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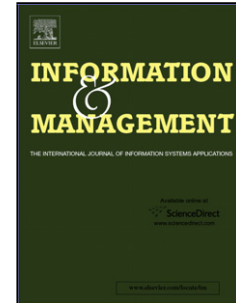
Effective Organizational Improvisation in Information Systems Development: Insights from the Tencent Messaging System Development

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Abstract

Organizational improvisation has been increasingly observed in information systems development (ISD), which leads to both positive and negative results. Extant studies have

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examined how to conduct effective improvisation, but findings are mainly based on variance-based models; a process model is missing. Our study fills this gap by conducting an in-depth case study of the Tencent messaging system development. Our study identifies a four-phase process model featuring a continuous iteration between improvisational search and build. Our findings make important contributions to organizational improvisation literature in ISD and general management and provide a step-by-step guide for ISD managers to conduct effective improvisation.

Motivation

Information systems development (ISD) has been an important research topic in the information systems (IS) literature (Akmanligil and Palvia 2004; Cram et al. 2016; Zeng et al. 2015). Although convention suggests that effective ISD should follow planned actions, one stream of ISD studies posits that ISD requires organizational improvisation, which refers to organizations' spontaneous and novel reactions to unexpected changes (Moorman and Miner 1998b; Weick 1998). Improvisation complements traditional planned actions and helps organizations respond to emergent opportunities and threats. As such, improvisation has been observed across various contexts, which range from small applications to large system infrastructures (Bansler and Havn 2004; Orlikowski 1996; Zheng et al. 2011), and from regular operation systems to special systems for security and crisis response (Njenga and Brown 2012; Pan et al. 2012).

Prior studies have also shown that organizational improvisation, if inappropriately managed, can lead to negative results, such as uncoordinated activities, drained resources, and distress (Brown and Eisenhardt 1998; Levallet and Chan 2013; Tjørnehøj and Mathiassen 2010). To avoid negative results and to conduct effective organizational improvisation, complementary activities and resources are needed. Extant studies have uncovered factors underlying effective organizational improvisation, such as cross-team collaboration, cooperative culture, organizational memory, and bricolage (Orlikowski and Hofman 1997; Pan et al. 2012; Teoh et al. 2012; Zheng et al. 2011). However, a process view of conducting effective organizational improvisation remains unknown.

A process theory is also less common in the organizational improvisation literature in general management, where extant studies on effective organizational improvisation have been

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dominated by variance-based models (e.g., Moorman and Miner 1998a; Moorman and Miner 1998b; Vera and Crossan 2005; Vera et al. 2016). Our study intends to fill this gap by constructing a process model. From there, we derive our research question: *"How do organizations conduct effective organizational improvisation step by step in ISD?"*

A process model is valuable because it can connect activities that explain how effective improvisation manifests and produces positive results for organizations. According to Vera and Crossman (2004), organizations that improvise effectively are similar to skillful improvisers, who focus more on the process than on the output. Given the exploratory nature of this study, we use a case study methodology. We chose the Tencent messaging system (TMS) development as the research setting. Tencent is one of the world's largest internet companies, and the messaging system is its flagship product. Our data have shown that many functions of TMS were developed on the basis of improvisational actions, rather than planned actions, and these improvisational actions met the criteria for both product and process effectiveness (Moorman and Miner 1998b).

Our data analysis uncovered a four-phase process model that portrays a continuous iteration between improvisational search and build. The process model makes important theoretical contributions to the organizational improvisation literature in regard to both ISD and general management. The model also has important practical implications. For example, ISD managers can use our model as a step-by-step guide to conduct improvisation, which is increasingly important in light of the fast-moving, unpredictable ISD context (Pan et al. 2012; Zheng et al. 2011).

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Literature Review

This literature review comprises three parts. First, we define organizational improvisation and compare it with related ISD constructs that can be confused with it. This section delineates the boundaries of this study. Second, we review the existing literature on organizational improvisation in ISD. This section maps out the findings of the extant literature and identifies a theoretical gap in the literature, which is the lack of a process model on effective organizational improvisation. Third, we review the literature on effective organizational improvisation, in particular, its criteria and underlying factors. This section provides us criteria to identify effective organizational improvisation and building blocks to construct the process model.

Organizational Improvisation and Related ISD Constructs

The concept of improvisation is adopted from jazz, which is renowned for its creative and spontaneous production and has been used as a metaphor for organizing (Barrett 1998; Hatch 1997; Lewin 1998). Researchers have described improvisation in regard to both individual actors, such as a firefighter (Weick 1993) and a musician (Hatch 1997; Peplowski 1998), and organizations, such as a jazz band (Hatch 1999; Meyer et al. 1998), a product development team (Brown and Eisenhardt 1997; Moorman and Miner 1998a), and an organization as a whole (Orlikowski 1996; Pavlou and El Sawy 2010). Our study examines improvisation at the organizational level and, in this manuscript, if not specifically stated, improvisation refers to organizational improvisation.

Moorman and Miner (1998b) define organizational improvisation as the temporal convergence between planning and execution. This definition helps researchers to identify and measure organizational improvisation. First, organizational improvisation is identified when

planning and execution converge in time. Second, the narrower the temporal gap between planning and execution, the more improvisational is the activity. Although the terms *"planning"* and *"design"* are often used interchangeably in improvisation research, *"design"* is preferred in the context of developing an artifact (Crossan et al. 2005). Hence, in this study, we use *"design"* instead of *"planning."*

In this study, we posit that organizational improvisation does not describe an entirely new phenomenon that has been overlooked by the prior ISD literature. Instead, improvisation has been observed in the discussion of innovation, experimentation, and agile development. Although related, improvisation is different from these constructs (see Table 1).

Table 1: Organizational Improvisation and Related Constructs in ISD			
Related Constructs in ISD	**Organizational Improvisation**		
	Similarity	Difference	Conclusion
Innovation	Organizational improvisation leads to unplanned innovation.	Innovation can also be created by planned actions.	Organizational improvisation is a subset of innovation.
Experimentation	Organizational improvisation can be seen as unplanned experimentation.	Experimentation can also be created by planned actions.	Organizational improvisation is a subset of experimentation.
Agile Development	Both organizational improvisation and agile development advocate spontaneous reactions to changes.	Both have unique features that are not shared by the other (e.g., leanness for agile development and creativity for organizational improvisation).	Organizational improvisation and agile development have both overlaps and unique features.

First, organizational improvisation is a subset of innovation. Because of the temporal convergence of design and execution, innovation occurs during organizational improvisation (Moorman and Miner 1998b). A well-known example of this is Post-it Notes of 3M, one of the most successful innovations of 3M. The product was a result of improvisation based on a failed

experiment, which was intended to create a super-tack adhesive, but accidentally created a low-tack adhesive. However, innovations can also be created by planned actions. For example, in waterfall software development, innovation results from a comprehensive design, followed by meticulous execution (MacCormack et al. 2001).

