper with a discussion of contributions and limitations.

2 Literature Review

Our review, synthesized below, is guided by a hermeneutic approach (Boell & Cecez-Kecmanovic, 2014). It highlights a continuing interpretation of the literature in the process of developing our understanding, which later guides our literature search, identification of relevant theoretical lenses, and (re)shaping of the research question. This recursive process is critical for our exploratory study. Further details of our literature review and analysis are provided in Appendix A.

2.1 Digital Platforms

Our study refers to a DP firm specifically as the provider of a DP that performs two primary functions: (1) matches users with the supply and demand and enables direct exchanges between them; and (2) provides value-added services, including infrastructure and rules, to facilitate exchanges among the users (Bakos & Katsamakas, 2008; Facin, De Vasconcelos Gomes, De Mesquita Spinola, & Salerno, 2016). Building on the concept of two-sided platforms, DPs are becoming more complex, with technology allowing a firm to connect easily with more than two actors, leading to the rise of multisided platforms or platform ecosystems (Hagiu, 2014).

As mentioned above, the expanded network of actors on a DP challenges the conventional notion of organizational boundaries that demarcate a firm according to its internal transactions or processes (Santos & Eisenhardt, 2005). In the conventional view, a boundary decision (e.g., whether a transaction should be conducted within a firm or outsourced) is largely driven by the consideration of efficiency. In contrast, a DP underscores the generation of value beyond efficiency (Hagiu, 2009; Iansiti & Levien, 2004). Because managing a DP involves managing assets owned by others (Iansiti & Levien, 2004), the firm boundaries of a DP must be considered from the perspective of resources. The boundary decisions of any DP firm (e.g., whether a firm should leverage resources owned by external actors) should also be driven by the maximization of total value for both the firm and the actors (Van Alstyne et al., 2016). Furthermore, when new actors emerge and new relations are formed on a DP, other boundary issues (including competing interests and power shifts) surface (Adner, 2017; Basole, 2009), again emphasizing the need to consider nonefficiency boundaries. Based on our review (Appendix B), the extant DP literature clearly continues to be largely driven by an efficiency model that focuses on reducing transaction costs (Van Alstyne & Schrage, 2016) by enlarging the user base (e.g., through pricing strategy).

Platform leadership is of critical importance to DP firms. Given the low participation cost of DP businesses, competition from other platforms in the form of envelopment or multihoming is especially threatening (Eisenmann, Parker, & Van Alstyne, 2006; Eisenmann et al., 2011; Koh & Fichman, 2014). The notion of platform leadership refers to the ability of a DP firm to manage the positive network effect without undermining contemporary boundary issues in its existing network of relationships (Adner, 2017; Basole, 2009). Platform leadership is usually measured by the number of connected actors, the level of market dominance (Evans & Schmalensee, 2016) and the platform-switching cost (Eisenmann et al., 2011). Being a platform leader can further strengthen positive network effects because the popularity of a platform can provide sufficient assurance to help new users overcome their uncertainties about participation (Koh & Fichman, 2014). Recent studies have suggested a few strategies to grow a network by leveraging technologies at a high level: collecting knowledge about customers to deepen their reliance on the DP (Weill & Woerner, 2015), creating and sharing values with actors, collaborating with technologically inferior platforms (Mantena & Saha, 2012) and empowering actors by enhancing their competencies (Iansiti & Levien, 2004; Van Alstyne & Schrage, 2016; for details, refer to the Platform Leadership section of Table B1 in the Appendix).

Whereas most platform studies focus on the dyadic relationship between a DP firm and actors, some allude to the complex dynamics within the network (see the Network Dynamics section of Table B1 in the Appendix). First, just as negative and positive network effects can occur concurrently, the same-side network effect can occur in tandem with the cross-side network effect (Eisenmann et al., 2006; Koh & Fichman, 2014). Second, among the heterogeneous actor groups, potential conflicts of interest may arise, such as the friction that emerged between individual and corporate users when LinkedIn attempted to grow its network by including the latter group (Hagiu, 2009, 2014). Third, this network dynamic is complicated given the fluidity and multiplicity of actors' roles (e.g., a customer can also be a service provider for Uber) (Adner, 2017; Cusumano & Gawer, 2002; Van Alstyne et al., 2016). Although solutions have been proposed, such as balancing collaboration and competition between a firm and actors (Gawer & Cusumano, 2008) or limiting the number of groups to connect (Hagiu, 2014), few studies have considered these network dynamics when examining DPs, possibly because of the risk of "drowning in the almost infinite web of interdependences" (Adner, 2017, p. 55).

Recognizing that the benefits of managing these dyadic networks will not aggregate to a supradyadic level (Davis, 2016), this paper's analysis includes three network types: dyadic (direct relations between a DP firm and actors), interconnected (relations between

different actor groups that are facilitated by a DP firm) and intraconnected (relations among the actors in a group facilitated by a DP firm). Accordingly, we move the focus beyond a single firm view to a network perspective, allowing identification of synergies or tensions between these networks. To the best of our knowledge, no study besides Hagiu (2009) has investigated the three network types concurrently while exploring the dynamics of managing a DP (refer to the Types of Network Studied section of Table B1 in the Appendix).

2.2 Boundary Management

To better understand how DP firms manage the growth of their networks, a boundary management perspective is adopted for two reasons. First, a boundary management perspective offers an expanded view of boundaries and thus an accurate representation of what is "within" the network of relationships of a DP. Drawing on Santos and Eisenhardt's (2005) concept that delineates boundaries of efficiency, competence, power, and identity, different purposes and concerns in building and maintaining a connection are explicitly expressed, thus providing a more comprehensive set of considerations to formulate strategies with which a DP firm can manage its network of relationships (Adner, 2017). Second, given the dual nature of a boundary in establishing agreement and differences, boundary management is suitable for investigating how a DP firm can manage a network of relationships in which mutually beneficial collaborations must be protected and their disparate interests preserved (Jarvenpaa & Lang, 2011; O'Mahony & Bechky, 2008). Specifically, boundary management studies suggest that spanning boundaries can play an important role in overcoming differences and that establishing boundaries protects autonomy, prestige, and control of resources (Burri, 2008; Gieryn, 1983). Below, we present the definition of boundary management, different concepts of boundaries, how boundaries have been studied in information systems (IS), and the relevance of boundaries to DPs.

Boundary management refers to "a set of activities involved in defining, negotiating and protecting organizational resources and domains of action, as well as managing relationships with external stakeholders, to achieve the organizational goals" (Jarvenpaa & Lang, 2011, p. 441). Boundary management is important in organizational design when coordination is established across boundaries (Barrett et al., 2012; Sinha & Van De Ven, 2005). This study builds on the four boundaries conceptualized by Santos and Eisenhardt (2005) to study different forms of organization, such as platform businesses.

Shaped considerably by transaction cost economics (TCE) and related exchange-efficiency perspectives (Nickerson & Silverman, 2003; Wareham, 2003; Williamson, 1985), the boundary of efficiency demarcates the transactions or processes undertaken within a firm and by internal actors. The focus of this boundary is on reducing transaction costs, including information and coordination costs, thereby creating the efficient buyer-seller matchmaking model that fundamentally drives most platforms (Van Alstyne & Schrage, 2016). However, this efficiency concept of boundaries in the IS literature provides an incomplete understanding of how a DP can be managed, considering the shift of attention toward value creation and tensions among interdependent actors (Adner, 2017). As noted above, other nonefficiency boundaries, including boundaries of competence, power, and identity, are critical in broadening the strategic considerations and choices of DP firms to attain platform leadership (Basole, 2009; Santos & Eisenhardt, 2005, 2009).

Competence is acknowledged as a boundary in managing a platform. In discussing how platform leadership can be achieved, Van Alstyne and Schrage (2016) propose the importance of "strategically invest[ing] in the capabilities, competence, and creativity of its users" (p. 4), which compels a platform firm to move beyond the boundary of its competence with continued emphasis on investing in its own capacity. Rooted in resource-based theory (Barney, 1991), the boundary of competence is associated with the resources possessed by the actors in a DP and, more importantly, with value maximization of these shared resources (Santos & Eisenhardt, 2005). Compared to traditional firms that harness competitive advantages through internal control and ownership of resources, DP firms leverage the broad range of competence available in a network by managing resources owned by external actors (Van Alstyne et al., 2016) and by sharing the values created with other participants (Iansiti & Levien, 2004). Cultivation of actor capability is therefore important to enhance the overall value of a platform and to reinforce the virtuous cycle of network effects (Cusumano & Gawer, 2002). EBay, an example of a successful DP firm, has focused on growing the competence of its sellers by offering tools such as the Seller's Assistant, which helps sellers prepare professional-looking product listings (Iansiti & Levien, 2004). EBay customers also serve as resources, particularly to the product development team of the firm, through sharing approximately 10,000 postings per week on purchase tips and technical glitches (Hof, 2001). Rather than focusing exclusively on efficiency, platform leaders, such as Intel, develop the capabilities of actors to ensure that they continue to produce complementary products (Cusumano & Gawer, 2002).

Though not explicitly studied, the existing platform literature recognizes other boundaries in attracting and retaining actors. In Adner's (2017) study highlighting interdependencies, the dependence and independence of an actor on a platform can be related to the notion of the boundary of power between the actor and the platform provider. By definition, the boundary of power is associated with influencing the strategic relationship with actors through control of dependencies (Santos & Eisenhardt, 2005). To attain platform leadership, a DP firm must create these dependencies such that the actors are "reliant" on the DP. When actors become less likely to switch to another DP or multihome, the status of a DP firm as a platform leader is strengthened (Koh & Fichman, 2014). One method of creating such dependencies is by occupying the position of an indispensable network hub through provision of a common asset, such as Microsoft's Windows operating system and tools upon which other actors build their offerings (Iansiti & Levien, 2004). Platform leadership can also be attained by reconfiguring relationships between actors; Google, for instance, has restructured relationships between advertisers and users (Gawer & Cusumano, 2008), and Apple has expanded its domain of influence beyond being a device maker by connecting previously separated developers and customers with their proprietary development tools (Ghazawneh & Henfridsson, 2013). By managing the boundary of power, these platform leaders control a wider set of exchange relations beyond those with their direct customers.

The boundary of identity is associated with the demarcation between the dominant mind-sets of "who the firms think they are" and "who the actors think the firms are" in attaining coherence in the exchange relationship (Jarvenpaa & Lang, 2011; Santos & Eisenhardt, 2005) along with the actors' attachment and deep commitment to this relationship (Kogut & Zander, 1996). Studies suggest that effective collaboration can be facilitated by a shared identity (Levina & Vaast, 2005) because this identity can engender common agreement among diverse actors and foster the "logic of confidence and good faith" (Meyer & Rowan, 1977) and the bond that is imperative to encourage sharing in a loosely coupled network of autonomous firms with no hierarchical authority (Dhanaraj & Parkhe, 2006), such as that of a DP. In platform studies, Cusumano and Gawer (2002) have suggested that platform leaders can create such an identity by demonstrating to other actors that they are acting on behalf of the collective, thus establishing their credibility and symbolic significance. In addition, IS research has presented the use of information and communications technology (ICT) in developing "practices and interactions, which provide the context for the enactment of identity" (Gal, Lyytinen, & Yoo, 2008). For instance, ICT that connects supply chain partners can lead to the development of an identity with a collective (Malhotra, Gosain, & El Sawy, 2007). ICT can serve as the purposeful strategy of a supplier to alter its institutionalized practices and identities, thus differentiating the boundaries of efficiency and identity (Gal et al., 2008).

Although platform studies have suggested the existence of multiple boundaries, little is known about how they can be managed by a DP firm. We therefore draw on IS studies that offer an understanding of boundary management, despite their focus on boundary spanning as the key mechanism. An example of such a study is that of Malhotra et al. (2007), who examined how the use of standard electronic business interfaces as a boundary-spanning mechanism improves efficiencies by coordinating tasks and streamlining processes across supply chain partners. Other studies have explored the use of boundary spanning to overcome differences in firms and to facilitate an understanding of information sharing for project governance (Dongus, Ebert, Schermann, Yetton, & Krcmar, 2014) and knowledge sharing in various contexts, such as between IT and business domains (Pawlowski & Robey, 2004), between heterogeneous groups in IS development (Doolin & McLeod, 2012), between vendors and clients in IS outsourcing arrangements (Gopal & Gosain, 2010; Levina, 2005), and in other cross-organizational collaborations (Gal et al., 2008). Boundaries can also be used to create and maintain distinctions to establish status inequalities in a relationship (Levina 2005).

Figure 1 provides a review and summarizes the focus of this study. Despite the growing prevalence of DPs and the numerous boundary issues surrounding DPs, our review reveals two theoretical limitations: (1) an overreliance on the efficiency concept of boundaries in understanding DPs; and (2) an emphasis on dyadic relationships that leads to incomplete observation of network dynamics within DPs. Accordingly, this study aims to answer the following question: "In the pursuit of platform leadership, how can digital platform firms manage the boundaries within their platforms?" With this overall question in mind, we aim to understand how the multiple boundaries of DPs, including nonefficiency boundaries, can be managed and to present a more holistic view of network dynamics within DPs.

