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When Ambiguity Rules: The Emergence of Adaptive Governance from (In)congruent Frames of Knowledge Sharing Technology

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ABSTRACT

As increasingly diverse stakeholders engage in technology-mediated knowledge sharing, the establishment of appropriate forms of governance becomes a challenge. Existing research highlights that successful governance is a result of congruence between different stakeholders' views and uses of technology, but the way suitable governance can emerge in the presence of incongruent or ambiguous framings of technology is still unclear. In this article, we present a case study of a collaboration between government, industry and university stakeholders, where the social media platform WeChat is used for knowledge sharing. Using the theoretical lens of the technological frames of reference (TFR), we investigate how views and uses of technology among different stakeholders shape the emergence of governance arrangements. We find that patterns of congruence and incongruence in the stakeholders' framings of technology for knowledge sharing lead to emergent adaptive governance practices, which are characterized by selective participation, role and capability identification, and ad-hoc decision-making.

Keywords: Knowledge Sharing, Adaptive Governance, Technological Frames of Reference, Social Media, Inter-organizational Collaboration

1. INTRODUCTION

Technological developments such as the open data movement, artificial intelligence, blockchain, and the sharing economy require organizations to adapt to changes that might otherwise become disruptive (Chatfield and Reddick 2018; Ganapati and Reddick 2018; Halaburda and Mueller-Bloch 2019; Janssen et al. 2012; Kolbjørnsrud et al. 2016; Mergel 2016). One way for organizations to deal with such changes is to collaborate with other organizations, communities, and individuals that can bring in various fields of expertise (O'Reilly 2011; Snow et al. 2017). Nonetheless, such collaborations can easily run into difficulties in adapting to changes due to the established patterns of decision-making and institutional arrangements among the diverse stakeholders (Janssen et al. 2015). Finding the best suitable approach to governance, defined as “the solutions that individuals and organizations devise for problems of coordination” (Markus and Bui 2012, p. 165), is thus key to enhancing the adaptive capacity of these collaborations.

Governance researchers claim that an adaptive governance approach can help inter-organizational collaboration stakeholders in effectively adapting to changes (Chaffin et al. 2014; Dietz et al. 2003; Janssen and van der Voort 2016). The core idea is to balance between stability-oriented and adaptability-oriented governance approaches through ambidextrous practices in participation, decision-making, and capability mobilization that emerge from interactions among stakeholders (Janssen and van der Voort 2016). Researchers suggest that certain conditions need to be met in order for these practices to emerge. One such condition is knowledge sharing, as it can bring together different decision-making authorities and encourage the mobilization of capabilities across organizations (Chaffin et al. 2014).

Nonetheless, as knowledge sharing is increasingly mediated through technologies (Snow et al. 2017), particularly social media (Charband and Navimipour 2016; Chatfield and Reddick 2018;

de Vreede et al. 2016; Kaplan and Haenlein 2010; Kapoor et al. 2017), research has yet to address the role of knowledge sharing technology in the emergence of adaptive governance. With organizations increasingly adopting social media for knowledge sharing, current research provides contradictory findings about the uses and effects of knowledge sharing technology. For example, studies show that social media can both enable and constrain knowledge sharing (Dulipovici and Vieru 2015; Treem et al. 2015), and findings on the views and uses of social media in organizational contexts are inconsistent (Gibbs et al. 2013; Leonardi and Vaast 2017; Majchrzak et al. 2013). The divergent views and uses of social media for knowledge sharing bring forward the question of whether or not consensus between views and uses of knowledge sharing technology by different collaboration stakeholders (Chaffin et al. 2014; Snow et al. 2017) is needed for adaptive governance to emerge in inter-organizational collaboration.

Given the lack of current research insights into understanding the role of knowledge sharing technology in the emergence of adaptive governance, we thus ask: *how do views and uses of social media for knowledge sharing among different stakeholders shape the emergence of adaptive governance?* To address this question, we draw on the concept of technological frames of reference (TFR) (Davidson 2006; Orlikowski and Gash 1994) to analyze the assumptions, expectations, and experiences that the different stakeholders have about the use of social media for knowledge sharing. In particular, we are interested in identifying if and how congruence and incongruence of their understandings influence the emergent process and outcome of adaptive governance.

We base our analysis on an in-depth case study of an open data initiative in China, in which government, university, and industry stakeholders collaborated by using the social media WeChat for knowledge sharing. The heterogeneity of the stakeholders and the prevalent use of WeChat for knowledge sharing provide a good context for understanding the different

interpretations around knowledge sharing technology and its role in the emergence of adaptive governance.

Our findings suggest that adaptive governance emerges from the ambiguity in the frames of knowledge sharing technology. The findings contribute to the existing adaptive governance literature by highlighting that knowledge sharing technology alone does not directly shape the emergence of adaptive governance in inter-organizational collaboration. Rather, it interplays with stakeholders' changing assumptions, expectations, and experiences with their roles and needs for knowledge sharing as the collaboration develops. We argue that ambiguity, rather than consensus, of technological frames plays a key role in the emergence of adaptive governance.

The remainder of this paper is organized as follows: in the next section, we position the study in relation to existing literature on adaptive governance, knowledge sharing, and social media. We then present technological frames of reference (TFR) as a useful concept when understanding people's assumptions, expectations, and experiences about the use of technology for knowledge sharing. Following the conceptual underpinnings of this study, we describe the case setting along with the data collection and analysis methods. Our findings section is divided into three main parts: first, we map the technological frames of three stakeholder groups; second, we identify patterns of frame congruence and incongruence; and third, we discuss the relationships between these patterns and the emergent governance practices. We conclude the paper by discussing our contributions to research and implications for practice.

2. BACKGROUND

2.1 Adaptive Governance and Knowledge Sharing

In the face of rapid changes in technological development, established governance approaches have been criticized for not being developed to adapt to changes (Janssen and van der Voort 2016). For instance, top-down approaches that emphasize centralized decision-making offer promises of control and stability yet fail to provide effective solutions for highly contextualized and dynamic situations (Heeks 2002). Bottom-up approaches that emphasize decentralized decision-making offer promises of learning and adaptability, yet suffer from a number of issues (e.g., goal congruence, loss of oversight, fragmented coordination, and accountability) that may threaten the stability of collaboration (Jarvenpaa and Välikangas 2016; Provan and Kenis 2008). Hence, there is a need to champion an alternative to the governance of inter-organizational collaboration that bridges between these approaches as well as balance between the quests for stability and adaptability, learning and control.

Adaptive governance is increasingly recognized as a way to address this need. The concept was first coined by Dietz et al. (2003) in the management of socio-ecological systems (Chaffin et al. 2014; Folke et al. 2005), and has recently been theoretically and empirically explored in the management of socio-technical systems (Chatfield and Reddick 2018; Hong and Lee 2018a; 2018b; Janssen and van der Voort 2016; Soe and Drechsler 2017; Wang et al. 2018). The core idea behind adaptive governance is that governance should be a “balancing act” between the top-down and bottom-up governance approaches. This also means that adaptive governance would need to rely on ambidextrous practices in areas such as participation, decision-making, and capabilities mobilization (Janssen and van der Voort 2016).

In managing socio-technical systems, Janssen and van der Voort (2016), for example, have proposed four conceptual characteristics of adaptive governance, namely “decentralized

bottom-up decision-making, efforts to mobilize internal and external capabilities, wider participation to spot and internalize developments, and continuous adjustments to deal with uncertainty” (Janssen and van der Voort 2016, p. 4). Empirical studies on adaptive governance have suggested that some of these characteristics, such as decentralization and distribution of decision-making power and accountability, are emergent from the actual interactions between stakeholders, and may change under certain conditions (Hong and Lee 2018a; Wang et al. 2018).

