A PROCESS MODEL OF EFFECTIVE IMPROVISATION: LESSONS FROM TENCENT'S PRODUCT DEVELOPMENT

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Abstract

Research on organizational improvisation has gained much momentum in information systems development literature. Although recent studies have started to explore how to conduct improvisation effectively and generated rich findings on the antecedents, the process of effective improvisation remains unknown and the lack of knowledge in this area may account for the difficulties faced by many IS practitioners in engaging in effective improvisation. Based on a case study on Tencent's software product development, we derive a four-phase process model of effective improvisation, which is a continuous iteration between improvisational search and build. The former consists of simultaneous grounded observation and situated reflection. The latter consists of simultaneous grounded design and situated execution. The findings contribute to both the IS and improvisation literature, and transform into practical implications for IS managers, who are increasing relying on real-time planning and spontaneous execution.

Keywords: Organizational Improvisation, Process Model, Case Study

1   MOTIVATION

Improvisation has been increasingly observed in IS development. First, as the business environment for IS development grows more and more unpredictable, IS managers are beginning to realize that planned actions alone are insufficient and spontaneous productions are imperative (Njenga and Brown 2012; Vessey and Ward 2013). Second, as the recent financial crisis renders austerity measurements prevalent, IT departments are given a limited budget and have to improvise based on whatever resources is at hand (Tan et al. 2010). Combining these two factors, IS managers today are facing a paradox of using decreasing resources to cope with increasingly turbulent demands and improvisation is an effective measurement to resolve that paradox.

However, not all improvisational activities lead to positive outputs. Similar to that in jazz performance, where mature improvisers produce pleasant surprises but novice improvisers produce noises, organizational improvisation that is conducted ineffectively leads to various issues, such as operational chaos (Brown and Eisenhardt 1998) and depletion of scarce resources (Vera and Crossan 2004). Therefore, recent studies have started to explore how organizations conduct improvisation effectively. However, extant research has primarily focused on factors that contribute to effective improvisation and has shed little light on the process of the improvisation.

This study intends to explore a process model on how organizations conduct effective improvisation step by step. The exploration takes place in a context of software product development, first because product development is a commonly used context for improvisation research (e.g. Eisenhardt and Tabrizi 1995; Miner et al. 2001) and second because the software marketplace is renowned for high-level time pressure and uncertainty, which means that insufficient time or information is available for planned actions (MacCormack et al. 2001). Given the exploratory nature of this study, we adopt a case study approach as our methodology and choose Tencent as the case company. Analysis of the case data reveals a four-phase process model, which features a continuous iteration between improvisational search and build. The former consists of simultaneous grounded observation and situated reflection. The latter consists of simultaneous grounded design and situated execution.

The remainder of this paper is organized as follows. First, we review the extant literature on organizational improvisation, in order to understand the evolution of the theory and the emergence of the theoretical gap. Second, we explain our qualitative research methodology and describe how it fits in with our research agenda. Third, we describe the case, highlighting important data pertinent to improvisation, and then analyze the data with theoretical support from the constructs gathered at the literature review. Finally, a four-phase process model is derived, and its theoretical and practical implications are discussed.

2   THEORETICAL BACKGROUND

2.1   Organizational Improvisation and IS

One of the enduring challenges faced by organizations is the need to adapt to the changing environment. Punctuated adaptation, which consists of rare and radical changes, have been the dominant paradigm in the past (Gersick 1991; Romanelli and Tushman 1994). However, as the environment grows turbulent, it is increasingly evident that this paradigm is no longer appropriate. In this environment, a new paradigm of continuous adaptation, which consists of relentless and endemic changes, has become popular. Because organizations following this new paradigm often engage in real-time planning and spontaneous production, many management scholars have resorted to the concept of improvisation to study this new paradigm of adaptation and used jazz as the metaphor to make sense of the phenomenon (Mangham 1986; Weick 1993).

Early studies that introduce improvisation to management research define the concept as a creative activity that takes place without planning (Mangham 1986; Weick 1993). For example, Mangham

(1986) defines improvisation as *"an activity which requires no preparation and obeys no rules."* Later studies challenge this definition by providing empirical evidence that suggests that planning, as brief as it may be, exists during improvisation, and is, in fact, an important component of effective improvisation (Brown and Eisenhardt 1997; Moorman and Miner 1998b). Moorman and Miner (1998a) synthesize this stream of work by defining improvisation as temporal convergence between planning and execution towards a novel production.