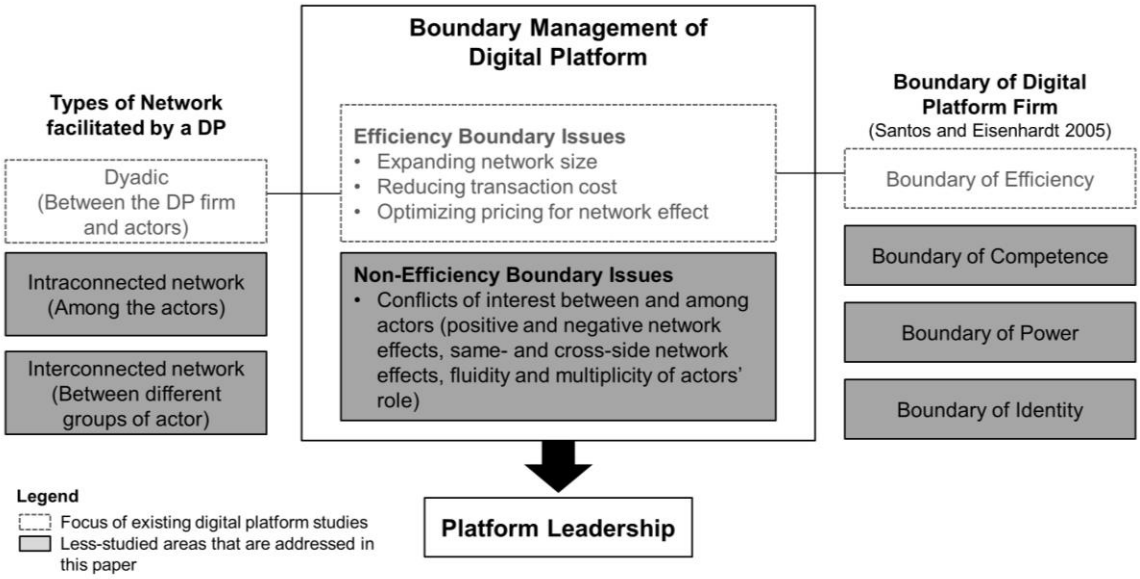

Figure 1. A Literature-Based Understanding of the Boundary Management of Digital Platforms

3 Methodology

We applied a case study research methodology because it is appropriate for addressing "how" questions (Pan & Tan, 2011; Walsham, 1995). Moreover, our phenomenon of interest is inherently complex, dynamic, and context-rich: it involves a range of simultaneous relationships with various groups of actors, their interactions, and multiple boundaries. This makes an objective approach to research difficult (Koch & Schultze, 2011). Using the boundary management perspective as the theoretical lens to serve as a "sensitizing device" (H. K. Klein & Myers, 1999 p. 75), we employ an interpretive approach because the analysis is largely based on texts that reflect interviewees' experiences with boundaries, which are often conceptual and invisible in nature. This approach not only enables us to analyze our data with certain expectations based on prior theory but also allows new, unexpected findings that were not identifiable at the outset of the inquiry to emerge from the data (H. K. Klein & Myers, 1999; Walsham, 1995). Embracing the principle of theoretical engagement (Sarker, Xiao, & Beaulieu, 2013), we first explicate the roles of the theoretical lens, i.e., an initial guide to design and data collection and part of an iterative process of data collection and analysis (Walsham, 1995). For instance, the four types of boundaries (efficiency, competence, power, and identity) serve as the categories of analysis that allow us to identify the boundaries in the case while anticipating the emergence of a boundary-spanning mechanism in the scaffolding process of building our findings.

3.1 Data Collection

After access to the firm was granted, we scanned for secondary data from the company website, newspaper articles, press releases, magazines, books, and journals, which initially served to build our understanding of the firm and the ticketing industry and later helped us identify additional sources for data triangulation. To further contextualize our understanding, we held informal conversations with five Damai customers, subscribed to Damai's news feed in Weibo, China's most popular Twitter-like microblog, and conducted ongoing observations beginning in 2011 via Weibo's social media channel. In 2011, we conducted 30 in-depth, semistructured interviews with the top management of the firm as well as the IT, sales, and operation departments that handle customers, agents, and suppliers, respectively. The data collection, primarily secondary data, and analysis continued until early 2017. The interviewees were identified jointly by senior management and the authors with a mutual understanding of the research objective and, in some instances, via the "snowballing" technique (Patton, 1990). Because we focused on relationships with external actors, we ensured that the interviewees either (1) had direct contact with the actors, (2) had been involved intensively in the development and maintenance of the DP that connects Damai with its actors, or (3) had been exposed to or in charge of strategic planning for initiatives and operations involving the use of ICTs that connect Damai with its actors (see Appendix C for the list of interviewees).

Each interview began with broad and generic questions and progressed to specific questions, allowing the researchers to move from a preliminary understanding to a global understanding of the overall context. Open-ended questions (see Appendix D) were prepared to facilitate more open sharing from the interviewees and new questions were devised based on the findings from previous interviews. Field notes and observations were captured by one researcher while another led the interviews. Half of the interviewees had more than five years of experience with the firm and were able to illustrate the contemporary conditions of critical development milestones. We requested an additional session with the CIO and a senior IT Division staff member at the end of the onsite data collection period to validate the information from the interviewees and to obtain feedback from the CIO regarding the interpretations of the researchers. All the interviews were recorded and transcribed, and the collected data amounted to approximately 212 pages of transcripts, field notes, and secondary data (Appendix E lists our secondary data).

3.2 Data Analysis

Our study addresses a "how" question: we are engaged in unearthing mechanisms that explain how boundaries are managed in DPs. Thus, our analysis is rooted in a process perspective, allowing us to both uncover the mechanisms and elucidate how different concepts of boundaries are used both in isolation and together (Bizzi & Langley, 2012; Santos & Eisenhardt, 2005). Our data analysis draws on methodological procedures that employ an interpretive approach and mechanism identification (Avgerou, 2013; Pan & Tan, 2011; Pentland, 1999). We rely on the guidelines of Pan and Tan (2011) together with the suggestions of Avgerou (2013) and Pentland (1999) to inform the process of abstraction from the descriptive "surface structure" in stories told by interviewees to the explanatory "deep structure" that underlies the sequence of events.

First, the data analysis began with *data organization*, which we used to chronicle narratives related to the use of ICT on our targeted DP. As we reviewed the *text* of the narratives (Pentland, 1999), three key external actors connected to the organizational platform and the main ICT systems used (i.e., the B2C portal, the distribution system, and the B2B platform) emerged, providing the backbone for further analysis. To prepare the main data used for subsequent analysis to identify mechanisms, we highlighted narratives of events, actions, and interactions—with a particular focus on *verbs* describing actions that produced a transformation from initial conditions to the observed outcomes (Avgerou, 2013).

The second stage of analysis involved application (and refinement) of the categories of analysis to filter the rich narratives for further development of tentative concepts. Given that "empirical investigation is not devoid of theoretical influence" (Avgerou, 2013, p. 411), we applied the concept of boundaries (efficiency, competence, power, and identity) to establish the categories of analysis. By utilizing a table, we assigned the narratives or the descriptive "surface structures" to the boundaries according to their relevance, and then considered the distinctive features of the three systems studied, how they were used to engage the three actors, and their impact on the relations between the actors. We created *stories* to describe our interpretation of how customers, agents, and suppliers were engaged, and identified tentative explanations to represent the processes. Appendix F shows how the boundaries serve as an analytical filter.

Next, we compared the explanations for similarities and differences. This step revealed numerous similarities across the three groups of actors; for instance, to ensure that Damai was easily accessible to the external actors, ICT was used to span the boundary of efficiency with customers, agents, and suppliers. Through further literature review, we realized that the simple categorization of actors could lead to a limited understanding of the multifarious roles played by actors in a platform. Therefore, we refined the categories of analysis from the actor type to the network type. More importantly, the three types of network (dyadic, interconnected, and intraconnected), in conjunction with the four types of boundaries (efficiency, competence, power, and identity), sensitized us to the tentative explanations, making it necessary to reconfigure the preliminary analysis framework to clarify explanations and reach a better understanding of the data (Pan & Tan, 2011; see the reconstructed framework in Appendix G). Following this refinement of the categories of analysis, we repeated the steps in the second stage of analysis to also refine the stories.

The third stage of analysis focused on the development of concepts. Using the refined framework, we reanalyzed the data and further abstracted tentative explanations developed earlier to present their empirical substance. These concepts formed a *fabula*— "an objective version of the basic events and characters required to uniquely identify a particular story" (Pentland, 1999, p. 720). One example of this is the derivation of "efficiency extension" and "capability diversification" in the dyadic network (as shown later in Figure 2). Concurrently, we focused on identifying connections among the concepts based on the principle of axial coding, and then derived *mechanisms* such as the "multiplexing platform function" according to the empirical characteristics of those two concepts.

Appendix H illustrates the derivation of concepts and the coding process for three of the mechanisms. With the interpretive approach allowing findings to emerge, we also noted the unanticipated consequences of the mechanisms (e.g., the negative externalities in Figure 2).

Our analysis entailed an iterative process involving disciplined imagination (Weick, 1989). By moving between the data and the theory-driven framework, the tentative explanations were refined and the framework was extended (with imagination) until we identified the framing that best explains the phenomenon observed (Avgerou, 2013). For instance, our literature-based framework of analysis was extended to include the new categories of analysis that emerged from the data—i.e., the boundary of ties (Figure 4)—and the fourth network type that represents the relationship between the platform and competitors (Figure 6).

We also considered competing evidence. For example, whereas some interviewees highlighted the importance of empowering the actors, others explicitly mentioned the importance of expanding the firm's control over them. Through an iterative analysis, we found that these competing interests in boundary management form a partial understanding because they are applicable to different network types (see our later findings), eventually leading to the conceptualization of different boundary mechanisms applicable to different network types—i.e., *spanning* boundaries between actors (to empower certain groups) and *erecting* boundaries between a firm and actors (to increase the control of the DP firm over the actors).

The last stage of analysis involved identification of the core mechanism in direct response to the research question. When the results of the partial analysis (Figures 2-6) were amassed (as shown in Figure 7), interactions between boundaries became identifiable (Avgerou, 2013), allowing us to extract the core story of managing boundaries to achieve platform leadership. Although functional multiplexing remains fundamental, three different value-extraction paths can lead to the escalation of network position, which is key to becoming a platform leader. This eventually gives rise to the *mechanism*, the deep structure that drives the process. We conducted a validation of the mechanisms under conjecture (McAdam, Tarrow, & Tilly, 2008) by ensuring that the derived mechanisms were transferrable to the context of the three groups of actors (Falleti & Lynch, 2009). During the development of our findings, we consistently ensured alignment between the data, theory, and our interpretations until the findings were finalized (H. K. Klein & Myers, 1999).

3.3 Case Site

Damai, a homophone for "best-selling" in Chinese, was founded in 1998 and currently enjoys a 70% market share (approximately 8 million customers), or about three times that of its closest rivals. By the time China became the world's largest e-commerce market in 2011, Damai had issued more than 10 million tickets. Damai was involved in the ticketing of more than 10,000 wide-ranging international and local events, including music, sports, culture, movies, entertainment, and travel; it was also the exclusive distributor of tickets for many major events in China, including the 2008 pre-Olympic trial events and the NBA Global Games. Considering its high growth rate, Lenovo invested in the company at the end of 2004, and the world's largest ticketing firm, Ticketmaster, has offered to acquire Damai on more than one occasion. The digital platform of Damai connects three main groups of actors: *customers* who purchase tickets for various events for their own consumption; *agents* who sell tickets to customers "on behalf of" Damai (e.g., travel agencies, hotels); and *suppliers* or the ticket generators who seek Damai's distributor services to sell tickets (e.g., event organizers, venue operators).

4 Case Analysis and Interpretation

Here, we present the analysis of Damai's network growth—specifically in terms of dyadic (direct relationships between Damai and actors), interconnected (relationships between different groups of actors), and intraconnected (relationships within a group of actors) networks. Within each of the following five subsections, we present our findings in two parts: (1) the development of networks connecting the three actors, including customers, agents, and suppliers; and (2) the boundary management mechanism, the processes derived from the analysis, and tensions in attaining platform leadership. The subsections are summarized in illustrative figures (Figures 2-6), which are later compiled and discussed in the Discussion section.

4.1 Managing the Dyadic Network

We first examine the direct relationship between Damai and its external actors, demonstrating the focus on improving efficiency and competency. Below, we illustrate how the boundary of efficiency was spanned, and then how the boundary of competence was spanned, as Damai connected to external actors.

In 1999 when Damai pioneered the online ticketing channel through Damai.cn, its B2C portal, it aimed to provide "the most convenient way for everyone to purchase tickets." (Senior Project Manager of the

Marketing Division, Business Development Department). Following its record of 4 million online ticket sales during the World Carnival 2005, Damai continued to improve the portal's accessibility for its *customers* through new technologies.