Scholars emphasize that in order for adaptive governance to emerge, certain conditions have to be met, of which knowledge sharing is a vital one (e.g., Chaffin et al. 2014). First, knowledge sharing involves different stakeholders, thus providing a connection point for different governance approaches in inter-organizational collaboration (Bodin et al. 2006; Bodin and Crona 2009; Folke et al. 2005). Second, knowledge sharing also facilitates the integration of local and specialized knowledge, which encourages diversity and mobilization of capabilities among organizations (Lebel et al. 2006). In this sense, knowledge sharing is believed “to generate or enhance the capacity necessary for flexible response, learning, and adjustment” (Chaffin et al. 2014, p. 8).

However, knowledge sharing also brings the question of consensus to the fore in the emergence of adaptive governance (Chaffin et al., 2014). As knowledge sharing involves different stakeholders, consensus has become increasingly difficult to reach. One reason is that it takes time for stakeholders that represent divergent interests to reach an agreement. Furthermore, it may be difficult to come to any agreement in situations of power imbalances (Ansell and Gash 2008). Difficulties in consensus-reaching may slow down collective actions in situations that require fast and flexible responses, hence it has become unclear how important consensus is to the emergence of adaptive governance.

In addition, as inter-organizational collaboration becomes increasingly mediated by knowledge sharing technologies, adaptive governance scholars have yet to address the role that such technologies play in the emergence of adaptive governance. In a broad sense, existing adaptive governance literature seems to have a deterministic view of technology by suggesting technology as the key driver in exploiting the fragmented knowledge and resources when addressing changes (Dietz et al. 2003). Nevertheless, as we will see in the following, knowledge sharing technologies, such as social media, do not always enable knowledge sharing among different groups of stakeholders in practice. The use of social media can in fact evoke conflicting views and ways of knowledge sharing that may forestall collective actions.

2.2 Social Media Technologies for Knowledge Sharing

Knowledge sharing technologies – ranging from email, text messaging, and social media, to sophisticated knowledge management systems – are widely present in today’s organizational environments (de Vreede et al. 2016). They are used to support a variety of knowledge sharing activities that involve “disseminating or transferring knowledge among individuals, groups, or organizations, where individuals exchange their tacit and explicit knowledge and create new knowledge” (Charband and Navimipour 2016, p. 1131).

Recently, considerable attention in research on knowledge sharing technologies has been directed towards social media and its prospects, as social media are increasingly adopted in workplaces to facilitate knowledge sharing (Ellison et al. 2015; Gibbs et al. 2013; Kapoor et al. 2017; Majchrzak et al. 2013; Treem and Leonardi 2013). Social media refer to Internet-based technologies that allow users to easily create, edit, evaluate, and link to content and to other content creators (Charband and Navimipour 2016; Chatfield and Reddick 2018; de Vreede et al. 2016; Dwivedi et al. 2018; Kaplan and Haenlein 2010; Kapoor et al. 2017). The shared knowledge on social media range from how to do something (i.e., instrumental

knowledge), to what and whom other people know in and across organizations (i.e., meta-knowledge) (Leonardi 2014; Leonardi et al. 2013).

Despite the intention of adoption, social media are observed to have evoked different views, uses, and effects for knowledge sharing in practice. For example, a majority of empirical studies have found that social media are used to *enable* knowledge sharing using blogs (Chai and Kim 2010; Papadopoulos et al. 2013), wikis (Wagner, 2004), public social networking sites (Jarrahi and Sawyer 2013), and enterprise social networking sites (DiMicco et al. 2008). In comparison to other commonly used technologies such as email, intranets, and websites, social media afford distinctive possibilities for knowledge sharing within and across organizations (e.g., the visibility and persistence of communicative actions), which can potentially expand the range of people, networks, content, and ideas from whom people can solicit and learn (Ellison et al. 2015; Leonardi et al. 2013; Schlagwein and Hu 2016).

A few studies have highlighted the divergence in the strategies behind knowledge sharing for collaboration purposes along with the influence of those strategies on social media use (Gibbs et al. 2013; Hwang et al. 2015; Majchrzak et al. 2013). These studies find that organizational users at times view and strategically use social media to *constrain* knowledge sharing in accordance with their own needs. For example, Hwang et al. (2015) conclude that employees tend to only share information on social media with peers that hold similar views, thus constraining rather than enabling the scope of knowledge sharing. Similarly, Gibbs et al. (2013) find that, in a distributed working environment, workers navigate tensions in knowledge sharing (i.e., visibility-invisibility, engagement-disengagement, and sharing-control), and strategically manage these tensions to preserve openness and ambiguity in knowledge sharing.

Existing studies demonstrate that the use of social media for knowledge sharing is highly contextualized and revolves around the dialectic tension between learning and control (Gibbs et al. 2013). Stakeholders' interests, their views of technology (i.e., what it can and cannot do),

and the nature of the knowledge shared (i.e., what can and cannot be shared) vary, thereby influencing the way they share knowledge by use of technologies (Charband and Navimipour 2016; Dulipovici and Vieru 2015). Hence, in the context of inter-organizational collaboration, social media-mediated knowledge sharing can be challenging. Each stakeholder may have distinct views of what needs to be shared, how knowledge needs to be shared, or whether they should share or control access to certain knowledge (Dulipovici and Robey 2013; Leonardi and Vaast 2017). These divergent views and ways of using social media technology for knowledge sharing could potentially forestall collective actions (Majchrzak et al. 2013; Treem et al. 2015). In order to be able to understand how different stakeholders can view and use social media technology for knowledge sharing, we turn to technological frames of reference (TFR) as the conceptual underpinning of this study.

3. THEORETICAL FRAMING

Orlikowski and Gash (1994) first proposed the TFR theoretical lens to study different stakeholders' interests and technology adoption behaviors, as well as the consequences of the consensus (or lack thereof) among the stakeholders' technology adoption. TFR originates from the concept of frames, or frames of reference, in socio-cognitive research (Bartunek 1984; Bartunek and Moch 1987; Goffman 1974). In an organizational context, the frames of reference refer to actors' implicit definitions of their organizational reality that serve to shape their interpretations of and actions around organizational phenomena (Gioia 1986).

Accommodating the idea of frames of reference in the context of technology adoption, the body of literature on TFR addresses how different stakeholders make sense of technology in an organization, and how the alignment of interpretations affects their technology-related actions (Barrett et al. 2013; Kaplan and Tripsas 2008; Leonardi 2010). Instead of assuming technology as a monolith for every stakeholder, TFR considers technology as something formative in an

ongoing interpretive process by which different stakeholders assign meanings to the technology according to their own frame of reference, hence developing a trajectory for its use in a particular setting (Cornelissen and Werner 2014; Davidson 2002; 2006; Kaplan and Tripsas 2008). For example, a TFR study on social media use by Treem et al. (2015) shows that the context in which stakeholders come to learn about social media influence their expectations and assumptions of the technology. Consequently, stakeholders who have adopted similar or identical technologies before in other contexts can have different expectations of social media utility, and such differences may pose problems for social media adoption in a new context. Along this line, in our study we distinguish between three groups of stakeholders: government, university, and industry. Such distinction follows existing studies on government-university-industry collaboration (Bjerregaard 2010; Etzkowitz and Leydesdorff 2000; Etzkowitz and Ranga 2015) that indicate how each stakeholder group is most often subject to certain institutional logics, forming different frames of reference.

To better understand and characterize the interpretations that government, university, and industry stakeholders make about social media, we engage with TFR along the three frame domains identified by Orlikowski and Gash (1994). The first domain, *nature of technology*, refers to people's images of what the technology is, including their understanding of its functionalities and capabilities. The second domain, *technology strategy*, refers to people's view on why a particular technology is implemented, including their views on the vision, value, and motivation behind the decision to adopt and use the technology. The third domain, *technology-in-use*, refers to people's understanding of how the technology is or will be used, including conditions and consequences with such use. While we acknowledge that these three frame domains interact and overlap, for analytical purposes in this study we separate them to gain an in-depth understanding of each dimension upon which the stakeholder groups interpret technology related to knowledge sharing. Furthermore, we contextualize the three domains in

relation to our empirical setting, in which social media technology is used for knowledge sharing in inter-organizational collaboration (see Table 1 for an overview).

