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Abstract
Enhancement of the effectiveness and efficiency of e-government services (EGS) is critical to better meeting the increasing public demands for services. One of the better solutions to meet such demands is improving the government’s EGS capability (EGSC). However, few studies discuss the issues. The purpose of this study was to employ capability management perspectives to develop theoretical linkages and path relationships among the components of EGSC. Comprehensive validation was further conducted through path analysis (PA) using structural equation modeling methods based on the data collected from 102 cities of the 26 provinces in Mainland China. The study unveiled the structure of EGSC, and PA results provided government policy makers or information technology managers insight into enhancing EGSC through the improvement of the components' performance.

Keywords
e-government, e-government service, service capability, capability management, path analysis

Introduction
E-government is regarded as an effective and efficient channel to deliver public services (Jansen, Vries, & Schaik, 2010; Ma, Chung, & Thorson, 2005), even in the midst of the global economic crises (UNDESA, 2010, 2012). According to the 2010 United Nations (UN) report, since the economic crisis in 2008, e-government services (EGS) have been useful tools for governments to enhance transparency, assuage public unease, increase public trust, enhance the tractability of the usage of public stimulus funds, and improve the added value of government data holding (UNDESA, 2010). EGS have such important functions that numerous organizations, both public and private,
exert great efforts to enter this “market” (Chase, 2009; Reddick, 2009). However, several studies also point out that whether the deployment of EGS can improve the effectiveness and efficiency of public service is unclear (Heeks & Bailur, 2007; Henriksen & Damsgaard, 2007). Heeks and Bailur’s statistic analysis indicates that the introduction of information technology (IT) into the public sector caused positive and negative impacts and that a particular impact can be perceived as positive by one stakeholder but negative by another (Heeks & Bailur, 2007). This controversial situation makes it necessary to find the key factors that impact the effectiveness and efficiency of EGS.

In practice, China has built thousands of e-government portals to enhance its online services since 2002. Some of these portals are independent, fully functional systems that consist of governmental websites, back-office operation systems, databases, and servers. For example, the “Three Golden Projects” (also known as the “Golden Bridge Project,” “Golden Card Project,” and “Golden Gate Project”), which started in 1993, aimed to build a fundamental information system infrastructure, backbone electronic interchange system, and online identity certification system to promote the use of various forms of digital currencies and personal identification such as credit cards, smart identity cards, and online banking. Other portals function as website groups (e.g., Zhengfu Wangzhan Qun) that involve several agencies’ service systems and websites integrated horizontally or vertically. For example, the public service website group of Jiangsu (http://www.js.gov.cn/wsfw) synthesizes 65 websites of different functional agencies into one portal. Additionally, these efforts were also viewed as tools to drive China’s administrative reform (Xingzheng Guangli Tizhi Gaige) and to improve government’s society-monitoring capability (Ma et al., 2005). According to Chinese e-government strategic file (“e-government twelfth five-year plan,” from 2011 to 2015), EGS will be further improved and regarded as the enabler to build a service-oriented government. Considerable efforts in this regard have already paid dividends. Hence, the effectiveness and efficiency of e-service becomes one of the critical issues that all levels of government must face to address the pressure from society (Hu, Pan, & Wang, 2010; Hu, Shi, Wen, & Wang, 2012; Lee, Kim, & Ahn, 2011).

Inspired by the successful practices and sound theories in the domains of capability-based theories (Dutta, Narasimhan, & Rajiv, 2005; Klievink & Janssen, 2009; Teece, 2008) and IT-related capability management (ITCM) (Iribarren et al., 2008; Kim & Lee, 2004; Wang & Liao, 2008), effective and efficient EGS should be derived from the capabilities of the governments using information communication technologies (ICTs) such as EGS capability (EGSC). However, very few studies discuss the following questions: What is EGSC? What is the structure of EGSC? What are the relationships among the structural components? To bridge the gap, this study proposes the measurement and structural models of EGSC and explores possible, latent relationships and evolution paths through an internal view. The results provide reference models for e-government leaders, chief information officers (CIOs), and managers to assess their organizations’ e-service capability. The critical path analysis (PA) also suggests comprehensive paths for policy makers to plan e-service capability strategies.

**Literature Review**

**The Service Quality-Based View**

Service quality-based view (SQV) mainly addresses the qualities of service contents and service delivery (Tan & Benbasat, 2009; Tan, Benbasat, & Cenfetelli, 2013). Specifically, the quality can be divided into three categories: quality of service (QoS) for web services (Papadomichelaki & Mentzas, 2012), portal/site quality (Webb & Webb, 2004), and customer-centered services (Chou, Chang, Cheng, & Tsai, 2007; Papadomichelaki, Magoutas, & Halaris, 2006; Yang, Cai, Zhou, & Zhou, 2005). These categories are scaled through the performance of front-office websites. They
provide an external view and emphasize the customer-perceived quality of services. Functional agencies in China, especially at the local government level, are always on duty to provide public services to society. The QoS content and efficiency of the delivery process are always regarded as key performance indicators (Wang & Liao, 2008). These dimensions construct the commonly used measurements in assessing content service capability (CSC) and service delivery capability (SDC) from user’s perspective.