> *Often, attending a performance is consumption driven by a stimulus. We make sure that we are accessible whenever customers wish to buy a ticket.... Users can download our B2C app. They can scan a 2D barcode on newspapers or posters for instant purchase.... When customers read about a concert on Weibo, they can also find us there. These are extensions of B2C... fast and convenient.* (Damai Senior Manager, IT Division—Product Development)

Damai worked with distribution *agents* to expand its market. In working with these agents, Damai had to overcome operational differences that hindered efficient exchanges. Collaborations with ticketing agencies differed across cities in terms of fee structures, charging procedures, authorization processes, and partnering models. Meanwhile, agents from industries such as hotels, convenience stores, third-party payment operators, and advertisers (e.g., JiaoFeiYi, Lakala, VELO)[1] were accustomed to a business operation vastly different from that of Damai. A proprietary system, *youpiaotong*, was deployed to link these diverse agents to Damai's back-end sales system, eventually leading to the formation of Damai's nationwide distribution network of approximately 25,000 agents. Damai also developed a network of *suppliers*, the event organizers who comprise the source of tickets. These event organizers could also be the operators of venues such as theaters, concert halls, sports venues, and tourist destinations. To widen its supplier network, Damai relied on Mai+, its B2B platform implemented in 2009.

> *We "compress" the operation flow so that the suppliers can deal directly with the agents via our B2B platform. This enables a "cleaner" and efficient transaction.... Suppliers can use the platform for their ticket sales*. (Senior Manager, IT Division—Product Development)

As soon as the connections were established with the actors (the boundary of efficiency), Damai worked on diversifying the capabilities of its technological entity, or the DP, to further engage the actors (the boundary of competence). For customers, Damai incorporated a shopping space into the portal (http://tang.damai.cn/). Customers also received recommendations for upcoming events based on an analysis of their past purchases, browsing behavior, and indicated preferences. Customers could also view sold-out events using Damai's virtual reality (VR) technology.

> *Imagine a scenario in which the 600,000 tickets to BIGBANG's concert are snapped up within tens of seconds. Many others who are unable to get a ticket would be disappointed. VR is a solution that can provide them with the live experience.* (Interview with Damai's VR manager [ZY News, 2016])

Damai went beyond its boundary of competence to further its relationships with agents and suppliers. The firm emphasized investing in the capabilities of these actors. For instance, systems were enhanced for the agents and suppliers; the *youpiaotong* allowed the agents to generate various reports with graphical representations based on time, product, customer segment, etc., whereas the B2B platform enabled real-time monitoring of ticket sales at the supplier end. Damai also leveraged agents' resources, such as the market capabilities of Lakala, wherein both parties explored strategies to share resources. According to the senior manager of the IT Division (Product Development): "We exchange tickets for advertising time.... We have organized several events jointly. We sponsor tickets as prizes, and Lakala helps us to promote Damai's brand."

Because boundaries were spanned in the above situations, tension occurred when Damai experienced boundary reinforcement. The senior manager of the IT Division (Product Development) explained the tensions between customer engagement via its B2C portal and through distribution agents:

> *Customer and agent engagement can cause a negative network effect—The more agents I use and the better they perform, the less the customers visit my B2C portal. Still, we need agents to expand the market. We hope to achieve a balance.*

"We need to share the profits with agents. This is necessary because we hope to increase our coverage," he added. One of the steps taken was to limit the number of distribution agents for popular performances, such as the famous pop singer Li Yuchun's concert, to encourage direct purchase from the portal, which also prevented ticket-hoarding and unreasonable price increases by agents

[1] JiaoFeiYi was the operator of third-party payment terminals deployed in locations such as office buildings, neighborhoods, banks, campuses, and supermarkets; Lakala was the operator of personal terminals in homes for payment of bills such as utilities and credit cards; VELO was the owner of interactive advertising terminals that were deployed at rapid transit stations.

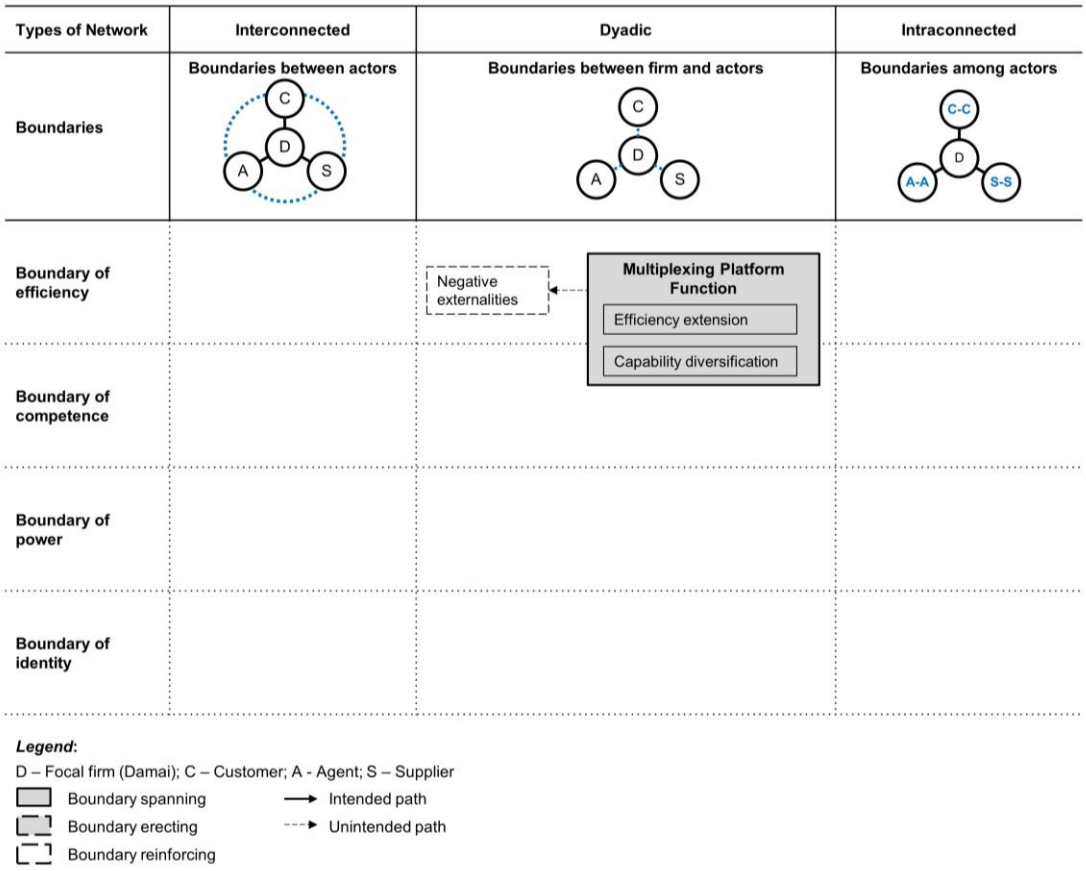

Figure 2. Boundary Management Between Damai and Actors

4.1.1 Boundary Management Mechanism: Multiplexing the Platform's Functions

As mentioned above, our analysis is grounded on three network types: dyadic, interconnected, and intraconnected networks. Figure 2 summarizes how Damai manages its dyadic network by multiplexing the platform's functions, showing that the DP intermediating the firm and actors is adapted to provide multiple functional services for both entities. Our data show that the mechanism is composed of two processes—efficiency extension and capability diversification—rooted in the spanning of the boundaries of efficiency and competence between the firm and actors.

Efficiency extension: An effective means of establishing a connection with actors is to span the *boundary of efficiency*—for example, by improving the speed and reach of exchanges for actors. Firms have been leveraging ICT for standardization and integration (Pawlowski & Robey, 2004), thus facilitating information sharing and process coordination for higher efficiency (Becker et al., 2013). In the context of a DP, the shift from offline to online exchanges (e.g., ticket purchase) lowers the search time and transaction costs, encouraging actors to connect with the firm. In addition, ICT can be quickly replicated and flexibly adapted to the needs of different actors. As shown by the example of moving from e-tickets to mobile apps and virtual reality shows, Damai deploys technology swiftly and thus increases the speed with which a network can be developed.

Capability diversification: When a firm diversifies the system's capabilities to intensify exchanges between a firm and actors, the *boundary of competence* is spanned. Leveraging the malleability of technology, services other than transactional exchanges are offered for the benefit of actors (e.g., online seat selection and event recommendations for customers, resource sharing with distribution agents, real-time monitoring features in the B2B platform, and analytical reports for suppliers). These additional functions increase the incentives for actors to engage with the firm (Bergman, Lyytinen, & Mark, 2007). In other words, the DP forms a shared context that diversifies and intensifies actors' interactions with the firm beyond transactional exchanges (Gal, Lyytinen, & Yoo, 2008).

Tension → negative externalities: Positive network externalities are critical when scaling a DP. However,

in some cases, the expected gain for users on one side of the platform decreases with higher activity levels on the other side (Eisenmann, Parker, & Van Alstyne, 2006). Our analysis shows that when a DP firm increases its functions and connects to a specific group of actors (functional multiplexing), the firm can risk reducing its connections to another group. In other words, the *boundary of efficiency* between the firm and actors is reinforced. This is largely attributable to the dual role played by the DP firm: it not only serves as the intermediary between the agent and the customer but also competes with the agent. The more a firm engages with its agents, the more it risks reducing its connections with customers and vice versa, resulting in a negative network effect. For firms that have networks with both groups of actors (agents and customers), maintaining the appropriate degree and type of agents while also maintaining the firm's direct engagement with customers is a delicate balancing act.

4.2 Managing the Interconnected Network

When Damai diversified the actors' capabilities, our analysis noted that relationships between actors could be changed simultaneously, thus shifting our focus from the dyadic network to the interconnected network. Below, we first illustrate how the boundaries of power and identity were spanned as Damai reconfigured the flow of exchange and its role.

One example of this phenomenon is Mai+, the B2B platform. Mai+ was critically important for redefining the flow of interactions between *suppliers and agents* in the ticketing industry. In the past, the sourcing of agents required suppliers to leverage their prior experience and existing networks. This "manual" process could be limiting, and most agents worked under a single distributor, such as Damai. With Mai+, ticket sales information was made available by suppliers. As the Damai vice president stated: "Our distribution agents can get in touch with a supplier proactively. This information, via Mai+, will reach suppliers, who can then make a choice based on their selection criteria."

Customers and suppliers are also interconnected. In the past, customers selected from a list of performances or shows predetermined by event organizers. Through the new feature on the B2C portal, customers can "vote" for performances or concerts they want to see (http://dianjiang.damai.cn/), thus establishing a channel for reverse communication between customers and suppliers. Damai then conveys the audience's preferences to event organizers, which has led to the successful organization of multiple events, including singer Zhou Bichang's "UNLOCK" concert and "The Grave Robbers' Chronicles" (a popular series of Chinese novels) stage drama, both in 2013. Through a crowdsourcing feature, customers can also support an event by paying an advance deposit. Should the performance be scheduled, those customers would receive priority ticketing and a discount.

> *Like many young people, Yang Jiao, a 24-year-old vocal art student, dreams of becoming a singer. After winning a singing competition in 2012, Damai allowed customers to vote for her concert. Eventually, she had her first concert on 29 Dec 2012, which is also her birthday... With that, a C2B [customer-to-business] model pioneered by Damai proved a success.* (China News, 2013)

With the change in the conventional power relationships within the network (the boundary of power), Damai's role extended beyond that of a ticket seller over time—especially when it shared its vision of cultivating a healthy ticketing industry in China with the public (the boundary of identity). According to the Damai vice president:

> *Other companies may think that we are developing our competitors (with the incorporation of B2B). However, our CEO is far-sighted. We need to create a healthy ecosystem [the interviewee was referring to the industry] together with our agents, especially in places where we need orderliness in the ticketing industry.*

Supported by the redefined relationships that allowed Damai access to the capital and preferences of its customers, the firm began to host and organize events, rather than limiting its role to that of a ticket seller. Below is an excerpt from an interview by *China Music Business News* with Damai's project director (China MBN, 2016):

> *In December 2016, Damai launched "MaiLive," its first large-scale musical event. Damai planned to host over 100 shows in 20 cities by 20 artists. This showed that Damai was moving up the value chain by leveraging its resources and new technology such as VR and AR [augmented reality]. It is also part of the vision of MaiLive to provide a nurturing environment for the music and entertainment industry in China.*

As boundaries were spanned in the above situations, tension occurred again when Damai experienced boundary reinforcement. The growth of Damai's capabilities, based on its access to a combination of resources, threatened to replace certain capabilities of its partners/actors. The C2B model and VR, for instance, constitute the enhanced capabilities that allowed Damai to assume the role of an event organizer. Recognizing that their actors may react

negatively to competition from Damai, Damai clarified its goal of working with multiple sides of a platform rather than replacing them. For instance, Damai's VR division focuses on generating content to attract more fans and boost box office results to serve their platform actors (China IT News, 2016). According to the division head, "The generation of VR content is not about making money. It is about value creation for our stakeholders: promoting the event for the organizers and improving the experience for the fans."

4.2.1 Boundary Management Mechanism: Expanding the Platform Scope

When we focus on the boundaries in the interconnected network, we find a different means of managing the DP compared to previous platform studies focused on internetwork externalities and how an optimized pricing strategy can amplify the number of connections (Eisenmann et al., 2006). The analysis shows that after establishing network connections to the various groups of actors, a firm can explore the flow of connections between actors to further expand its influence and value. We refer to this mechanism as expansion of the platform scope, which indicates that the DP has been adapted to generate a new scope of services. The mechanism is composed of two processes—flow reversal and role reconfiguration—that are rooted in spanning the boundary of power between actors and the boundary of identity between the firm and actors (see Figure 3).

