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Inter-agency information sharing for Chinese e-government development: a comparison between vertical and horizontal dimensions

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ABSTRACT

Effective inter-agency information sharing can facilitate the internal administration and external service delivery of government agencies, as well as help them address some complex social issues and then promote social development. Thus, how to promote the success of inter-agency information sharing has attracted the attention of researchers and public administrators. A lot of research has investigated the influential factors of inter-agency information sharing; however, few studies have taken account of the governmental administrative systems, which may influence the collaborations among agencies. Given the composition of the Chinese governmental administrative systems, this study investigated and compared the factors that influence the inter-agency information sharing in vertical and horizontal dimensions. An extended technology–organization–environment (TOE) framework was used to organize the influential factors. The results show that marked differences in influential factors between vertical and horizontal inter-agency information sharing indeed exist.

1. Introduction

As more and more public services are provided via information and communication technologies, government agencies have recognized the critical role of inter-agency information sharing (Fan & Jiang, 2016), which is closely related to the integration stage of e-government development (Layne & Lee, 2001; Yang & Wu, 2014). In China, the development of e-government started in the 1980s and has made substantial progress (Cooley, 2018). However, inter-agency information sharing is still a big challenge for its development. According to the investigation of Zhang et al. (2015), the top three key issues of Chinese e-government development are all related to inter-agency information sharing. Moreover, even though inter-agency information sharing has been achieved in some businesses (Fan et al., 2014), citizens and enterprises still need to interact with various government agencies. Additionally, proactive government service delivery also asks for inter-agency information sharing (Scholta et al., 2019).

The General Office of the State Council of the People's Republic of China (2018) issued the notification on '*Further Deepening "Internet + Government Affairs Services," Promoting the Reform of Governmental Affairs Services "One Network, One Door, One Time"*', which highlighted the necessity and future direction of inter-agency information sharing in Chinese e-government.

Government agencies at all levels have tried to achieve inter-agency information sharing and provide 'one-stop services' (Liu & Zheng, 2018; Zhang et al., 2017). Consequently, citizens would be required to make fewer visits to government agencies through more information exchange among agencies. Moreover, government agencies hope to achieve scientific decision-making, precise governance, and efficient public service delivery through inter-agency information sharing (Gil-Garcia et al., 2019; Gil-Garcia & Sayogo, 2016; Twizeyimana & Andersson, 2019). Solving some complex social issues that are beyond the capabilities of a single agency also needs inter-agency information sharing and collaborations (Gil-Garcia et al., 2019), such as the aging problems, the novel coronavirus control. Therefore, investigating the influential factors of inter-agency information sharing is critical and timely for the further development of Chinese e-government.

Inter-agency information sharing can be divided into two dimensions: vertical and horizontal (Fan, 2013). These two dimensions correspond to the 'TIAO' and 'KUAI' in the Chinese governmental administrative systems, respectively (Fan et al., 2014; Fan et al., 2019). The functions and relationships of participating agencies between the two dimensions are different. In the vertical dimension, agencies' functions are similar, and the relationships in this dimension are 'leadership relations' (Chen et al., 2020; Fan et al., 2014; Mertha, 2005); whereas the functions of agencies in the horizontal dimension are varied, and agencies collaborate by negotiation (Fan et al., 2014; Michels & Meijer, 2008). Compared with other contexts, the TIAO-KUAI segmentation and hierarchy contribute to the uniqueness of the Chinese governmental administrative systems (Chen et al., 2020). This uniqueness makes that vertical inter-agency information sharing is easier than horizontal inter-agency information sharing (Chen et al., 2020; Fan et al., 2014).

Furthermore, the differences in organizations' functions and inter-organizational relationships bring the differences in influential factors of inter-agency information sharing between the two dimensions. For example, different functional specialties in the horizontal dimension may indicate different organization cultures. It is difficult to carry out information sharing among agencies in different cultures (Drake et al., 2004). As to the relationships, the high-level agencies could exert coercive pressure to make low-level agencies behave as expected in vertical inter-agency information sharing (Zheng et al., 2013), while this cannot occur in the horizontal dimension. Thus, the vertical and horizontal inter-agency information sharing should be discussed separately in the Chinese context.

Existing research has demonstrated the differences between vertical and horizontal dimensions in terms of information sharing boundaries and type selections (Yang et al., 2012; Yang et al., 2014). Several studies also have mentioned the different dimensions of inter-agency information sharing (e.g. Chen et al., 2020; Fan et al., 2014; Fan et al., 2019; Fan & Jiang, 2016). All of these studies indicate that information sharing in vertical and horizontal dimensions should be considered separately, but most of the previous studies on influential factors did not distinguish the two dimensions (e.g. Fan et al., 2014; Fedorowicz et al., 2010; Yang & Wu, 2014). Moreover, although the study of Fan (2013) specified the dimension, only horizontal inter-agency information sharing for e-government development was studied. The factors influencing agencies' willingness to share information in the vertical dimension and the differences between the two dimensions have not yet been discussed. To fill these research gaps, we focus on the following questions in this study:

> RQ1: Why are government agencies willing or unwilling to share information in vertical and horizontal dimensions for e-government development?

> RQ2: What are the similarities and differences of the influential factors between the two dimensions?

The rest of this paper is organized as follows: Section 2 describes the theoretical background of this study; the research method is presented in section 3 and followed by the results in Section 4.

Finally, we draw a conclusion with the theoretical contributions, practical implications, and limitations and future work in Section 5.

2. Theoretical background

2.1. E-government development and inter-agency information sharing

E-government refers to using information and communication technologies to facilitate their internal administration and external service delivery (Lee, 2010; Siau & Long, 2006). As e-government is an evolutionary phenomenon (Layne & Lee, 2001), many stage models have been developed for depicting the improvement of e-government (e.g. Kim & Grant, 2010; Klievink & Janssen, 2009; Layne & Lee, 2001). In those models, integrating systems and services are important for e-government development, and they cannot work without the inter-agency information sharing (Yang et al., 2014). For example, in the four-stage model of e-government development proposed by Layne and Lee (2001), inter-agency information sharing is needed in both vertical and horizontal integration. Through the vertical and horizontal integration, 'one-stop services' would be realized (Layne & Lee, 2001). Furthermore, along with the rapid development of society, the integrated and proactive government service delivery in a broader scope is required by citizens, which also depends on the inter-agency information sharing (Klievink & Janssen, 2009; Scholta et al., 2019).

E-government development aims to improve public service delivery capability, governance, transparency, and accountability (Chatfield & Alhujran, 2009). Inter-agency information sharing would contribute to achieving some of these goals. On the one hand, information sharing can reduce agencies' efforts on duplicate data collecting and processing (Yang et al., 2012). Thus, the operating cost decreases, and service efficiency increases. The public service delivery capability would be improved. On the other hand, the government agencies would be more informative though obtaining business-related information from other agencies. It would help agencies handle the complexity and uncertainty of the environment and then improve the agencies' decision-making capability (Gil-Garcia & Sayogo, 2016). In the context of this study, inter-agency information sharing would make agencies learn more about the situation of their jurisdictions. Then, these agencies could make more reasonable and practical policies to improve the elderly's life and gain legitimacy from citizens. Also, inter-agency information sharing could help improve governments' governance and accountability by enhancing supervision and control on the payment of pension and subsidiaries. Therefore, inter-agency information sharing about senior care services could also contribute to social development, which focuses on the living standards improvement of citizens, especially the vulnerable and oppressed groups (e.g. the elderly) (Midgley, 2003).