The Organization Performance-Based View (OPV)

According to Papadomichelaki, Magoutas, and Halaris (2006), five approaches are used to assess and enhance the quality of EGS from the performance management perspective. Common assessment framework is a quality assessment toolkit used across European public sectors as an instrument for organization performance analysis (Cresswell, Pardo, & Canestraro, 2006). The balanced scorecard is a tool for an organization to monitor its current performance and efforts to enhance the efficiency of information systems as well as to motivate and educate employees (Chase, 2009; Davis, 1989). Six Sigma (6-σ) and the Baldrige Criteria are the widely adopted organization management scales to achieve continual performance improvements (Cresswell et al., 2006). And policy makers have tried to adopt these approaches in evaluating e-gov service operation and delivery performance (Chase, 2009; Kim & Lee, 2004; UNDESA, 2012). However, more effort is still needed to tailor these practices to make them work in Chinese public sectors.

The Resource-Based View

In the literature of competence, the dominant opinion on augmenting IT’s effects on a firm’s capability is the resource-based view (RBV) that links the capability to IT resources and skills that are firm specific, rare, and difficult to imitate or substitute (Bharadwaj, 2000; Dutta et al., 2005). To public organizations, however, capability may not be associated with rare, unit-specific resources but with efficiency, usability, accessibility, and equity in the delivery of public goods (e.g., public services). Through this perspective, EGSC is founded on the government’s IT infrastructure, skills, information and human resources, information systems, and so on. These resources are critical factors in guaranteeing the QoS contents and the efficiency of service delivery. In other words, these resources provide the material foundation to build the CSC and SDC.

Social demands and IT change quickly. These changes require the government to respond by adjusting relevant resources and arranging them in a flexible and agile manner (Klievink & Janssen, 2009). In the RVB context, specific embranchments (e.g., dynamic capability) tackle such an issue (Døving & Gooderham, 2008; Kindstr, Kowalkowski, & Sandberg, 2013; Teece, 2008). However, it is not easy for the public sector to adopt those capabilities because of well-known institutional restrictions or other process obstacles (UNDESA, 2012).

The ITCM-Based View

A multidimensional technical approach to capability is also common. The well-known Information Technology Infrastructure Library (ITIL) is adopted worldwide, and it is the best practice for IT service management (McNaughton, Ray, & Lewis, 2010). Capability Maturity Model Integration (CMMI) (Davis, 1989) and IT Capability Maturity Model (IT-CMM; Iribarren et al., 2008; U.S. GAO, 2004) are the other examples adopted by software and IT service organizations for software/IT development/service capability assessment and improvement. These frameworks are the idealized representations of organizational processes judging the actual process in use and providing a path for improvement (Iribarren et al., 2008; U.S. GAO, 2004). Although widely accepted in
software development, the maturity models appear too restrictive for the broader range of innovation activities in public organizations. Actually, China is still a one-party Marxist-Leninist state that is governed in a much different manner than many Western democracies when the frameworks such as ITIL or CMMI were developed. For example, Hu et al. tried to tailor these models to use for measuring and enhancing EGSC based on empirical investigation (Hu et al., 2012).

Research Model, Constructs, and Hypotheses

Measurement Model of EGSC

In the views of SQV and OPV, the EGS capability is shown through service outputs (e.g., service contents, service quality, etc.) and effective service delivery processes (Baker, 2009; Lindgren & Jansson, 2013; Papadomichelaki et al., 2006). In terms of service outputs, the higher the EGSC, the more qualified the service contents will be provided. As to the EGS contents, one of the widely adopted taxonomies classifies them into three kinds of functional services: information, transaction, and participation (Gronlund, 2003; Hu et al., 2012; Hu, Zhong & Mei, 2008; UNDESA, 2010, 2012). Accordingly, we define e-government’s CSC as information service capability (ISC), transaction service capability (TSC), and participation service capability (PSC). The combination of the three capabilities creates the structure of CSC.

In terms of service delivery processes, the governments can provide e-services efficiently when they possess high SDC (Hu et al., 2012; Tan & Benbasat, 2009; Tan et al., 2013). The taxonomy focuses on the service providing characteristics (e.g., reliability, availability, usability, security, etc.) that may influence customer’s perceived satisfaction.