Second, organizational improvisation is also a subset of experimentation. The temporal convergence between design and execution can be seen as a quick, unplanned experimentation (Moorman and Miner 1998a). For example, some successful software companies use improvisation to launch prototypes to test market needs and shape future behavior (Brown and Eisenhardt 1997). However, similar to innovation, experimentation can also be created by planned actions, such as the experimentation that takes place during a missile launch or nuclear reactor testing.

Third, agile development is another concept that can be easily confused with organizational improvisation. Both agile development and improvisation advocate spontaneous reactions to changes. Existing agile development studies have also adopted improvisation as a lens to examine how to conduct agile development (Bansler and Havn 2004; Zheng et al. 2011). However, the two constructs have different features. On the one hand, flexibility and leanness are the two pillars of agile development (Conboy 2009). While flexibility is shared by organizational improvisation, leanness is not. In fact, leanness can be detrimental to organizational improvisation, because organizations often require slack resources to launch spontaneous reactions (MacCormack et al. 2001; Miner et al. 2001).

On the other hand, spontaneity and creativity are the two pillars of improvisation (Crossan et al. 2005). While spontaneity is shared by agile development, creativity is not. For example, the generation of novel ideas (Miner et al. 2001) and the making do with existing

resources at hands (Bansler and Havn 2004) are often required in improvisation but are not necessary for agile development. These differences between the two constructs can be attributed to their different origins. While improvisation originates from the literature on art and stresses creativity (Barrett 1998; Sawyer 2000), agile development originates from the manufacturing literature and stresses efficiency (Conboy 2009; Lowry and Wilson 2016; Maruping et al. 2009).

Organizational Improvisation in ISD

Organizational improvisation is a popular perspective by which ISD can be examined (see Table 2). Extant studies can be categorized into two streams. The first stream examines how to develop IT systems to support organizational improvisation. For example, Mendonca (2007) uncovers the principles for developing decision support systems to enable improvisation in regard to crisis response. This stream of research has shown that IT systems can play an important role in enabling organizational improvisation, which is a desirable ability for modern organizations; IT systems enable improvisation through facilitating resource management, cross-team collaboration, organizational learning, and dynamic capabilities (Levallet and Chan 2013; Pavlou and El Sawy 2010).

Table 2: Selected Studies on Organizational Improvisation in ISD			
References	**Types [1]**	**Contexts**	**Key findings**
(Mendonca 2007)	ISD for organizational improvisation	ISD for improvisation in crisis response	This study examines how organizations design computer-based systems to support improvisation in regard to crisis response and uncovers five design principles, such as categorization, search assembly, and constraint satisfaction.
(Pavlou and El Sawy 2010)		ISD for improvisation in new product development	This study examines whether and how IT systems help in the development of improvisational capability and reveals that IT-enabled resource management and collaboration are important mechanisms.
(Levallet and		ISD for	This research-in-progress posits that IT

Chan 2013)		improvisation in innovation	systems facilitate improvisation through enabling organizational learning and dynamic capabilities.
(Orlikowski 1996)		Improvisation for IT-enabled organizational change	This study reveals that improvisation exists in IT-enabled organizational change, wherein organizational actors improvise, innovate, and adjust their work routines over time.
(Orlikowski and Hofman 1997)		Improvisation for IT-enabled organizational change	This study unveils an improvisational change model for IT-enabled organizational change and two enabling conditions for effective improvisation: (a) adaptive technology and cooperative organizational culture and (b) dedicating resources to ongoing support.
(Macredie and Sandom 1999)		Improvisation for IT-enabled organizational change	This study extends Orlikowski and Hofman's (1997) improvisational change model by confirming that the model applies to hierarchical organizations as well, and improvisation is often caused by customer dissatisfaction.
(Bansler and Havn 2004)	Organizational improvisation for ISD	Improvisation for technology adoption	This study shows that improvisation, bricolage, and emergent actions can play vital roles in ISD, which depends on serendipity to a much higher degree than people admit.
(Tjørnehøj and Mathiassen 2010)		Improvisation for technology adoption	This study shows that improvisation facilitates technology adoption by enhancing employee creativity, motivation, and empowerment, but some improvisation activities can be uncoordinated with the organization's goals.
(Zheng et al. 2011)		Improvisation for developing infrastructure systems	The study, through the development of a particle physics grid, reveals that agility in ISD can be seen as a process supported by six improvisational paradoxes, such as learned improvisation, planned agility, and structured chaos.
(Teoh et al. 2012)		Improvisation for designing healthcare information systems (HISs)	This study examines how improvisation leads to the creative design of an HIS and unveils the evolution of bricolage across three stages of improvisation.
(Njenga and Brown 2012)		Improvisation for IS security	This study, using a hermeneutical research methodology, finds that improvisation is

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			commonly found in IS security; it manifests in 25 concepts and can be conceptualized by rational-adaptive expression.
(Pan et al. 2012)		Improvisation for developing crisis response systems	This study shows that improvisation plays an important role in the development of a crisis response system; prior knowledge, real-time information, and cross-team collaboration contribute to effective improvisation.
[1] We did not categorize studies on the basis of their approaches, because most studies are based on the case study methodology (except Levallet and Chan (2013) and Pavlou and El Sawy (2010)).			

The second stream of research examines how to conduct organizational improvisation in ISD. Our study intends to contribute to this stream. Studies in this stream range from productivity systems (Bansler and Havn 2004; Teoh et al. 2012; Tjørnehøj and Mathiassen 2010), to transformation systems (Macredie and Sandom 1999; Orlikowski 1996; Orlikowski and Hofman 1997), to infrastructure systems (Zheng et al. 2011), and cover both regular operation systems and special systems, such as crisis response systems (Pan et al. 2012) and security systems (Njenga and Brown 2012). Although these studies are based on different contexts, their findings converge in three key aspects.

First, in contrast to the conventional notion that ISD should follow proper planning, improvisation is commonly observed in ISD, in both organic organizations and hierarchical organizations (Macredie and Sandom 1999). Second, improvisation complements planned actions, which do not respond well to unexpected changes and emergent user dissatisfaction in ISD (Orlikowski 1996). Therefore, improvisation can produce positive results, such as innovation (Njenga and Brown 2012; Teoh et al. 2012), agility (Pan et al. 2012; Zheng et al. 2011), and local adaptation (Macredie and Sandom 1999; Orlikowski and Hofman 1997). Third, improvisation, when it is inappropriately managed, can also produce negative results, such as

uncoordinated actions (Tjørnehøj and Mathiassen 2010), draining of resources (Levallet and Chan 2013), and distress (Brown and Eisenhardt 1998).