Flow reversal: When a DP firm reconfigures connections to change the flow of exchange between actors, the *boundary of power* is spanned. By leveraging the capability of ICT to reorganize and reconfigure business relations (Jarvenpaa & Ives, 1994; Son, Narasimhan, & Riggins, 2005), such as in supply chain partnerships and B2B platforms, a firm spans the boundary of power between the actors, thus redefining the relationships between actors by empowering a group of actors through allowing them direct access to other actors or to areas or processes previously under the complete control of another actor. Such an arrangement reverses the conventional flow of interactions. For instance, agents can make a proactive move by contacting suppliers via the B2B platform, or customers can communicate their requirements to the supplier and even be part of the production process that was previously controlled solely by the supplier. Although existing platform studies suggest an empowerment strategy, the design has mainly centered on a dyadic view in which the capability of actors is bestowed by the focal firm rather than generated by manipulating relationships among the different groups of actors using technologies.

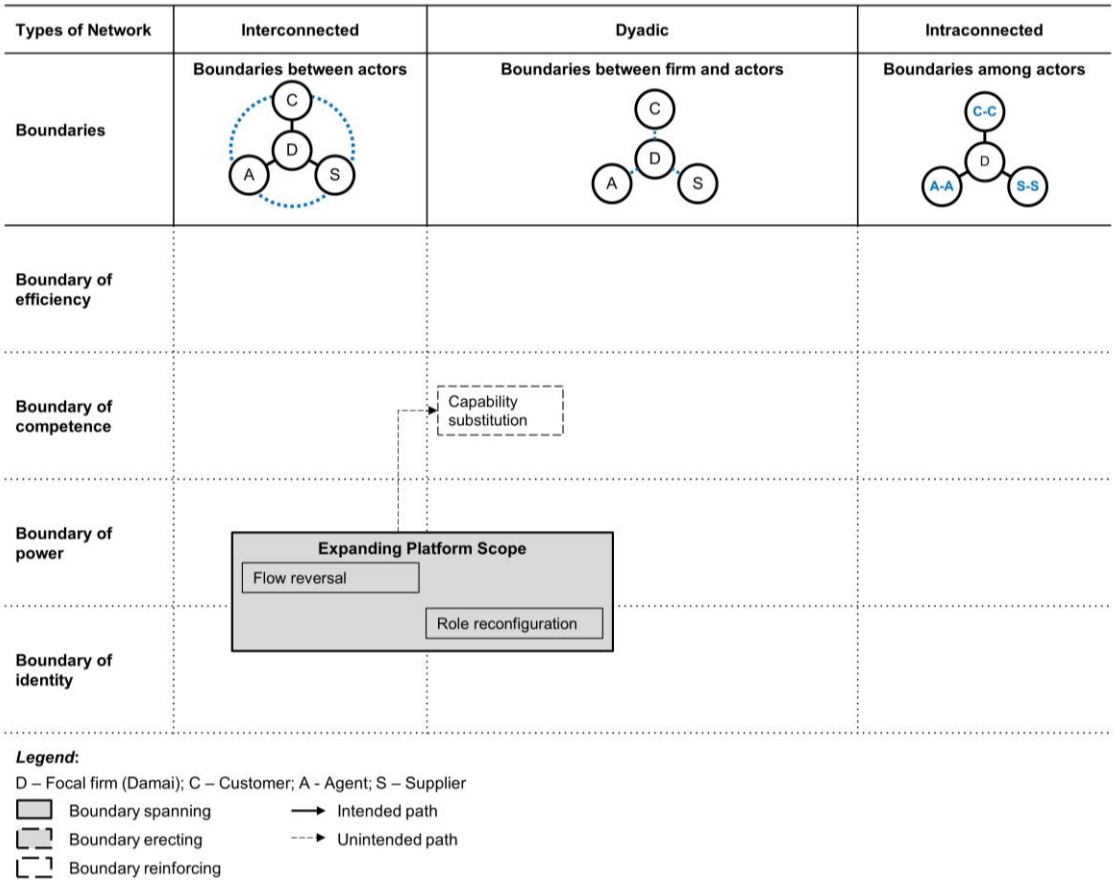

Figure 3. Boundary Management Between Different Actors

Role reconfiguration: Based on the case data, the reversal of flow described above is clearly associated with a challenge to the identity of the DP firm. When the traditional power relationship between actors is redefined, industry practices can be disrupted, leading to resistance and uncertainties, especially for new actors. Therefore, the DP firm must reconfigure its value proposition and role to reach a clear understanding with the actors, underscoring the applicability of the boundary of identity in a dyadic network. Our data show that the case company is proactively sharing its vision (e.g., to nurture a healthy ticketing industry in China) to establish a consensus that draws actors together. Notably, different technologies (including the B2B platform of Mai+ and VR and AR for MaiLive) are integrated on the platform, effecting a reconfiguration of the firm's value proposition and industry role.

Tension → capability substitution: When resources from diverse actors are synergized and reconfigured in a creative manner, the scope of platform services can be enhanced to the extent that the conventional practices followed by actors are redefined and the existing capabilities of actors are replaced. However, expansion of the platform scope may lead to invasion of the actors' market (Cusumano & Gawer, 2002). The *boundary of competence* between the firm and actors can be reinforced in response to a feeling of threat among the actors. An example of this phenomenon is the C2B model and VR functions on the Damai platform that lead to inferior competence among the suppliers. Greater expansion of a firm's service scope may correspond to lower commitment of the actors who feel threatened. Although studies have suggested market invasion as a strategy to make complementors wary (Cusumano & Gawer, 2002), our case suggests that avoiding an actor's market can be another strategy for long-term engagement.

4.3 Managing the Intraconnected Network

Although Damai worked on connecting different actors, it also emphasized the connections within the same group of actors. Next, we analyze the intraconnected network in which the boundary of competence and the boundary of ties—an emergent type of boundary—were spanned among the actors themselves.

The B2C portal catered to different needs. By leveraging the collective participation of customers and their aggregated resources, more value-added services could be provided, as articulated by the assistant director of the Web Division:

> *We were thinking from a more interactive perspective. We considered the functions that customers would require when they bought a ticket. This function of "yiqipin" (which means "fight together" in Chinese) allows customers to buy tickets together [for a discount] and to share accommodations and transportation if they must travel to another city for the performance.... Put simply, we allow the customers to make requests to other customers.*

Meanwhile, Damai extended its services in the B2B platform for the *suppliers and agents*. A "business circle," which incorporated the concept of social network sites, was integrated into Mai+, enabling informal sharing of information among suppliers, particularly with regard to an agent's performance. It also allowed sharing among agents in evaluating the profitability of tickets released by suppliers. Furthermore, Damai facilitated the exchange of resources among suppliers that could be categorized as venue operators and event organizers.

> *We built the repository of the available venues on our website (Damai.cn) so that the event organizers could find the information easily.... The organizers would want to find a venue popular within the audience.... For the venue operators, they will, of course, earn from the rental.* (Senior Project Manager, Marketing Division)

In addition to the benefits from aggregation of the resources owned by the actors themselves (the boundary of competence), the platform firm further engaged the actors by encouraging the development of interpersonal relationships (the boundary of ties). One means of facilitating the development of ties laid within the design of the B2C portal, where groups were categorized by fans of rock music, classical performances, and family- or child-related events and performances. Within the categories, virtual community sites were constructed and discussion topics revolved around customer interests, pop culture icons, or recent trends, creating a continuous stream of visits and interactions among customers who share similar interests. To further encourage their interactions, Damai leveraged Weibo. An average of three million visits per month was recorded from users of these social network sites.

> *The consumption of cultural and entertainment products is driven by stimuli. By providing peripheral services, we are part of a stimulus, too. Because of the social network platform, customers are encouraged to make friends as they purchase their tickets. They can make friends with those who share the same interest or the same idol as them. In other words, we are fulfilling other aspects of*

customer needs in addition to simply providing tickets. (Damai Vice President)

In the past, customers had no other relationship with Damai after they finished purchasing tickets. However, as we launch various initiatives in Weibo, a connection can be maintained among customers. They can share a photo of a concert while at the scene. In addition, customers may use mobile phone positioning to locate a friend at the venue. (Damai Assistant Director, Web Division)

However, this free flow of interactions, especially on an open and transparent platform, can have undesirable side effects, such as dilution of the platform's reputation. In an open exchange space, negative comments are unavoidable. "Some time ago, a guy was complaining about our company. Our system captured his comment and we were alerted. After investigation, we found that he did it because he was rejected for a technician post," recalled the IT Division (Research & Development) director of social media. Considering the potential effect on the company's image, a substantial amount of effort was spent analyzing and filtering negative comments about the company in its social media channels. Although avoiding such incidents is impossible, the company tried to mitigate its impact by promptly acting to resolve customer grievances.

4.3.1 Boundary Management Mechanism: Curating the Platform Community

Although the online community and its formation are not new in IS, these items have not been explicitly studied in the context of DPs. In this study, we examine a DP that has been adapted to establish direct exchanges (which were previously nonexistent) within a group of actors by leveraging technologies that allow for mutual resource sharing and social interactions and describe this boundary mechanism as *curation of the platform community*. The mechanism is composed of two processes—resource aggregation and social interaction—that are rooted in spanning the boundaries of competence and ties within the actor groups. Notably, in addition to the four boundary concepts, our findings suggest another boundary concept defined by the relational value in a network. Figure 4 illustrates this boundary and its management among actors.

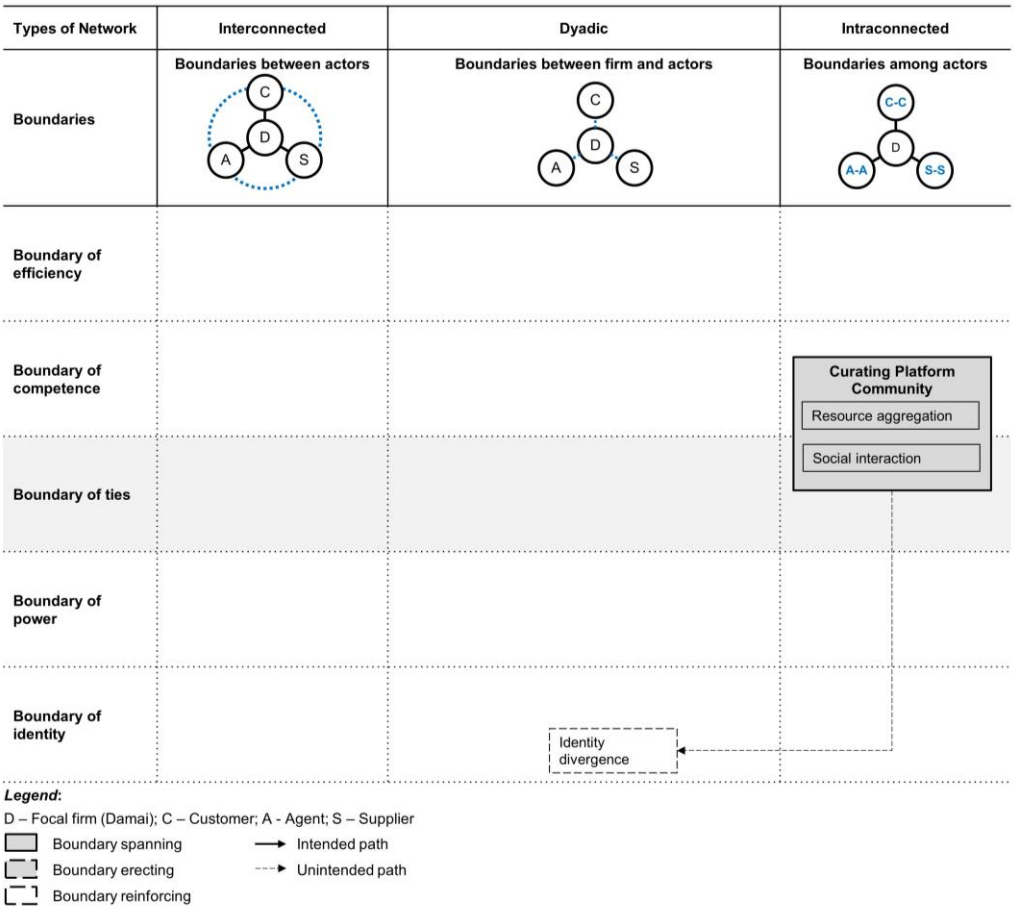

Figure 4. Boundary Management Among Actors

Resource aggregation: When a firm combines the capacity of actors to enhance their collective capability, the *boundary of competence* is spanned. Research has long suggested that digitally enabled linkages create new collaborative opportunities (Gosain, Malhotra, & Sawy, 2004). Building on direct interactions on a DP, actors can participate in the collective exchange, sharing, and development of resources among themselves (Bergman et al., 2007). Their individually owned resources, including both tacit resources such as buying power and physical resources such as transport, can be assembled and redistributed through technological means to address the demands of their peers, which are often peripheral needs surrounding the core products of the platform. This engagement in mutual practices creates synergy among the actors by optimizing the value of the fragmented individual resources dispersed among the actors. As the capabilities of individual actors grow, along with their collective capability on the platform, they become attached to the additional values they are afforded. In turn, this attachment contributes to the continuity of the DP firm-actor relationship and the expansion of the firm's network.