In the public area, social demands and IT change quickly (Demirkan & Delen, 2013). These changes require the government to respond by adjusting relevant resources and arranging them in a flexible and agile manner (Klievink & Janssen, 2009; Pardo, Nam, & Burke, 2012). RBV context (e.g., dynamic capability) suggests that the government should concentrate on adjusting its tech schema, service supply strategy, and alignment of the two previous adjustments to the changes in ICT and user demands (Døving & Gooderham, 2008; Salunke, Weerawardena, & McColl-Kennedy, 2011; Teece, 2008). This kind of capability is defined as on-demand capability (ODC), which focuses on the adaptive ability that responds to the changes in public demands and technological advancement.

Therefore, we assume that the EGSC can be measured by three sections (Figure 1). To examine the measurement model, this article poses the following hypothesis.

Hypothesis 1: EGSC can be measured by CSC, SDC, and ODC.

The Components and Constructs

We reviewed the works of highly cited authors such as West (2006), and Baker (2009), and professional organization, such as the United Nations Department of Economic and Social Affairs (UNDESA, 2010, 2012) to extract the practical and operable items used in the evaluation of government e-service. A group containing the possible items was developed for the evaluation of CSC, SDC, and ODC. Sorting and combining were then conducted. Similar, repeating, and overlapping items were removed through two workshops. We interviewed 26 government officials and academic experts (senior Management Information System [MIS] and Information Management [IM] staff) to appraise the items for the questionnaires based on assessment-oriented, easy-of-use, and simple-to-implement principles. The appraisal used a 5-point Likert-type scale, with options ranging from 1
really unimportant) to 5 (really important). Items that scored higher than 4 (important) were selected as the questionnaire items. So the components and constructs of EGSC were developed.

Content Service Capability. As discussed previously, CSC consists of three types of capabilities.

1. ISC: Information services typically include information for research, government forms, public policy information, employment and business opportunities, and voting information, among others. In China, nearly 70,000 government portals provide information services. Taking the Window of Capital (http://www.beijing.gov.cn) for example, the portal provides information such as About Beijing, Travelling in Beijing, Food in Beijing, and Culture of Beijing. Two key aims are rooted in ISC, delivering public information and improving government transparency. Also, the government transparency improvement is regarded as part of the Chinese administrative reform (Ma et al., 2005).

2. TSC: According to the first definition of e-government transaction service, West concludes that only those services in which the entire transactions can occur and be fully executed online are transaction services (West, 2006). In the 2012 UN annual report, the e-government maturity degree consists of five phases; transaction service matches these features in the fourth stage and higher stages (UNDESA, 2012). Generally, services such as tax filing, license registration or renewal, fine payment, and marriage/birth/death registration are categorized as transaction services. Taking the Window of Shanghai (http://www.shanghai.gov.cn) as an example, in accordance with the three typical e-government models (G2B, G2C, and G2G), three kinds of transaction services are available, including transactional service to business, transactional service to citizen, and transactional service to government. Hence, we define the governmental capability for effective and efficient delivery of transactional service as TSC.

3. PSC: E-participation is discussed initially in the context of e-democracy, which is usually regarded as the online way of public involvement (Gronlund, 2003; Helbig, Gil-Garcia, & Ferro, 2009; Sandoval-Almazan & Gil-Garcia, 2012). With the development of ICTs and the prevalence of EGS, e-participation is not only the politicians’ authority but also the ordinary citizens’ rights. The citizenry has a chance to vote and contribute in deciding on civil and public issues (Evans & Yen, 2006; Helbig et al., 2009). E-participation has clearly become one kind of online service for public involvement (Helbig et al., 2009). With the rapid development of the Chinese economy and technologies, especially with the wide
expansion of Internet use, China has improved substantially in response to escalating public pressure for reforms in bureaucratic public administrative procedures. All government levels have thus loosened their mandate and control on the free use of Internet applications (e.g., social network tools) for participation in civil and public issues. For example, web hearing of witness are becoming more and more common e-participation channels at the level of China’s local government. Through e-participation activities, the level of democracy, quality of government decision, and acceptability of policy can be enhanced (Hu et al., 2012; Quintelier & Theocharis, 2013). Although important modifications to the organizational and institutional frameworks would be necessary, the potential for local electronic governance through networks of government and nongovernment actors via Internet portals is clearly present (Helbig et al., 2009). Therefore, the e-PSC should not be neglected. We then define PSC as the governmental capability to deliver effective and efficient e-participation services.