To conduct effective organizational improvisation, complementary activities and resources are needed. For example, effective improvisation requires organizations to dedicate resources to situated changes (Orlikowski and Hofman 1997), promote cross-team collaboration (Zheng et al. 2011), encourage bricolage (Teoh et al. 2012), and link spontaneous actions with organizational knowledge (Pan et al. 2012). Despite the rich insights, these findings have mainly focused on factors that lead to effective organizational improvisation. How to conduct effective organizational improvisation in ISD step by step remains unknown. Our study intends to fill this gap by constructing a process model.

Effective Organizational Improvisation

Organizational improvisation has been an important field of literature in general management. The literature has shifted from examining the manifestations and implications of organizational improvisation to examining how to conduct effective organizational improvisation, given the increasing recognition that improvisation can produce both positive and negative results. Moorman and Miner (1998a) have provided two criteria for effective organizational improvisation: (1) product effectiveness concerns the product's performance in the market and (2) process effectiveness concerns internal efficiency, coordination, and effective learning during the improvisation process.

Currently, a large number of studies are viewing organizational improvisation as a business process rather than an *ad hoc* course of action, because many organizations have routinized the processes for stimulating and implementing improvisation, and some have developed improvisation as an organizational capability (Pavlou and El Sawy 2010; Teoh et al.

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2012; Vera and Crossan 2005). Organizational improvisation needs to satisfy both criteria to be considered effective. For example, improvisation that creates popular products in the market but incurs high costs and disrupts learning is not considered effective (Miner et al. 2001).

Existing research on effective organizational improvisation has generated rich findings. However, similar to improvisation studies in regard to ISD, the majority of the findings are based on variance-based models; a process model is missing. Some underlying factors of effective improvisation are consistent with those in ISD, such as cross-team collaboration and bricolage. Although some studies have claimed to study the process of improvisation, they have mainly discussed the activities and lessons in the process and have not abstracted a process model that connects these activities and lessons (e.g., Barrett and Peplowski 1998; Peplowski 1998).

Factors underlying effective organizational improvisation can serve as building blocks in constructing the process model; they can be divided into two categories. The first category consists of factors that support effective search activities, which unveil emerging opportunities and threats. Examples include real-time information (Vera and Crossan 2005), extensive communication with external stakeholders (Brown and Eisenhardt 1997), clear responsibility with autonomy (Brown and Eisenhardt 1997; Vera and Crossan 2005), and organizational memory (Miner et al. 2001). The second category consists of factors that support effective build activities, which respond to emerging opportunities and threats. Examples include bricolage (Baker et al. 2003; Hatch 1997), cross-team cooperation (Crossan et al. 2005), conducive environment for experimentation (Crossan et al. 2005; Vera and Crossan 2005), and organizational memory (Moorman and Miner 1998b).

Methodology

We chose a case study as our research methodology for two reasons. First, because the research question is a *"how"* question, an inductive method is suitable (Pan and Tan 2011; Walsham 2006). Second, effective organizational improvisation is a process that occurs in a complex organizational context that consists of both market conditions and internal operations, and it is more suitable to study it using qualitative rather than quantitative data (Klein and Myers 1999). Third, a case study is suitable for building a process model because it provides a complete story and rich narratives, which allow researchers to conceptually distinguish between different phases (Langley 1999). Case studies have been commonly used to build process models (e.g., Huang et al. 2017; Montealegre 2002), and we follow these studies as examples in this research.

Case Setting

Tencent was founded in 1998 by five graduate students from a local university in Shenzhen. The company started with developing an online messaging system[1]. In the 1990s, TMS was merely one of many messaging systems in the market. However, the company differentiated its product from competitors by constantly adapting the system to the local market and launching functions targeted at Chinese users. For example, the company added an auto-lock function after learning that most Chinese internet users in the 1990s logged into the messaging system using public computers at internet cafés. Many of these functions did not come from planned actions but were the results of serendipitous discoveries and spontaneous responses to emerging opportunities and user demands. By 2008, TMS had become the most popular online messaging system in China and had a 400-million user base across individual and corporate users.

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[1] Tencent has two major messaging systems, namely QQ and WeChat. QQ is the company's first product and WeChat is a more recent product created for the mobile platforms. Our study focuses on the former, and in the study, TMS refers to the QQ messaging system.

TMS then expanded from a messaging system to an integrated communication system. Our study covers four modules of the system (namely, messaging, blogs, video conferencing, and emails). We interviewed teams that developed these modules. According to Brown and Eisenhardt (1997), a multiple team setting is more effective than a single team setting in investigating organizational improvisation, because effective improvisation often relies on cross-team collaboration.

We chose TMS development as our research setting because improvisation was both prominent and effective in its development. First, the product was known for its rapid adjustment to changes in user requests, technologies, and competitor movements. Analysts also stated that TMS development often deviated from plans to respond to emerging calls, and suggested that this spontaneous production was an important success factor (Lan 2011; Lin and Zhang 2009). Our interviews and observations also confirmed it. We asked the informants to list functions they were working on and assess whether these functions were developed by planned actions or emergent actions. We also monitored discussions in online forums to identify new functions and assess their development processes. As Table 3 shows, nearly a third of the functions that we identified in three sample modules were developed on the basis of emergent actions.

Table 3: Planned and Emergent Functions in Three Sample Modules				
Modules	**Type of Functions**	**Number of Functions**		
		2011	**2012**	**2014**
Messaging	Planned	7*	8	7
	Emergent	4	5	3
Blog	Planned	7	6	4
	Emergent	4	4	3
Video Conferencing	Planned	10	6	7
	Emergent	7	5	4
* These numbers were based only on our interviews and observations. The actual numbers of functions launched by these teams were larger.				

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Second, improvisation activities were also effective in TMS development. They met the criteria of both product and process effectiveness (Moorman and Miner 1998a). First, the majority of the emergent functions were well received by users, and most of the emergent functions still remained popular in the system. From this, we deemed that product effectiveness was achieved. Second, the process of improvisation was efficient and coordinated, and learning during the process was effective. From this, we deemed that process effectiveness was achieved. Our case description will show more evidence regarding process effectiveness.

Data and Analysis

We collected data from October 2011 to June 2015. Data came from both primary and secondary sources. Secondary data comprised internal and external archives. Internal archives included email correspondence, business cases, and annual reports. External archives included books, news articles and analyst reports. Because Tencent is a high-profile company, the external archives were rich. Secondary data served two purposes. First, they provided the background information for our case analysis. Second, they supplemented the interview data in regard to building the process model. In total, we collected 44 articles: 15 were from internal sources and 32 were from external sources (for a summary of the data, please refer to Appendix 1).