Table 1. Overview of the Three TFR Domains and our Contextualization

	Questions	Key domain	Our contextualization
Nature of technology	<i>What is the technology?</i>	Functionalities and capabilities of the technology	The functionalities and capabilities of social media related to knowledge sharing
Technology strategy	<i>Why adopt the technology?</i>	Motivation and vision behind the adoption and its likely value to the organization	The values/visions/motivations that drive individuals or groups to adopt social media for knowledge sharing
Technology -in-use	<i>How is the technology used to create changes on a day-to-day basis?</i>	The actual conditions and consequences associated with the daily use of the technology	The situated use of social media for knowledge sharing and its consequences

Based on the analysis of the three frame domains, we engage with the notion of inter-group congruence and incongruence. We use the term *congruence* to describe the consensus on the technological frames, and *incongruence* to describe the lack of consensus on the technological frames among different groups of stakeholders. Previous studies emphasize that incongruence between groups lead to radically different patterns of technological implementation and result in project failure or ineffectiveness (Barrett 1999; Hsu 2009). Therefore, a certain extent of congruence in frames across stakeholders is critical to aligning behaviors into similar patterns of use, and to ensure that information systems (IS) development projects and associated organizational change efforts will likely be more successful (Davidson 2006). For example, Barrett (1999) found that incongruence between information technology (IT) innovators and insurance brokers' frames related to an electronic trading system is the main contributor to high levels of resistance to and non-use of the system. Hsu (2009) examined how frame incongruence stimulated sensemaking about the need for the implementation of IS security

certification and emphasized the need of early intervention to align frames in order to achieve security effectiveness in the organization.

Nonetheless, some TFR studies also argue for a more nuanced understanding of ambiguity, incongruence, and inconsistency in technological frames (Azad and Faraj 2008; Mazmanian 2013; van Burg et al. 2013; Young et al. 2016). For instance, Mazmanian (2013) showed that even though groups may broadly share a congruent frame about a technology, very different trajectories of uses and consequences can still emerge. Rather than congruence in technological frames, van Burg et al. (2013) highlighted the importance of ambiguity in enabling knowledge exchange and innovation. Their study showed that ambiguity in frames helps to create a minimum level of agreement about the general goal and direction of actions yet leaves ample space for situated actions and motivations. Azad and Faraj (2008) added to the understanding of frame evolution processes and found that an aligned “truce frame” around a new technology can reduce ambiguity, foster joint understanding, and direct specific patterns of use. Young et al.’s study (2016) took the challenge even further by highlighting how between-group incongruences can interact with within-group inconsistencies in meaningful and influential ways in IT-enabled organizational change.

These recent studies on the productive role of incongruence in technology nature, strategy, and use align with the literature on adaptive governance, which advocates for the importance of ambidextrous practices towards learning and control in ensuring the adaptiveness and stability of inter-organizational collaboration. TFR allows for an in-depth account of the alignment between organizational interests and technology by unfolding stakeholders’ congruence and incongruence in how a technology is framed. In this sense, we find the concept of TFR insightful for understanding the effects of different stakeholders’ views and uses of social media for knowledge sharing on the emergence of adaptive governance.

4. RESEARCH DESIGN

To address our research question of *how views and uses of social media for knowledge sharing among different stakeholders shape the emergence of adaptive governance*, we present a case study of an open data initiative in China – the Shanghai Open Data Apps (SODA) – in which government, university, and industry stakeholders collaborate by using the social media platform WeChat for knowledge sharing. In the following, we introduce the case setting and describe our data collection as well as analysis method.

4.1 Case Setting

SODA is a municipal level contest in Shanghai City that invites individuals and organizations to compete in the development of public service applications utilizing the available open datasets of the Shanghai Municipality.¹ The contest, officially launched in August 2015, is the outcome of a collaboration among a group of organizations from government, university, and industry. The focus in this study is on the collaboration among the stakeholders involved in planning, organizing, and running the contest, and not on the contest itself.

We choose the collaboration behind the SODA contest as our case to understand the role of knowledge sharing technology in the emergence of adaptive governance for three reasons: first, the collaboration behind the SODA contest was formed to adapt to the rapid development in the movement of open data, which means that the collaboration faced pressure to enhance its adaptive capacity, providing us with opportunities to study the emergence of adaptive governance practices in inter-organizational collaboration. Second, the collaboration was

¹ The participants of the SODA contest need to solve a particular theme of challenge for the Shanghai Municipality using the dataset provided by local government agencies and companies. The winners are selected based on various criteria. For example, the theme of the challenge for SODA 2015 was “smart transport”. The datasets were provided by Shanghai Municipal Transportation Commission and public service companies such as Shanghai Public Transport Card CO., Shanghai Pudong New District Public Transport CO., and Shanghai Qiangsheng Intelligence Navigation Technology Satellite CO. There were 823 teams participated in the contest and 15 were selected as winners (Gao 2018).

constituted by stakeholders of various backgrounds and capabilities, providing a baseline for understanding diverse views on knowledge sharing practices. Third, the stakeholders' heavy reliance on the social media platform WeChat for knowledge sharing provides an appropriate setting for understanding the views and uses of knowledge sharing technology in the emergence of governance practices.

The collaboration of SODA went through two phases – idea formation and actual organization – during which the range of stakeholders expanded. In the first phase, the idea of SODA was formed among a group of eight stakeholders, who were affiliated with the municipal government (Shanghai Municipal Commission of Economy and Informatization (SMCEI)), two universities (Open Meta Nexus Innovation Lab (OMNILab) at Shanghai Jiaotong University, and Lab for Digital and Mobile Governance (DMG) at Fudan University), two state-owned enterprises (China Industrial Design Institute (CIDI) Shanghai, 021 Incubator), a small IT company (Enerlong), an IT start-up (Kesci), and a NGO (Open Data China). The stakeholders represented upper management in their respective organization, which meant they had access to key resources and knowledge and had the mandate to make decisions on behalf of the organization. The four stakeholders from the private sector were either CEOs or vice CEOs of their company. The two university professors were heads of labs and were both already collaborating with government and industry. The stakeholder from the municipal government was a Deputy Division Director who was connected to a large number of local companies as well as local agencies in Shanghai. The stakeholder from the NGO was the organization's founder, who was connected to a wide range of experts, and was specialized in the area of open data.

In the second phase of the SODA project, the stakeholders reached out through their personal or professional network, seeking partners and resources. The range of stakeholders grew considerably during this phase, consisting of approximately 50 stakeholders. Depending on

their level of engagement, the stakeholders were divided into four clusters: 1) the core organizing committee (i.e., the original eight organizers); 2) data providers; 3) other operational organizers (i.e., contest infrastructure providers); and 4) supervisors from central government. Stakeholders from these organizations engaged with a range of tasks, such as identifying the theme of the contest, disseminating, planning, and managing contest-related events, and selecting the contest winners.

The stakeholders primarily collaborated in a virtual environment, using the social media platform WeChat as the primary technology for knowledge sharing. WeChat is one of the most popular social media platforms in China. It integrates multiple built-in apps that can serve a wide variety of purposes, including chat, newsfeed, and peer-to-peer digital payments (Tencent Holdings Ltd. 2020). The stakeholders in this case primarily used the chat features for knowledge sharing. These features include: 1) instant messaging – an online chat function that allows and archives real-time text transmission over the Internet; 2) notification alert – a notification appears when the recipient receives a message; 3) file transfer and preview – files can be sent and previewed as a message; 4) grouping – chat with a group of selected people where the host of the group holds the admin rights to the group; 5) mention via the “@” feature – a specific group member can be mentioned within a group chat and will receive a notification alert. When the collaboration initiated in 2015, a chat group was set up for sharing initial ideas on the possible ways of collaboration amongst the stakeholders. At the time, there were eight stakeholders in the group, which was named ‘the organizing committee of SODA’. In 2015, during the first year of collaboration, the interactions in the chat group outweighed the offline interactions amongst the stakeholders (i.e., only two official offline meetings took place during this period of our observation).