2.2. Chinese governmental administrative structure and inter-agency information sharing

Most of the existing research on inter-agency information sharing is conducted in Western countries (e.g. Akbulut-Bailey, 2011; Ramon Gil-Garcia et al., 2007; Sayogo & Gil-Garcia, 2014), while the governmental administrative systems of China are different from the Western countries in politics, culture, organizational structure, and degree of autonomy (Fan et al., 2014). Chinese governmental administrative structure is networked-oriented and composed of 'TIAO' and 'KUAI', in which the 'TIAO' refers to the functional administrative systems in the vertical dimension; and 'KUAI' refers to the horizontal administrative systems and includes agencies with different functions at the same level (Chen et al., 2020; Fan et al., 2014; Fan et al., 2019). The TIAO-oriented mode is dominant because of the hierarchical administration model (Chen et al., 2020). With the increasing interrelations of government services, government agencies are required to connect seamlessly with other agencies, excepting managing their own businesses (Kettl, 2006). Information not only needs to be shared and integrated in the vertical dimension but also in the horizontal dimension (Fan & Jiang, 2016; Yang & Wu, 2014). However, the influential factors of inter-agency information sharing between the two dimensions

may be different because of the differences in inter-agency relationships and agencies' functions. To promote the development of Chinese e-government, it's valuable to discuss the inter-agency information sharing in different dimensions separately.

Some similarities and differences between vertical and horizontal inter-agency information sharing have been discussed in Taiwan context (Yang et al., 2012; Yang et al., 2014; Zheng et al., 2009). Yang et al. (2012) studied the boundaries of inter-agency information sharing in the vertical and horizontal dimensions and found that some boundaries only exist in one dimension. Regarding the types of inter-agency information sharing, Yang et al. (2014) investigated the determinants of information sharing types selection in the two dimensions by the case study of one Taiwanese e-government project. The results of their study implied that determinants of information sharing types selection in the two dimensions are not exactly the same. For example, information characteristics only affect types selection in the horizontal dimension. A decentralized type is more favored by agencies when the information shared is highly sensitive.

The studies of Yang et al. (2012) and Yang et al. (2014) suggested that there are differences between vertical and horizontal inter-agency information sharing, but they did not discuss the influential factors of agencies' willingness of inter-agency information sharing. Moreover, previous studies on the influential factors of inter-agency information sharing seldom distinguish the dimensions of inter-agency information sharing, even though they have been aware of the two dimensions in the governmental administrative systems (e.g. Fan et al., 2014; Yang & Wu, 2014). Fan (2013) studied the factors that influence the inter-agency information sharing for e-government development in the horizontal dimension through the survey. However, he only discussed four factors (i.e. the experience in general management, reforming authority, experience in projects, legal regulation) due to the limitation of the research method. The influential factors in the vertical dimension and the differences between the two dimensions were not investigated in the study of Fan (2013). To fill these research gaps, we try to explore the differences and similarities in the influential factors of vertical and horizontal inter-agency information sharing.

2.3. Conceptual framework

Government inter-agency information sharing is not only a matter of information and communication technologies (ICTs), but a complex socio-technical phenomenon (Gil-Garcia et al., 2010). When inter-agency information sharing is viewed as an IT initiative, the TOE (technology-organization-environment) framework is suitable for organizing the influential factors (Akbulut et al., 2009; Akbulut-Bailey, 2011). That framework is a 'flexible generic theory that allows for the formulation of wide range of research problems that involve context-driven phenomena' (Bailey & Osei-Bryson, 2018), which is proposed by Tornatzky and Fleischer (1990). TOE framework is mainly used to explain the technology adoption and use at the organization level from three perspectives: technological, organizational, and environmental (e.g. AlBar & Hoque, 2019; Ghobakhloo & Tang, 2015). Several studies have used this framework to investigate the factors influencing inter-agency information sharing (Akbulut et al., 2009; Akbulut-Bailey, 2011). Yang and Wu (2014) extended the TOE framework based on previous work. They investigated the complexity of inter-agency information sharing from four perspectives: technological, organizational, legislation and policy, and environmental.

Besides the TOE framework, there are also many other frameworks in this field (e.g. Bigdeli et al., 2013; Dawes, 1996; Gil-Garcia & Sayogo, 2016; Yang, 2011). For example, Dawes (1996) discussed the influential factors from three perspectives: technical, organizational, and political. Yang (2011) added a contextual perspective to Dawes' framework. Through a review of existing frameworks of inter-agency information sharing, three hints emerged. First, organizational, technological, and policy and legislation are three perspectives discussed in most of the research on inter-agency information sharing. Second, researchers in this area are interested in the influences deriving from the political and social environment after 2010. Third, the importance of inter-organizational factors has been recognized, but there is no consensus on their categories. Some research investigated inter-

organizational factors as a part of organizational factors (e.g. Dawes, 1996). However, these factors are included in the contextual perspective (e.g. Gil-Garcia & Sayogo, 2016; Yang, 2011), or they are considered as a separate aspect in other research (e.g. Bigdeli et al., 2013; Fan et al., 2014).

Based on the above observations, we learned that the TOE framework is more comprehensive and covers all aspects of other frameworks. Besides, inter-agency partnerships and network collaboration are quite important for inter-agency information sharing (Bigdeli et al., 2013; Fan et al., 2014). It is necessary to investigate inter-organizational contextual factors separately. Thus, we further divide the environmental perspective into two parts: the inter-organizational context, and the political and social environment (see Figure 1).

On the basis of the extended TOE framework, we will investigate the influential factors of inter-agency information sharing in different dimensions from four perspectives: (1) technological, (2) organizational, (3) inter-organizational contextual, and (4) political and social environmental. The technological perspective focuses on factors related to software, hardware, and data (e.g. data structure inconsistency, software incompatibility, information security, and privacy) (Joia, 2007; Santos & Reinhard, 2012; Yang & Maxwell, 2011). The organizational perspective emphasizes the influences from intra-organizational context, such as organizational goals and cultures, the support and participation of leaders, experiences, and resources (Atabakhsh et al., 2004; Drake et al., 2004; Gil-Garcia & Sayogo, 2016). Inter-organizational contextual factors are related to inter-agency relations and the influences exerted by other agencies in collaboration networks, such as *guanxi* (the interpersonal connections in China, which derives from social networks), trust, and power (Chen et al., 2019; Fan et al., 2014; Wang, 2018). The political and social environmental perspective focuses on 'those external factors which have strong institutional influences on inter-agency information sharing' (Bigdeli et al., 2013), such as legislation and policies, critical mass, and mass media (Gil-Garcia & Sayogo, 2016; Karlsson et al., 2017; Sayogo & Gil-Garcia, 2014).
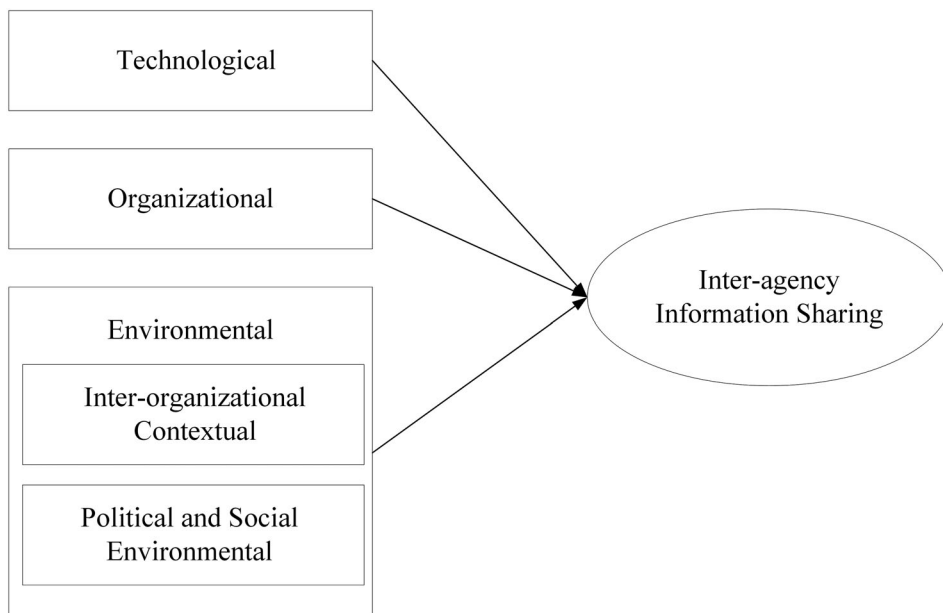