We interviewed 23 informants from Tencent in total. Some informants attended more than one session. Most interviews were conducted onsite, but some were conducted over the telephone. An onsite interview session lasted from 45 minutes to 1 hour, and a telephone interview lasted from 15 to 30 minutes. We selected informants across multiple levels: senior management (five participants), middle management (nine participants), and junior staff (nine participants); this gave us a balanced view of what occurred in regard to improvisation in ISD (Klein and Myers 1999; Pan and Tan 2011). Interviews were conducted in Chinese. The research

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team took extensive field notes at each interview session to ensure the completeness of the transcripts. Transcripts relevant to our research question were later translated into English by one of the authors, who is a native Chinese speaker and fluent in English. Our interview questions focused on the process and implications of the improvisation. For sample interview questions, please see Appendix 2. We also interviewed seven users to understand their experience with TMS and how they interacted with the development teams.

We used open, axial, and selective coding to analyze the data (Corbin and Strauss 1990). The objective of open coding is to identify broad concepts in the data without any preconceptions. The research team met regularly to review emerging concepts and to ensure the consistency of coding. For example, when we asked the development teams how they captured emerging opportunities for functions that were not planned, we derived concepts such as *"making no assumptions about market situation," "self-organizing teams,"* and *"real-time information."* These concepts were later grouped into a major theme of *"grounded observation,"* which is the first phase of the improvisation process. This grouping process, which aims to form themes among concepts derived during open coding, is known as axial coding.

During open and axial coding, we also began selective coding, which aims to identify the core theoretical patterns of the paper. We did so by constantly comparing data, emergent themes, and the prior literature and revealed a four-phase process model featuring an iteration of improvisational search and build. We used the process model as the core theoretical pattern of the paper and organized our findings around it (see Figure 1).

Figure 1: Data Analysis Approach
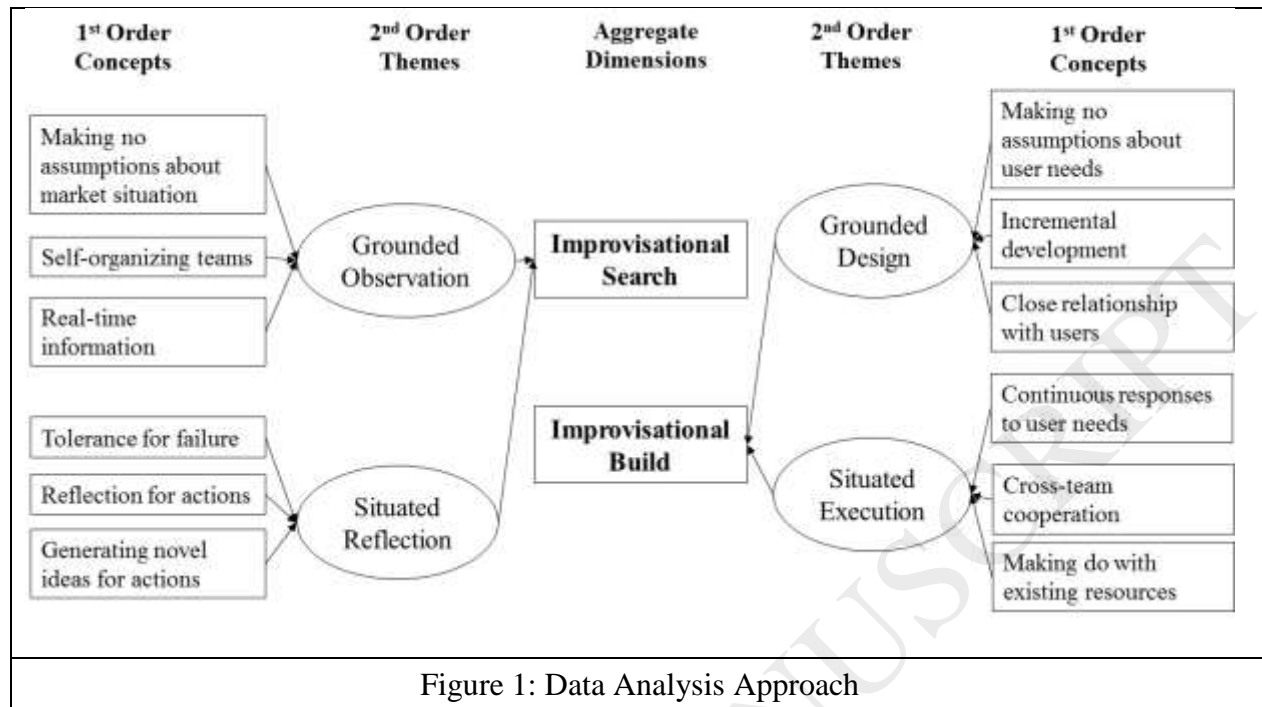
As we built the process model, some new themes emerged, but data relevant to them were insufficient. We thus conducted follow-up interviews. Some follow-up interviews were conducted over the telephone and some were conducted onsite. This iteration between data collection and follow-up interviews continued until the findings reached theoretical saturation, where the newly collected data failed to reveal new or contradictory themes (Eisenhardt 1989).

Case Description

We observed four phases of organizational improvisation in TMS development. In the following section, we describe each phase in detail (for sample data, see Table 4).

Table 4: Phases, Elements, and Sample Data		
Phases	**Elements**	**Sample Data**
	Making no assumptions about market situation	*"The market has taught us to be very sensitive to changes. Because technologies and competitors change every day and often in unexpected manners, **we must be open to all changes and make no assumptions.**"* – Director A, messaging module.

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Observation Phase	Self-organizing teams	*"The development teams **take ownership of the product directions and make their own decisions**. In some international players, to get a new function approved, their (development teams) need to report to the headquarters and the headquarters do not understand the Chinese market."* – Product manager A, messaging module.
	Real-time information	*"**We expect everyone to be a keen market observer.** We encourage people to share (their observations on) the latest technology trends and competitor movements...I am a user of several competitor products."* – Lead engineer B, blog module.
Design Phase	Making no assumptions about user needs	*"**We do not guess what users want.** Gone are the days when you can lock your staff in a basement, sign a non-disclosure agreement (with them), and develop something that astonishes the world."* – Director D, video conferencing module.
	Incremental development	*"**We break a function (development process) into several pieces and regularly update it to collect user feedback.** You don't want to invest a lot (of resources) and then realize you are heading in the wrong direction."* – Product manager B, messaging module.
	Close relationship with users	*"The highly acclaimed email product used to be very cumbersome and difficult to use. We had to re-engineer it. We studied users' habits and needs and asked what functions they needed the most. **During the process, we developed the "10/100/1000" method… This method requires hard work, but it is effective."*** – Adopted from CEO's letter to business partners (Ma 2012).
Execution Phase	Continuous responses to user needs	*"**We frequently adjust our development schedule** because, if users do not see their feedback (suggestions) incorporated, they stop participating. That's what happened with many international brands. They paid little attention to local users' requests."* – Director B, messaging module.
	Cross-team cooperation	*"We have been educated to work with a mentality of change. At times, **we may put down the task at hand and join an ad hoc team to help in an urgent task."*** – Engineer C, video conferencing module.
	Making do with existing resources	*"A couple of us (who worked together before) have formed an online group. For example, **if I need a script and I feel someone may have already developed it, I will ask** (in the group). Sometimes, I get surprisingly good answers and this is especially helpful when you are under a tight deadline."* – Lead engineer C, video conferencing module.