In the IS literature, there are more and more studies featuring improvisation. These studies can be found in various stages of IS development, from design (Teoh et al. 2012), to implementation (Berente and Yoo 2012) and to post-implementation (Rodon et al. 2011), various scales of IS development, from intra-organizational IS (Tan et al. 2010), to inter-organizational IS (Rodon et al. 2011) and to IS that connects the entire society (Pan et al. 2012), and various types of IS development, from the traditional ERP system (Berente and Yoo 2012) to the emerging healthcare information system (Teoh et al. 2012) and security system (Njenga and Brown 2012). However, despite the rich findings from these studies, how to conduct effective improvisation, especially how to do it step by step, remains unknown.

2.2   Organizational Improvisation and Related Constructs

Organizational improvisation is often confused with some closely-related constructs, such as innovation, experimentation and agile software development. Innovation, which is defined as the deviation from existing practices or knowledge (Zaltman et al. 1973), can be attained via improvisation, because improvisation promotes novel productions and encourages deviation from existing practices and knowledge (Crossan et al. 2005). For example, in 1974, 3M improvised a temporary placeholder based on a failed glue, an accidentally created low-tack adhesive in an attempt to create a super-tack adhesive, and this improvisation led to the creation of Post-it, one of 3M's most successful innovations. However, innovation can also be created by planned actions. For example, product innovations in the automobile (Adler et al. 1999) and pharmaceutical industry (Rothaermel and Deeds 2004) are often the results of comprehensive planning followed by choreographed execution.

The relationship between innovation and improvisation is similar to that between experimentation and improvisation. First, experimentation can be created by improvisation. This is a common phenomenon in software product development, where experiments usually involve an iteration between design and execution, and as the time pressure increases, the iteration becomes so frequent that design and execution occur simultaneously (MacCormack et al. 2001). However, experimentation can also be attained by planned actions. For example, in many published scientific papers, readers will find a methodology section describing how the experiments are meticulously designed and then carefully executed.

The relationship between improvisation and agile software development is more complicated. Lacking a concise definition, agile software development is often defined by various principles that it advocates, such as rapid iteration, self-organizing teams and minimalism (Conboy 2009). Improvisation is, in essence, an integral part of agile software development, because adapting to changes rather than following existing plans is the foundation for agile software development (Beck et al. 2001). For example, Tan and his colleagues (2010) have empirically verified that routinized improvisation can lead to agility in software development. However, improvisation and agile development are not the same, because there are agile principles that are not essential to improvisation, such as leanness; in his attempt to re-construct agility in software development, Conboy posits that leanness and flexibility are the two underlying constructs of agility (2009, p334). While flexibility has been commonly observed in improvisation (e.g. MacCormack et al. 2001), leanness has not. In fact, research has suggested the opposite of being lean, demonstrating that a healthy level of slack resources is important to improvisation, because they provide a resource buffer for real-time responses to unexpected situations (Lee and Grewal 2004; MacCormack et al. 2001).

Despite these differences, improvisation is a novel and sound theoretical lens to study agile software development. This lens can help address two major issues faced by the agile literature. First, agile

literature is replete with disparate findings, many of which are redundant, because the literature lacks an underlying logic to organize them (Conboy 2009, p330). To this end, improvisation theory can serve as the theoretical glue which connects these findings. Second, the agile community starts to play concepts within itself and lacks new concepts from other communities. Kruchten (2011) coins this issue as *Agile's Teenage Crisis*. To this end, improvisation theory can shed new light on the agile literature, and this study provides a space for such a cross-fertilization. In fact, practitioners have already been using improvisation to study agile software development. Andrian Cho, a senior IBM developer, drew an analogy between jazz process and agile software development, using jazz concepts to explain what it takes to achieve agile software development (Cho 2010).

2.3   Process Model of Effective Improvisation

Not all improvisational activities lead to successful outputs. Early studies on improvisation have primarily focused on its positive implications, such as accelerated adaptation (Eisenhardt and Tabrizi 1995), real-time learning (Miner et al. 2001), and resolute action (Bigley and Roberts 2001), but they have also documented the ineffective improvisations and their negative implications, such as disrupted knowledge accumulation (Miner et al. 2001), deviation from the core competence (Hmieleski et al. 2013) and waste of scare resources on urgent but non-strategic issues (Vera and Crossan 2004). In the light of these contrasting results, scholars have started to move from the descriptive aspect of answering what improvisation is and what its implications are, to the prescriptive aspect of answering how to conduct improvisation effectively. Studies in this stream have focused on variance models, and uncovered various factors underlying effective improvisation (Kamoche and Cunha 2001; Moorman and Miner 1998b).