Figure 1. Conceptual framework.

3. Research method

This study aims to explore why government agencies are willing or unwilling to share information in the vertical and horizontal dimensions, and then investigate the similarities and differences of influential factors between the two dimensions. To achieve our goals, we used a case study approach. This method is suitable for understanding 'why' and 'how' (Yin, 2017), and contributes to exploration, classification, and hypothesis development in knowledge building (Benbasat et al., 1987). The data collection and analysis processes adopted the structured-pragmatic-situational (SPS) approach (Pan & Tan, 2011).

3.1. Study context

In 2016, the Beijing Municipal Committee on Aging (MCA) proposed to establish the Senior Care Service Guidance Centers (SCSGCs) at the district-level. District Committees on Aging (DCAs) were to be responsible for the development of their SCSGCs. Information integration was a part of these centers' functions. SCSGCs had to build information platforms for integrating distribution information, physical conditions, family information, and the elderly's service demands within their district jurisdictions. The operation, service delivery, and management information of senior care institutions also had to be integrated into these platforms.

Inevitably, information integration involved sharing information among high-level agencies, peer agencies, and low-level agencies. For example, basic information about each elderly person (such as age, gender, address, and ID number) is kept in DCAs' high-level agency (the MCA), which obtained the basic information from the Municipal Public Security Bureau. Physical condition information is held by DCAs' peer agencies (the Health and Family Planning Commissions[1] (HFPCs)). In June 2018, most SCSGCs had been established and started operating.

Two aspects of these DCAs prompted our research interest. First, providing senior care services is an essential part of social development, especially for countries with a rapidly aging population. Investigating the inter-agency information sharing in this context would entail some implications for policymakers and public administrators to promote the role of information communication technologies in development. Second, to achieve information integration, DCAs need to share information with their high-level agency (i.e. the MCA), low-level agencies (i.e. the sub-district offices), and peer agencies (i.e. the HFPC and the Public Security Bureau). It enabled us to explore the similarities and differences of influential factors between vertical and horizontal dimensions.

3.2. Data collection

We collected data from June to November 2018. In-depth interviews and semi-structured interviews were used to collect data. The sample size of qualitative research is dependent on the 'data saturation', suggesting that researchers can stop interviewing more candidates or groups when no new concepts or themes are emerging in three successive interviews after at least ten interviews (Francis et al., 2010). To assess whether the data saturation has been reached, we conducted data collecting and data analysis at the same time. In the process of data analysis, we did not identify new factors from the eleventh to the thirteenth group interviews. However, to ensure that identified factors are confirmed by as many evidences as possible and conduct a full investigation in Beijing, we still made the group interviews in the remaining three districts since there is a total of 16 districts in Beijing. Furthermore, we conducted two one-to-one interviews in the high-level agencies for multi-angle validation. Finally, we conducted sixteen group interviews and two one-to-one interviews. Every district was interviewed, but two districts are excluded from our results because they did not officially start building the SCSGCs at the time of the interviews.

For the selection of interviewees, we followed the recommendation of Hancock and Algozzine (2006) and selected the persons 'who may have the best information with which to address the study's research questions' (Hancock & Algozzine, 2006, p. 41). Regarding our research questions and theoretical

framework, we selected three types of persons as our interviewees in group interviews: (1) government agency leaders, who were responsible for the coordinating and communicating with peers and high-level agency and could provide information about the influences from the organizational and environmental perspectives; (2) platform development heads, who were responsible for the technical implementation of inter-agency information sharing and may have the best information about the influences from the technical perspectives; (3) platform operation heads, who were responsible for the use of shared data and had a whole picture of inter-agency information sharing process. We invited the platform operation heads to participate in our group interviews because they can provide us some new insights. As mentioned before, one-to-one interviews in the high-level agencies were conducted for multiangle validation. The interviewee from the Information Technology Center was responsible for the technical guidance of inter-agency information sharing. The interviewee from the Basic Level Guidance Offices was responsible for business guidance. They both had information about inter-agency information sharing at the district level. Altogether, thirty-eight government agency leaders, seven platform operation heads, and eleven platform development heads were interviewed. Appendix 1 shows the details of the interviewees. As to secondary data, we collected policy documents related to information sharing, screenshots of platforms, and meeting minutes. The semi-structured group interviewees were asked the following questions: (1) Does your agency share information with the Municipal Committee on Aging, the sub-district Offices, or other agencies with different functions at the district-level? (2) Why are you willing or unwilling to share information with them?

3.3. Data analysis

The data analysis process included four steps that corresponded to selective coding and theory-data-model alignment in the SPS approach.

Step 1: Segmented original materials according to the definitions of vertical and horizontal inter-agency information sharing.
Step 2: Identified any sentences or snippets in original materials related to increasing or decreasing inter-agency information willingness and tagged them with conceptual labels separately, that is, influential factors.
Step 3: Categorized influential factors obtained in Step 2 separately in accordance with the conceptual framework.
Step 4: Compared factors of different dimensions.

To ensure research reliability and validity, two researchers codified independently in Step 2, and then compared the results. For inconsistent codes, the third author joined and was responsible for coordinating to help reach an agreement. After the agreement was reached, Step 3 was carried out independently. Two researchers compared the categorizing results. When there were inconsistent categorizations, they worked with the third author again to reach an agreement. Secondary data was used to triangulate the coding and categorizing results. When new problems were found, we conducted an online return interview for further confirmation.

