

Received July 11, 2019, accepted July 23, 2019, date of publication August 9, 2019, date of current version August 23, 2019.

Digital Object Identifier 10.1109/ACCESS.2019.2934138

# The Influence of Public Engaging Intention on Value Co-Creation of E-Government Services

GUANGWEI HU<sup>1,3</sup>, JIAQI YAN<sup>1</sup>, WENWEN PAN<sup>1,2</sup>, SOHAIL RAZA CHOHAN<sup>1,3</sup>, AND LIU LIU<sup>3</sup>

<sup>1</sup>School of Information Management, Nanjing University, Nanjing 210093, China

<sup>2</sup>School of Management, Nanjing University of Posts and Telecommunications, Nanjing 210093, China

<sup>3</sup>Institute of Government Data Resources, Nanjing University, Nanjing 210093, China

Corresponding author: Guangwei Hu (hugw@nju.edu.cn)

This work was supported in part by the National Natural Science Foundation of China (NSFC) under Grant 71573117 and Grant 71701091, in part by the Chinese Ministry of Education Project of Humanities and Social Science under Grant 17YJC870020, in part by the Jiangsu Department of Human Resources and Social Security under Grant 2015-XXRJ-001, and in part by the Nanjing University.

**ABSTRACT** The wide acceptability of ICTs and social media enriches the delivery platform of e-government (E-gov) services. The public can explore problems, provide ideas, and design solutions to improve E-gov services (EGS) in a convenient and timely manner. The role of the public transforms from passive users to active, informed partners or co-creators of EGS innovations and problem solving. However, value co-creation is an interactive process, and service value can only be created through joint efforts of all participants. This study builds an influence factor model of public engaging intention towards EGS value co-creation, based on technology acceptance theory, trust theory, and motivation theory, to explore the impact factors and impact paths. Comprehensive validation is further conducted through path analysis using structural equation modeling (SEM) methods. Path analysis interprets how the public will accept and adopt value co-creation behavior for EGS. The results presented in this study might be helpful for government policymakers or IT managers seeking to enhance EGS value creation through designing more effective incentive mechanisms. This study also introduces a comprehensive picture of the potential paradigm of public service value creation in an era of increasing user dominance.

**INDEX TERMS** E-gov service, value co-creation, technology acceptance, public engaging intention, social media.

## I. INTRODUCTION

The Internet has exerted increasing influence on people's lifestyles given the development of ICTs [1], [2]. E-gov services (EGS) continue to receive increased public attention [2]–[4]. The wide application of government social media, such as government microblogs (i.e., Facebook accounts, Twitter accounts, WeChat accounts) and APPs, expanded the scope of government service-providing platforms and approaches to public interaction [5]. However, the demand for public services will not be met if needs/interests are not identified. Government agencies or organizations that bear the responsibility of providing EGS often have limited awareness of the demand; sometimes they remain unaware of needs until an urgent solution becomes essential for a particular situation [1]. Individuals involved in these contexts are likely to be the first to gain awareness

of these service needs. The disconnection between government agencies and citizens who have knowledge about these demands has resulted in the failure to identify these needs in a timely manner. When these demands are identified, sometimes they are not defined accurately, thereby leading to inefficient and/or costly service delivery. New technologies and mechanisms can help address this issue and enable citizens to assume an active role in discovering, identifying, and defining public services that need to be provided [3], [6], [7]. Therefore, the value creation pattern of government services is transformed from independent government creation to collaborative co-creation [6]. The role of the public in the value creation process of government services then changes because the public is not only the user and receiver of EGS but also the value co-creator [4], [8].

A mapping study was carried out to investigate the trend in e-service domains over time, and it was shown that there is increasing demand for government e-services adoption among the citizens of various countries [9]. Rapidly increas-

The associate editor coordinating the review of this manuscript and approving it for publication was Saqib Saeed.

ing volumes of information, along with data resources on government big data-based platforms, have motivated public involvement, which helps people develop abilities related to the construction, design, supply, and improvement of EGS and also increased the value of public service to satisfy personal and social needs. These data resources encourage organizations and the public to participate in data mining and data application through innovative competitions, government procurement, businesses, and welfare. Individuals and organizations can identify possible service value opportunities along with introducing solutions and suggestions based on their opinions, real needs, and contexts. They can share and transfer information and suggestions to relevant government sectors in a timely, convenient, and accurate manner [1]. The purpose of this initiative is to make the government smarter by improving the effectiveness and efficiency of government decisions and expanding the value dimensions of government services [10].