These factors can be divided into two categories. One category is related to organizational contexts. The core tenet is that effective improvisation needs a conducive environment to take place. Some contexts are at an organizational level such as experimental culture (Vera and Crossan 2005), organizational memory (Moorman and Miner 1998a), and real-time information (Moorman and Miner 1998b), while others are at the group level, such as teamwork quality (Vera and Crossan 2005) and domain expertise (Moorman and Miner 1998a). The importance of organizational contexts in effective improvisation is also evident in jazz performance, where successful improvisation often takes place in bands that have a high tolerance for mistakes, that have known each other for a long period of time and that can exchange information via subtle cues such as an eye contact (Berliner 1994; Cho 2010).

Another category is related to organizational structures. The core tenet is that effective improvisation cannot take place in the air, and needs a structure to support it. Brown and Eisenhardt (1998) refer to this need as structured chaos. The importance of organizational structures in effective improvisation is also evident in jazz performance, where musicians need a basic melody, chord structure, and a rhythmic order to guide their improvisation, and the lack of these structures results in a series of random and dissonant voices (Berliner 1994). Some structures are visible, such as clear accountabilities (Brown and Eisenhardt 1998) and role switching principles (Bigley and Roberts 2001), while others are invisible, such as information networks (Pan et al. 2012) and dynamic knowledge structures (MacCormack et al. 2001) and informal interdependence (Vera and Crossan 2004).

However, despite the rich findings in both streams of research, how organizations conduct effective improvisation step by step remains unknown and we will use the structures and contexts as the background to explore the different phases of effective improvisation.

3   RESEARCH METHODOLOGY

We chose a case study as our research methodology for three reasons. First, since the research question is about *'how'*, it is better answered through inductive methods (Walsham 1995). Second, since organizational improvisation is an intricate business process, closely bound up with complex organizational context (Moorman and Miner 1998a, p703), it is more suitable to study it via

qualitative data (Klein and Myers 1999). Third, a case study has been recognized as an effective method for developing process models (e.g. Montealegre 2002), because richness of the information enables researchers to establish logical connections between constructs and form a process view. We choose Tencent as the case organization. The company was founded in 1998 as an Instant Messaging (IM) provider. It is now the world's fourth-largest Internet company, after Google, Amazon and Alibaba (Forbes 2014). The reason we choose Tencent over other software vendors is not merely because of its success, but because its success is attained through constant adaptation in its product development, which gives us a rich research ground.

To leverage the flexibility of the case study, data collection and analysis were undertaken simultaneously across three phases (see Table 1). Phase 1 began in January 2012, when we obtained access permission from the company's Vice President of Human Resource. In this phase, data collection focused on both streams archives. Internal archives include email correspondence, business cases, and annual reports. External archives include news articles, analyst reports and journal articles. Primary data were also collected to complement the archives. These data also came from two streams: interviews with the VP and his direct subordinate, and interviews with Tencent users. Because the research team resides in a leading research university in Asia, which has a large population of Chinese nationals, user samples are rich. In total, we conducted in-depth interviews with 7 Tencent users, three from the undergraduate program and four from the graduate program.

Table 1: Data Collection and Analysis Across Three Phases		
	Data Collection	Data Analysis
Phase 1 (Jan - Mar 2012)	Internal and external archives Employee and user interviews	Search for patterns behind Tencent's success and identify effective improvisation as the key factor
Phase 2 (Mar – May 2012)	Face-to-face interview with four senior managers, eight middle managers and nice junior staff	Construct a preliminary model that fits the emergent themes during the interview
Phase 3 (May – Nov 2012)	Follow-up interviews with six Tencent employees	Augment the theoretical model and ensure data-model-theory alignment

Phase 2 began in early March 2012, with an onsite visit. As suggested by the literature review, the software product development process should be the unit of analysis, and our interview questions should focus on the key activities of the process and the underlying structures that support these activities. In total, 21 unique informants participated in the interview, and some participated in multiple sessions. Each session ranged from 45 minutes to 1 hour. The informants were equally distributed across senior management, middle management, and junior staff. The informants were key members selected from two core product suites: the Internet service suite and the entertainment suite. The former is Tencent's oldest product suite that consists of its classic products, such as QQ IM, Video Chat and Desktop. The latter is Tencent's fastest-growing product suite, which consists of the latest blockbusters, such as Mini MMO (Massively Multiplayer Online) games and hard-core MMO games. Data across these two distinct suites provided us with a balanced view of the product development process, and excluded elements that were idiosyncratic to individual product histories.