4. Results

4.1. Vertical dimension: factors influencing inter-agency information sharing

We extracted the factors influencing vertical inter-agency information sharing and discuss them from the technological, organizational, and environmental perspectives. Environmental perspective includes two sub-perspectives: inter-organizational contextual, political and social environmental. Figure 2 shows these factors.
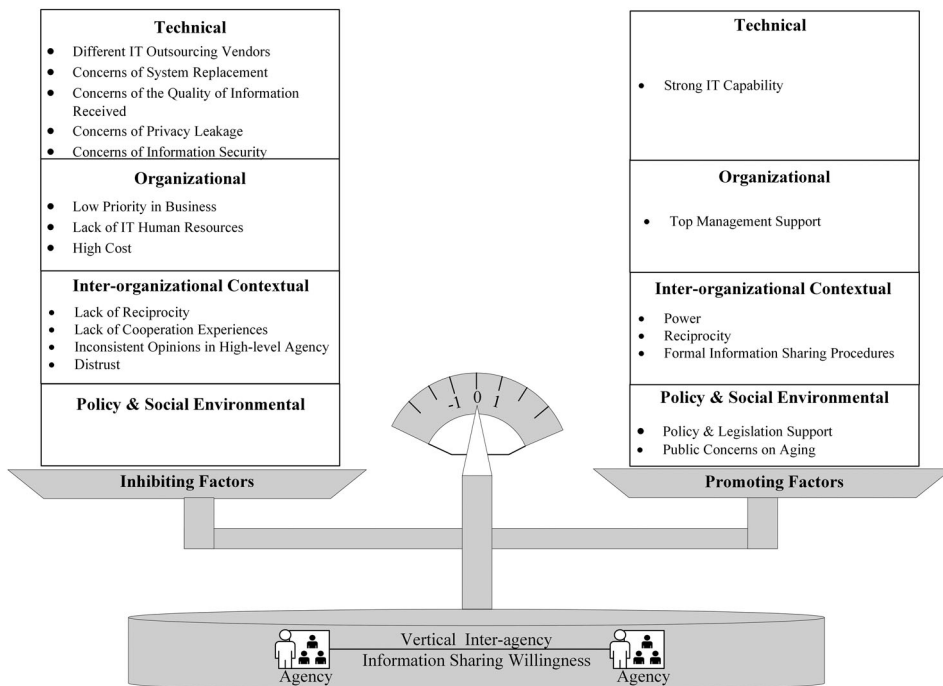
Figure 2. Influential factors of inter-agency information sharing in vertical dimension.

4.1.1. Technological perspective

We identified six influential factors in technological perspective: strong IT capability, different IT outsourcing vendors, concerns about system replacement, concerns about the quality of information received, concerns about privacy leakage, and concerns about information security. Table 1 shows some statements concerning these factors.

IT capability refers to the ability to manage information, develop a platform, and maintain the platform for information exchange. Almost all interviewees said that their agencies had strong IT capability in information sharing. Through field observation and early investigation, we found that the IT capability of government agencies depended on IT outsourcing. External vendors were the main implementers of government IT projects. Commercial competition existed among the vendors that served the agencies with similar functions. Some vendors may not actively participate in inter-agency information sharing. Therefore, different IT outsourcing vendors of the high-level agencies and low-level agencies may impede vertical inter-agency information sharing.

With the advent of the information era, more and more IT resources in the external environment are available for governments. Some agencies had used these resources to develop their own information systems. Participating in vertical inter-agency information sharing may require introducing a new system for information collection and transmission. Concerns about system replacement may decrease the agencies' willingness to share information vertically. For example, D12 had established an information system for information collection and business operations. The interviewees from D12 worried that vertical inter-agency information sharing might adopt the centralization type (that is, all agencies use the same information system developed by the super-ordinated agency) and inferred that their information system would be discarded. Thus, they were unwilling to participate in inter-agency information sharing. Besides, the introduction of new systems would increase the staff members' workload, which may lead to their resistance.

Regarding the information itself, concerns about the quality of information received, privacy leakage, and information security occurred in vertical inter-agency information sharing. The DCAs

Table 1. Some interviewee statements concerning technological factors in vertical inter-agency information sharing.

	Factor	Example of Statements
Promoting	Strong IT capability	'Now the municipal government agency required that our platforms should be linked to its systems. There are no technical difficulties for us … ' (D7)
Impeding	Different IT outsourcing vendors	'XX vendor [that is the IT outsourcing vendor of the MCA] wanted to contract the project [that is, the information platforms implementation in our SCSGC]. However, it failed in opening bidding … , now, it is very difficult to make progress in information sharing negotiation.' (D11)
	Concerns about system replacement	'We have spent a lot of money on developing trading systems and home visiting systems before the request of the Municipal government agency. However, the retention of our system comes into question after the Municipal government agency introduced the new system.' (D12)
	Concerns about the quality of information received	' … the information update at the municipal level is not timely.' (D11)
	Concerns about privacy leakage	'There is no problem in sharing senior care institutions and operation information with SCSGCs, but they need to sign a confidentiality agreement. We do not trust them fully and are worried that SCSGCs may leak out the data.' (M1)
	Concerns about information security	'Currently, [the platform is] only available for display. The most important matter is data security. The MCA asked us to solve the security problem of information storage if we want to get information from them. Additionally, we can not store the information on the servers of outsourcing vendors. We are negotiating with the District Bureau of Economy and Information Technology and hope to store the data on its servers … ' (D14)

were concerned about the quality of the information received from the MCA because information of the MCA may not be updated in time. Regardless, the DCAs still wanted to get information from the MCA about senior care. However, the interviewees from the MCA stated that they did not trust the DCAs, worrying that the DCAs may leak information related to the elderly's privacy. Besides the concerns about privacy leakage, the MCA also required the DCAs to guarantee information security before information sharing.

4.1.2. Organizational perspective

Table 2 shows the identified organizational factors and some of the interviewees' statements in the vertical dimension. Agency leaders play a crucial role in promoting vertical inter-agency information sharing. Many interviewees mentioned that the vertical inter-agency information sharing required their leaders to communicate with the high-level agencies.

Low business priority, lack of IT human resources, and high cost are expected to decrease agencies' willingness to share information. For example, some D12 staff members said that their leader had been paying more attention to the development of senior care institutions currently and was not concerned about e-government development. Therefore, that agency now does not regard information sharing as a business focus. Low business priority resulted in the agency not allocating enough IT personnel to inter-agency information sharing. One D12 interviewee stated that

Table 2. Some Interviewee statements concerning organizational factors in vertical inter-agency information sharing.

	Factor	Example of statements
Promoting	Top management support	'The top-down information sharing requires the DCA to make a request to the MCA and the leaders of the Municipal Information Center. The MCA and Municipal Information Center also need to report to their superior leader, after that we can begin the next step.' (D5)
Impeding	Low business priority	'The focus of our district's senior care work is the development of senior care institutions, but not the development of e-government … ' (D12)
	High cost	'Home visiting information enters directly into the municipal-level platform. If we want to integrate it, we need to invest human and financial resources in new module development and information integration. We do not consider to integrate it because of cost now.' (D5)
	Lack of IT human resources	' … I am the only one responsible for informatization.' (D12)

there was only one staff member who was responsible for business related to IT. The high cost also inhibited vertical inter-agency information sharing. Through the interviews, we learned that IT projects in governments are budgetary. Agencies were sensitive to information sharing costs to prevent over budgeting.