Social interaction: When a space enabling direct social-based exchange among actors is established, we argue that the *boundary of ties* among actors is spanned. When actors internalize the use of the DP in their local context beyond utilitarian transactions (Gal et al., 2008), a social context in which the DP is continuously used is created, which shapes their identification with other actors. Firms can incorporate the concept of interest groups and social networking technologies such that customers, especially customers with similar interests, can interact among themselves. This nonutilitarian use of the DP enables actors to go beyond their individual-oriented, dyadic relationships with the firm, giving rise to virtual ties among the actors (Levina, 2005) that can inspire emotional attachment and further commitment to the platform. This fifth type of boundary forms part of our emergent findings, which will be further elaborated in the Discussion section.

Tension → identity divergence: A contradictory force is at play in the mechanism of community curation. Earlier, we mentioned that DP firms work toward helping actors develop a coherent and shared understanding of their roles. However, as a firm facilitates open communication among actors through its social network platforms, avoiding the spread of negative commentary is difficult. Even when a firm attempts to develop consistency between its intended and perceived identities, the *boundary of identity* between the firm and its customers (or differences in their understanding) may be reinforced as a result of the spread of online criticism. Because of negative posts, customers may reinterpret or misinterpret the identity of a firm, including its roles, reputation, quality of performance in relation to the industry, and its position as a platform leader. These perceptions can threaten the formation of a coherent customer understanding of the organization's identity (Santos & Eisenhardt, 2005). Because boundary spanning in one network (the intraconnected network) may provoke changes to the boundaries in another network (the network between firm and actors), direct exchanges within actor groups should be carefully managed and prompt responses should be provided to contain any repercussions.

4.4 Managing the Dyadic Network (Again)

Next, we illustrate how the boundaries of competence and power were spanned as Damai further nurtured the capabilities of the overall platform. With access to multiple actors, Damai later leveraged the resources owned by a specific actor to develop complementary capabilities for other actors (the boundary of competence). One example of developing a complementary capability is collaboration with hotels. If a hotel guest purchases a ticket online prior to arrival, the hotel can hand it to the guest upon check-in, providing the guest with a seamless experience. In other words, Damai offered agents an opportunity to provide value-added services.

A reputation assessment feature was offered in Mai+ to help *suppliers and agents* evaluate and identify a partner. Based on past transactions (e.g., transaction volume, timeliness in payment, and accuracy of payment), agents and suppliers were rated by Damai. These ratings became important considerations in partner selection. All the transaction records were made available on the platform such that the suppliers and agents could conduct a sales analysis.

In addition to resources, the "network position" of the actors was redefined (the boundary of power). In contrast to the typical principal-agency relationship, Damai granted equal rights to *agents* selling tickets by ensuring transparency in the *youpiaotong* system. Although Damai sold tickets through its B2C portal, it allowed its agents to access the same pool of tickets through *youpiaotong*. Moreover, Damai adopted a flat structure in its commission sharing with agents.

> *Our main difference from our competitors is our sales strategy—if the event organizer gives us a 15% agent fee, we give a 15% commission to our distribution agents, whereas other companies may keep the difference. We hope this will increase our agents' competitive advantage because small agents may need to give discounts to their customers. We ensure that this feature is visible in our system.* (Damai Channel Development Manager)

Similar to the manner in which Damai treats agents as part of its business, Damai's development of a venue management system clearly shows its plan to include suppliers in overall DP development. Damai provides venue operators with mobile ticket verification devices to protect them against counterfeit tickets. The entrance information gathered through the devices also allows suppliers to coordinate manpower on-site in real time. In addition, the platform enables suppliers to generate a series of reports describing, among other things, the sales volume of each agent and sales trends by region.

> *The chief operating officer revealed Damai's plan to enhance the management of the venue operator. Because of a lack of governance in venue management, the issue of ticket scalping could not be eliminated. "Damai is determined to improve the collaboration with the venue operators. Damai will offer a ticket verification service, VR-based seat selection, and ID-based ticket purchasing to the venue operators." said the officer* (Interview excerpts from yicai.com, June 17, 2016).

However, as boundaries are spanned in the above situations, tensions can occur when the boundary of power is reinforced between Damai and its actors. After abandoning tradition to establish direct relationships between suppliers and agents via Mai+, Damai recognized the propensity of some agents to bypass the system.

> *Some agents would get in touch with the suppliers directly. In fact, many event organizers started with ticket selling. Therefore, there is a chance that after using our system (Mai+) once, the agents will go directly to the suppliers without using our system again.* (Damai Senior Project Manager, Marketing Division—Business Development Department)

One of the adjustments in Damai's channel expansion plan was to limit the number of same-industry agents (i.e., ticketing agencies) and to work with more cross-industry agents. Damai hoped that through this strategy, competition for similar target customers with same-industry agents could be avoided.

4.4.1 Boundary Management Mechanism: Empowering the Platform Actors

Our data show instances that illustrate actor empowerment, and our analysis provides insights that go beyond anecdotal descriptions (e.g., Iansiti & Levien, 2004; Van Alstyne & Schrage, 2016). We found that the mechanism of actor empowerment is composed of two processes—resource orchestration and status equalization—rooted in spanning the boundaries of competence and power between the firm and actors. We refer to the empowerment of platform actors as the use of a DP to capacitate actors through orchestration of resources and equalization of their network positions on the platform (Figure 5).

Resource orchestration: When a firm orchestrates resources in a network of actors, the *boundary of competence* is spanned. Directly or indirectly, actors contribute resources to the DP. Unlike the conventional practice of resource control, a DP firm redistributes resources from one actor to another, thus enhancing the capability of the actors. One example of resources is the rating of agents on Mai+. When these data are displayed on Mai+, suppliers can evaluate the agents. The competence of a supplier is enhanced, and the boundary that previously demarcated resources by their ownership is therefore blurred.

Status equalization: Through a DP, the norms of exchanges among actors can also be redefined, with one actor being granted greater control or influence over one relationship or another. In other words, the *boundary of power* is spanned. Transparency enabled by the technology contributes to this outcome. When the DP firm, in our case, deliberately allows agents to view the commission rate, information asymmetry is removed. More importantly, the rates are the same as those received by Damai, illustrating the equal position between the firm and the actors. Although some of these measures involve sacrifice of the platform's short-term interests, they promote both the common good and the sustainability of the network (Cusumano & Gawer, 2002).

Tension → platform disintermediation: The last tension occurs in the *boundary of power* as a corollary of the actor empowerment mechanism. As a DP firm facilitates direct communication between two groups of actors—for example, agents and suppliers—through its B2B platform, some agents may bypass the system and approach suppliers on their own after becoming familiar with them through the system. In promoting B2B interactions, a firm may unwittingly boost the power of its agents, thus threatening to the autonomy of the firm (Tsai & Pai, 2012) and leading to the subsequent discontinuation of the agents' participation and exclusion of the DP firm, a process known as "disintermediation." In our analysis, the case company alleviates this tension by leveraging its technological innovation to create value for the actors such that the intermediated relationship via the platform generates more benefits than direct exchanges with the other side of the platform.

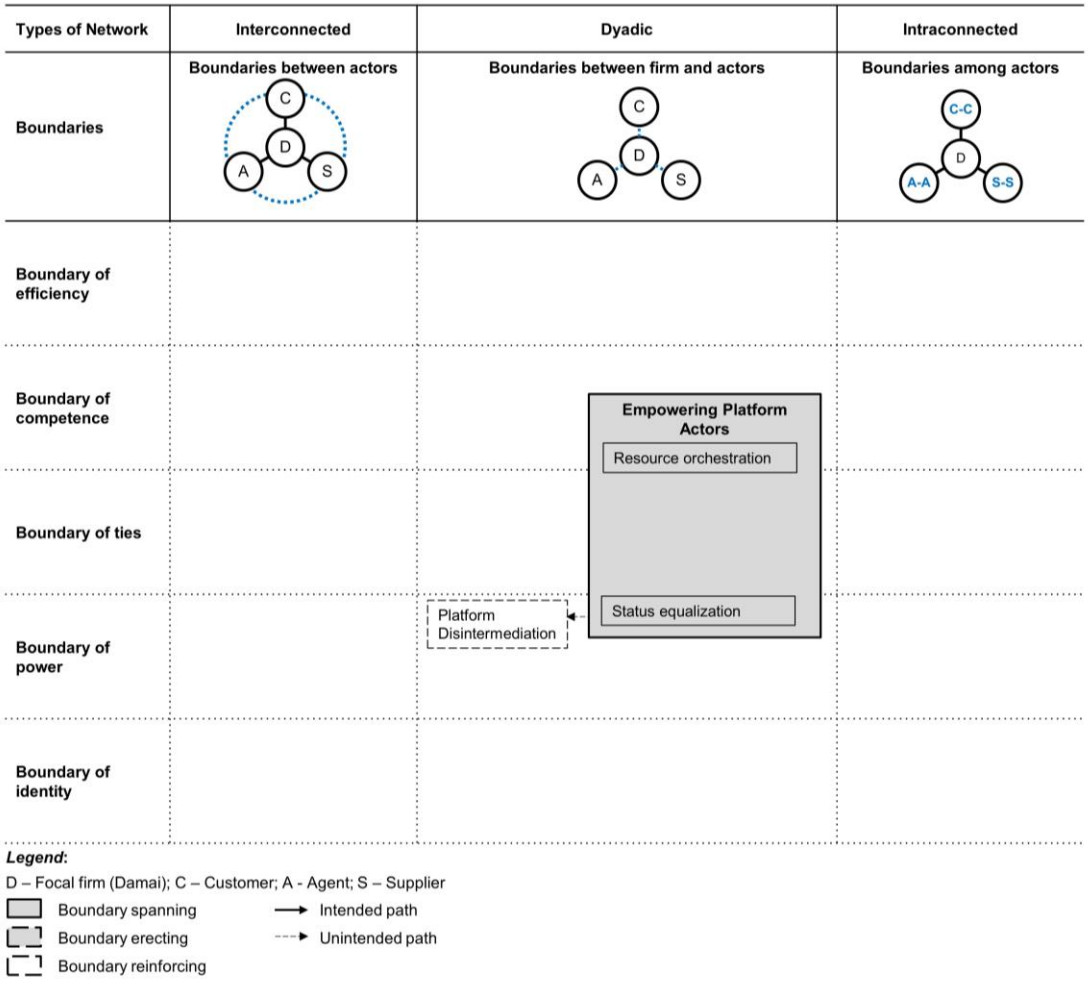

Figure 5. Boundary Management between Damai and Actors

4.5 Managing the Dyadic Network (Toward Platform Leadership)

Through the various functions and capabilities enabled by its B2C portal, Damai has clearly expanded its services beyond the role of a conventional ticket seller. More importantly, it has expanded its influence on the industry. According to the assistant director of the Web Division: "Technology helps us to grow bigger and stronger. More importantly, it nurtures customers' dependence on Damai and their habitual use of our platform, given the evolving use of IT."

Damai has maintained control over its agents and suppliers. Using the data collected via the *youpiaotong* system, it is clear that Damai monitors the quality of its products (i.e., tickets for different events) and the performance of the agents; distribution agents who violate the company's rules are denied access to the system. These actions contribute to the sustainable development of the distribution agents and strengthen their long-term relationship with Damai. Damai has also maintained its control over the platform, such as the choice of products offered on Mai+. When Damai found that long-distance travel packages may not be suitable for trading on its platform because of the subjective quality assessment of travel guides (who were beyond the agent's control), Damai decided to stop selling these packages to ensure that this subjectivity would not affect member performance.

To become a platform leader, our case shows that a firm must differentiate itself from its competitors. Accordingly, a fourth type of network emerges from our analysis. Damai allows customers to purchase tickets, receive recommendations for upcoming events, buy peripheral products online, communicate with others who share similar interests, etc. Through these actions, Damai differentiates itself from competitors, especially as a trustworthy seller. In the words of the senior project manager of the Marketing Division (Business Development Department): "Customers do care who they buy the tickets from, whether it is from us or Yongle (a competitor of Damai).... They like to buy from us because the information on our website is updated and accurate."

Furthermore, although Damai was not the only firm offering online seat-selection features during our study period, Damai's system was more customer-oriented than that of competitors and was therefore a preferred option.

Through development of its system, Damai has established an image for itself as a trustworthy partner. According to the senior project manager of the Marketing Division (Business Development Department):

> *We are the appointed system provider at the Great Hall of People [a venue in Beijing often used for legislative and ceremonial activities]. Their requirements are stringent and other providers have encountered problems. That is why we were chosen.... Once, there was a football match for which the lowest-priced ticket of 100 RMB was completely unavailable on the market because ticket distributors and sellers had sold their tickets to scalpers for 110 RMB, who in turn could sell those tickets to the audience at a much higher price. This is very bad in the long run.... One of the reasons that many suppliers choose us is because of our system. We never allow the overissuance of tickets. Although other companies have similar policies, staff behavior is difficult to control. We have strong internal governance and we are well-known for that.*

4.5.1 Boundary Management Mechanism: Escalating the Platform Position

Our analysis reveals a critical mechanism that determines whether platform leadership can be achieved. Platform leadership is partly determined by a platform's influence over its actors (Cusumano & Gawer, 2002) and by a firm's ability to establish and enhance its position in the network of actors. We refer to this mechanism as escalation of the platform position. This mechanism indicates that a DP is adapted to both centralize the role of the DP firm and reinforce the differences between the DP firm and its competitors, thus establishing a unique, core position of the firm in the network of relationships. In particular, the escalation of platform position mechanism is composed of two processes—influence expansion and image differentiation—that are rooted in the boundary of power between the firm and actors and the boundary of identity between the firm and competitors. What sets this mechanism apart from others that we have discussed is that rather than being spanned, the boundaries are erected in order to both enhance the differences and increase the switching costs of a platform. Figure 6 illustrates boundary management toward platform leadership.