Generally, the aim of CSC is to transfer government-held information, data, infrastructure, and human resources, among others, into service contents. Therefore, Model 2 (Figure 2) is proposed. The hypothesis is stated as follows:

**Hypothesis 2:** CSC can be measured by ISC, TSC, and PSC.

**SDC.** Following the views of SQV, conveniently accessed design and quickly accessed services make users feel convenient and save time when accessing public services through e-government websites (Carter & Belanger, 2005; Papadomichelaki & Mentzas, 2012). Low equipment requirements can make EGS easier to use especially in some undeveloped areas (Chen, 2009). Jaeger and Thompson suggest that the equity to user of e-government systems is important to change the states of information scarcity (Jaeger & Thompson, 2004). Hung, Chang, and Yu (2006) consider personal privacy-protected function, reliability in service delivery, and service access assistance as three key factors influencing user behavior when using e-government systems. Therefore, the attributes of SDC are described as technical quality, technical adequacy, assurance, reliability, accountability, accessibility, and so forth (Hu et al., 2012; Tan et al., 2013). Moreover, from the view of OPV and ITCM, service process management is usually regarded as the necessary tool to assess and improve service performance. As a delivery mechanism of EGS, the SDC is paid greater attention compared with the service-providing characteristics that influence user’s satisfaction when using e-service systems.

**ODC.** The needs of users and technology are ever changing (Apostolou, Mentzas, Stojanovic, Thoenssen, & Lobo, 2011). The following are questions discussed in literature on RBV. How can
governments catch up with these ever-changing demands? How can governments implement newer IT to meet the users’ current and future demands? The term dynamic capability is often cited (Døving & Gooderham, 2008; Teece, 2008; UNDESA, 2012). In this context, “time” is the key variable that enables organizations to adjust their capabilities to provide proactive services (Klievink & Janssen, 2009). However, as a kind of public goods, EGS should take user demand as a key variable. Thus, “ODC” is considered here to describe the ability to meet the users’ ever-changing needs by adopting, developing, copying, adjusting, or creating new IT applications (Hu et al., 2012).

Specifically, ODC means that governments always initiate the adoption of new and advanced IT, continuously develop information resources and transform them into new service items, absorb new successful practical experiences and implement them into providing better services, change the inner resources configuration when providing new services or heightening service quality, and set suitable reaction measures to deal with emergencies. ODC also focuses on the adaptive ability of responding to the changes in public demands, organizational renovation, and technological advancement.

Structural Model of EGSC

From OPV and ITCM, the EGSC can be improved by effectively guiding its structural components. In Figure 3, we assume that several potential relationships exist amongst ODC, SDC, and CSC, which make EGSC components an organic system and cooperatively provide expected outcomes.

CSC is discussed in numerous studies and practices, as reported in Section on CSC. It is one of the core functions of an e-government system, whether in a developing country like China or in developed countries such as the United States, Republic of Korea, or the United Kingdom (Chen, 2009; Ma et al., 2005; Reddick, 2009; UNDESA, 2012).

However, an important issue is whether SDC has effects on CSC or moderates the effects of ODC on CSC. These different roles are depicted in Figure 3. Understanding whether, or how, SDC affects CSC is important because it will provide effective references in designing an EGS delivery mechanism. In addition, whether SDC should be modeled as an antecedent or a moderator of CSC has yet to be empirically investigated. Many studies have also examined and concluded that ODC has direct effects on an organization’s performance (IBM, 2010). However, no evidence exists whether ODC directly affects CSC and SDC or indirectly affects CSC through mediating the SDC.

Therefore, we expect that SDC will moderate the effects from ODC to CSC. The outcome of EGS will be directly affected by SDC and indirectly affected by ODC. Moreover, SDC will be directly affected by ODC. Thus, to state the next hypotheses is appropriate.

**Hypothesis 3:** SDC has significant, direct, and positive effects on CSC.
Hypothesis 4: ODC has significant, indirect, and positive effects on CSC.

Hypothesis 5: ODC has significant, direct, and positive effects on SDC.

Research Design and Data Analysis

We examined the models of EGSC using data collected from the subjects who worked in government service functional agencies. Generally to say, they know more about their sector’s EGSC than outer users including citizens, businesses, or other government sectors. For each subject, a questionnaire was used to measure his or her feeling about EGS implementation. The 5-point Likert-type scale was adopted. Levels 1 to 5 represent the negative or positive response to a statement, from strongly disagree to strongly agree.

Instruments Development

To collect data, we designed the questionnaire in four steps. First, the field studies were reviewed and a group containing the possible items was developed for the evaluation of CSC, SDC, and ODC (detailed see the section on data collection). Then, a small range sampling was executed. For the sampling, we asked for comments on the constructs and a detailed description from 26 senior MIS and IM staff or experts who were managers or operators of EGS systems in Chinese local governments, such as the State Information Center and the Information Center of Jiangsu Province (ICJP). As a result, the revised and refined constructs, including 11 items dealing with CSC (i.e., 4 for ISC, 4 for TSC, 3 for PSC), 7 for SDC, and 5 for ODC, were developed, and the list of questions or indicators to be used in assessing capability was produced. Next, Chinese/English translations were done for five rounds to ensure that no interpretation differences exist in the questionnaire items.