4.1.3. Environmental perspective

Table 3 shows identified factors and some statements in the environmental perspective, including seven inter-organization contextual factors and two political and social environmental factors. Power is related to the influence that a high-level agency exerts on its subordinate agencies. Low-level agencies need to obey commands from high-level agencies. Power asymmetry can force low-level agencies to participate in information sharing. However, reciprocity is still an important prerequisite for vertical inter-agency information sharing. Interviewees' statements show that although the low-level agencies may yield to power and participate in information sharing, they still tended to react negatively to information sharing if they did not perceive the benefits.

Distrust challenged vertical inter-agency information sharing, but following formal inter-agency information sharing procedures and signing a formal confidentiality agreement can reduce the negative effect of distrust on information sharing by legal constraints. Interviewees' statements show that the concerns of high-level agency about privacy leakage by its subordinate agencies were actually

Table 3. Some interviewee statements concerning environmental factors in vertical inter-agency information sharing.

		Factor	Example of statements
Inter-organizational contextual	Promoting	Power	'The development of the platform follows the "*Opinions on Strengthening the Construction of the Senior Care Service Guidance Centers at District Level*" issued by the MCA.' (D1)
		Reciprocity	'[An integrated platform needs] to be accessible to sub-district offices so that they can use the data analysis function, which can be of great help for their daily business … ' (D7)
		Formal information sharing procedures	'There is no problem in giving the operation information of the senior care institutions to the DCAs, but they need to follow the formal procedures and sign a confidentiality agreement.' (M1)
	Impeding	Lack of reciprocity	'If low-level agencies can not benefit from information sharing, there is no way to drive them to participate in information sharing.' (D6)
		Lack of cooperation experiences	'For what information should be shared from top to down and what information should be shared from down to top, we lack specific business experiences and information sharing experiences. We need a period of cooperation to know how to address this problem' (D2)
		Inconsistent opinions in the high-level agency	'For the supervision [related to the information sharing], the goals and opinions have not yet reached an agreement. The current mode is comprehensive supervision, which requires all DCAs to share all service information with the MCA. The other suggestion is the random inspection that does not require the DCAs to share all information with the MCA.' (M2)
		Distrust	'We still do not trust the SCSGCs, worrying that they will leak out the data.' (M1)
Political and social environmental	Promoting	Policy and legislation support	'A few days ago, the Municipal Bureau of Economy and Information Technology took the lead in setting up a sharing mechanism for more than 600 data fields involving about 40 commissions and bureaus … There are more than 90 data fields relating to senior care. After final confirmation, this data should be able to be shared with us.' (D10)
		Public concerns on aging	'Now, it is quite well for us to discuss the issue of senior care with various agencies, especially at the sub-district level … This is because the whole social environment has changed, especially after 2012. The whole society has been aware of the problem of aging.' (D12)

due to distrust. Therefore, low-level agencies should follow some formal information sharing procedures and sign a confidentiality agreement to guarantee they will not leak the data. Inconsistent opinions of leaders in the high-level agency on how to share information and what kind of information should be shared made DCAs take a wait-and-see attitude. Furthermore, the lack of cooperation experiences also negatively affected the agencies' willingness to share information. It led to the DCAs not knowing how to cooperate and share information with the MCA.

In the political and social environmental perspective, we found that policy and legislation support promoted inter-agency information sharing. In recent years, many policies and documents have been issued to support government inter-agency information sharing, such as Notification on '*Further Deepening "Internet + Governmental Affairs Services", Promoting the Reform of Governmental Affairs Services "One Network, One Door, One Time"*'. The catchwords 'up and down link,' 'right and left connect,' and 'break the information islands' are the keywords of information construction in China's 13th Five-Year Plan. A D10 staff member indicated that putting these policies into practice was to make the SCSGCs become the information management center for all senior care services at the district level. The D10 interviewees also hoped these policies could promote the achievement of information sharing among the municipal, district, and sub-district agencies.

Apart from policy and legislation support, public concerns on aging was another promoting factor. It was a unique factor in our research context. The rapid increase of the aging population aroused concerns about aging issues in all walks of life, especially in the government. Public concerns on aging make governments at all levels attach great importance to all matters related to senior care services, including information sharing among agencies.

4.2. Horizontal dimension: influential factors of inter-agency information sharing

Figure 3 shows the factors of horizontal inter-agency information sharing from technological, organizational, and environmental perspectives. Inter-organizational contextual, and political and social environmental are two sub-perspectives of environmental perspective.

4.2.1. Technological perspective

In the horizontal dimension, we identified five technological factors. Only IT capability was found to increase agencies' information sharing willingness. IT outsourcing allows agencies to acquire enough IT capability to address technological problems. Therefore, all interviewees who talked about the implementation of information sharing declared that there is no difficulty in technical implementation. Table 4 shows some statements about technological factors in the horizontal dimension.

Four impeding factors were all related to information. Concerns about the quality of information shared were related to the information passed to other agencies. Internal heterogeneous information systems raised agencies' concerns about the quality of information shared with other agencies. More than one information system was used in these agencies' daily business. The consistency of information in these heterogeneous systems was not certain, which implied that some information owned by these agencies was incorrect. Agencies worried that sharing wrong information may cause some unfavorable outcomes. Concerns about the quality of information received occurred when the information received was not updated in time, or information collection requirements were inconsistent. For example, the differences in health information collection requirements between the DCA and the HFPC impeded information sharing in D6 because the requirements of the HFPC were more rigorous. Concerns about privacy leakage and information security also decreased the willingness of information sharing with peer agencies, especially with the HFPC and the Public Security Bureau. Furthermore, sharing information with other agencies through data interfaces may incur the risk of systems being attacked.
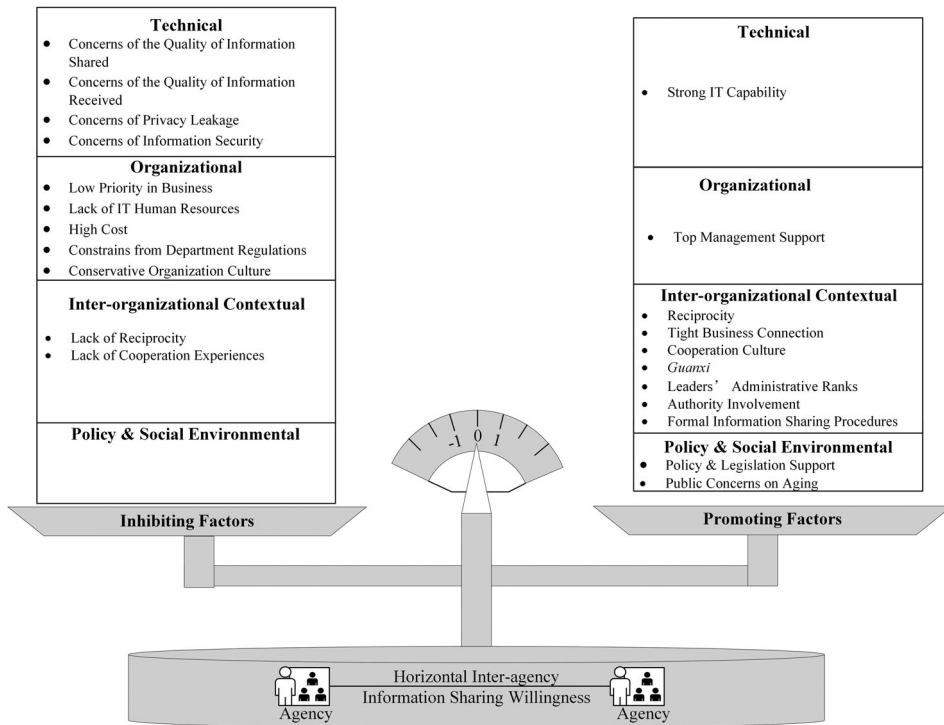
Figure 3. Influential factors of inter-agency information sharing in horizontal dimension.