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	Tolerance for failure	*"**We encourage our employees to take risks and try out new ideas**. Failures are acceptable and are sometimes expected. For example, (for the mobile messaging system) we had three teams working on it and finally we picked the WeChat team."* – Director A, messaging module.
Reflection Phase	Reflection for actions	*"We do not reflect for the sake of doing so. We do not have the time for that. **A reflection should consider the present situation and aim to produce something that can turn into actions**."* – Product manager C, blog module.
	Generating novel ideas for actions	*"Employees who have been working with each other in the same team tend to think alike. We intentionally **add new members to increase the diversity and they [new employees] bring in new knowledge**."* – A human resource (HR) manager.

Observation Phase: Capturing Emergent Market Opportunities and Threats

Organizational improvisation in TMS development began with observation, rather than planning. *"The market is too volatile, and anything beyond six months is hard to predict. Thus, we closely monitor what is going on in the market"* said the Tencent president at an internet conference (adopted from Lan's (2011) book "Tencent under X-Ray" (p. 97)). The development teams paid close attention to changes in the market and made no assumptions about the market situation. Market situations were often unexpected, and overlooking one opportunity or threat could be detrimental. Opportunities and threats came not only from users but also from technical advancements. According to a Harvard Business Review article, many local internet companies such as Tencent outperformed their western counterparts, because contrary to popular perceptions, they often incorporated the latest technologies faster than western counterparts (Bhattacharya and Michael 2008).

To support the close observation of the market, the development teams were given a great deal of autonomy and were not interfered with by the top management. The top management managed the individual teams by dictating general policies, such as the mobile internet policy.

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Enacted in 2012, the mobile internet policy dictated that new systems and functions must be friendly to mobile platforms. Other than following the general policies, the development teams remained independent. The top management also encouraged the development teams to make their own decisions, because they were close to the market. Instead of acting like administrators, the top management positioned themselves as orchestrators who mobilized resources to support the development teams.

Capturing emerging opportunities and threats required timely information. To this end, development teams encouraged all employees to be market observers and share their latest observations with one other. *"You can hear discussions about the market, the competitors, and the new technologies at any corner [of the company]; new product ideas usually come from these discussions"* said an HR manager. Our observations also confirmed this. For example, new technological trends and competitor movements were common topics during lunch breaks.

Design Phase: Capturing Emergent User Needs

The observation phase is followed by the design phase. Instead of designing the system in-house, Tencent leveraged the wisdom of its users and involved users at the early stages of the design. Engineers refrained from speculating about what users wanted. As we repeatedly heard during the interviews, *"guessing what users want from an engineering perspective is a recipe for failure."* Instead of launching major releases, the development team launched incremental releases to collect real-time feedback and adjusted the design depending on the feedback. For many new functions, a simple prototype was first developed for pioneer users to try out. The prototype was gradually upgraded into a full-fledged function if user feedback continued to be positive. Otherwise, the function would be cancelled before more resources were committed to it.

Sometimes, a new function could change direction. For example, in the early days, some users requested a video conferencing function, but after adding the function to the system, the users complained about the increased download time due to a large installation package. The development team then realized that a bigger issue was in fact the bandwidth constraint faced by Chinese households and companies at that time. After realizing this, the development team removed auxiliary functions and reduced the installation package to 1 Megabyte (MB) in size, a change that brought TMS many new users. According to an associate product manager of the blog module, *"Many companies engage users in system design but few succeed. An important reason is that they listen to users at the beginning but then move on to the development. Companies need to continuously probe users in order to really understand their needs."*

To gather user feedback, the top management enacted a 10/100/1000 policy for product managers. The policy dictated that every month, a product manager needs to interview 10 users, follow 100 user blogs, and respond to 1,000 user posts. Some user blogs were hosted on Tencent platforms, while others were hosted on third-party platforms, such as Weibo (the Chinese equivalent of Twitter) and various technology forums. The CEO led this exercise by example. As he commented, *"User experience is the biggest thing, bigger than anything…I spend more than 50% of my time with users, reading what users say about our products"* (a CEO interview adopted from Lin and Zhang's (2009) book "Ma Huateng's Tencent empire" (p. 89)).

Execution: Occurring in Tandem with Design

Execution and design occurred in tandem. As a product manager of the email module explained, *"Design and execution are difficult to separate. It is difficult to develop something without a design, and it is also difficult to design without something concrete for users to feel, touch, and give feedback."* This simultaneous execution allowed the development team to

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quickly respond to user needs and let new user needs emerge. For many users we interviewed, what impressed them was that Tencent managed to incorporate their requests swiftly, while competing products often failed to acknowledge their requests.

However, simultaneous design and execution placed a great deal of pressure on the development team. For example, during the initial launch of emergent functions, change requests from users often exceeded the team's capacity. The development team had to cope with these overwhelming demands effectively, because failing to respond to these requirements in a timely fashion reduced users' intention to participate further. Tencent resorted to *ad hoc* teams, which consisted of members from both the focal teams and temporary recruits from other teams. For example, when launching a new blog function, the blog team could receive help from the messaging team. As a lead engineer of the blog module explained, *"One major success last year was the microblog. It went through 16 rounds of updates in the first two weeks of its launch. For many companies, this rate was impossible. An important reason (we made it) was that we managed to bring in people from other teams."*

Working under tight deadlines also encouraged Tencent employees to seek help. For example, before developing a script, many engineers would ask whether their peers had developed a similar script or knew someone who had developed it. According to the HR manager, in general circumstances, some engineers could not ask for help because of their pride, but under a tight schedule, they cared less about the pride and strived to do with existing resources available to them. Tencent encouraged this exercise and facilitated it by creating a knowledge sharing culture.

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Reflection: Occurring in Tandem with Observation

The simultaneous design and execution continued until a new function reached maturity, when the targeted users were satisfied. There were cases in which new functions were canceled halfway, because these functions were not well received by users. Tencent encouraged development teams to take risks while facing uncertainties. The top management believed that this was an effective way to test an idea and prepare for disruptive innovation from competitors. Sometimes, for one system, there could be multiple teams working on it and, in the end, only the most promising one could be continuously funded. Under these circumstances, reflection focused on learning instead of punishment.

As the CEO reflected on the success of a mobile phone-based messaging software, *"Many people have seen the success of WeChat, but they don't know that in Tencent, there are several teams developing this kind of mobile phone-based messaging system simultaneously. Each team had different design concept and approach. Finally, WeChat stood out. Although the rest failed in the competition, their experiences were valuable"* (Adopted from CEO's letter to business partners (Ma 2012)). Consistent with the CEO's message, reflection upon both successful and failed development projects aimed to generate new ideas that were actionable in the current situation rather than merely summarizing the past. Hence, reflection and observation occurred in tandem.