Value creation in the digital age, represented by co-creation between organizations and users, is seen as increasingly important [11], [12]. As a matter of fact, value co-creation is an interactive process, and service value can only be created through joint efforts of all participants (i.e., citizens, IT providers, and government agencies). Thus, the public's willingness and attitude toward EGS value co-creation impacts participation. What factors influence public engaging intention (PEI) toward EGS value co-creation? How do these factors influence PEI? How should the government motivate the public to participate in these activities? Understanding the reasons for such behavior is vital to the adoption of EGS value co-creation. However, the empirical discussions on the influence factors and paths of acceptance and adoption of EGS co-creation mechanisms are still lacking. This has made it difficult for governments to formulate guiding policies and implement strategies. This study fills this gap by developing an SEM model that aims to investigate the factors that affect PEI in EGS value co-creation. This study also attempts to explain the behavioral characteristics of public participation in value co-creation and identify ways to promote a positive attitude towards participation. It is hoped that this research can provide a theoretical explanation for the increasing EGS value co-creation activities.

The study is structured as follows. The introduction is followed by an extensive research background that reviews EGS value co-creation and its practices. The subsequent section explains the theoretical framework, followed by methodology and an empirical study. Findings and suggestions are presented. Finally, the study ends with a conclusion and limitations.

## II. RESEARCH BACKGROUND

### A. E-GOVERNMENT SERVICES

Technological innovation provides an opportunity for the public of any country to have equal access to all government

services being offered from time to time, which is formally known as EGS [2], [13], [14]. EGS is regarded as an effective and efficient channel to deliver public services, even in the midst of global economic crises [83], [84]. This may require the government to transform itself by using E-gov systems [85]. At the same time, the interaction between the government and society influences the government to use the latest technology trends in government electronic applications and e-services. We are in a new era of machine-driven societies due to the 4th industrial revolution and deployment of innovative technologies like AI, IoT, big data, geo-spatial data, deep machine learning, etc. Due to this revolution, the government sector is rapidly embracing new technology trends to meet the EGS needs of society on demand [86], [88].

### B. VALUE CO-CREATION

Value co-creation is becoming a dominant trend in service science, particularly in the information management and service domains [8], [11]. According to Vargo and Lusch, the dominant marketing logic is transforming from a Good Dominant (G-D) logic to a Service-Dominant (S-D) logic, and the role of consumers is changing from passive product and service recipients to active development partners [15], [16]. This framework leads to the assumption that the value creation process is transformed from enterprise and product-centered to individual and experience-centered [11], [17]. Value co-creation theory has been the focus of research and discussion among scholars since 2000, with two representative viewpoints, namely, co-creation theory based on "S-D logic" and co-creation theory based on consumer experience. Despite the differences in research perspective and connotation, both viewpoints aim to create product and service value through effective interaction between consumers and enterprises [18], [19]. Value co-creation theory received significant attention from scholars, who explained its general concept and connotation from different perspectives (Table 1). Existing literature indicates that scholars have different viewpoints elaborating the concept of value co-creation. Their core ideas are summarized in the following aspects:

- a) The stakeholders of value co-creation usually include two or more core entities, namely, providers (manufacturers) and consumers (users) of a product or service. The process of co-creation implies the need for each side to contribute.
- b) Interaction is the reason, intermediary, and result of the collaboration between providers (manufacturers) and consumers (users) of a product or service.
- c) Value co-creation can provide consumers (users) with improved product or service usage experiences and will increase the providers' efficiency and cost savings.
- d) Value co-creation is complex when the boundaries between collaborating communities are complex or not clearly defined.