Interview data were analysed in real time. While one researcher engaged with informants and initiated questions, the other interpreted the responses, ensured data validity, and identified new themes. Every time a new theme emerged from the data, the interview panel would quickly readjust questions to explore that theme (Pan and Tan 2011). Pictures and videos were taken at operational sites relevant to product development, such as brainstorming sessions and product review meetings. Field notes were taken during informal chats and interview breaks. These observations generated interesting findings that complemented the interview data. At the end of phase 2, a preliminary model of improvisation emerged.

Phase 3 began in May 2012, when the data were systematically analysed, coded, and arranged into themes according to the emergent model. Regarding coding techniques, this study adopted both open

and selective coding. Open coding was used in Phase 2 and at the beginning of Phase 3; its objective was to unveil an emergent theoretical model. Selective coding was used in Phase 3, with the purpose of augmenting the emergent model. Follow-up interviews were conducted when a new theme emerged, but data relevant to the theme were insufficient. E-mail and telephone were the common tools for follow-up interviews. This iteration between data analysis and follow-up interviews lasted more than three months until the model reached theoretical saturation, when the newly collected data began to repeat themselves and failed to challenge the existing model (Eisenhardt 1989).

4   CASE DESCRIPTION

China has the world's largest Internet population of 513 million (CINIC 2012), and the largest Internet market, twice the size of the U.S. market (Mourdoukoutas 2014). This market has thus attracted many local and international players. The history of Tencent resembles the history of many Chinese Internet companies in that era. It was founded in 1998 by five graduate students from a local university in Shenzhen. Its first product is QQ Instant Messaging (IM), one of many local emulations of ICQ in that era. ICQ is the first IM product launched by the Israeli company Mirabilis, in 1996. Despite much resemblance to its predecessor, QQ had several custom-built functions that made it popular among Chinese users, such as the auto-lock function, which addresses the security concerns of using public computers and a 1MB installation package that deals with bandwidth constraints facing most Chinese households. These innovations, while seemingly minor, are deeply rooted in the local context. They differentiate QQ from ICQ and other ICQ variants, and help QQ thrive while others, including ICQ, have ceased to exist. The early success of IM not only provides Tencent with a 400-million user base, but also provides it a product development process, which the company replicates and refines in its future expansion. Tencent's product development consists of four phases. We will describe each phase in detail.

4.1   Observation Phase

A typical product development starts from observation. *"The market is too volatile and anything beyond 6 months is not predictable. Thus, we monitor what's going on rather than forecast it"*, said Tencent's president (06/10/2010) at an Internet conference. The main task of observation is to scan the environment for new product ideas. Tencent pays close attention to environment changes, because failure to capture any emerging idea may lead to disastrous results. These changes come from new technical advancements, user needs, and competitor movements. Although competitor movements are the greatest threat to the company's business, they are an important reference for new product ideas.

> *"The Internet market is filled with many opportunities and threats. The competition is not about who has the largest market share or largest scale. **It is about who can catch the next big wave.** We should never feel complacent and always stay alert. Essentially, we are just one opportunity away from be irrelevant to the market."(CEO, 12/11/2010)*

To ensure emerging trends are captured in a timely manner, environment scanning is seen as the responsibility of all employees, rather than that of selective individuals. Employees are encouraged to share observation with their peers. Our field observation also confirmed this. During the lunch break, new technological trends and competitor movements were two universal topics across lunch tables.