Reflection situated in the present situation was most effective when it generated novel ideas for actions. Tencent realized that members who had been working together on the same project tended to apply similar ideas, extract similar information from the environment, and view the information from the same light. To overcome this, the company regularly rotated employees and built teams that comprised members from different backgrounds. For example, employees

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working on the email module were rotated to work for the messaging module, and these employees proposed a new function that allowed users to talk to strangers; a similar function had been successfully adopted in the email module.

Sometimes, members from the research centers were also rotated to the development teams. Tencent had two research centers: one for investigating user behaviors and the other for investigating cutting-edge technologies. The company believed that sustainable systems relied on an in-depth understanding of users and access to proprietary cutting-edge technologies. This rotation also prevented organizational improvisation at the individual team level from overlooking long-term trends.

After simultaneous observation and reflection, ideas for new functions could emerge; then, a new round of design and execution would begin. This iteration helped Tencent enhance and expand the system to what it is today. The effectiveness of this development process has also been recognized by industry analysts. For example, as one industry analyst commented, *"Successful internet companies need to take incremental changes, refine products relentlessly, experiment with new ideas fast…In this aspect, Tencent is a role model* (Wu 2017, p.14)." In the next section, we analyze the above four phases considering the organizational improvisation literature and discuss the process model that we derived from the analysis.

Discussion

This study aims to explore how organizations conduct effective improvisation step by step in ISD. By going back and forth between the data and the literature, we derive a four-phase process model (see Figure 2). We first discuss each of the four phases and then discuss how the

four phases form improvisational search and build. Our discussion focuses on how the model is supported by both the empirical data and the corroborating literature.

Figure 2: A Process Model of Effective Organizational Improvisation in ISD
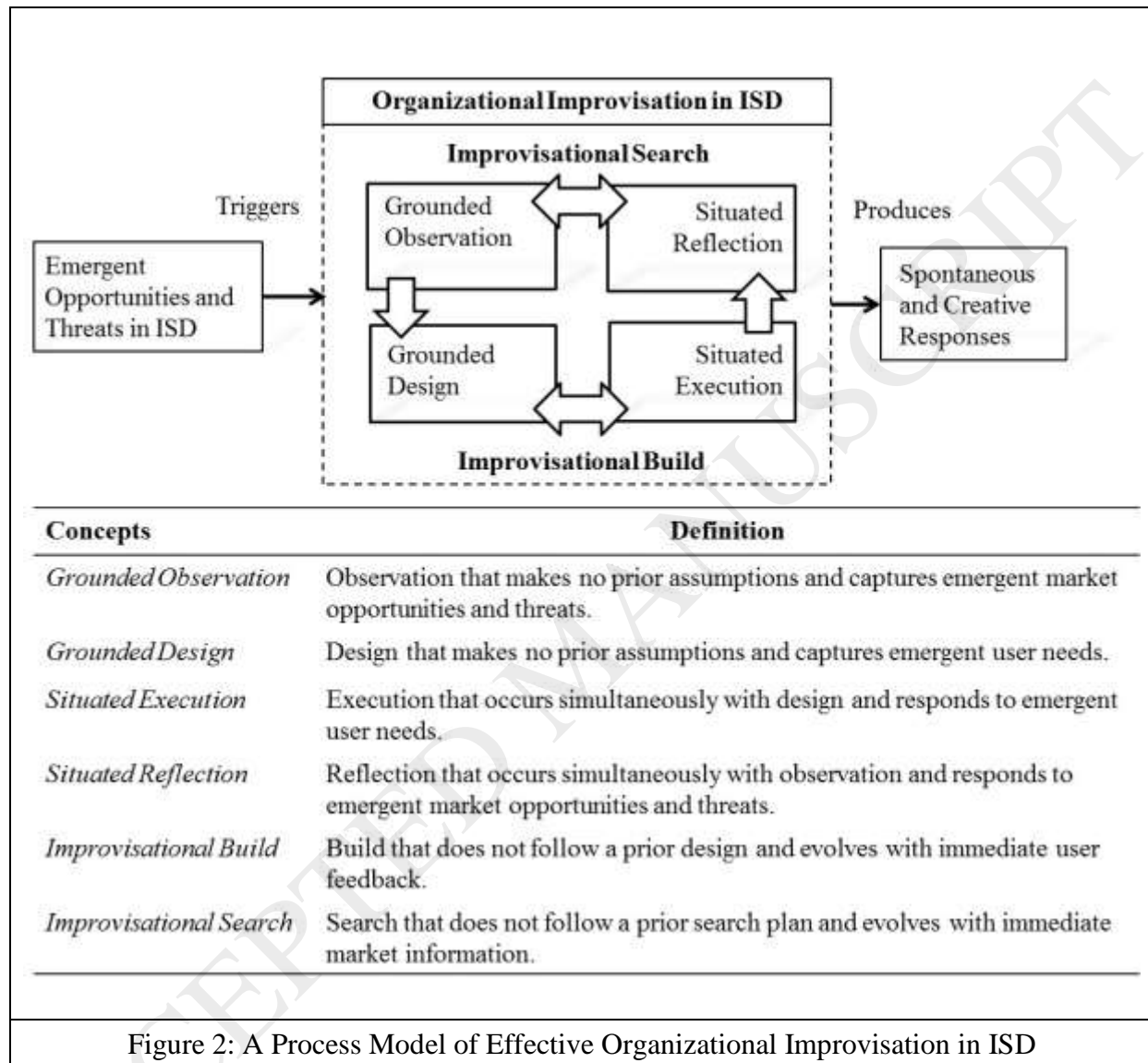
Grounded Observation

Organizational improvisation in TMS starts with closely observing the environment to capture unexpected opportunities and threats, which are triggers for organizational improvisation (Miner et al. 2001). We label this phase as *"grounded observation."* This labeling is inspired by

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the concept of grounded theory, a qualitative research methodology, which argues that findings emerge from the observed reality, rather than prior propositions (Corbin and Strauss 1990). Similarly, grounded observation makes no prior assumptions about what will occur in the market. As the interview and secondary data have shown, observation in Tencent aims to discern what is in the market, rather than to confirm what has been predicted (e.g., Lin and Zhang 2009; Ma 2012). This attitude is consistent with a key principle of improvisation: when the future is difficult to predict, it is important to monitor the environment closely and remain flexible (Miner et al. 2001).

Grounded observation is executed by self-organizing teams. As aforementioned, top management does not interfere with the daily operations of or impose their ideas on the development teams, which have first-hand knowledge of the market (Bansler and Havn 2004). The development teams can, in turn, focus their attention on the market, rather than seeking approval from their managers. Prior studies have found that autonomy, combined with clear responsibility, supports effective improvisation (Peplowski 1998; Vera et al. 2016).