Given the success of the first year’s SODA contest, it was decided that SODA would become an annual event. SODA has run for the fifth time in 2019 (“Shanghai Open Data Apps” 2019).

For this study, we use the data collected from the first year of the SODA project, when WeChat was used the most.

4.2 Data Collection

We conducted an in-depth case study (Walsham 2006), in which we employed a variety of data sources in order to capture stakeholders' framings of WeChat use in the organization of SODA. We focused on stakeholders' ideas and experiences in understanding how they framed their use of WeChat in vision and in practice (Feldman et al. 2004; Kendall and Kendall 2012). Sources of data included fifteen semi-structured interviews with the stakeholders, offline participant observations of meetings, online observation of conversations in WeChat groups, as well as documents linked to SODA's official campaign and evaluation. We provide an overview of the data sources in Table 2.

Table 2. Overview of Data Sources

	Informant²	Organizational affiliation	Title	Interviews (N)	Duration (minutes)
Interviews	Government 1 (G11)	SMCEI	Information Chief	2	21
					27
	University 1 (UI1)	DMG Lab	Professor	1	120
	University 2 (UI2)	DMG Lab	Lab member	1	63
	Industry 1 (II1)	CIDI Shanghai	Vice-CEO	2	43
					58
	Industry 2 (II2)	Kesci	CEO	1	78
	Industry 3 (II3)	Opendatachina.com	Director	4	30
120					

² We use the code name to refer to the informants in the rest of the paper. For example, G1, or [G1] refers to government informant 1.

					70
					120
	Industry 4 (II4)	CIDI	Secretary	2	30
	Industry 5 (II5)	Enerlong	CEO	1	106
	Industry 6 (II6)	021 Incubator	CEO	1	36
Observations	Type of observation		Participants		Duration (minutes)
	Online observations on WeChat including discussions of ideas and organization of tasks		All stakeholders		600
	Internal DMG Lab meetings		DMG lab members		180
	Road Show for SODA 2015 Final		All stakeholders, contest participants, public audience		720
	Review meeting for SODA 2015 and Plan meeting for 2016		SMCEI, CIDI Shanghai, OMNI Lab, DMG Lab, Kesci, Enerlong		180
Documents	Official campaign plan				
	Campaign materials				
	Stakeholder presentation slides				
	Evaluation reports				

Interview questions preliminarily focused on the planned and actual use of WeChat in order to capture the nuances of stakeholders' views and uses of WeChat for collaboration. During the interviews, we realized that the stakeholders used WeChat intensively for knowledge sharing. Open-ended questions were then asked regarding how knowledge was shared, for instance, what kind of knowledge the stakeholders shared with each other, how they experienced sharing knowledge with stakeholders from other sectors, and what was their overall impression of the role of WeChat in knowledge sharing. The duration of the interviews varied from 21 minutes to 2 hours. Shorter interviews were followed up by informal chats. All interviews were carried out in Chinese. The interviews were documented and transcribed with the interviewees' consent and then translated to English. The protocols used for the interviews are available from the first author upon request.

Participant observation, documented in the form of field notes, was conducted to uncover contextualized and otherwise inaccessible data so that we could capture the multiple organizational realities evoked by the use of WeChat (Locke 2011). The online observations included unobtrusive observation of the chat groups used by the core organizing group, where the stakeholders discussed ideas and organized tasks on a daily basis. Offline observations included the following: the internal meetings that took place among the university stakeholders; the road shows of SODA, where the first author engaged in informal conversations with different stakeholders; and the wrap-up meeting, where all organizing members presented and reviewed the organizing processes. The online and offline observations compensated each other by providing access to the diverse dynamics among the stakeholders.

4.3 Data Analysis

Our data analysis involved coding of the interview transcripts, fieldnotes, and documents collected about the collaboration, and developed through three broad steps.

The analysis began with coding separately government, university, and industry stakeholders' accounts of knowledge sharing activities and governance practices in the collaboration. For coding knowledge sharing activities, we used Charband and Navimipou (2016)'s definition as our sensitizing device (Klein and Myers 1999). For coding governance practices, we used the list of adaptive governance strategies proposed by Janssen and van der Voort (2016) as our sensitizing device. We chose to identify the groups as such based on our impression of the interviews, where the informants seemed to at times emphasize the differences between government, university, and industry stakeholders. At this stage, we paid particular attention to the different groups' views and uses of WeChat in these knowledge sharing practices as it appeared to be the main communication channel between the stakeholders.

After the initial coding, we started to see both converging and diverging patterns in the stakeholders' views and uses of social media for knowledge sharing in the collaboration. For the converging patterns, the stakeholders mentioned similar functionalities of WeChat such as “instant messaging”, “grouping”, “file transfer and preview”, “mention”, and “notification alert”. Nevertheless, their knowledge sharing practices around WeChat seemed to diverge in some situations. Some of the interviewees found the functionalities useful for “assigning tasks”, while others deemed the functionalities useful in “developing tasks”, “dividing tasks”, and “protecting information privacy”. Similarly, as the collaboration evolved, we identified diverging governance practices among the participants when it comes to “defining membership”, “defining ways of participations”, and “distributing decision-making authority”. These different patterns of views and uses of social media for knowledge sharing and as part of their governance practices prompted us to start the second step of analysis, where we further explored literature in order to sort out the codes derived from the first phase of the data analysis. After a few iterations of comparison between the codes and the literature, we chose to engage with the concept of TFR (Orlikowski and Gash 1994) to identify the stakeholders' views and uses of WeChat along the three different domains of nature of technology, technology strategy, and technology-in-use. In addition, we refined our reading of adaptive governance (Janssen and van der Voort 2016) to limit its characteristics to three core areas: participation, decision-making, and capability mobilization. We also relied on extant studies on government-university-industry collaboration (Bjerregaard 2010; Etzkowitz and Leydesdorff 2000; Etzkowitz and Ranga 2015), which suggest that the organizing practices of government, university, and industry stakeholders are often subject to different institutional logics, thus confirming our choice of the group divide.

Based on the insights from the literature, we constructed a coding book (see Table 3) to group the identified codes from the first phase of the analysis. For example, the codes “instant

messaging”, “grouping”, “file transfer and preview”, and “notification alert” were labeled as ‘nature of technology’. And the codes “developing tasks”, “dividing tasks”, and “protecting information privacy” were labeled as ‘technology-in-use’. We also used the concept of TFR, especially ‘technology strategy’ to recode our data, as the frames of technology strategy among the different groups of stakeholders were not identified during the first phase of coding. Similarly, we regrouped the codes on governance practices that derived from the first phase according to the core area of adaptive governance. The second step of data analysis resulted in a list of second step codes under the labels “nature of technology”, “technology strategy”, and “technology-in-use”, “participation”, “role and capability”, and “decision-making”.

In the last step, we compared the congruence and incongruence of the codes on “nature of technology”, “technology strategy”, and “technology-in-use” across the three groups of stakeholders. We then linked the patterns of congruence and incongruence in the framing of WeChat to the emergent governance practices along the three dimensions of “participation”, “role and capability”, and “decision-making”. The data analysis ended when we reached a saturation point, in which we had identified enough categories to describe the existing views and uses of WeChat for knowledge sharing among the three groups of stakeholders, and when we had reached sufficient insights into the emergent governance practices in the collaboration.