Influence expansion: Our case illustrates how a *boundary of power* between a firm and actors is erected when their inequality is deepened; the asymmetrical expertise of actors is increased and the dependence of actors on the platform is heightened. As the central organization, a DP firm can conceivably access, collect, and analyze data regarding interactions between and within actor groups. Therefore, the firm maintains control over the participating actors, expanding its sphere of influence in the industry (Santos & Eisenhardt, 2005). The firm can also develop its power, for instance, by dictating which products are sold over its platform and reinforcing the growing reliance of actors on their unique service offerings. Through such a power imbalance, a firm maintains actors' dependency on its DP (Tsai & Pai, 2012).

Image differentiation: A firm's identity evolves (in the case of Damai, from a ticket provider to a platform provider and a trustworthy partner) as the firm promotes multiple connections with actors, facilitates direct connections between actors, and encourages social exchanges among actors. More importantly, the network position of a firm can be raised to that of a keystone organization in the network of relationships by advancing the uniqueness of the platform in terms of its technologically induced quality and the governance over its platform. Purposeful or inadvertent alteration of institutionalized practices in the industry, innovative products, and value propositions of companies are some examples of instances that strengthen the firm's unique identity, reinforcing a *boundary of identity* between the firm and its competitors (Gal et al., 2008). When such differentiation is acknowledged by the actors, the platform's credibility as a leader can be built (Cusumano & Gawer, 2002).

5 Discussion

This study investigates the question of *how digital platform firms can manage the boundaries within their platform in the pursuit of platform leadership*. Our findings show that depending on the types of network, different boundary-spanning mechanisms should be adopted by DP firms, apart from their fundamental functions of matchmaking, and that the attainment of platform leadership hinges on the enactment of boundary-erecting mechanisms that differentiate DP firms from their competitors. Figure 7 illustrates our findings, which are summarized based on the analysis above. Next, we discuss how boundaries are managed in different networks built on a DP in three parts: (1) the intended path of boundary management toward achieving platform leadership, (2) the unintended path where tensions arise, and (3) the emergent findings that extend our analysis framework.

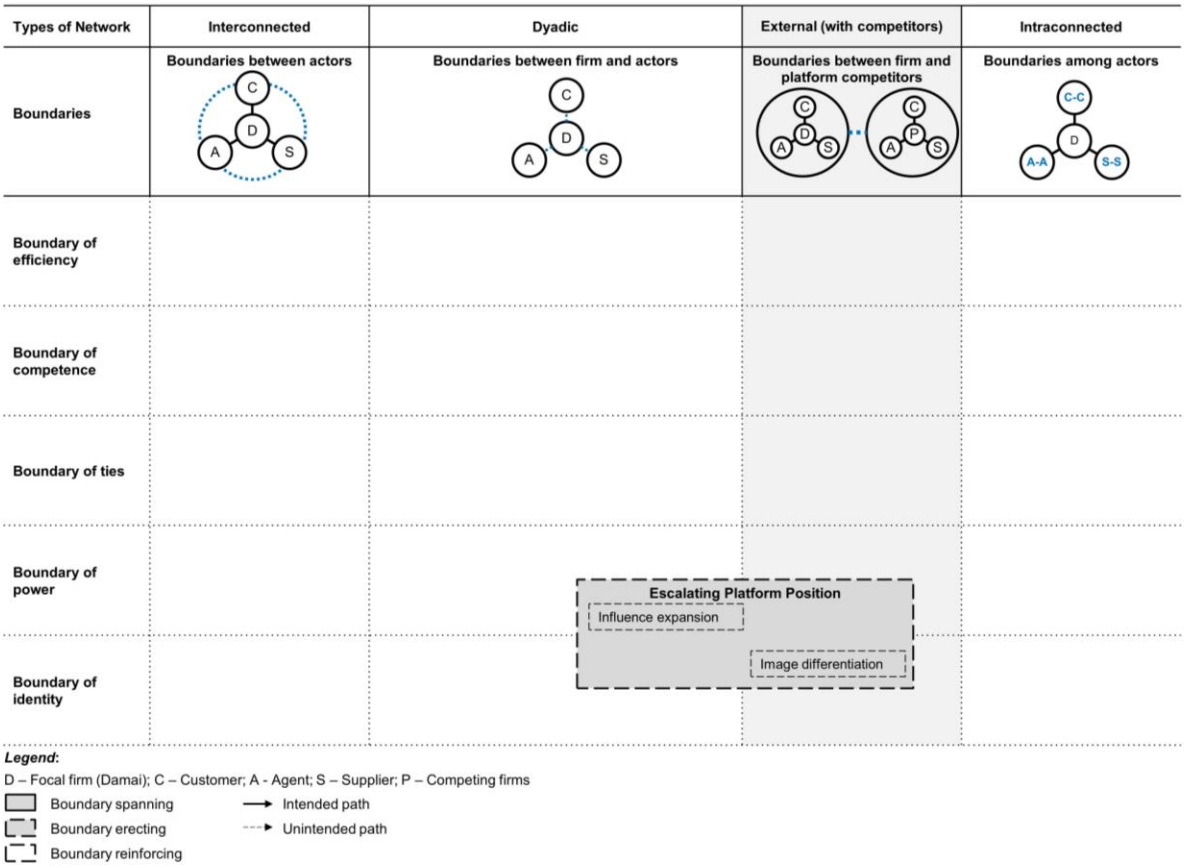

Figure 6. Boundary Management Between Firm and Actors

5.1 Boundary Management Toward Platform Leadership and Tensions

Functional multiplexing is a fundamental step in building a platform network (Figure 7). The following discussion of the network is justified only after connections with external actors are established. Although the spanning an efficiency boundary does not constitute a new finding in itself (given the key defining aspect of a platform in facilitating efficient connections and value exchanges—Evans & Schmalensee, 2016), the spanning of a competence boundary (capability diversification) further enhances the value of a DP, attracting more sign-ups.

With multiple actors on board, a DP firm can move from an efficiency-driven strategy to one that emphasizes value generation (Hagiu, 2009; Iansiti & Levien, 2004), and this transition can be achieved by expanding the platform scope (see Path 1 in Figure 7), curating the platform community (Path 2) and empowering the platform actors (Path 3). These three paths demonstrate different methods of value extraction when a DP firm focuses on different network types and, more importantly, the key boundaries to be spanned for that purpose.

While the above boundary-spanning mechanisms focus on value generation that contributes to the network effect, the findings further reveal boundary erection as a critical boundary management mechanism that can generate high switching costs through the development of differences (Jonsson, Holmström, & Lyytinen, 2009). Both network effect and high switching costs are important to achieve platform leadership (Eisenmann et al., 2011). As illustrated by Path 4, what sets a DP apart from other platforms is the ability to escalate the network position of the DP firm, which can be established by developing actor dependence on the DP (the boundary of power) and distinguishing between the DP firm and its competitors (the boundary of identity), thus protecting the prestige of the DP firm (Burri, 2008; Gieryn, 1983). To the best of our knowledge, this study is the first to explicitly articulate strategies to attain platform leadership.

As discussed in the case analysis, tensions that arise when boundaries are spanned/erected should be managed. Although some of these tensions in our findings (such as negative externalities) are not new in the platform literature, they are rarely presented either systematically or alongside the DP strategy.

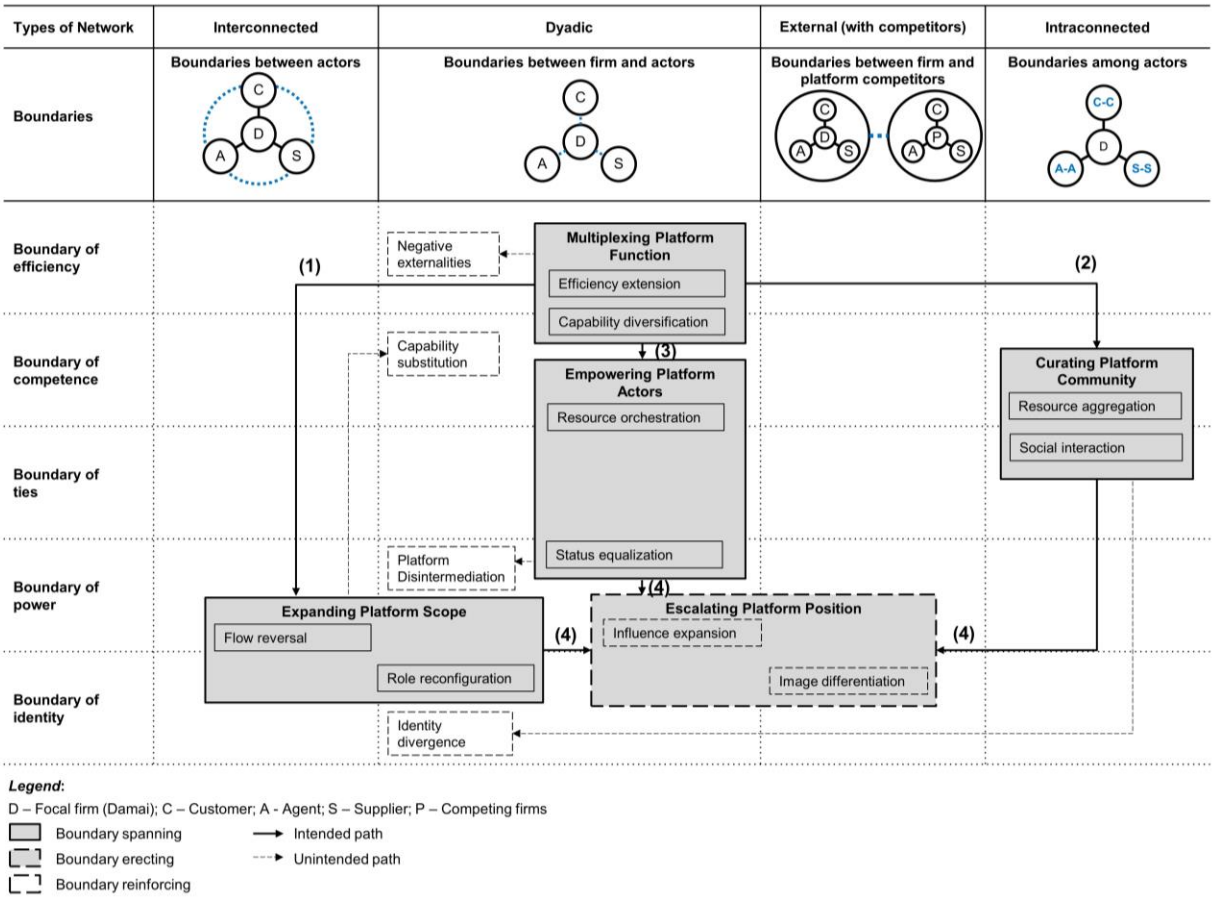

Figure 7. Managing Boundaries in a Digital Platform

5.2 Emergent Findings: An Extension of the Analysis Framework

The findings that emerge from our data extend the preconceived analysis framework in two ways. First, the concept of boundaries (Santos & Eisenhardt, 2005) is extended to the *boundary of ties*. Grounded in the relational view of management (Dyer & Singh, 1998), interpersonal relationships are a key factor explaining the different levels of collaboration across companies and external actors. We argue that this boundary may have been subsumed under the four existing boundaries; for instance, Tsai and Pai (2012) studied how online communities develop deep enduring bonds for group *identity*, and other studies underscore an IT bonding capability that enables the pooling of *resources* from external actors (e.g., Tang, Rai, & Wareham, 2011). We contend that this boundary should be treated as a single category of analysis for two reasons. First, only when this category is analyzed explicitly and alongside other boundaries can we see the shift of strategic emphasis from enhancing tie strength (through means such as repeated interactions, reciprocity, overlapping identities, shared norms, and interpersonal trust—e.g. Kilduff & Brass, 2010; Moran, 2005; A. Rai, Maruping, & Venkatesh, 2009) to creating value (through reconfiguration of other types of boundaries). Second, when juxtaposed with other types of networks, DP firms can clearly see where they should be spending time deepening tie strength. Our findings show that although the ties between the DP firm and other actors are downplayed, the boundary of ties remains critical to managing the intraconnected network.

Another emergent finding is the fourth type of network that is applicable in analyzing DPs, i.e., the *relationship between the platform and competitors.* Consistent with recent platform studies highlighting the relationship between the platform and competitors (e.g., Eisenmann et al., 2011; Koh & Fichman, 2014), our analysis shows that this view of the network is critical for determining platform leadership. Within this type of network, our findings illustrate only the boundary of identity between a DP firm and other competing firms; this boundary should be erected to attain platform leadership. The need for this boundary can be attributed to the fact that because of the existence of digital transparency, any differentiation that applies to other types of boundaries is relatively easy for competitors to emulate. However, we do not intend to argue that other boundaries can be safely ignored.