Finally, to examine the reliability of the constructs, 120 presurvey questionnaires were carried out and 99 were obtained. The constructs’ reliability and validity were tested using AMOS Version 8.7.0. Two SDC items were eliminated because of their insignificant loading coefficients. Consequently, the final questionnaire contained 11 items dealing with CSC, 5 for SDC, and 5 for ODC (see Appendix).

Data Collection

The survey was conducted through face-to-face and telephone interviews, e-mail correspondence, and paper questionnaire from August 2009 to January 2010. To attain a high response rate, we sampled the government employees in government offices or university master of public administration (MPA) centers. To obtain high-quality data, the participants were asked to apply a reasonably consistent understanding of the dimensions and indicators. To achieve this, the questionnaire was bound, including the detailed descriptions of the goal, interpretations of the higher and lower scale of capability, and the instructions of how to complete the survey as well as how to leave their comments and suggestions.

A total of 1,942 questionnaires were distributed among 42 samples, including 7 government departments and 35 MPA centers. Data were collected in 2 months. A total of 1,372 completed questionnaires were collected, of which 860 questionnaires were considered valid after excluding those with missing values (163) and inconsistent responses (349). The respondents were taken across Mainland China.

Data Analysis

Demographics and Descriptive Statistics. Of the 860 government employee respondents, nearly 57% were male and 43% were female. Among them, 93% were MPA students who had attended the course electronic government or other related courses. As such, they should be familiar with the
methodology, technology, and theory of EGS. The mean age of the respondents was 38 years, and 72.67% worked in governments for about 3 to 8 years, thus reflecting the fact that the subjects should have higher perceptions and experiences of EGS applications. Regarding the educational level, 100% had high school diplomas. The respondents were from 102 cities of the 26 provinces and have worked in various positions. Table 1 shows the demographics of the subjects.

**Scale Validation.** Given that the instruments were summarized from the existing studies, we first tested the construct through two independent stages, similar to McDonald and Ho’s approach (2002). The first- and second-order confirmatory factor analyses (CFAs) were used to appraise measurement models, and the structural equation analysis was used to appraise structural models. The measurement models were tested and reported by Hu, Shi, Wen, and Wang (2012).

The overall construct validity was tested using hierarchical CFA (HCFA). The scale validation of the constructs was checked first. To examine the goodness of fit to the overall CFA model, a correlation was imposed such that the $\chi^2$ normalized by degree of freedom ($\chi^2/df$) should not exceed 5. In addition, the goodness-of-fit index (GFI) and normed fit index (NFI) exceeded 0.90, and the adjusted GFI (AGFI) and the non-NFI (NNFI) exceeded 0.80. All the parameters shown in Tables 2 and 3 were AMOS estimates obtained using maximum likelihood estimation.

HCFA results (Table 3) indicated that the measurement model (M1) adequately fits the observed data: $\chi^2$ was sensitive to sample size and likely to be significant for a large sample, ($\chi^2/df$) was 3.0, NFI was 0.95, NNFI was 0.96, GFI was 0.942, AGFI was 0.93, and comparative fit index (CFI) was

<table>
<thead>
<tr>
<th>Table 1. Demographic Background of Subjects (N = 860).</th>
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<td><strong>Categories</strong></td>
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<tr>
<td>Male</td>
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<tr>
<td>Female</td>
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<tr>
<td>No information</td>
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<tr>
<td>&lt;25 Y</td>
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<tr>
<td>26–35 Y</td>
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<tr>
<td>36–45 Y</td>
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<tr>
<td>&gt;46 Y</td>
</tr>
<tr>
<td>&lt;1 WLY</td>
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<tr>
<td>1–3 WLY</td>
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<tr>
<td>3–5 WLY</td>
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<tr>
<td>&gt;5 WLY</td>
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<tr>
<td>No information</td>
</tr>
<tr>
<td>Bachelor’s degree</td>
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<tr>
<td>Master’s degree</td>
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<td>Doctor’s degree</td>
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<tr>
<td>Clerk level</td>
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<td>Vice-township level</td>
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<td>Township level</td>
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<td>Vice-county level</td>
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<td>County level</td>
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<td>Vice-province level</td>
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<td>Province level</td>
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<tr>
<td>No information</td>
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<td>Cities</td>
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<td>Provinces</td>
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*Note. Y = years old; WLY = working life (years); S = sum.*
0.96, thus suggesting adequate model fit. Additionally, the root mean square error of approximation (RMSEA) was 0.049, also indicating an adequate model fit. Furthermore, all factor loadings were significant \((p < .001)\), indicating convergent validity that was used to assess the agreement among different measurement methods. Generally, these statistics indicated a good fit for the measurement model.