> *"The amount of new information is amazing and it's impossible to have a central agency for this. So, **we expect everyone to be a market observer**. Now, in any corner of the company, you can hear people discussing new technologies and competitors, and good product ideas usually come from these discussions." (Engineering Manager B, 08/03/2012)*

4.2   Design Phase

Design begins when a new product idea is approved by the business policy division. Innovation is the centrepiece of the design phase. Instead of taking innovation as something completely original or cutting-edge, Tencent views innovation as creative advancement in user experience. As a senior product manager of a hard-core MMO game (08/03/2012) explained, *"Strictly put, there are few original products in our business. If we have to call some products innovative, they are the ones that are close to user needs."* Therefore, Tencent involves users in product design, rather than relying on internal speculation. As we repeatedly heard from the product managers *"Internal speculation is a recipe for failed products."*

> *"We don't speculate about what users want. Instead, **we actively seek user opinions and do this as early as possible**. Gone are the days when you can lock your staff in a basement, sign a non-disclosure agreement, and develop something that astonishes the world."*
> *(Director A, 07/03/2012)*

To gather user inputs, a 10/100/1000 rule is enacted for product managers. According to this rule, a product manager must interview 10 users, follow 100 user blogs, and respond to 1,000 user posts every month. *"I spend more than 50% of my time with users... For me, this is more important than attending PR events."* said Tencent's CEO (01/01/2006), who leads this practice by example.

> *"There is no short-cut in understanding users. You just have to engage them all the time. Tencent's 1000-100-10 rule is an excellent example. **It forces product managers to get out of the lab and meet real users**. As it makes Tencent more approachable as compared to the competitors, users are more likely to participate."(Industry Analyst, 04/05/2012)*

4.3   Execution Phase

Execution and design occur in tandem. A product manager of an online card game (09/03/2012) explains the rationale: *"Design and execution are difficult to separate. While it's difficult to develop something without a design, it's equally difficult to design without something concrete for users to feel, touch, and give feedback."* However, this simultaneous act increases the time pressure in execution, as late responses to user needs upset users, and hurt their enthusiasm in further participation. For example, during the initial launch of a product, the workload often exceeds the team's capacity.

> *"**We frequently adjust our development schedule** because if users don't see their feedback being incorporated quickly, they stop participating. To make the adjustment easier, tasks are divided into small pieces – as the old saying goes, a small boat is easy to turn."(Engineering Manager A, 07/03/2012)*

To cope with this overwhelming workload, Tencent resorts to ad hoc teams, which include both members from the focal team and temporary recruits from other teams. An engineering manager of the video chat (08/03/12012) illustrated the efficacy of these ad hoc teams by relating the story of WeChat: *"Last year, the biggest success was WeChat. The product went through 23 updates in the first two weeks of its launch. This was impossible for many other companies, but we made it possible by mobilizing people across different teams and concentrating them at a critical spot."*

> *"We've been educated to work with a mentality of change and adapt to the fact that **if an urgent task emerges, we need to put down the task at hand and join an ad hoc team**…Skill-wise, we don't have much problem, as we have experience working in different teams." (Engineering Manager B, 15/03/2012)*

4.4   Reflection Phase

The simultaneous design and execution continue until the new products or product updates reach their maturity, where targeted users have been acquired and satisfied. However, there are cases where new

products or product updates are cancelled halfway because they are not well received by users. *"New products have risks. When a product has to fail, we just make sure we learn something that helps move things forward."* said the CEO (01/01/2006). Consistent with the CEO's message, reflection aimed at generating implications for the current situation, rather than merely summarizing the past. In this case, reflection and observation take place in tandem, where one informs the other. As an engineering manager of the QQ desktop (04/05/2012) stated, *"History is a mirror, through which we see the presence better, while presence is a light, through which we see the history better."*

> *"**We don't reflect for the sake of doing so**, because we don't have the time to merely summarize the past, without producing anything applicable to the current situation. Sharing at work makes it possible to **combine past experience with current trends and bring history to life.**" (Product Manager C, 04/05/2012)*

Reflection situated in the present condition is most effective when product teams consist of members from different backgrounds, because members from the same background tend to employ the same way of thinking and lock reflection in historical anecdotes. To this end, Tencent establishes a regular rotation program that seeks to create teams of both native and new members. Employees also welcome this rotation, as it gives them broader exposure.