6 Theoretical and Practical Contributions

The boundary condition of the findings includes DP firms operating exchange platforms where the fundamental value lies in efficient matchmaking between supply and demand. Specifically, this study provides two theoretical contributions. First, the study conceptualizes the development of a DP as a set of boundary management mechanisms centered on the use of ICT. We believe this has important implications because the increasingly prevalent DP model draws on the notion of a network as a distinct mode of organization (Thomas & Autio, 2014), but few studies have explored beyond the foci of cost reduction, pricing, and user base increments (Van Alstyne & Schrage, 2016). This can be limiting considering emergent issues in a network— for example, power shifts. The boundary management perspective adopted in this study allows for an expanded view of boundaries and thus an explicit analysis of how multiple boundaries are spanned, erected, and reinforced in growing a network built on a DP. The four boundary concepts by Santos and Eisenhardt (2005) that guide our study compel us to explore beyond preoccupation with the role of ICT that is often associated with the boundary of efficiency (i.e., improving process efficiency and knowledge interactions (e.g., Doolin & McLeod, 2012; Gal et al., 2008; Gopal & Gosain, 2010; Levina, 2005; Pawlowski & Robey, 2004)). In particular, our case provides an account of how ICTs can also affect the boundaries of competence, power, and identity. Five boundary management mechanisms are conceptualized to reflect the principles of how technologies can be adopted, adapted, and integrated in the development of a digital platform. To the best of our knowledge, this study is the first to offer a systematic analysis of the network growth of a DP, advancing our knowledge of how platform leadership is achieved.

Second, our findings unveil the network dynamics of DPs by explicating the synergy and tension associated with boundary management. Whereas DP studies have alluded to issues such as negative network effects and contradictory effects when a platform focuses exclusively on enlarging the network, few studies have examined the underlying dynamics involved. To generate a more holistic and nuanced understanding, our study presents both synergies and tensions as the intended and unintended paths. Our work scrutinizes the complex network of interdependencies by examining three types of networks: dyadic, interconnected, and intraconnected networks. This examination may allow subsequent studies to move away from a simple dyadic view of relationships (e.g., Im & Rai, 2014; R. Klein & Rai, 2009; Ou, Pavlou, & Davison, 2014; Arun Rai, Pavlou, Im, & Du, 2012; Tang et al., 2011; Tsai & Pai, 2012) to a deeper (but manageable) investigation of interactions across various types of networks. By incorporating new categories of analysis—i.e., the boundary of ties and the external network (with competitors) found in our analysis—this study offers a multidimensional framework for future research on DPs.

Our findings also generate practical contributions for digital platform firms. First, the narrative accounts of how Damai has achieved platform leadership can be considered a contribution in general (Walsham, 1995). Second, in addition to technology-enabled efficiency in matchmaking (i.e., *functional multiplexing* in Figure 7), our findings offer subsequent guidelines on how DP firms can identify opportunities for new value creation from the different networks: dyadic, interconnected, and intraconnected networks. We suggest that depending on the targeted network type, a corresponding mechanism including a*ctor empowerment*, *scope expansion*, and/or c*ommunity curation* should be adopted by DP firms. Although not explicitly studied, decisions about the targeted network type may depend on the size of the actors already connected and the strategic intent of firms. For instance, a firm may decide to implement *community curation* when it has accumulated a sufficiently large user base to generate additional value for the firm (e.g., eBay's analysis of 10,000 customer postings per week) or when it decides to offer an additional mechanism for interaction and trust building among the actors (e.g., informal sharing among Damai's suppliers). Accordingly, our findings show that the three mechanisms can serve as three independent paths that may be implemented at the same time.

Our third managerial implication refers to the significance of the positional escalation mechanism to eventually achieve platform leadership, refocusing our attention toward platform differentiation for a platform that is distinct from the often-studied software platforms. In digital exchange platforms, the technical architecture and innovativeness may not serve as keys for differentiating a DP firm from its competitors as they did for Apple's iOS system as a software platform (Tiwana, Konsynski, & Bush, 2010). While they empower actors, DP firms are also reminded of the necessity of maintaining the power imbalance such that the actors continue to be dependent on the DP. Fourth, our study confers significance to boundary management mechanisms and boundary types; accordingly, we offer more specific actions for digital platform firms to manage their networks. In addition to the details of boundary management mechanisms, our findings highlight that a critical shift from boundary spanning to boundary erection is important in the process of attaining platform leadership. Lastly, in managing these complex digital networks, this study draws the practitioner's attention to tensions across

networks. Firms' deployment of ICT based on the intention to span a specific boundary may unexpectedly lead to reinforcement of a boundary in another network. By delineating the complementary and contradictory effects of boundary management mechanisms, our findings shed light on how DP firms can better manage external relationships at the supranetwork level.

7 Limitations and Conclusion

This study has certain limitations. First, compared to digital software platforms such as the Apple iOS system, our analysis is more applicable to digital exchange platforms (Evans & Schmalensee, 2007). Whereas the former types of platforms are more concerned with technological advances as the critical elements that bind actors, our findings primarily involve the exchanges and relationships among actors. Future studies should examine our findings against other types of DP firms with different network configurations, products/services, and emphases. Examples, in addition to software platforms (which focus on technological innovation and platform openness for R&D spillover), include content-based platforms (e.g., MakerBot, which focuses on digital or information goods and intellectual property) and community-centered platforms (e.g., crowdsourcing, with a greater emphasis on one group of actors) (Parker, Van Alstyne, & Jiang, 2017).

Second, although the case firm exhibits no significant differences from technology startups outside China with respect to its flat hierarchy, we caution against direct application of our findings. Network capitalism is tenacious and distinctive in Chinese society (Boisot & Child, 1996; Child & Möllering, 2003; Redding, 1980). Although DPs underscore the fundamental importance of the network, claiming that our findings are not at all affected by the conflated network-prone ideology of a Chinese management team with a high regard for collectivity is difficult.

Third, given that our study is situated in a dynamic environment, we should caution against generalizing the results to DP firms in relatively stable environments. Our findings require discrete application to firms with a strong physical presence and frequent face-to-face interactions with external actors. This need arises because actors with previous interpersonal interactions may compare those interpersonal interactions with ICT-facilitated interactions and perceive the latter as less "intimate" (Schultze & Orlikowski, 2004). Moreover, a stable environment can afford gradual development of a network through conventional personal interactions (Fowler, Lawrence, & Morse, 2004). Therefore, our findings on digitally enabled networks grounded in the increased efficiency of tie formation through ICT (Hallen & Eisenhardt, 2012) may be less relevant in a stable context.

Despite these limitations, we believe that our study should be of interest to practitioners and researchers in the field of digital platforms. This study is among the first to provide an explicit account of the nuances in attaining platform leadership. Considering the rising competition amid the prevalence of digital exchange platforms, we hope that the intended and unintended paths of development presented in this paper will serve as a foundation for reflection and application by DP firms. In addition, our framework offers an integrative view of boundary management and explicates network dynamics. We are hopeful that the multidimensional framework will provide a basis for deep but manageable investigations of the complex interactions on DPs by IS scholars examining the growth of networks on DPs.

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Appendix A

A1. Literature Review Analysis

Consistent with the hermeneutic framework (Boell & Cecez-Kecmanovic, 2014), our literature review began with searching and an acquisition circle to identify information that informs our research focus on DPs and further literature. We began our IS literature search (mainly the Basket of Eight journals) with key terms, including two-sided platform, multisided platform and platform ecosystem, which returned a total of 18 articles. We read all the papers with a particular focus on DPs as the unit of analysis and on organization as the level of analysis. Through citation tracking, we further reviewed the citations of these articles to gain insight into the fundamentals of exchange relationships on a platform, expanding the scope of our review to economics (examples include *RAND Journal of Economics*, *Journal of the European Economic Association*, and *National Bureau of Economic Research*), organization, management (including *MIT Sloan Management Review*, *Harvard Business Review*, *Academy of Management Review*, *Strategic Management Journal*, *Journal of Management*, *Organization Science*, *Academy of Management Review*, and *Administrative Science Quarterly*), and other IS journals. At the same time, to ensure a comprehensive understanding, we expanded the list of search terms to include ecosystem, ICT, network, network strategy, interfirm relationships, and boundary (which were used both independently and simultaneously through the "AND" search operator), increasing the number of articles to 92.

As the list of articles and our overall understanding of DP grew, our acquired information laid the groundwork for further assessment of the literature. We began sorting, comparing, and contrasting the literature by using the possible means of classification summarized by Boell and Cecez-Kecmanovic (2014, p. 266) (e.g., the level of analysis, the unit of observation, and major concepts). We actively sought a perspective that would help us grasp the state of knowledge in our targeted domain, justify our actions, and open a space for developing a new synthesis or relationships to address our research question. This analytical review seeking clarification of the literature with respect to the research problem, also known as the analysis and interpretation circle (Boell & Cecez-Kecmanovic, 2014), was facilitated by the use of data summary devices such as tables and diagrams (e.g., Appendices B and F). Although this is not an exhaustive list of the papers reviewed in the scope of platform articles, Appendix B summarizes the key papers (based on the number of citations and the recency of the article). More importantly, this appendix provided a topic-centric summary of our literature review (Webster & Watson, 2002), which "contours an opening or a space into which our theorized storyline will fit." (Golden-Biddle & Locke, 2007, p. 32). The platform strategy's focus on the sheer number of users and pricing structure (one of the topics in Appendix B), for instance, can only address a limited extent of the challenges stipulated in platform leadership (another topic in Appendix B), especially in view of the often-neglected topic of network dynamics (another topic in Appendix B). While we map and classify the literature, the boundary of our review (Webster & Watson, 2002)—not the boundary condition of our study—is shaped and summarized as follows.

Table A1: Boundaries of Literature Review

Elements	Description
Scope of review	Information systems, organization and management, economics, sociology and psychology (which further substantiate our understanding of the boundaries of power and identity)
Temporal range	(As emerged from our literature search) From 2002 to mid-2017 for DP studies, and from 1983 to mid-2017 for boundary studies
Contextual limitation	An exchange platform versus software platforms (e.g., Apple IOS platform), content-based platforms (e.g., MakerBot) and community-centered platforms (e.g., crowdsourcing) (Evans & Schmalensee, 2007; Parker et al., 2017)
Level of analysis	Organization (i.e., a DP firm)
Unit of analysis	Digital platform (a technology entity)
Unit of observation	Dyadic, interconnected, and intraconnected networks (along with networks between platforms that emerged from the study)

Appendix B

Table B1. Key Literature

Author/Year	Key points related to the platform	Highlight of DP management	Types of network studied
Number of users in a network			
Edelman 2015	Argues that firms should focus on the *number of users* in the network when launching a platform.	Number of users	Dyadic
Zhu and Furr 2016	Argues that firms should focus on the *number of users* in the network to maximize the number of interactions in a platform-based business model (versus a product-based business model).	Number of users	Dyadic
Facin et al. 2016	Suggests pricing strategy as the key to growing network size (*number of users*).	Number of users (pricing strategy)	Interconnected
Bakos and Katsamakas 2008	Focuses on how a firm can increase the *number of users* through *pricing strategy*.	Number of users (pricing strategy)	Interconnected
Lin et al. 2011	Focuses on how a firm can increase the *number of users* through *pricing strategy*.	Number of users (pricing strategy)	Interconnected
Rochet and Tirole 2006	Focuses on how a firm can increase the *number of users* through *pricing strategy*; investigates the derivation of optimal pricing formulas and obtains new results on the mix of membership and usage charges.	Number of users (pricing strategy)	Interconnected
Rochet and Tirole 2003	Focuses on how a firm can increase the *number of users* through *pricing strategy*, unveiling the determinants of price allocation and end user surplus for different governance structures (profit-maximizing platforms and not-for-profit joint undertakings).	Number of users (pricing strategy)	Interconnected
Armstrong 2006	Focuses on how a firm can increase the *number of users* through *pricing strategy*; suggests that the determinants of equilibrium prices are (1) the magnitude of cross-group externalities, (2) whether fees are levied on a lump-sum or per-transaction basis, and (3) whether agents join one platform or several platforms.	Number of users (pricing strategy)	Interconnected
Platform leadership			
Cusumano and Gawer 2002	Suggests *platform leadership* as a key challenge. In particular, argues that platform leadership is about maintaining platform dependency and *balancing collaboration and competition* to recognize mutual dependency. Notably, some companies have multiple roles, thus complicating management of relationships with external actors.	Balancing act for platform leadership	Dyadic
Gawer and Cusumano 2008	Focuses on the number of users in the network and suggests that the pricing strategy can grow the network size, *platform leadership* can help govern business relationships on the platform, and the challenges of *balancing the profits of a DP firm and actors* can be overcome.	Balancing act for platform leadership	Dyadic
Mantena & Saha, 2012	Suggests that collaborations between rival platforms are more likely when the differences in their technological	Balancing act for platform leadership	Relationship with other platforms