4.2.2. Organizational perspective

In the organizational perspective, there are one promoting factor and five impeding factors (see Table 5). Communication and negotiation are important for inter-agency information sharing, which need the engagement of top managers. The case studies revealed that top management support was necessary and could create a favorable climate for inter-agency information sharing.

In our interviews, some agencies seemed to be less interested in informatization and did not treat information sharing as a priority in business. This resulted in few resources being allocated for information sharing. Participating in information sharing requires that agencies invest effort, money, and IT human resources. The interviewees of D4 and D12 stated that lack of IT human resources and high cost restricted the DCAs' participation in information sharing. Constraints from department

Table 4. Some interviewee statements concerning technological factors in horizontal inter-agency information sharing.

Factor		Example of statements
Promoting	Strong IT capability	'Information is exchanged through the data interface … , the technical implementation is very easy.' (D13)
Impeding	Concerns about the quality of information shared	'There are three systems related to senior care services … The information of these three systems is inconsistent. Those closely related systems should be integrated before sharing information with other agencies.' (D12)
	Concerns about the quality of information received	'The basic information of citizens in the Public Security Bureau is very limited, only including name, ID number, and the location of the household registration. This information comes from residents' declarations. So the address information will not be changed unless the residents declare it or relocate their residences.' (D6)
	Concerns about privacy leakage	'The information of the HFPC relates to privacy. Its principals are unwilling to share with us.' (D6)
	Concerns about information security	' … Another is that level of their system security may not be very high. Once data sharing is permitted, it may break down or be attacked.' (D11)

Table 5. Some interviewee statements concerning organizational factors in horizontal inter-agency information sharing.

Factor		Example of statements
Promoting	Top management support	'After we reported the plan of this system to the chief of the district, he paid special attention to it and required us to share information with the system of city management center.' (D3)
Impeding	Low business priority	'Nowadays, the focus of our district's senior care is the development of senior care institutions, but not the development of e-government … '(D12)
	Lack of IT human resources	' … I am the only one responsible for informatization.'(D12)
	High cost	'XX planned to share information with the HFPC, but it has not proceeded because of money.' (D4)
	Constraints from department regulations	'We ever wanted to share health information with the HFPC, but were rejected. Its principals told us that this information could not be shared because of the specific department regulations.' (D3)
	Conservative organization culture	' … the HFPC is very prudent and attaches great importance to the risks in actions … we are more active, while the HFPC is more rational.' (D7)

regulations were also one of the reasons for the HFPCs rejecting the requirements of information sharing from the DCAs. As to the organization culture, the interview content analysis shows that the HFPCs were more prudent than the DCAs; and they were unwilling to share information with others unless there were clear policies and legislation for inter-agency information sharing.

4.2.3. Environmental perspective

Table 6 shows the factors in the environmental perspective. The essence of inter-agency information sharing is inter-organizational cooperation. Reciprocity is the basis of cooperation. Agencies have a positive attitude toward information sharing only when information sharing can bring benefits to all participating agencies. Interviewees from five district government agencies emphasized the importance of cooperation. The analysis of coding shows that agencies in a region with a favorable cooperation culture were more willing to work with others, which was conducive to inter-agency information sharing. A tight business connection often goes with the cooperation and helps for crossing the departmental boundary. For example, at the earlier stage, D13 wanted to share information with the HFPC. It failed, even with the strong support of the deputy director of that district. However, with the development of the integrated-care pilot program at the district level, tight business connections were formed between the two agencies. Information sharing became feasible with business cooperation. As can be seen from this example, the benefits for their own business of information sharing can be gradually learned as tight business connections form.

Guanxi, leaders' administrative ranks, and authority involvement are all conducive to inter-organizational cooperation. *Guanxi* is a type of informal support for information sharing. In this study, good *guanxi* between the leaders of different agencies contributed to negotiation. Agencies with leaders at the same administrative rank were more likely to collaborate with each other than with those at different ranks. Conversely, the greater the administrative level gap between two agencies, the more difficult it was to achieve cooperation.

Authority involvement had a positive effect on inter-agency information sharing in the horizontal dimension. In our cases, there was more than one deputy district director in district governments. A deputy director is usually responsible for the businesses of several agencies. Information sharing occurring in agencies within the scope of one deputy director was easier to achieve with the involvement of the deputy director. Apart from these, following formal procedures is necessary for government inter-agency information sharing and can help reduce the peer agencies' concerns about privacy leakage.

For the impeding factors, lack of reciprocity and cooperation experiences are two factors that were mentioned many times in interviews. Lack of cooperation experiences impedes information sharing by increasing the communication efforts of participating agencies. Two agencies that have not worked together are unfamiliar with each other's business processes and do not know how to

Table 6. Some interviewee statements concerning environmental factors in horizontal inter-agency information sharing.

Factor			Example of statements
Inter-organizational contextual	Promoting	Reciprocity	'The information sharing between the HFPC and us uses an exchange model. It gives us the health records of the older adults, and we give it senior care service information, such as the information about the nursing home that the older adults live in and the information about services that the older adults have received.' (D13)
		Tight business connection	'At present, our integrated-care pilot project has run for two years. During this period, there were more connections with the HFPC … ' (D13)
		Cooperation culture	'Our deputy head of the district said that the senior care services in our district are not just the business of the DCA and it needs the participation and support of many agencies, such as the HFPC, the Bureau of Economy and Information Technology, and the Disabled Persons' Federation … this has indeed brought us some conveniences.' (D10)
		Guanxi	'Under the premise of going through normal procedures, it is certainly helpful if the *guanxi* between the leaders of the two agencies is good.' (D7)
		Leaders' administrative ranks	'In other districts, the administrative rank of the director in charge of senior care services does not exceed the assistant section level, while the administrative rank of our director is section level [that is the same as the rank of peer agencies' leaders]. Our director directly reports work to the district chief. This brings convenience for us [to promote the success of information sharing].' (D10)
		Authority involvement	'In a district, if one deputy district director is responsible for civil affairs, health, human resources, and social security, the coordination among these agencies will go well. If two deputy directors are in charge of these agencies, it will be difficult to coordinate these agencies.' (M1)
		Formal information sharing procedures	'Besides the HFPC, we also need the information owned by the Public Security Bureau. We need to send an official letter to these agencies before information sharing.' (D7)
	Impeding	Lack of reciprocity	'The Public Security Bureau does not need our data. The Human Resource and Social Security Bureau attaches great importance to management, while we value services. It also does not need our information. Therefore, it is difficult for us to cooperate with these agencies.' (D7)
		Lack of cooperation experiences	'It is easy for us to work with the HFPC [for information sharing] because we worked well with each other in another project. However, I think it's difficult to cooperate with the Public Security Bureau.' (D9)
Political and social environmental	Promoting	Policy and legislation support	'If we need the physical examination information, the HFPC should share it with us because our district has jointly issued a document about integrated care.' (D8)
		Public concerns on aging	'Now, it is quite well for us to discuss the issue of senior care with various agencies, especially at sub-district level … This is because the whole social environment has changed, especially after 2012. The whole society has been aware of the problem of aging.' (D12)
	Impeding	–	–

cooperate. Thus, they need to put more communication efforts into information sharing cooperation than agencies that have prior cooperation experiences.