Table 3. Example of Code Book

Code	Description	Example
Nature of technology	The functionalities and capabilities of WeChat related to disseminating or transferring knowledge among stakeholders	“Instant messaging in WeChat is a good way to initiate conversations and to bring the discussion to some depth.” (G11)
Technology strategy	Values/visions/motivations that drive stakeholders to adopt WeChat for disseminating or transferring knowledge	“The main idea of using WeChat is to share ideas among us, plan together, and contribute together.” (G11)
Technology-in-use	The actual use of WeChat in disseminating or transferring	“People upload a task, get the feedback from others, take it offline, and then

	knowledge on a day-to-day basis and its consequences	upload it again, and basically the task is completed. It is always done within this two-online-one-offline routine” (II1).
Participation	How stakeholders define group membership in the collaboration	“People know WeChat is OK to use for this [SODA] because it is in many ways convenient. Things stay in the group, and if there are new members to join, we can create twin groups to include them while the old one remains exclusively for the old members. And if there are old members who may not be that relevant anymore, we could also do the same so things won’t turn awkward. [...] Things don’t always stay the same when it concerns this [open data], so one needs to learn to be flexible”. (II3)
Role and capability	How stakeholders identify with and modify their roles as well as the technical and managerial skills needed to fulfill these roles in the collaboration	“The so-called labor divide between us was not settled until quite late. There is no clear division of jobs or tasks in the group. Apart from the government’s job, which is clear. For other stakeholders, it is just people sharing and making efforts together” (GI1).
Decision-making	How stakeholders make decisions through WeChat	“People who do it the old way in the government, they always have meetings. You don’t often see people doing other things but talking. [...] But what we have here is a much more diverse team where people come with a lot of different backgrounds. What we do is just chatting on the Internet [i.e., WeChat], yet we are still very efficient, and we get things done!” (GI1)

5. FINDINGS

In order to address our research question, in this section we first identify each of the three stakeholder groups’ technological frames of social media (see Table 4). We then highlight the patterns of congruence and incongruence between the technological frames before presenting the emergent governance practices that are linked to the patterns of congruence and incongruence (see Table 5).

5.1 Mapping Social Media Technological Frames

5.1.1 Nature of Technology: Framing Social Media Functionalities

During interviews and observations, government, university, and industry stakeholders exhibited similar views regarding the knowledge sharing-related functionalities and capabilities of social media; i.e., *what* is the technology. They considered the social media platform WeChat as a knowledge sharing platform that primarily consisted of five functionalities: *grouping, instant messaging, file transfer and preview, notification alert, and mention.*

All stakeholders viewed *grouping* as a fundamental functionality that facilitated knowledge sharing to happen among a group of stakeholders of different organizational backgrounds. From the government's point of view, the grouping feature allowed stakeholders to connect, and thus opened up for participation that was previously external to the organizational boundaries of government. Similarly, industry and university stakeholders believed that the grouping feature enabled knowledge sharing by providing a common platform for different organizations to communicate across time and space.

At the same time, the stakeholders also considered grouping as a functionality of WeChat that constrained who and how they could share knowledge amongst each other. First, the stakeholders believed that the grouping functionality divided the collaboration from "a big world" into "many smaller worlds" [UI1], which created silos among the stakeholders. For instance, SMCEI managed its contacts with industrial partners through separate chat groups that were parallel to the SODA core-organizing group. Stakeholders that belonged in the core organizing group could not communicate with SMCEI's industrial contacts without the mediation of SMCEI. Second, the grouping functionality also confined knowledge sharing within the boundary of each group. For example, seeing the positive side of this confinement,

industry informant III1 noted: “[Within the group] we do not have to be concerned about privacy. If we don’t invite other people, then the conversation just stays between us”.

When it came to group communication, the stakeholders saw *instant messaging, file transfer and preview*, and *notification alert* as important functionalities for enabling knowledge sharing, by supporting active communication, creating a common working space, and fostering equal membership. For example, government stakeholders reported that they generally saw *instant messaging* enabled real-time interactions among the stakeholders. As government informant 1 [GI1] put it: “Especially at the beginning when establishing contacts with companies or institutions, instant messaging in WeChat is a good way to initiate conversations and to bring the discussion to some depth”. In situations when real-time interaction was not possible, stakeholders saw *notification alert* as a way to share discussions with those not being able to participate at a particular time. As put by GI1: “People are often busy with their own tasks, which makes it difficult to have meetings. The chat group makes it rather flexible because we can see the notifications when we come back from meetings and get informed on what is going on”.

As the project developed, the stakeholders also relied on the *file transfer and preview* functionality to archive, access, and get feedback on work-in-progress. Describing the process of task development, GI1 noted: “People who come up with an idea, they take home the tasks with them. Once it is done, they can put it back in the group [as a document file] and we all can contribute to improving it. Then they take it back and have a second revision, and so on. People usually give feedback quite fast”. By doing this, the stakeholders could co-develop tasks via “real-time interactions” between stakeholders [III1].

5.1.2 Technology Strategy: Developing Social Media Strategies

At the beginning of the collaboration, government, university, and industry stakeholders expressed their shared aspiration to *connect* across working spaces and time, regardless of their organizational affiliation and work norms. This vision, i.e., the *why* of adopting the technology, drove all three groups of stakeholders to engage with WeChat for knowledge sharing by creating a common online space (i.e., the chat group) for real-time interaction. Government informant GI1 expressed this vision with a real-life example: “We are all very busy and we have to attend other work or go on business trips. With WeChat, we no longer need to have [physical] meetings all the time. So, WeChat is good in the sense that if we were not present when things were discussed, we can always come back and comment on what other people said. It happened a lot. For instance, once Prof. Z. was attending a conference in Beijing, we could still discuss via WeChat when he had time”.

As the quote from GI1 suggests, the stakeholders’ motivation to connect via WeChat was closely linked to their strategic interests in *idea mining and resource exchange* amongst each other. By connecting stakeholders from different organizational backgrounds, the stakeholders adopted WeChat as an important platform for pooling together ideas and resources from different fields of expertise. As GI1 explained, “The main idea of using WeChat is to share ideas among us, plan together, and contribute together”. As the collaboration developed and the number of tasks increased, *idea mining and resource exchange* were particularly valued by industry stakeholders and university stakeholders, who were mostly in charge of task management and project coordination. Driven by the need to collect feedback and allocate resources for task development, industry stakeholders used WeChat intensively for enabling knowledge sharing. Considering that SODA was an informal collaboration at the time (in 2015), it was particularly important for the industry stakeholders to expand their networks to channel financial and human resources. As UI1 mentioned: “In a way, it doesn’t matter to CIDI which

organization these people come from, as long as they are trusted [...]. And WeChat provides a platform for these people of different organizational backgrounds to chip in their ideas”.

Meanwhile, constant connectivity and participation also caused concerns among industry stakeholders. Increasingly involved in task management and coordination, industry stakeholders soon ran into difficulties in getting an overview of tasks. II1 repeatedly brought this matter up in the interviews: “The thing about WeChat is that it is very efficient for discussion. But WeChat is more of a laundry list of details. As a coordinator, I need to understand what has been discussed, and sort out the thread in the chat. I need to be clear about what events have been discussed and at what time to finish which tasks. I just need to keep an account of what took place on WeChat, and this can really give you a headache!” Similarly, industry informant 3 [II3] framed the possibilities of increasing connectivity and exchange of ideas and resources as a challenge, rather than an opportunity, in organizing the collaboration: “This [using instant messaging for collaboration] is a new organizational challenge. The organizational structure becomes very flat. The information flows to everywhere”.

The industry stakeholders’ concern of losing sight of tasks and control of knowledge flow eventually drove them to shift their interest in adopting WeChat to constrain knowledge sharing for more *effective task management* in the collaboration. University stakeholders experienced a similarly strategy shift, as they also took active part in task execution. These strategy shifts among university and industry stakeholders also led to shifts in their use of WeChat for knowledge sharing, which we discuss next.

5.1.3 *Technology-In-Use: Agreeing on Daily Usage of WeChat*

Despite having different motivations for adopting WeChat, stakeholders were observed using WeChat at various occasions in their daily work. In this section, we describe *how* WeChat was

used on a day-to-day basis in *participatory* and *targeted task assignment*, *task division*, *task development*, *triggered attending*, and *information protection*.

In daily operations, government stakeholders mostly used WeChat for *participatory task assignment*. This was due to the fact that the creation and assignment of the tasks, especially at the beginning of the collaboration, heavily relied on the sharing of project-related knowledge in the chat group. As G11 mentioned, “We chat a lot on WeChat. It is often so that whoever comes up with a certain idea in the group claims the task. We are quite lucky to have committed people; people didn’t stop contributing because of the task they had to complete”.