Moreover, grounded observation is supported by real-time information. To this end, the development teams ask every team member to act as a market observer. Similarly, Vera and Crossan (2005) recommend that all participants in organizational improvisation should be attentive to what is occurring around them. Real-time information reduces the risks in spontaneous actions, thereby encouraging improvisation and making improvisation more effective (ibid).

Grounded Design

To pursue new ideas that emerge from the grounded observation, the development teams engage in grounded design, which we define as a design that makes no prior assumptions and

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captures emergent user needs. Grounded design requires development teams to engage users in the early stages of development. This helps the development teams to avoid a common pitfall in ISD: producing advanced functions that users do not need (Chau et al. 2013; Pan et al. 2015). Similarly, MacCormack et al. (2001), through a study of software product development, find that early user engagement is key to effective improvisation.

Grounded design is supported by incremental development. As mentioned above, the development teams break the development tasks into small pieces and gradually upgrade the system to collect immediate feedback and adjust the development in real time. This incremental development allows the development teams to probe users, gradually commit resources, and stay flexible in regard to unexpected needs (Brown and Eisenhardt 1997). It also allows the development teams to discover users' intrinsic and authentic desires by continuously assessing user feedback regarding incremental changes (Bansler and Havn 2004; Macredie and Sandom 1999).

Grounded design requires a close relationship with users. As the interview and secondary data have shown, Tencent enacts the 10/100/1000 rule for product managers (e.g., Lan 2011; Ma 2012). Product managers thus pay close attention to users' welfare and develop a close relationship with users (Chau et al. 2013). This close relationship helps to maintain high-quality user feedback. Prior research has shown that extensive communication with key stakeholders ensures a stable source of information and knowledge, which is an important antecedent to effective improvisation (Brown and Eisenhardt 1997; Vera et al. 2016).

Situated Execution

Because design and execution are conducted in tandem, execution responds to emergent user needs and encourages the emergence of new demands. Because execution occurs in

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situations in which outputs are applied and adjusted depending on real-time feedback, we label this phase as *"situated execution."* Situated execution is similar to a common scenario in jazz improvisation: when new audiences enter or leave the scene, an experienced jazz band will sense the change in the ambience and smoothly adjust the tone to fit the change (Barrett 1998).

Situated execution is performed when the development teams continuously respond to user needs. As an analyst report has shown, the continuous response maintains user enthusiasm throughout the development and secures continuous feedback (Wu 2017). Prior research has also shown that continuous response creates a sense of urgency that forces development teams to think fast (Pan et al. 2012). However, if there are only limited resources to handle urgent demands, urgency translates into distress and disruption (Brown and Eisenhardt 1998).

To overcome resource constraints, Tencent promotes cross-team cooperation by establishing *ad hoc* teams, which collect resources across different development teams and redeploy them to areas that require immediate attention (Miner et al. 2001; Orlikowski and Hofman 1997). Moreover, cross-team cooperation also integrates different types of knowledge possessed by different teams and thus spurs creativity (Njenga and Brown 2012; Pan et al. 2012; Zheng et al. 2011). Spontaneous reaction and creativity are two pillars of effective improvisation (Crossan et al. 2005).

As mentioned in the case description, Tencent has created close social and professional ties among employees through exercising regular cross-team cooperation. According to the literature, these ties increase the likelihood of network bricolage, in which employees make do with resources residing in social relationships (Baker et al. 2003). Bricolage not only helps organizations overcome resource constraints but also helps them produce novel outputs (Crossan et al. 2005; Teoh et al. 2012).

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Situated Reflection

Tencent conducts reflection and observation in tandem; reflection produces insights that help to guide observation and respond to emergent opportunities and threats. As such, reflection occurs in situations in which outputs are applied; we label this phase as *"situated reflection."* Unlike conventional reflection, which focuses on the past and on the creation of knowledge, situated reflection focuses on guiding further actions. Linking organizational memory to the situation at hand enables organizations to seize the emerging opportunities and facilitate effective improvisation (Miner et al. 2001).

In regard to failed projects, as the interview and secondary data have shown, Tencent reflection does not focus on imposing sanctions, but instead focuses on how to learn from failures and inspire new innovations (e.g., Ma 2012; Wu 2017). According to the literature, tolerance for failure promotes an experimental culture and creates a safe environment for experiments; both are critical to effective improvisation (Crossan et al. 2005; Miner et al. 2001; Vera and Crossan 2005).

As the case has shown, situated reflection is effective when it generates novel ideas. This is also consistent with the prior literature (Miner et al. 2001). Novel ideas come from employees with different backgrounds, because employees with similar backgrounds tend to think alike and pay attention to similar pieces of market information (MacCormack et al. 2001). As such, Tencent regularly rotates employees to create teams that consist of employees from different backgrounds. This rotation also facilitates learning and enables the circulation of knowledge; both have been found critical to effective improvisation (Miner et al. 2001).

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Improvisational Search and Build

The four phases constitute two improvisational activities. First, the temporal convergence between grounded observation and situated reflection replaces the need for a prior search plan and turns the search for new functions into a spontaneous activity that evolves with immediate market feedback. We label it as *"improvisational search."* Second, the temporal convergence between grounded design and situated execution replaces the need for a prior design and turns the build of new functions into a spontaneous activity that evolves through immediate user feedback. We label it as "*improvisational build."*

In the prior literature, studies have mainly focused on improvisational build (Miner et al. 2001; Moorman and Miner 1998a; Moorman and Miner 1998b) and have overlooked improvisational search. However, improvisational search has been commonly found in practice, such as the improvised search activities in product innovation (Katila and Chen 2009) and crisis response (Pan et al. 2012). Improvisational search can be seen as real-time interpretation of the environment by an organization. It is similar to a practice described by Miner et al. (2001), *"They [employees] reframed the meaning of the unexpected events in a novel way, and they infused the prior events with new meaning"* (p. 312). Improvisational search can also be conceived as a form of short-term learning (Bansler and Havn 2004) or spontaneous reflection, where real-time experience informs actions at the same time as these actions are being taken (Zheng et al. 2011).

The relationship between improvisational search and build has also been covered in the prior literature. For example, Miner and her colleagues (2001) suggest that the initial moment of improvisation is the interpretation of the environment, and the subsequent moment is the response to environmental changes. While the former constitutes improvisational search, the

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latter is improvisational build. Our model extends this unidirectional relationship by showing that improvisation can be a continuous iteration between improvisational search and build. This iterative process is consistent with Sawyer's (2000) finding in regard to improvisational theaters, whereby actors identify a problem, spend time solving the problem, and, while solving that problem, identify a new problem.