Table 2 also enlists standardized parameter estimates that are often more interpretable in the case of social science data than nonstandardized estimates; the associated \(t\) values, squared multiple correlations \(R^2\), composite reliability \(CR\), and average variance extracted \(AVE\) were included. Notably, the \(t\) values were all significant, \(R^2\) values ranged from 0.42 to 0.91, \(CR\) values all exceeded 0.50, thus indicating acceptable reliability for all latent variables (factors; Raine-Eudy, 2000).

Table 2. Standardized Parameter Estimates and \(t\)-Value for Confirmatory Factor Analysis \((n = 860)\).

<table>
<thead>
<tr>
<th>Observed Variables</th>
<th>Latent Variables</th>
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<tbody>
<tr>
<td>Item</td>
<td>Std. Factor Loading ((t)-value)</td>
</tr>
<tr>
<td>PUI</td>
<td>0.72(^a)</td>
</tr>
<tr>
<td>PAI</td>
<td>0.67 (17.76)</td>
</tr>
<tr>
<td>PTI</td>
<td>0.75 (19.82)</td>
</tr>
<tr>
<td>PRI</td>
<td>0.75 (19.71)</td>
</tr>
<tr>
<td>PCT</td>
<td>0.86(^a)</td>
</tr>
<tr>
<td>FFT</td>
<td>0.87 (31.27)</td>
</tr>
<tr>
<td>PET</td>
<td>0.68 (22.17)</td>
</tr>
<tr>
<td>PST</td>
<td>0.66 (21.26)</td>
</tr>
<tr>
<td>PCS</td>
<td>0.72(^a)</td>
</tr>
<tr>
<td>PHRS</td>
<td>0.90 (24.78)</td>
</tr>
<tr>
<td>PQFS</td>
<td>0.90 (24.82)</td>
</tr>
<tr>
<td>CAD</td>
<td>0.65 (19.17)</td>
</tr>
<tr>
<td>QAS</td>
<td>0.70 (17.99)</td>
</tr>
<tr>
<td>PPD</td>
<td>0.66 (17.39)</td>
</tr>
<tr>
<td>CDS</td>
<td>0.66 (17.34)</td>
</tr>
<tr>
<td>SAA</td>
<td>0.70(^a)</td>
</tr>
<tr>
<td>ANA</td>
<td>0.79 (19.71)</td>
</tr>
<tr>
<td>DTS</td>
<td>0.88 (21.29)</td>
</tr>
<tr>
<td>AIP</td>
<td>0.82 (20.25)</td>
</tr>
<tr>
<td>CPS</td>
<td>0.81 (20.10)</td>
</tr>
<tr>
<td>SRM</td>
<td>0.65(^a)</td>
</tr>
</tbody>
</table>

Note. CR = composite reliability; AVE = average variance extracted.

\(^a\)A parameter fixed at 1.0 in the original solution. \(t\)-value for item factor loadings are indicated in parentheses.

Results

Hypotheses Testing. The M1 results show that Hypothesis 1 is supported. Given that few efforts were exerted to discuss whether the instruments (i.e., ISC, TSC, and PSC) could explain CSC, we proposed the measurement model of CSC (M2; Figure 2). M2 was tested via first-order CFA. The testing indicated that it adequately fits the observed data (Table 3). Thus, Hypothesis 2 is supported. In general, the EGSC of Chinese local governments can be fully predicted by ISC, TSC, PSC, SDC, and ODC.
Path Analysis of Structural Model. Hypotheses 3 to 5 were tested using M3. The hypothesized model consisted of three paths among the latent constructs (Figure 4). The structural model $\chi^2/df$ had a value of 2.92, whereas RMSEA was 0.047, NFI was 0.95, NNFI was 0.96, GFI was 0.94, and CFI was 0.97 (Table 2). An adequate fit was demonstrated between the hypothesized model and the observed data.

PA was used to examine the significance and strength of the hypothesized effects in the research model. According to Figure 4, three path coefficient-related hypotheses were examined. Figure 4 showed the path coefficients and path significance.

A significant path was revealed from SDC to CSC (with a path coefficient of 0.68, ($\gamma_1 = .68, p < .0001$)), supporting Hypothesis 3. Similarly, the path coefficients of factors between ODC and CSC ($\gamma_2 = .21, p < .0001$) and between ODC and SDC ($\gamma_3 = .80, p < 0.0001$) were also significant, supporting Hypotheses 4 and 5, respectively.

Discussion

As a kind of organizational capability, EGSC is embodied through the results of business processes and the outputs of EGS (Hu et al., 2012). Moreover, it involves the complex interplay of various components. Previous studies separately discussed the aspects of the problem while a systematic classification of factors was also minimal. Thus, to fill this gap, we proposed relevant measurement models and structural models to examine the interplay of relationships among the components of EGSC. These models explored the mechanism of how capability components affect one another and how they shape the government’s abilities in delivering e-services.