**TABLE 1. Various viewpoints of value co-creation.**

Authors	Viewpoints
Vargo & Lusch [15]	The emergence of service-dominant (SD) logic has reinstated that the firm is merely the facilitator of value proposition and it is the customer who co-creates value.
Prahalad & Ramaswamy [16]	Co-creation builds a connection between enterprises and consumers. Enterprises actively engage in dialogue with consumers instead of catering to consumers. In this way, both sides participate in the construction of service experience
Xie et al. [18]	Value co-creation is presumed because value creation activities undertaken by the consumer result in the production of goods that they eventually consume, which becomes their consumption experiences.
Adeleke & Abdulrahman [20]	Cooperative activities launched by product and service providers to promote product and service innovations give providers and consumers mutual benefits.
Grönroos & Voima [7]	Value co-creation refers to customers' creation of value-in-use, whereas co-creation is a function of interaction.
Vartiainen & Tuunanen [21]	Value co-creation and co-destruction are especially interesting in relation to information systems (IS) because they simultaneously occur when IS is used for collaboration.
Uppström & Lönn [22]	Value is co-created and co-destroyed in the collaborative processes. Value co-creation is complex when the boundaries between collaborating communities are complex; when boundaries are complex, collaboration requires complex IS artifacts in e-government.
Osei-Frimpong, Wilson, & Lemke [8]	Effective value co-creation activities require service providers to adopt delivery approaches that would effectively integrate user resources to co-create value.

- e) Effective co-creation requires IS artifacts or platforms.
- f) The emergence and usage of social media, big data, and cloud computing are effective drivers of value co-creation between organizations and users.

### C. E-GOVERNMENT SERVICES VALUE CO-CREATION

Value co-creation theory was disseminated quickly from the marketing field and is now incorporated into fields such as public service, society governance, manufacturing, and education [18], [20]. In the field of EGS, the government and the public (citizens, enterprises, government employees, social groups, and non-governmental organizations) are collaborating in value co-creation in traffic services, food security, social work, environmental protection, policy making, and neighborhood maintenance [12], [23]. A case summary suggests that the government first provides relevant information and skills in public service and service provision for relevant users through EGS platforms [22]. These platforms relate to the physical or virtual venues of citizen co-creation by facilitating knowledge-sharing and interaction among participants and modularizing or partitioning the problem-solving process. The public then perceives the quality of service according to their demands while capturing and consuming

these services. The public can interact with government employees via various participation interfaces [1]. Based on relevant knowledge and skills, they can fully express their expectations, requirements, and suggestions for EGS design, provision, and improvement [10]. Four distinct roles of citizens in co-creation are identified, namely, explorer, idea creator, designer, and diffuser [1]. Through such joint public efforts, the government can provide EGS experiences with increased effectiveness, efficiency, and capability to understand and meet personalized demands [22].

The governments of various countries, such as the United States, Australia, Greece, Korea, Canada, and China, embarked on novel initiatives to engage citizens and organizations in collaborative innovation and problem solving [1]. Examples of co-creation in government services include the U.S. government's crowdsourcing initiative (i.e., Challenge.gov); FixMyStreet initiative, which was launched in the United Kingdom; the initiative of the Danish government to co-create climate strategy with citizens (Climate Consortium Denmark); and the "e-People initiative" of the South Korean government to support online civil petitions. Singapore applied value co-creation in its "2011-2015 e-government masterplan" (eGOV2015), which explicitly pointed out that the delivery of EGS in this phase will be converted from "Government-to-You" to "Government-with-You"; the goal of this initiative was "through more interaction and value co-creation activities between the government, the public and the private sectors, to create better service value experience for Singapore citizens" [24].

Existing studies related to EGS value co-creation in the academic field mainly focus on the participation process, value co-creation tools (system), and approaches to promote value co-creation [12], [17]. Research on the participation process mainly emphasizes the interaction process between the government and the public in value co-creation [17]. Reference [13] built a process model of EGS value co-creation to explain the value co-creation mechanisms based on the DART model and initiative of interaction while giving full consideration to factors such as service orientation, experience, knowledge, and skills required. The study also proposed a prospective EGS value co-creation framework, which consisted of three parts, namely, personal unique experience value of co-creation, public cooperation in co-creation, and acquisition of management value, government partners, and competitors [4]. In this framework, interaction is the center of co-creation and value is the core output decided by the public through communication and service networks. This study indicated that the knowledge, skills, and experience mastered by the public plays an important role in value co-creation, and the interaction between the government and citizens is an essential and indispensable condition in value co-creation [4].

Moreover, the complexity of boundaries among communities affects inter-organizational collaboration outcomes in terms of co-created value [22]. The government and the public use government IS artifacts in the process of value

co-creation to “connect with” each other and establish dialogues; thus, EGS is an indispensable part of value co-creation [25]. Social media is considered a potential tool for EGS value co-creation, which contains several essential elements such as determination and involvement of the government, a designated community manager who follows up with the community of users, secured privacy of users, and an easy-to-use technological platform [5].