> *"The most valuable knowledge gained from prior projects is within the employees. Thus, we rotate them regularly so that they can share with more people…**The mix of newcomers and natives in a team broaden their (natives') perspective** and enable them to escape the mental groove."(Product Manager A, 09/03/2012)*

Jack Ma, the CEO of Alibaba Group, once commented on the turbulence of the Chinese Internet market as *"Changes are measured in hours. If you cannot get a product out in a month, you should be terrified and if you cannot get it ready in three months, you will be dead."* In this marketplace, an important reason that Tencent manages to sustain its leadership is the product development process, which enables it to stay alert to environment changes and form quick responses to such changes. The process also enables it to expand. After IM, the company has successfully penetrated into nearly every aspect of the Internet business, such as social networking, gaming, web portal, electronic and mobile commerce, and search engine. *"Tencent has cracked the code of developing popular Internet products. Each time when entering a new area, they just replicate what they did in the past."* a senior industry analyst commented on the success of Tencent's expansion. The success has also been recognized by the western world. Ever since 2008, the company has been ranked by Forbes as one of the world's most innovative companies (Forbes 2008-2013), and in 2014, it was ranked as one of the world's most respected companies by the Wall Street Journal (WSJ 2014).

5   DISCUSSION

To recall the research question, this study aspires to explore the process model of effective improvisation. By progressing back and forth between data and literature, we derive four phases of the effective improvisation and the two improvisational acts that they form (see Figure 1). We will first discuss the nature of each phase and then discuss the two improvisational acts. Given that these four phases and the two improvisational acts are inductively derived from the empirical data, we will provide an explanation of how they are corroborated by the existing literature.
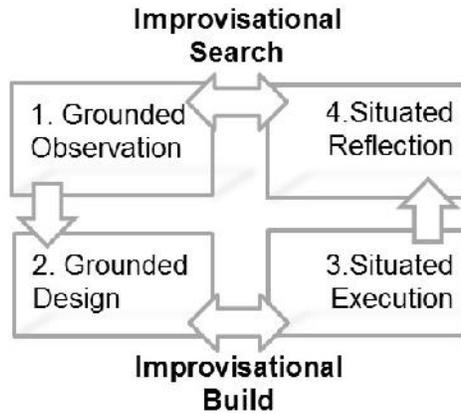
Figure 1: Process Model of Effective Improvisation

When scanning the market for new product ideas, Tencent engages in grounded observation. This term is inspired by the concept of grounded theory, a qualitative methodology that advocates that theoretical findings should emerge from the data and should not be influenced by any prior propositions (Corbin and Strauss 1990). Observation in Tencent's product development shares similar traits. First, because individual teams have autonomy in product development, and are not influenced by directives from the top management, they can make rapid adjustment based on real-time information and capture emergent opportunities (Hoda et al. 2012). This is consistent with a key principle of improvisation, namely that when no one can predict how things will evolve, the key is to monitor the outside world and stay flexible (Miner et al. 2001). Second, because there are no prior assumptions about what will happen in the market, the observation aims to discern what is actually there, rather than confirming what has been predicted (Vera and Crossan 2005).

When co-creating design with users, Tencent engages in grounded design. This labelling follows the same corollary as the above, because design draws heavily from user participation rather than internal speculation and makes no prior assumptions about what users want. Grounded design is carried out through two mechanisms. First, design focuses on user experience and avoids distractions that add no value to users, such as engineer-centric features that have no user endorsement. This user-centric model helps Tencent to avoid a common pitfall that traps many high-tech companies, namely producing advanced products that users do not need (Ulwick 2002). Second, design focuses on incremental improvements. Although many companies engage users when designing products, few get the design right. Those that fail tend to engage users in a punctuated fashion. This approach is problematic because in a turbulent environment, user preferences constantly shift, and a punctuated engagement may produce a design that is soon outdated (Birkinshaw et al. 2011). Such practice is consistent with Brown and Eisenhardt's work in the computer industry (1997, p16), which demonstrates that constant probing is necessary when it comes to product design in a turbulent marketplace.

Because user participation and execution are conducted in tandem, execution takes place in the context where its outputs are applied. We label this situated execution, as inspired by the concept of situated learning – learning that takes place in context where learning outputs are applied (Lave and Wenger 1991). This situated execution is similar to a signature jazz practice: when new audiences enter the scene, the experienced jazz band senses the ambience change, and smoothly adjusts the tone to fit the new ambience (Barrett 1998). A similar case is observed by Miner and her colleagues' research (2001, p310), where a food company temporarily slowed down products in one category and mobilize resources to focus extensively on products in another category, after learning a competitor movement in that category. Situated execution is not punctuated. It is a continuous response to user needs. This continuous response maintains user enthusiasm, and keeps them engaged throughout the development process (Ulwick 2002).