Content Service Capability. Accordingly, CSC was found to have a significant positive effect on EGSC (Table 2). Quantitatively, CSC has the strongest explanation ability to EGSC ($R^2 = .81$). ISC, TSC, and PSC were also found to have significantly affected CSC with high coefficients. That is, changing ISC, TSC, and PSC can effectively explain the changing CSC. Information services, catering to demand, authoritative, timely, and reliable information services to citizens and businesses are helpful in enhancing the capability of EGS system, in improving government transparency, and in eliminating information asymmetry. Similarly, the improvement in TSC and PSC will meet public and government needs on transactional and participation services.

SDC. The SDC was found to have a significant, positive effect on EGSC and is thus useful for improving EGSC. The path coefficients from ODC to SDC and SDC to CSC were also found to

Table 3. Fit Statistics of the Hypothesis Models.

<table>
<thead>
<tr>
<th>Fit measures</th>
<th>Model 1</th>
<th>Model 2</th>
<th>Model 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\chi^2/df$</td>
<td>3.0</td>
<td>2.65</td>
<td>2.92</td>
</tr>
<tr>
<td>RSMEA</td>
<td>0.049</td>
<td>0.044</td>
<td>0.047</td>
</tr>
<tr>
<td>NFI</td>
<td>0.95</td>
<td>0.98</td>
<td>0.95</td>
</tr>
<tr>
<td>NNFI</td>
<td>0.96</td>
<td>0.98</td>
<td>0.96</td>
</tr>
<tr>
<td>CFI</td>
<td>0.96</td>
<td>0.99</td>
<td>0.97</td>
</tr>
<tr>
<td>RMR</td>
<td>0.039</td>
<td>0.030</td>
<td>0.038</td>
</tr>
<tr>
<td>GFI</td>
<td>0.94</td>
<td>0.98</td>
<td>0.94</td>
</tr>
<tr>
<td>AGFI</td>
<td>0.93</td>
<td>0.96</td>
<td>0.93</td>
</tr>
</tbody>
</table>

Note. AGFI = adjusted goodness of fit index; CFI = comparative fit index; df = degrees of freedom; GFI = goodness of fit index; NFI = normed fit index; NNFI = nonnormed fit index; RMR = root mean square residual; RMSEA = root mean square error of approximation.
be significant. The SDC, therefore, has a direct, positive impact on CSC, whereas ODC has a direct, positive impact on SDC. In other words, the EGS delivery capability is helpful in improving effective and efficient content services, whereas ODC is helpful in effectively enhancing EGS delivery abilities. Furthermore, the PA indicated that ODC has an indirect positive influence on CSC through SDC.

Chinese local governments can improve the quality of content services by paying more attention not only on content services but also on the capabilities in providing service (i.e., SDC) and in predicting service demand (i.e., ODC).

ODC. In the measurement model of EGSC, ODC had significant effect with a path coefficient of 0.83 ($p < .0001$). We measured ODC using five subdimensions. Among these, “continuously develop information resources and transform them into new service items” has the highest significant path coefficient of 0.88 ($p < .0001$; Table 2). Hence, developing information resources and transforming them into available services are the most important facets for the improvement in ODC. Otherwise, ODC has significant, direct/indirect, positive impacts on CSC. Therefore, the improvement in ODC has direct positive effects on the quality of content services on one hand and indirect positive effects through SDC on the other hand.

Structural Relationships Among Them. Furthermore, we proposed a microstructural model (M4; see Figure 5) to analyze the detailed relationships among ODC, SDC, ISC, TSC, and PSC.

Figure 5 indicates that ISC is directly affected by SDC and TSC, significantly with high coefficient. This means that the higher SDC will lead to ISC, and the higher ISC will lead to a higher TSC. Therefore, the e-SDC will significantly help in improving effective and efficient information service, and ISC will help in improving the efficiency of transactional services.

Moreover, ODC directly affects TSC and PSC, and indirectly affects ISC, TSC, and PSC by mediators with a significant coefficient. This corresponds to the explanation on mediation effects of MacKinnon, Lockwood, and Williams (2004). Hence, elevating ODC does not directly improve the e-service outcomes but directly improves the SDC first, then the e-service outcomes. Similarly, ISC indirectly affects PSC via the mediator of TSC so that the effect from ISC to PSC becomes insignificant based on SEM results.

For ISC, TSC, and PSC, the effect from TSC to PSC was direct, whereas the effect from ISC to PSC was completed through mediation effects. To improve the effectiveness and efficiency of participation service, a high ISC is necessary. According to Jaeger and Thompson (2004) and Carter and Belanger (2005), easy and reliable information service is helpful for users looking for the required transactional services. Furthermore, enhancing the quality of transactional services is
a part or a full objective of e-participation in various countries. Therefore, ISC and TSC are the antecedents of PSC.