Scholars exerted efforts to identify approaches to promote the effectiveness and efficiency of value co-creation. A conceptual model was proposed to promote communication among key stakeholders (i.e., system designer, the public, and government agencies) to implement the goal of social inclusion [26]. To effectively implement public-centered EGS, the Australian Department of Human Services (DHS) extends public participation to the design process and uses the power of the public to decide “what type of service to implement in what type of way” [26]. From the perspective of innovation, the co-creation of services by public authorities and community groups is essential in realizing the benefits of investment in ICTs; open innovation reveals the effect of the nature of EGS value creation and the nature of their organization [6].

Research on value co-creation in EGS remains in the initial stage. Only a few studies examined aspects such as the participation process, co-creation tools, and promotion methods. Their main contributions focused on constructing a conceptual framework, empirical discussions on the influence factors, paths of acceptance, and adoption of co-creation mechanisms. There is still a need to understand theoretical influences and persuasion methods/approaches. The present study attempts to fill this gap.

#### D. E-GOVERNMENT SERVICES VALUE CO-CREATION IN CHINA

Nowadays, China’s government websites are located in all of the provinces and cities to open public participation channels for value co-creation activities [2], [3], [27], [28]. The public can share problems and express opinions, comments, and suggestions by name to related government functional departments through methods such as e-participation, e-petitions, online questionnaires, online interviews, and electronic message boxes [29], [30]. The government can then standardize services to improve the effectiveness and satisfaction level of EGS in a timely and personalized manner. Such government online channels make it easy for the public to be involved in EGS value co-creation [1], [30]. Based upon these approaches, the government has designed and developed a series of value co-creation channels, such as the “transportation facilities woodpecker” and “traffic violation photography” modules offered by the WeChat account “Wuxi traffic police” and the “#Hefei real-time road situation#” launched by the Anhui traffic information service website’s official microblog. Some interactive e-participation channels are available as mobile APPs, such as the “Public Supervision APP” [Figure 1(a)], the “Environmental Protection Snap APP” [Figure 1(b)], and the “Social Governance



FIGURE 1. E-participation and e-petition apps.

Proposal APP” [Figure 1(c)]. Wuxi is a middle-sized city in the Yangtze River Delta, and Hefei is the capital of Anhui province in mainland China.

Though the Chinese government has clearly embraced EGS value co-creation, there are few studies that discuss users’ intention to participate in value co-creation activities. This study was put forward under the above background.

### III. HYPOTHESES AND RESEARCH MODEL

This study aims to explore the possible influencing factors that affect the intention of social users to engage in EGS value co-creation. One of the value co-creators in EGS is the service provider, known as the public agency (or the government). The other entity is the public (or social users), which include citizens, government employees, private businesses, or social communities. In terms of process, the information interaction between the public and government is based on interaction platforms, such as government-owned EGS platforms (e.g., websites and APPs) and social media channels (e.g., Twitter, Facebook, WeChat, SinaBlog); thus, public participation in value co-creation can be viewed as acceptance of value co-creation systems [26], [31]. A significant study suggests that trust has an important influence on use, acceptance, and participation in EGS [32]. Therefore, this study explores the influencing factors of PEI from three aspects: technology acceptance, trust, and participation motivation.

#### A. TECHNOLOGY ACCEPTANCE FACTORS ON PEI

Venkatesh, Morris, and Davis introduced the Unified Theory of Acceptance and Use of Technology (UTAUT), which was combined with eight user behavior theories and models [32]. In UTAUT, personal use intention is affected by performance expectancy (PE), effort expectancy (EE), and social influence (SI) and restricted by gender, age, experience, and volunteerism.

Performance expectancy is defined as the degree to which an individual believes that using the system will help him or her to improve job performance; empirical study has proved it is the most powerful influencing factor on the intention to use information technology [32]. Various studies that examined the use and acceptance of EGS have recognized that the key

influencing factor of public acceptance and usage intention is performance expectancy [6], [31], [33].

Effort expectancy is defined as the degree of ease associated with using a system. It was noted in one study that the effort exerted to learn a technology will affect individual acceptance of that technology, and various scholars confirmed this point through empirical research [32]. A study on the influence factors of intention to use EGS among students at Sri Lanka University found that effort expectancy is an important factor; the ease of operation of a mobile government system is the primary consideration in the decision to use mobile e-government [34].