Meanwhile, as the university and industry stakeholders took active part in *co-developing tasks*, they also reported occasions in which people had misunderstandings of who was the responsible stakeholder for a certain task. For example, in situations where multiple stakeholders proposed to contact potential sponsors, it became unclear who should make the contacts. Such challenges appeared in situations when the stakeholders were inundated with multiple ongoing discussions and task assignments, and when university and industry stakeholders failed to see what their responsibilities were.

To better supervise task execution, industry stakeholders reported using WeChat for *targeted assignment of tasks*. For instance, secretary I15 reported that as collaboration progressed, she started to get mentioned more via the “@” symbol when there was a specific task targeted at her. Whenever she was mentioned with the “@” symbol, she received a notification alert from WeChat saying: “you have been mentioned in a group chat”. Then she knew the information was directed to her.

Meanwhile, some stakeholders also used the “@” symbol to disengage from the discussion, and responded only when directly mentioned, and ignored the rest of the conversations – a social media-enabled phenomenon also labeled as *triggered attending* (Majchrzak et al. 2013,

p. 42). I15 for instance reported that even though she was included in the SODA core chat group, she did not participate in the conversation as much as the other members of the group who were in management positions. She only responded when directly mentioned with an “@” symbol in the group.

As the number of tasks increased in the collaboration, industry stakeholders also used the grouping feature for *task division* to manage the tasks more efficiently. For example, at the beginning of our study, we were introduced to the industry stakeholder as a research group brought in to evaluate the collaboration of SODA. One of the industry stakeholders, who got assigned to help us to get access to informants, then placed us into a separate chat group with the informants we needed – i.e., the vice CEO of CIDI, his secretary, and sub-contractor – rather than with the core organizing group. Dividing groups as such effectively segregated the people and knowledge needed for different tasks, making it more efficient for the stakeholders to manage different tasks at the same time.

The university stakeholders also emphasized the importance of group division for *information protection*. From the university stakeholders’ point of view, as new stakeholders joined the collaboration, they paid particular attention to “respect and protect different stakeholders’ interests” [UI2]. And the way they chose to protect different stakeholders’ interests was to segregate stakeholders into different groups based on their shared interests or the lack thereof and share certain knowledge only within relevant groups. For example, when new government officials proposed to partake in the online discussion, the existing stakeholders invited the officials into a new chat group. The previous stakeholders continued discussions in the old chat group while sharing a summary of their discussions in the new group with the officials. By doing so, the previous stakeholders temporarily constrained knowledge sharing among themselves, and prevented potential conflicts of interests with the newcomers.

5.2 Congruence and Incongruence in Social Media Framing

Based on the analysis, we have identified patterns of congruence and incongruence in the three framings across the involved stakeholder groups. Regarding the *nature of technology*, we find that there is an overall congruence between the framings held by government, university, and industry stakeholders. The three groups of stakeholders agreed that the WeChat functionalities of *grouping, instant messaging, file transfer and preview*, as well as *notification alerts* could enable knowledge sharing. At the same time, all three stakeholder groups considered *grouping* as a potential constraint to knowledge sharing among a broad audience.

Regarding *technology strategy*, there is a mixture of congruence and incongruence between the three groups of stakeholders. While all three groups initially agreed that the visions and motivations of *connectivity* and *idea mining and exchange* drove the adoption of WeChat for knowledge sharing, only the government stakeholder group stuck to this strategy. The industry and university stakeholders shifted their strategies at a later stage of collaboration. The involvement of industry and university stakeholders in operation pushed them to only share task-related knowledge with the designated task executor to ensure effective task management, making their strategy incongruent with that of government stakeholders.

Regarding *technology-in-use*, we find more pronounced incongruence in framings among the three stakeholder groups. Government stakeholders used WeChat mostly for *participatory assignment of tasks*, using WeChat to enable knowledge sharing. Industry and university stakeholders also enabled knowledge sharing by *co-developing tasks*. However, as the collaboration developed, their use of WeChat was largely geared towards activities that constrained knowledge sharing, such as *targeted tasks assignment* and *triggered attending* through the use of “@” symbol, and *information protection* through the segregation of chat groups.

Table 4. Technological Frames of WeChat Use for Inter-Organizational Knowledge Sharing

	Nature of technology		Technology strategy		Technology-in-use	
	Enable knowledge sharing	Constrain knowledge sharing	Enable knowledge sharing	Constrain knowledge sharing	Enable knowledge sharing	Constrain knowledge sharing
Government	Grouping; Instant Messaging; File transfer and preview; Notification alert	Grouping	Connectivity; Idea mining and resource exchange	N/A	Participatory task assignment	N/A
Industry	Grouping; Instant Messaging; File transfer and preview; Notification alert	Grouping	Connectivity; Idea mining and resource exchange	Effective task management	Task development	Targeted task assignment; Triggered attending; Task division
University	Grouping; Instant Messaging; File transfer and preview; Notification alert	Grouping	Connectivity; Idea mining and resource exchange	Effective task management	Task development	Information protection

5.3 Governance Response

As the collaboration evolved, we saw a growing divergence in the stakeholders' framings of technology strategy and technology-in-use. Nonetheless, the stakeholders were still able to deliver tangible results throughout the duration of the project. To understand how, we looked into the stakeholders' governance practices on participation, capability mobilization, and decision-making (Janssen and van der Voort 2016). We found that the stakeholders engaged in three governance practices – selective participation, role and capability identification, and ad hoc decision-making – through which they made sense of and reconciled the mix of congruence and incongruence in technology framings.

5.3.1 Selective Participation

One of the governance practices that emerged among the three groups was *selective participation*. At the beginning of the collaboration, the participating stakeholders brought in additional knowledge and resources by expanding the range of stakeholders and encouraging the participation of new stakeholders. However, to prevent potential conflicts of interests, the existing stakeholders also controlled what knowledge to share and whom to share it with. The stakeholders' views were congruent on the nature of WeChat (i.e., enabling and constraining knowledge sharing), reflecting stakeholders' expectations with regards to the range and the specific ways of participation.

Through the analysis of the stakeholders' views of the nature of WeChat, we found that the stakeholders (i.e., GI1, II3, II4, UI1) shared a strong belief in SODA as a collaborative project. From the government's perspective, SODA was a project that was co-developed by the stakeholders in the core organizing group. As GI1 clearly articulated, "there is no owner of SODA among us. We all contribute and we co-own it". Similar views came across in our interviews and informal conversations with the director of the NGO II3 and the university

professor U11. They both emphasized that SODA was a “collaborative work within the whole committee [the core organizing group]” [II3], rather than “the work of a single organization” [II3]. Moreover, industry stakeholder II4 also mentioned that the expansion of the network was necessary for the project development: “The people in the core group have brought their own resources [...] these people are like hubs in the network, they all have their own circles and networks that they can introduce”. II4 specifically emphasized the importance for the network to stay open when further developing the project: “I don’t really care about whether it is a specific type of organization or an individual. As long as they can make things work, we welcome them all. It is really about this idea of being open”.

We also find that the stakeholders’ view of WeChat as a platform that constrains knowledge sharing reveals their anticipation of changes in the collaboration, and their shared interests in adapting the collaboration to such changes. As industry stakeholder II3 put it, “people know WeChat is OK to use for this [SODA] because it is in many ways convenient. Things stay in the group, and if there are new members to join, we can create twin groups to include them while the old one remains exclusively for the old members. And if there are old members who may not be that relevant anymore, we could also do the same so things won’t turn awkward. [...] Things don’t always stay the same when it concerns this [open data], so one needs to learn to be flexible”.