Policy and legislation support, and public concerns on aging are two political and social environmental factors. The interviewees of D8 declared that the document on integrated care in their district was helpful for information sharing between the HFPC and the DCA. Public concerns on aging issues affect the sharing of aging-related information in the entire administrative systems for both vertical and horizontal dimensions.

Table 7. Comparison of influential factors in vertical and horizontal inter-agency information sharing.

Perspective		Factor	Similarities Vertical and horizontal dimensions	Differences Vertical dimension	Horizontal dimension
Technological		Promoting	• Strong IT capability	–	–
		Impeding	• Concerns about the quality of information received • Concerns about privacy leakage • Concerns about information security	• Different IT outsourcing vendors • Concerns about system replacement	• Concerns about the quality of information shared
Organizational		Promoting	• Top management support	–	–
		Impeding	• Low business priority • Lack of IT human resources • High cost	–	• Constraints from department regulations • Conservative organization culture
Environmental	Inter-organizational contextual	Promoting	• Reciprocity • Formal information sharing procedures	• Power	• Tight business connection • Cooperation culture • *Guanxi* • Leaders' administrative ranks • Authority involvement
		Impeding	• Lack of reciprocity • Lack of cooperation experiences	• Inconsistent opinions in the high-level agency • Distrust	–
	Political and social environmental	Promoting	• Policy and legislation support • Public concerns on aging	–	–
		Impeding	–	–	–

4.3. Comparison of influential factors in two dimensions

Figures 2 and 3 show that there are some similarities and differences between vertical and horizontal dimensions. Table 7 shows the factors that have the same effects on inter-agency information sharing in the two dimensions and the factors that are found only in one dimension.

4.3.1. Similarities between vertical and horizontal dimensions

In the technological perspective, only IT capability is found to have a positive impact on inter-agency information sharing. For the interviewed agencies, open bidding ensures that IT outsourcing vendors are competent enough to address the technological problems of information sharing on either dimension. However, concerns about the quality of information received, privacy leakage, and information security diminish the willingness of agencies to share information.

Top management support, low business priority, lack of IT human resources, and high cost are four organizational factors found in both dimensions. Top management support contributes to inter-agency information sharing negotiations, helps provide enough resources for information sharing, and increases the enthusiasm of the involved staff members. However, if information sharing is a low priority in agencies' business, the top managers will provide less support for it, which may lead to insufficient resources. Lack of IT human resources and high cost reduce agency willingness to share information due to the constraints of resources.

In the inter-organizational contextual perspective, reciprocity, formal information sharing procedures, lack of reciprocity, and lack of cooperation experiences were identified in the two dimensions. The benefits for both sides should be taken into serious consideration when sharing information with others. Agencies often reject the requirements of information sharing because the information they receive may be useless to them. Formal information sharing procedures constrain inappropriate agency behaviors by legislation and help reduce privacy leakage concerns. Lack of cooperation experiences increases the communication efforts of cooperation and then decrease the agencies' willingness.

Policy and legislation support and public concerns on aging affect the agencies' willingness to share information in the two dimensions. In recent years, Chinese governments have become increasingly aware of the importance of information sharing for e-government development and have issued several governmental documents to promote information sharing. These policies and legislation have convinced agencies that information sharing is legitimate. Besides, the public is paying more and more attention to aging because the rapid population aging has changed the social environment. These public concerns exert pressure on agencies in charge of senior care and impel them to engage in aging-related information sharing actively.

4.3.2. Differences between vertical and horizontal dimensions

Different IT outsourcing vendors and concerns about system replacement are recognized as two important technological issues that impede only vertical inter-agency information sharing. There is competition among IT outsourcing vendors of agencies with similar functions, whereas competition is rare among IT outsourcing vendors of agencies with different functions due to their business differences. Therefore, different IT outsourcing vendors bring challenges to only vertical inter-agency information. Concerns about system replacement in low-level agencies also impede vertical inter-agency information sharing. Centralization type is often used in vertical inter-agency information sharing. However, some agencies have developed their information systems to collect and store information in digital form. Sharing with high-level agencies may necessitate discarding the low-level agencies' existing systems and introducing new information systems. The risk of system replacement leads agencies to lean toward rejecting vertical inter-agency information sharing. The concerns about system replacement may also cause the staff members to resist the new information systems because introducing new systems will increase their workload. However, these concerns did not appear in horizontal inter-agency information sharing. A plausible reason is that horizontal inter-agency information sharing is more likely to adopt a decentralized type (that is, information is shared among agencies by electronic interfaces or electronic media storage) and does not introduce new systems into those agencies.

In the horizontal dimension, internal heterogeneous information systems give rise to concerns about the quality of information shared, as mentioned before. However, this does not affect vertical inter-agency information sharing. One possible reason is that the information inconsistency caused by internal heterogeneous information systems may be addressed when all information is aggregated to the high-level agencies in the vertical dimension.

The horizontal dimension has two unique barriers: constraints from department regulations and conservative organization culture. If one agency's regulations do not allow information sharing or its culture does not encourage it, inter-agency information sharing will be impeded. The regulations and cultures of agencies with similar functions in the vertical dimension are similar. Therefore, the barriers related to regulatory and conservativeness are not found in vertical inter-agency information sharing.

Differences in the environmental perspective are mainly reflected in the inter-organizational context, whereas influences from political and social environment are the same for the two dimensions. Power is a unique inter-organization contextual factor in the vertical dimension that can promote inter-agency information sharing. High-level agencies use power to exert formal pressure on low-level agencies and make them function as expected, while the agencies at the same level

have equal powers. As for the specific impeding factors in the vertical dimension, inconsistent opinions among them impede information sharing because high-level agencies play dominant roles in vertical inter-agency information sharing.

The other specific impeding factor identified in the vertical dimension is distrust, which may be attributed to IT outsourcing. At present, high-level agencies do not distrust low-level agencies, but do distrust the IT outsourcing vendors serving those agencies. However, there are no trust or distrust problems identified in horizontal inter-agency information sharing because of the weak ties among agencies with different functions.

In the horizontal dimension, we identified five specific promoting factors. The tight business connection is important for information sharing because it implies that all participating agencies can benefit from information sharing. Conversely, it is a difficult task to implement information sharing among agencies without a tight business connection. Two agencies with tight business connections often cooperate with each other. Good cooperation culture in a region facilitates the horizontal inter-agency information by providing a favorable climate for cooperation. Good *guanxi* between the leaders of two agencies is conducive to negotiating information sharing. In addition, the leaders' administrative ranks also affect inter-agency negotiation. Generally, cooperative negotiations between agencies with leaders at the same rank are easier than between agencies with leaders at different ranks. For vertical inter-agency information sharing, the concern is more about power but not cooperation. Therefore, these factors were not found in the vertical dimension. Of course, authority involvement can facilitate effective negotiations among agencies at the same level because of coercive pressure.