Table B1. Key Literature

Author/Year	Key points related to the platform	Highlight of DP management	Types of network studied
	capabilities are significant. In some cases, the collaboration may enhance the degree of differentiation.		
Eisenmann et al., 2011	Highlights the threat of envelopment from *adjacent platform* providers as they bundle the functionality of the targeted platform within their own platform; presents a typology of envelopment attacks.	Threat of envelopment	Relationship with other platforms
Koh & Fichman, 2014	Highlights the threat of multihoming, where platforms regard low usage as a reflection of users who concurrently participate in more than one platform.	Threat of multihoming	Relationship with other platforms
Iansiti & Levien, 2004	Highlights the platform leadership of the keystone organization, which rests on *creating and sharing value with other actors*	Deepened relationship with actors	Dyadic
Weill & Woerner, 2015	Focuses on how the firm can deepen its relationship with actors (customers) by *gathering knowledge* about them on the DP	Deepened relationship with actors	Dyadic
Van Alstyne & Schrage, 2016	Indicates the need to move beyond an efficiency model for platforms (which focuses on establishing connections to reduce transaction costs) and suggests *empowering actors* (i.e., enhancing their competence) as a strategy of platform leadership to cultivate a transaction surplus	Deepened relationship with actors	Dyadic
Network dynamics			
Hagiu, 2009	Highlights that the dynamic effects of multisided platforms (MSPs). *Deepening the network* with the existing sides to make them "stickier" (e.g., by deepening the fundamental functions of the MSP or providing quality certification) may lead to potential *conflicts of interest* with the MSP's ecosystem	Deepened relationship with actors; network dynamics	Dyadic, interconnected, and intraconnected networks
Eisenmann et al., 2006	Highlights both the importance of *pricing strategy* in generating internetwork externalities and the potential for *negative intranetwork externalities*; hence, argues that excluding some users from a network may sometimes make sense.	Network dynamics	Inter- and intraconnected networks of relationships with other competing platforms (in isolation)
Hagiu, 2014	Highlights the need to avoid design and features that "put the interests of different sides of the MSP at odds with each other or with those of the MSP," and also suggests the need to control the number of sides and highlights the existence of *conflicting interests* and the trade-off of quantity in favor of quality.	Network dynamics	Primarily dyadic; suggests the potential conflicting interests between the different groups of actors

Appendix C

Table C1. List of Interviewees

No.	Position	Division (Department)
1	VP-cum-CIO	Top management
2	Director (ticketing system)	IT Division (Research & Development)
3	Director (website)	IT Division (Research & Development)
4	Director (social media)	IT Division (Research & Development)
5	Director (product)	IT Division (Product Development)
6	Senior manager	IT Division (Product Development)
7	Senior manager (Damai)	IT Division (Product Development)
8	Senior manager (customer)	IT Division (Product Development)
9	Senior technical manager	IT Division (New Technology)
10	Senior manager	IT Division (Testing)
11	Manager	Corporate Management Division (Corporate Governance)
12	Director	Web Division
13	Assistant director	Web Division
14	Senior project manager	Marketing Division (Business Development)
15	Channel development manager	Marketing Division (Channel Development)
16	Senior manager	Marketing Division (Sales)
17	Beijing branch manager	Operations Division
18	Manager	Operations Division

Appendix D

D1. Excerpt of Interview Topic Guides

General questions for the interviewee:
Please tell us about your background (education, work experience, number of years at Damai, etc.).
What is the role of your department?
What is your role in the department and organization?
How is your role/department role related to other departments?

General questions regarding the DP firm in its environment:
How does the ticketing industry operate?
Who are the key external stakeholders with whom you or your department interact?
What are some key challenges of operating in this industry?
Who are your competitors, and what is your market position compared to theirs?

General questions regarding DP development:
How has the organization evolved since its inception? What are some key milestones?
What are the key competitive advantages of the organization? Can you provide some examples?
What are the core capabilities of the organization? Can you provide some examples?

General questions regarding the role of IT on the DP:
What is IT's role in the organization?
What are some of the key information systems used?
How do the systems connect you to external stakeholders (customers, agents, and suppliers)?
How do you manage those systems?
What are some challenges faced in managing those systems, and how do you overcome them?

Appendix E

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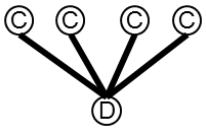
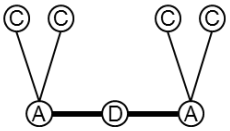
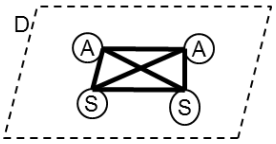
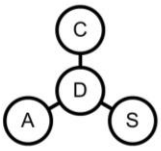
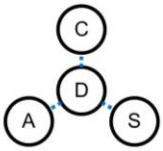
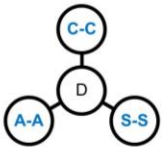
Appendix F

Table F1: Illustration of the Data Analysis: Boundaries as the Categories of Analysis

	Customers	Agents	Suppliers
External actors and ticket-selling scenarios	 Tickets are sold directly to customers through Damai's B2C website.	 Tickets are sold to agents or indirectly to customers through Damai's distribution system.	 Tickets are sold directly from suppliers to distribution agents through Damai's B2B platform.
ICT applications	Damai.cn (B2C portal)	*Youpiaotong* (Distribution system)	Mai+ (B2B platform)
Boundary of efficiency	Damai streamlined the ticket purchasing process (e.g., online channel, ticket delivery).	Damai standardized the interface to connect to agents and enabled flexible deployment to agents' sites for agents' ease of adaptation.	Damai mediated the agent sourcing process of suppliers (through Mai+) and ensured that the platform was widely accessible for customer convenience.
Boundary of competence	Damai transformed the pool of customers into resources (e.g., transactional records, collective purchase power) and offered value-added services to customers.	Damai exchanged and synergized complementary resources of both parties to optimize the impacts of the relationships.	Damai transformed the pool of suppliers into resources (e.g., past transactional records) and built reciprocal relationships by offering value-added services for supplier continuity.
Boundary of power	Damai revolutionized conventional ticketing practices and reversed the role of customers as "passive buyers" (e.g., self-selection of seat, voting for a desired concert).	Damai introduced transparency in the system and allowed access to the same resources (e.g., tickets, commission) for equality between agents and Damai.	Damai reversed the ticketing agent sourcing process and enabled suppliers to select agents independently (leveraging the recommendation system) for supplier autonomy.
Boundary of identity	Damai expanded its services and increased the interaction frequency with and among customers (e.g., online shopping, interest groups) for customer attachment.	Damai provided services beyond ticket distribution and maintained the health of the agents' ecosystem for agents' identification with Damai.	Damai provided services beyond platform provision and equipped suppliers with resources that they would need in their own arena (e.g., real-time monitoring at venues, analysis reports).

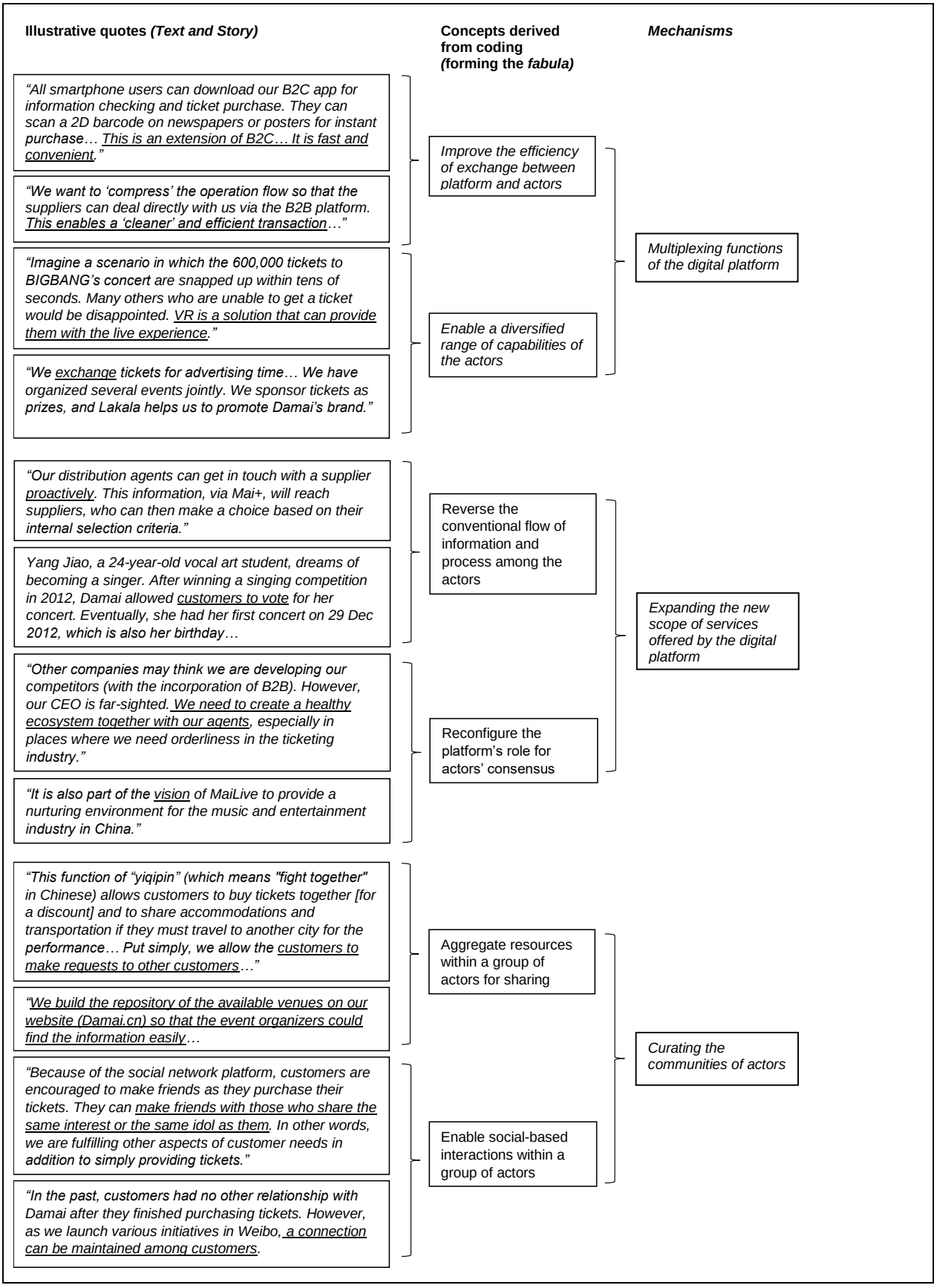
Appendix G

Exhibit G-1. Reconstructed Analysis Framework

Types of Network	Interconnected	Dyadic	Intraconnected
Boundaries in different networks	Boundaries between actors 	Boundaries between Damai and actors 	Boundaries among actors 
Boundary of efficiency			
Boundary of competence			
Boundary of power			
Boundary of identity			

Legend:
D - Damai; C – Customer; A - Agent; S – Supplier

Appendix H


Illustrative quotes (Text and Story)
Concepts derived from coding (forming the fabula)
Mechanisms
"All smartphone users can download our B2C app for information checking and ticket purchase. They can scan a 2D barcode on newspapers or posters for instant purchase… This is an extension of B2C… It is fast and convenient."
"We want to 'compress' the operation flow so that the suppliers can deal directly with us via the B2B platform. This enables a 'cleaner' and efficient transaction…"
Improve the efficiency of exchange between platform and actors
"Imagine a scenario in which the 600,000 tickets to BIGBANG's concert are snapped up within tens of seconds. Many others who are unable to get a ticket would be disappointed. VR is a solution that can provide them with the live experience."
"We exchange tickets for advertising time… We have organized several events jointly. We sponsor tickets as prizes, and Lakala helps us to promote Damai's brand."
Enable a diversified range of capabilities of the actors
Multiplexing functions of the digital platform
"Our distribution agents can get in touch with a supplier proactively. This information, via Mai+, will reach suppliers, who can then make a choice based on their internal selection criteria."
Yang Jiao, a 24-year-old vocal art student, dreams of becoming a singer. After winning a singing competition in 2012, Damai allowed customers to vote for her concert. Eventually, she had her first concert on 29 Dec 2012, which is also her birthday…
Reverse the conventional flow of information and process among the actors
"Other companies may think we are developing our competitors (with the incorporation of B2B). However, our CEO is far-sighted. We need to create a healthy ecosystem together with our agents, especially in places where we need orderliness in the ticketing industry."
"It is also part of the vision of MaiLive to provide a nurturing environment for the music and entertainment industry in China."
Reconfigure the platform's role for actors' consensus
Expanding the new scope of services offered by the digital platform
"This function of "yiqipin" (which means "fight together" in Chinese) allows customers to buy tickets together [for a discount] and to share accommodations and transportation if they must travel to another city for the performance… Put simply, we allow the customers to make requests to other customers…"
"We build the repository of the available venues on our website (Damai.cn) so that the event organizers could find the information easily…
Aggregate resources within a group of actors for sharing
"Because of the social network platform, customers are encouraged to make friends as they purchase their tickets. They can make friends with those who share the same interest or the same idol as them. In other words, we are fulfilling other aspects of customer needs in addition to simply providing tickets."
"In the past, customers had no other relationship with Damai after they finished purchasing tickets. However, as we launch various initiatives in Weibo, a connection can be maintained among customers.
Enable social-based interactions within a group of actors
Curating the communities of actors

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