Along this line, the congruence in stakeholders’ framing of WeChat as a knowledge sharing platform that both enable and constrain knowledge sharing reveals that the stakeholders shared two related but somewhat opposing interests in coordinating the range and ways in which stakeholders participate. On the one hand, the stakeholders viewed WeChat as a platform that could enable knowledge sharing through functionalities such as instant messaging, file transfer and preview, notification alert, mention, and grouping. Such a congruent framing reflects and reinforces the stakeholders’ shared interest in growing the membership and strengthening the

connection of participation in the collaboration in order to spot and internalize developments. On the other hand, as stakeholders anticipated changes in the membership and dynamics of collaboration, a control mechanism was also implied in the stakeholders' framings of WeChat's functionality (i.e., through the grouping feature).

5.3.2 *Role and Capability Identification*

As the collaboration developed, we have identified another emergent governance practice – *role and capability identification* – among the three stakeholder groups. During the collaboration, stakeholders did not only identify with but also constantly modified their roles and skills (e.g., technical or managerial ability) needed to fulfil these roles. We observed this governance practice in relation to the mix of congruent and incongruent framings of *technology strategy*.

At the beginning of the collaboration, all three groups of stakeholders recognized that they relied on each other's capabilities to co-develop an open data project. For instance, government stakeholder GI1 emphasized the importance of combining the capabilities of different stakeholders: "Government follows formal procedures, where we don't consider sponsorship, don't publish advertorials, and we don't use the kind of language that the market uses. The government's campaign is often more formal. Companies don't have enough credibility to motivate other agencies to open their data. And university has all the novel ideas. We therefore need to bridge these needs". This view of compensating capabilities was echoed by industry stakeholder II2's view that the exchange of capabilities between different groups of stakeholders was a "win-win" approach. University stakeholders UI1 and UI2 also shared a similar view by emphasizing the importance of "crowdsourcing" in the collaboration.

As the collaboration developed, a division of roles between the stakeholders started to emerge, where government stakeholders took the steering role and the non-government stakeholders

took the operational roles. Identifying different roles for themselves, the stakeholders started to see different values in adopting WeChat. Government stakeholders used WeChat to engage other groups of stakeholders to partake in tasks; consequently, they used WeChat to enable knowledge sharing by sharing resources and contacts with the other stakeholders. Both industry and university were task-executers in mind (e.g., targeting task assignments) because their roles were to manage the operation of the project and complete tasks. Hence, they were more inclined to consider WeChat strategically as a tool to control knowledge sharing. The divergence widened at the end of the project in 2015 as the number of operational tasks increased.

We see the mix of congruent and incongruent framings of technology strategy as a result of shared goal of collaboration and divergent needs for managing the operations. As we have seen above, the framings of technology strategy for knowledge sharing were partly congruent in terms of the goal of collaboration, that is, to co-develop an open data project, drawing on each other's help. Therefore, strategically it was a must for the stakeholders to adopt WeChat for connectivity, idea mining, and exchange (See Table 5). However, when it came to execute operational tasks, government and non-government stakeholders identified with different roles and capabilities, based on which they engaged in divergent strategies for adopting WeChat.

5.3.3 *Ad-Hoc Decision-Making*

The third emergent governance practice is *ad-hoc decision-making*. In the analysis, we identified multiple decision-making authorities in different daily operations, which ensured the stakeholders' autonomy to make use of their own tacit knowledge and hence solving problems in a timely manner. This particular governance practice was manifested in the overall incongruence among stakeholders' framings of *technology-in-use*.

As we have mentioned above, in daily operation, the stakeholders' roles and interactions could shift from situation to situation. For example, industry stakeholder II1 could use WeChat to

encourage the participation of other stakeholders in situations where III needed ideas to co-develop tasks. But in other situations where III needed someone to execute a specific task, WeChat was used to direct knowledge sharing to a specific person in order to manage task assignment more efficiently.

These varied uses of WeChat during collaboration gave rise to multiple decision-making authorities and discursive decision-making processes in the collaboration. In our case, there was no pre-determined decision-maker or a formal reporting procedure in the collaboration. Even though in the local context, government stakeholders often had decision-making authority in the collaboration with non-government stakeholders, during the collaboration of SODA, decision-making was organized in an ad-hoc manner. For instance, government stakeholder G11 contrasted her previous experiences of public private collaboration with the current collaboration in SODA: “People who do it the old way in the government, they always have meetings. You don’t often see people doing other things but talking. [...] But what we have here is a much more diverse team where people come with a lot of different backgrounds. What we do is just chatting on the Internet [i.e., WeChat], yet we are still very efficient, and we get things done!”

Meanwhile, the stakeholders still imposed control and evoked hierarchical order when deemed necessary. As the collaboration started to materialize into offline events and campaign, decision-making needed to involve higher-level officials who were not part of the core-organizing group. In order to accommodate this situation, the stakeholders established a new group with the original group members and higher-level officials. They kept the discussions in the original group and only summarized the relevant information in the new group to inform the officials. Our observation suggests that stakeholders contingently decided on whether or not to share certain knowledge, depending on their role and relations with other stakeholders in a particular situation.

Overall, our observation suggests that, as the range of stakeholders expanded and their interaction changed, the stakeholders had to juggle different roles, giving rise to contingent framings of technology use. These incongruent framings resulted in multiple decision-making authorities in the collaboration so that the stakeholders could make use of their tacit knowledge in a timely manner. The stakeholders sometimes also voluntarily evoked hierarchical order and imposed control on the decision-making process when it was necessary, making the collaboration more adaptive to different dynamics between the stakeholders. Table 5 summarizes the relationship between patterns of congruence and incongruence between stakeholders' framings, and the emergent governance practices.

Table 5. Emergent Governance Practices as Response to Patterns of Framing (In)Congruence

Framing dimension	Congruence/Incongruence between stakeholders' framings	Emergent governance practices	Examples
Nature of technology	<i>Overall congruence</i>	Selective participation	Existing group members introduced new members to the group to take advantage of the diversity of knowledge and resources Existing group members placed new members into different groups to avoid potential conflicts of interests
	All stakeholders were aware that WeChat can be used to both enable and constrain knowledge sharing		
Technology strategy	<i>Mix of congruence and incongruence</i>	Role and capability identification	Stakeholders drew on each other's identified capabilities to complete tasks at the beginning of the collaboration Stakeholders identified their roles as the collaboration developed, and specified their needs for new capabilities
	At the beginning of the collaboration, all stakeholders were motivated to adopt WeChat to enable knowledge sharing by improving connectivity and sharing ideas As collaboration developed, industry and university stakeholders shifted their strategy by focusing on how to better manage operational tasks		

	on WeChat, hence constraining knowledge sharing		
Technology -in-use	<i>Overall incongruence</i>	Ad hoc decision-making	At the beginning of the collaboration, there was no pre-determined decision-maker within the collaboration As the collaboration progressed, multiple decision-making authorities emerged
	Government stakeholders used WeChat to enable knowledge sharing in assigning tasks to other stakeholders on-the-go Industry and university stakeholders used WeChat to enable knowledge sharing in developing tasks only at the very beginning of the collaboration As the collaboration progressed, industry and university stakeholders used WeChat to constrain knowledge sharing in accomplishing tasks and protecting information privacy		

6. DISCUSSION AND CONCLUDING REMARKS

The findings reveal a mix of congruent and incongruent framings of WeChat among the stakeholders. By showing how the stakeholders' framings of social media shaped the emergent governance practices in an inter-organizational collaboration, this study contributes to research on the conceptualization of adaptive governance and to the theory of TFR. Furthermore, our study has implications for inter-organizational collaboration in practice, which we will elaborate on next.

6.1 Summary of Findings

Our findings can be summarized under three overall headings. First, the analysis shows that, with a congruent understanding of the nature of WeChat, the stakeholders came to a shared practice of selective participation in developing the collaboration. In our case, while all stakeholders recognized the importance of WeChat in enabling knowledge sharing, they also

emphasized the need for controlling the knowledge being shared. In particular, it was important for the stakeholders to maintain control of the range and extent of knowledge sharing as participation widened. This means that existing stakeholders were able to continuously adapt to external developments by absorbing new stakeholders, while at the same time ensuring the stability of the collaboration by avoiding potential conflicts of interests. Our findings concur with previous studies on the importance of widening participation in inter-organizational collaboration to spot and internalize developments (Janssen and van der Voort 2016). Our findings also show the importance of control in the stakeholders' efforts to widen participation, as the disparity between the stakeholders' goals can hinder the effectiveness of adaptive governance (Ganapati and Reddick 2018).