**Implications for Management**

Twofold implications for management are considered. First, the PA results provide referenced routes to improve EGSC. The enhancement of SDC was suggested to lead to a better EGSC and ISC. Unexpectedly, SDC indirectly affected TSC, which was mediated by ISC. Hence, to enhance transaction service quality, the improvement in ISC was an antecedent factor. The analysis also suggested that SDC and ODC have significant and positive impacts on PSC, meaning that PSC will be improved by enhancing the capability to provide service and increasing the social demand. The ODC has a positive, significant effect on SDC, which proves that IT absorption capability, on-demand resources configuration, and continuous development of information resources are helpful in meeting the ever-changing service needs of users.

Second, the measurement model of EGSC provides a quantitative and easy-to-use tool for e-government leaders, CIOs, and managers to assess the EGSC. This model is a basis for judging whether agencies are prepared to lead e-government initiatives. The measurement model can also be developed into a set of toolkits (e.g., automatic software or management guideline) used in EGS performance management. The approaches of CMMI and ITSM provide useful path to develop the measurement model into a toolkit.

We believe that the above-mentioned facets are significant for the Chinese local government sectors in designing an effective EGS delivery mechanism and improving their EGSC.

**Limitations and Conclusion**

This study has several limitations. One relates to nonresponse bias, which is normally associated with a survey. Determining how respondents differ from nonrespondents is possible. Although MPA students in China are limited to bachelor’s degree holders and government employees, some of them may not be engaged in EGS-related jobs and may not be familiar with IT. Moreover, employees come from different social, cultural, economic, or technical backgrounds and Chinese bureaucratic levels. Hence, nonresponse may occur under certain circumstances, from which some measurement bias could have resulted. Another limitation is the uncertainty regarding the effectiveness of the method to improve the success of EGSC initiatives. Some agencies would possibly try to brag about their e-gov achievements based only on their EGSC scores, but they in fact intentionally ignore their e-gov systems’ usability. Therefore, the government is suggested to use this measurement method with other service quality/usability assessment approaches, such as eGov-ACSI (Papadomicelaki et al., 2011).
et al., 2006), SERVQUAL (Cresswell et al., 2006) and GovQual (Batini, Viscusi, & Cherubini, 2009).

The other limitation is the uncertainty in the effectiveness of the method to improve the success of EGSC initiatives. The practitioners’ easy acceptance of the measurement suggests that it can be used as designed. However, as of this writing, there is no direct evidence of the impact that such use will have on the progress or ultimate success of EGS projects. Additional practical research is needed in the future to explore this objective.

This article therefore proposes a framework of EGSC based on the literature review and the Chinese e-government practices. It also constructs measurement models and structural models of EGSC. These new models unveil the structure of EGSC, and the PA results provide government policy makers or IT managers details on how to enhance EGSC by improving the components’ performance. This article represents a first step toward a deeper understanding of the EGSC’s structure. We hope that other researchers will build on and extend the approach outlined in this study.

Appendix

The Constructs of E-Government Services Capability (EGSC)

Content Service Capability (CSC)

Information Service Capability (ISC). The information service system (ISS) of your department is:

- PUI: always providing useful and demanded information to public.
- PAI: always providing information services from firsthand data or authoritative data.
- PTI: always providing timely information services.
- PRI: always reliable and accessed successfully.

Transaction Service Capability (TSC). The transactional services system (TSS) of your department is:

- PCT: convenience oriented designed for meeting users’ demands.
- FFT: providing fully functional transaction services to public.
- PET: providing effective and efficient transaction services to public.
- PST: always successfully accessed by public.

Participation Service Capability (TSC). The participation service system (PSS) of your department is:

- PCS: convenience oriented designed for users’ e-participation.
- PHRS: always highly responsive to user’s e-participation actions.
- PQFS: always quick feedback to public participation actions.

Service Delivery Capability (SDC)

The EGS system of your department is:

- CAD: conveniently accessed design for user’s access.
- QAS: designed to provide quickly accessed service for user.
- PPD: privacy protected designed for user.
- CDS: consistent in delivery services to user.
- SAA: designed with service access assistance.
On-Demand Capability (ODC)

Your department:

ANA: takes an open mind in adoption of new and advanced information technology (IT; hardware and software) when providing e-government services (EGS).

DTS: pays much attention to continuously develop information resources and transform them into new service items for public.

AIP: pays much attention to absorb new successful practical experiences and implement them into providing more and better services.

CPS: pays much attention to change the inner resources configuration for providing new services or heightening service quality.

SRM: has set suitable reaction measures, such as double modular fault-tolerant computer system, uninterruptable power supply (UPS), and duplicate hot standby system (DHSS) for dealing with emergencies.

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