Contributions and Limitations

This study makes important theoretical contributions to the organizational improvisation literature in regard to both ISD and general management. First, organizational improvisation has been found to be effective in various ISD contexts, which range from small applications to large system infrastructures (Bansler and Havn 2004; Orlikowski 1996; Zheng et al. 2011), and from commercial systems to special systems for security and crisis response (Njenga and Brown 2012; Pan et al. 2012). However, improvisation can also lead to negative results if it is not properly managed (Levallet and Chan 2013; Tjørnehøj and Mathiassen 2010; Zheng et al. 2011). Extant studies have uncovered several factors underlying effective improvisation, but how to conduct effective improvisation step by step remains unknown. Our study fills this gap by constructing a four-phase process model based on the case study of TMS development.

Second, the process model also has important contributions to the organizational improvisation literature in general management, which has been dominated by variance-based models (e.g., Moorman and Miner 1998a; Moorman and Miner 1998b; Vera and Crossan 2005; Vera et al. 2016). Our process model integrates disparate findings on effective improvisation factors from previous studies into a process that follows coherent logic around the iteration of improvisational search and build. Moreover, prior studies have focused mainly on organizational

improvisation in build and have overlooked improvisation in search (Moorman and Miner 1998b). Our study shows that improvisational search coexists with build, and the iteration between search and build forms the improvisation process.

This study also has important practical implications. ISD managers who are expected to engage in organizational improvisation can use our model to guide their practice. Our model can help ISD managers conduct effective improvisation and achieve positive results in ISD, such as innovation (Njenga and Brown 2012; Teoh et al. 2012), agility (Pan et al. 2012; Zheng et al. 2011), and productivity improvement (Pan et al. 2015). Moreover, the practical implications can be extended beyond the ISD context. For example, senior managers can follow our model in conducting organizational improvisation step by step and, by doing so, can effectively respond to the changing business environment (Crossan et al. 2005; Crossan and Hurst 2006).

Despite these contributions, the findings must be considered in light of their limitations, which also point to important directions for future research. First, although we have closely analyzed each phase of organizational improvisation in ISD, we have mainly focused on internal stakeholders. External stakeholders, such as third-party technology providers and developers in open-source communities, can also play important roles in ISD improvisation (Akmanligil and Palvia 2004; Xie et al. 2016). For example, as Pan and his colleagues (2012) have found in the development of a crisis response information network, strong collaboration with external technology providers was an important reason why the central response agent was able to conduct effective improvisation. Therefore, a future study that incorporates external stakeholders would be valuable.

Second, as an internet company in a fast-moving, competitive landscape (Chiu et al. 2012), TMS development is an extreme case in terms of uncertainty and time pressure. This

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results in what Crossan et al. (2005) refer to as *"full-scale improvisation"* (p. 133). Although this extreme characteristic makes the theoretical phenomenon salient (Eisenhardt 1989), findings may not be readily applicable to cases of moderate improvisation. Future studies may explore such cases and conduct a comparative study between moderate and full-scale organizational improvisation in regard to ISD.

Appendices

Appendix 1: Informants and Secondary Data

Informants (Number of Informants)	*Secondary Data (Number of Articles)*
Senior Management (5) - Vice president, human resources - Director A, messaging module - Director B, messaging module - Director C, blog module - Director D, video conferencing module **Middle Management (9)** - HR manager - Product managers A and B, messaging module - Product manager C, blog module - Product manager D, video conferencing module - Product manager E, email module - Lead engineer A, messaging module - Lead engineer B, blog module - Lead engineer C, email module **Junior Staff (9)** - Associate product manager A, messaging module - Associate product manager B, blog module - Associate product manager C, video conferencing module - Associate product manager D, email module - Engineers A and B, messaging module - Engineer C, video conferencing module - Engineers D and E, email module **User (7)** - Individual users A, B, C, and D - Corporate users A, B, and C	**Internal Publications (15)**, such as - Ma, H. 2012. "A letter to business partners: seven principles of product development (In Chinese)," Retrieved at 1 August 2017 from http://tech.qq.com/a/20120709/000099.htm. - Ming, W. 2012 "New interpretations of Tencent's agile development" *Tencent's Internal Circular* **Books and News Articles (18)**, such as - Lan, S. 2011. "Tencent under X-Ray (In Chinese)," China Citic Press: Beijing, China. - Lin, J., Zhang, Y. 2009. "Ma Huateng's Tencent empire (In Chinese)," China Citic Press: Beijing, China. - Wu, X. 2017. "The history of Tencent: survivor, challenger and leader," Zhejiang University Press: Hangzhou, China. - Century, A. 2012 "Chinese messaging app gains ground elsewhere" in *New York Times,* Retrieved at 1 August 2017 from http://www.nytimes.com/2012/11/05/technology/chinese-messaging-app-gains-ground-elsewhere.html **Analyst Reports (14)**, such as - Chiu, C., Ip, C., Silverman, A. 2012. "Understanding social media in China," in McKinsey Quarterly: Retrieved at 1 August 2017 from https://www.mckinsey.com/business-functions/marketing-and-sales/our-insights/understanding-social-media-in-china. - Bhattacharya, A. K., and Michael, D. C. 2008 "How local companies keep multinationals at bay" *Harvard Business Review* (86:3)

Appendix 2: Examples of Interview Questions

General Topics
- Could you describe a typical working day at Tencent?
- In your view, what are the success factors of TMS? What are the main challenges in TMS development, and how does Tencent effectively address them?
- What are the functions that you have been working on recently? For the development of these functions, did you figure out the actions as you went along? Did you follow a plan in the development?

Questions about the Improvisation Process in ISD

Observation Phase
- Could you describe the process of introducing a new function that is not planned ahead of time? How do you search for new functions when the TMS is already very mature?
- How do you capture unexpected threats and opportunities? How do you make sure you do not miss emerging threats and opportunities?

Design Phase
- How do you design new functions that meet users' changing demands? How do you incorporate the latest technological advancements? How do you capture unexpected user requirements? How do you probe user needs?
- How do you ensure user engagement and the quality of user input during TMS development?

Execution Phase
- How does your team cope with the sudden increase in workload when launching unplanned functions? Have you been asked to help out with an urgent assignment in another team? Can you describe that experience?
- How important is cross-team collaboration in spontaneously launching a new function? How do you facilitate cross-team knowledge sharing? How does it affect TMS development?

Reflection Phase
- What happens after a new function is canceled? What do you do in the reflection phase of TMS development?
- How do you learn from a successful or failed project? How does that learning affect current operations? How do you make sure the experience of a successful or failed project can be applied to future development?

Questions from User Interviews
- When did you/your company start using TMS? What kept you from switching to other systems?
- Have you participated in the design of TMS? Can you describe that experience?
- You mentioned that TMS rapidly incorporated new functions. Can you give us an example? How did these functions affect your experience with the system?

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