Second, our findings show that the stakeholders' motivations to use WeChat changed as the collaboration developed, resulting in a mixed pattern of congruent and incongruent framings of technology strategy. We argue that the development of adoption strategies triggered the governance practice of role and capability identification. In our case, even though the stakeholders adopted WeChat for similar reasons at the beginning of the collaboration, as the collaboration developed, different patterns of social media use emerged among the stakeholders. These different uses brought awareness to the stakeholders with regards to the different roles they played and the capabilities they possessed in developing the collaboration, driving them to reflect and adjust their motivations to adopt WeChat for knowledge sharing. The previous conceptualization of adaptive governance shows that mobilizing capabilities is important for the stakeholders to spot changes (Janssen and van der Voort 2016). Our findings show that prior to capability mobilization, stakeholders identify their roles and capabilities that form the basis for adapting to changes as the collaboration progresses.

Third, our findings show that stakeholders used WeChat differently in daily practice, which allowed decisions to be made in an ad hoc fashion. Previous conceptualization of adaptive

governance suggests that bottom-up decentralized decision-making is key to ensuring the adaptability of the collaboration, as it allows stakeholders to act fast based on the knowledge they have at hand. Yet, empirical studies have informed us that bottom-up decentralized decision-making does not always lead to effective collaboration (Hong and Lee 2018a). Our findings suggest that the decision-making authority depends on what types of decisions are at stake, and who the stakeholders are in relation to a specific decision. For instance, in our case, when it came to daily operations, the stakeholders often had the autonomy to decide what actions to take and how to use social media accordingly. Nonetheless, when it came to important decisions that may undermine the government's accountability, the stakeholders referred to higher-ranking officials as the decision-making authority by sharing information in a specific chat group. Therefore, we argue that the incongruent uses of social media allowed stakeholders to engage in ad hoc decision-making, in which both decentralized and centralized decision-making are crucial for the adaptability of the collaboration efforts.

6.2 Contributions to Research

Our findings provide three contribution to research. First, we unfold the role of knowledge sharing technology in the emergence of adaptive governance. Previous literature suggests that knowledge sharing is vital to the emergence of adaptive governance (Chaffin et al. 2014) but does not account for the role of technology in this process. The few studies that have touched upon technological mediation of knowledge sharing suggest that technology plays a determinant role in exploiting the fragmented knowledge and resources (Dietz et al. 2003).

Adopting a social constructivist view of technology (i.e., TFR), our findings suggest that adopting knowledge sharing technology does shape the emergence of adaptive governance. However, it does so not because the technology necessarily leads to more shared knowledge among the stakeholders. Rather, using knowledge sharing technology pushes the stakeholders

to make sense of their assumptions, expectations, and experiences of knowledge sharing (i.e., what, how, and why) in different situations, which then allows them to identify roles and capabilities, define who to share knowledge with, and choose decision-making authority based on the situations they are in.

This study also sheds light on the question of consensus in adaptive governance (Chaffin et al., 2014). Our findings suggest that ambiguity in the frames of knowledge sharing technology, rather than an overall consensus or congruence, is more important for cultivating governance practices, especially in a newly formed inter-organizational collaboration setting. We show that having partial consensus or congruence of knowledge sharing technology can be sufficient for the stakeholders to develop adaptive governance.

Second, we elaborate on the characteristics of adaptive governance in socio-technical systems. The notion of adaptive governance has only been recently conceptualized in the management of socio-technological systems (Janssen and van der Voort 2016). Empirical studies suggest that the characteristics of adaptive governance are contingent and may change under certain conditions (Hong and Lee 2018a; Wang et al. 2017). We contribute to the conceptualization of adaptive governance by mapping the emergent governance practices in an empirical case of inter-organizational collaboration that is mediated through knowledge sharing technology.

Consistent with the previous conceptualization (Janssen and van der Voort 2016), our findings show that the stakeholders had a strong interest in learning and knowledge sharing at the beginning of the collaboration, to widen participation, diversify capabilities, and decentralize decision-making. However, as collaboration developed, the stakeholders emphasized more control in the governance practices by engaging in targeted participation, group segregation, role identification, and centralized decision-making. Our findings confirm the previous conceptualization of adaptive governance as a range of practices on participation, capability mobilization, and decision-making that move along a spectrum between learning and control.

Third, our findings allow us to articulate some contested points regarding the TFR framework (Davidson 2006). In the original formulation of the framework, incongruence of technological frames have been linked to negative effects (Azad and Faraj 2008; Barrett 1999). Our study critically revisits this assumption by providing evidence of an effective – and so far, sustainable – use of social media for knowledge sharing that builds on a mix of congruent and incongruent technological frames. We concur with recent TFR studies that advocate for the enabling role of ambiguity (Hsu 2009; Mazmanian 2013; van Burg et al. 2013; Young et al. 2016) by demonstrating that the effects of incongruence can be productive.

6.3 Implications for Practice

Our study also has three implications for practice. First, our study shows that the emergent governance practices are derived from the interactions between different groups of stakeholders as well as the social and technical components of knowledge sharing. Thus, when managing inter-organizational collaboration, stakeholders should pay particular attention to relevant social groups, observe closely the interactions between these groups, and facilitate emergent ways of coordination. Such practices should stand instead of the imposition of top-down policies to unify social media use among the stakeholders.

Second, from the findings we know that incongruence, or lack of consensus, on views and uses of social media for knowledge sharing can play a productive role in ensuring the effectiveness of inter-organizational collaboration in solving complex issues. Thus, during the initial phase of collaboration, project managers should allow different groups of stakeholders to explore ways of social media use that are suitable for their own needs. Nonetheless, it is also worth noticing that the ambivalent uses of social media for knowledge sharing might introduce unintended consequences, such as conflicts and confusion as the project moves along and new stakeholders take part. Project participants thus need to take into consideration the different

situations and facilitate the reflection and articulation of the shifting roles during the collaboration.

Third, the emergent technological framings of social media also have implications for the design of the technology. By eliciting what social media means to different users in the collaboration, developers can gain a better understanding of how to enhance the collaboration-specific features in the design of social media. For example, developers could diversify the options of grouping features to accommodate different needs of access control, to organize the relations between groups, and to prioritize the notification of activities in certain groups.

6.4 Limitations and future research

It is important to note that our findings in this study are based on a particular kind of inter-organizational collaboration and a specific knowledge sharing technology. Thus, readers should be careful in generalizing the findings of this study to other types of inter-organizational collaboration and knowledge sharing technologies. In the future, research should look into the framings of other types of knowledge sharing technologies (e.g., Slack), or collaboration at a different scale (e.g., global collaboration), to understand how the framings of knowledge sharing technology shape the emergent governance practices.

In addition, future research can extend our findings on the emergent governance practices by taking a longitudinal approach to observe changes over time. For example, it could be interesting to investigate how government and non-government stakeholders in inter-organizational collaboration can reconcile the disparity between their goals via knowledge sharing technology when new stakeholders join the collaboration. It would be relevant to understand what motivates stakeholders to exchange capabilities as the collaboration develops. In addition, future studies can unfold the different governance modes at play and investigate

how they can be connected and integrated in inter-organizational collaboration via knowledge sharing technology.

Some of our data suggest that, as collaboration develops, stakeholders become aware of inconsistent framings within their own group, as well as the similarity across groups. These within- and cross-group inconsistencies can potentially lead to the reconfiguration of grouping among the stakeholders and give rise to new groups. In line with the study by Young et al. (2016), we recommend authors to study how the interplay between intra- and inter-group technological frames influences the grouping of the stakeholders over time and its implications for the governance of inter-organizational collaboration.

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