Because observation and reflection are conducted in tandem, reflection takes place in the same context where its outputs are applied. We label this situated reflection, following the same corollary as the above. Unlike conventional reflection that focuses on the past and the creation of knowledge (Alavi and Leidner 2001), situated reflection focuses on the implications of prior knowledge in face of emergent trends and the enactment of knowledge in the new context. A typical example is the reflection at work, whereby teams refresh prior experiences in the light of emergent trends and leverage prior experiences to conceive of new ideas that respond to those trends. Situated reflection is not a punctuated activity that occurs at a specific time slot, but a continuous response to market trends. This continuous reflection is necessary in the turbulent environment, because knowledge without frequent updates offers little practical value (Carlile 2002) and traps the organization in its prior competence (March 1991). This is also consistent with an improvisation principle by which prior memory must be linked to the local issue and the present time (Miner et al. 2001, p318).

The four SPD phases constitute two improvisational acts. First, the temporal convergence between grounded observation and situated reflection constitutes an improvisational search, as it replaces the coordinating role of a search plan and makes the search for new product ideas a spontaneous act that evolves with immediate market feedback. Similarly, the temporal convergence between grounded design and situated execution constitutes improvisational build, replacing the need for a prior design and making the build for new products a spontaneous act that evolves with immediate user feedback.

While improvisational build is consistent with the existing definition, which only concerns design and execution (Miner et al. 2001), improvisational search is not covered by the definition, despite it has been commonly observed in prior literature, such as improvisational search in product innovation (Katila and Chen 2009) and improvisational search in crisis response (Pan et al. 2012). Following the existing definition, we define improvisational search as the temporary convergence between observation and reflection. Improvisational search is the real-time interpretation of the environment, where members frame the meaning of unexpected events in the light of prior knowledge and reactivate prior knowledge in the light of these unexpected events.

The relationship between improvisational search and build has been suggested by Miner and her colleagues (2001, p313), who state that the initial moment of improvisation is the interpretation of the environment, and the rest is the response to the environment. Our model extends this unidirectional relationship, showing that, improvisation is a continuous iteration between improvisational search and build. This iteration between improvisational search and build is consistent with Sawyer's (2000) finding in improvisation theatre, where improvisation is a balance between problem finding and problem solving; actors find a problem for themselves, spend some time solving the problem, and find a new problem whilst solving the previous one.

6   CONTRIBUTIONS AND LIMITATIONS

This study has important contribution to the IS development literature, where improvisation is gaining momentum. However, extant studies have several gaps. First, prior studies have mainly focused on implications of improvisation, whereas how to do it effective has remained largely unknown. Second, prior research has treated improvisation as a monolithic concept, and what is inside it remains unknown. Third, prior studies have only focused on the build activities, whereas search activities are left out. This study, based on Tencent's software product development, develops a process model, which consists of four phases and two constituent improvisational acts. The process model delineates how effective improvisation takes place, explicates its internal dynamics, and presents a new view that consists of both improvisational search and build.

The study also has important practical implications. As improvisation is becoming an imperative for IS development, an empirical study on how to carry out effective improvisation is valuable. Our process model can act as a specific referent for IS practitioners to follow during improvisation and the process of building improvisational capability. As managers gradually realize that organizational improvisation is a deliberate business process, rather than a random series of activities (Pavlou and El Sawy 2010; Vera and Crossan 2005), this process model will become more valuable. This model,

derived from experiences of a world-renowned Internet company, is also a timely response to an emerging paradox faced by IS managers, which is to use decreasing resources to cope with increasingly turbulent demands.

Despite these contributions, findings must be considered in the light of their limitations. First, although each phase of organizational improvisation has been closely analyzed, attention has focused on the internal members, whereas external members, such as third-party service providers and open-source communities, are not included. External stakeholders also play an important role in organizational improvisation. As Pan and his colleagues demonstrate in a crisis response case (2012), collaboration with external stakeholders is an important reason the central response agency is able to launch effective remedies in real time. A future study that incorporates this external aspect will thus be valuable. Second, as an Internet company, Tencent is an extreme case in terms of environmental turbulence. Although this extreme nature makes the theoretical outputs salient (Eisenhardt 1989), it overlooks cases of moderate turbulence, in which organizations may engage in a combination of improvisation and planned actions. Future studies may seek to explore this area and examine how organizations balance improvisation and planned actions.

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