5. Conclusion

The composition of the Chinese governmental administrative systems asks for studying the inter-agency information sharing in vertical and horizontal dimensions separately. In this study, we conducted a case study in the context of information integration relating to senior care services in Beijing. Influential factors in vertical and horizontal dimensions were summarized based on an extended TOE framework, and some new factors were identified. Through comparing the similarities and differences between vertical and horizontal dimensions, we found that marked differences between the two dimensions indeed exist. Therefore, we believe this study has important theoretical and practical implications for e-government development, especially for Chinese e-government development.

5.1. Theoretical contributions

First, our study sheds new light on inter-agency collaboration research in the field of e-government. This study roots in the context of TIAO-KUAI segmentation and hierarchy in the Chinese governmental administrative systems, in which the achievement of a smart and holistic government is difficult. We focused on inter-agency information sharing that is not only a kind of inter-agency collaboration but also the basis of some inter-agency collaborations, such as emergency management (Fan et al., 2019), one-stop services (Zhang et al., 2017). Inter-agency information sharing in vertical and horizontal dimensions were investigated separately in this study. The results confirm that marked differences between these two dimensions do exist, especially in the inter-organizational contextual perspective. Thus, future research on inter-agency collaboration in the field of e-government, especially in the Chinese context, should not conflate these two dimensions.

Second, this study enriches the research on inter-agency information sharing by differentiating the dimensions of information sharing. Several studies have investigated the differences between vertical and horizontal dimensions in terms of organizational boundaries and information sharing types selection (Yang et al., 2012; Yang et al., 2014). However, prior studies on inter-agency information sharing did not discuss the differences in influential factors between vertical and horizontal

dimensions (e.g. Fan et al., 2014; Yang & Wu, 2014). Inspired by previous works, we extended the TOE framework and compared the influential factors of inter-agency information sharing in the vertical and horizontal dimensions. The results show that the influences from the social and political environment would affect the inter-agency information sharing in both dimensions, while the influences from the inter-organizational context on the inter-agency information sharing in the two dimensions are different.

Third, this study extends our current knowledge on the influential factors of inter-agency information sharing by identifying new factors. For example, we verified the negative impact of concerns about the quality of information shared on inter-agency information sharing, which was not mentioned in previous research. Also, we found that tight business connection and cooperation culture are effective in horizontal inter-agency information sharing, which had been discussed in research on inter-organizational collaboration (Bruneel et al., 2010; Kożuch & Sienkiewicz-Małyjurek, 2016). Therefore, the above findings related to the newly identified factors contribute to our knowledge of the influential factors of inter-agency information sharing.

5.2. Practical implications

This study focused on inter-agency information sharing in Chinese e-government development. All the findings could provide implications for policymakers and public administrators to promote the success of inter-agency information sharing.

To promote inter-agency information sharing in both dimensions, participating agencies should notice the following three points. First, a decentralized type is more suitable for inter-agency information sharing for either the horizontal or vertical dimension. Second, top management support seems to be a big concern in the organizational perspective for information sharing advocating agencies. Training, online learning, and symposiums about inter-agency information sharing may be useful for improving top managers' understanding of the importance and benefits of information sharing and then increase the top management support. Third, policy and legislation support can promote the establishment of relationships, the development of trust, and the reduction of risks. Therefore, the policymakers should issue policies and legislation that stipulate the content, ways, and responsibilities of information sharing. Apart from these, there are also some specific suggestions for the participating agencies in different dimensions.

Regarding the vertical inter-agency information sharing, participating agencies should pay particular attention to different IT outsourcing vendors at different levels. It brings many problems, such as commercial competition, concerns about information security, and distrust. To address these problems, formal inter-agency information sharing procedures and confidentiality agreements can help constrain the participating low-level agencies' behaviors. Participating agencies also need to establish formal contractual mechanisms to have control over their IT outsourcing vendors' behaviors and constrain them from misusing the information. Moreover, concerns about information security can be alleviated by using some advanced technologies, such as blockchain, electronic certificates. Besides different IT outsourcing vendors, participating agencies should also attach importance to the benefits for others. Although power plays a vital role in the vertical dimension because of the bureaucracy in the governmental administrative systems, the benefits offered to low-level agencies should be valued to increase their enthusiasm in inter-agency information sharing.

For the horizontal inter-agency information sharing, the heterogeneity of internal information systems for a specific agency influences the quality of information shared. Thus, it is necessary to integrate internal information systems. Furthermore, integrating internal information systems also offers benefits for reducing other agencies' concerns about the quality of information received and for reducing the workload of information input. Initiating business cooperation is an efficient channel to make participating agencies understand the benefits of information sharing in the horizontal dimension. Thus, if one agency encounters resistance for inter-agency information sharing, it can try to cooperate with them on business and then launch information sharing when both sides have learned the benefits.

The above suggestions would benefit the success of inter-agency information sharing in the Chinese context, and then promote the development of e-government. In the process of promoting inter-agency information sharing, the unified data standards and technical frameworks may be established, which lay the foundation of Chinese e-government development. With the success of inter-agency information sharing, the operational cost of government agencies will decrease by reducing duplicate data collecting and processing, as well as achieving the 'one-stop services' and even the proactive services. Through inter-agency information sharing, government agencies can have more accurate information about citizens and enterprises, which will contribute to the achievement of precision subsides and then reduce public expenditures. Particularly, inter-agency information sharing can help government agencies address some complex social issues, such as the aging problems, the control of novel coronavirus. Those would further strengthen the function of e-government in social development. On the whole, inter-agency information sharing can increase the governments' responsiveness and efficiency, improve the citizens' satisfaction with the e-government, and enhance the governments' legitimacy.

5.3. Limitations and future work

Although we have dedicated a lot of effort to investigate the influential factors of inter-agency information sharing in different dimensions, three limitations of this study should be noticed. First, the research context may prevent us from identifying all influential factors of agencies' willingness to share information in the two dimensions. Future work can use other cases for further investigating the factors of inter-agency information sharing in the two dimensions, such as concerns about losing autonomy, competing interests. Second, with the differences in the administrative systems of different countries, the similarities and differences of influential factors in the two dimensions may be different in other countries. Future research could extend our research by having case studies in other countries. Third, this study focuses only on identifying the factors in the two dimensions but not on exploring the influencing degree of those factors. A survey method may be useful for future work.

Note

1. After the issue of 'the State Council of the People's Republic of China Institution Reform Plan' in 2018, the Health and Family Planning Commission was renamed to the Health Commission. However, when we did the interviews, the institutional reform has not been completed at the district-level in Beijing. Therefore, in this paper we still use 'the Health and Family Planning Commission' (HFPC).

Disclosure statement

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Appendix: Details of the interviewees

Type	District Agency	Interviewees		
		Government staff leaders	Platform operation heads	Platform development heads
Group interview	D1	4	2	–
	D2	4	1	–
	D3	3	–	–
	D4	–	1	2
	D5	1	1	–
	D6	1	–	2
	D7	3	1	–
	D8	4	–	2
	D9	5	–	–
	D10	4	–	3
	D11	2	–	1
	D12	2	–	–
	D13	1	1	1
	D14	2	–	–
Individual interview	M1	1	–	–
	M2	1	–	–
Totals		38	7	11