Social influence, which includes media influence and interpersonal influence, is the degree to which an individual perceives that the external environment will influence their use of the target system. Scholars studied the influencing factors of public use of EGS in Saudi Arabia, Kuwait, and other countries, and they proved that social influence plays a role in the public use of EGS [34], [35].

In EGS value co-creation, the process of public participation is completed through specific platforms, such as government service websites, microblogs (e.g., Facebook, Twitter), WeChat accounts, and APPs; thus, public participation in value co-creation can be viewed as the acceptance of the technology adopted in EGS. This study suggests that increased technological acceptance of value co-creation platforms increases the willingness of the public to engage in value co-creation.

Therefore, this study proposes the following hypotheses.

**H1:** PE, EE, and SI have a positive influence on the public's technology acceptance (TA) of EGS value co-creation platforms.

**H2:** The TA of the public toward value co-creation platforms positively influences PEI toward EGS value co-creation.

## B. TRUST FACTORS OF PEI

Trust is the expectation of the reliability of commitment made by individuals or organizations [36]; the role and function of trust is fully reflected in socio-economic exchange [32]. Literature suggests that trust may be viewed as an important factor influencing EGS adoption [37]. Gupta, Bhaskar, and Singh argued that trust of e-government websites in terms of technological acceptance is based on the perception of information, system, and service [38]. They proved that trust in technology and government is a significant predictor of citizen adoption of e-government platforms/services. These findings indicate that additional attention to trust is valuable when developing and implementing e-government initiatives.

There are two types of trust objects, namely, trust in the entity of service provision and trust in the channels of service provision [39]. Before using electronic services, users should consider the characteristics of the service providers and the technical infrastructure [37], [38]. Therefore, trust in EGS should include trust in the EGS entity, which is known as trust

in the government (TG), and trust in the reliability of applied technology, which is known as trust in the platform (TP).

The government and the public are two essential entities of value co-creation in the EGS value co-creation process. The government provides value co-creation channels and the public participates in the co-creation process [21], [22], [29]. The public's belief or trust that the government has a positive attitude toward public participation becomes important when they are deciding to participate in value co-creation [20]. Damodaran, Olphert, and Balatsoukas considered that the public needs to trust in the government's sincerity to provide information, solve problems, and offer suggestions [26]. However, value co-creation between the public and the government is completed through electronic channels, thus public trust in the safety and reliability of these channels is an essential factor [40]. The public trust in personal information security, privacy security, and whether the information they release can be delivered accurately, completely, and timely also positively impacts their decision making [41], [42]. Moreover, trust is fragile, so it is important to develop government infrastructures that assist the trust-building process with citizens [43].

Therefore, this study considers that public trust (PT) influences engaging intention toward value co-creation: higher public trust leads to stronger engaging intention. In particular, public trust in the government and the value co-creation platforms influences the overall public trust, leading to strong public engaging intention toward value co-creation. Therefore, the following hypotheses are proposed.

**H3:** TG and TP have a positive influence on public trust (PT).

**H4:** PT has a positive influence on PEI to participate in EGS value co-creation.

## C. MOTIVATION FACTORS OF PEI

Motivation is the core principle in understanding individual behavior and the driving force for individuals to take action and achieve goals [36], [44]. Motivation theory examines behavior attitude, behavior intention, and the actual behavior of information users from the angles of psychology and behavior, including self-efficacy, sense of achievement, personal appearance, recognition, and external rewards.

Self-efficacy is a measure of confidence in the ability of an individual to achieve a goal. Self-efficacy is not the actual ability of an individual, but rather the cognition of his/her ability [44]. Self-efficacy positively affects the willingness of the public to engage in value co-creation [45]. Therefore, the willingness of the public to participate in EGS value co-creation will be strong when they believe they have enough knowledge and abilities to provide valuable information to others, solve problems, and offer helpful suggestions.

The sense of achievement is a psychological feeling generated when a person strikes a balance between desire and reality [32], [35]. In a study on participation motivation of problem solvers in the crowdsourcing model, the pursuit of a sense of accomplishment is considered one of the internal

influence factors [33]. This study believes that if the public obtains an inner sense of achievement along with internal satisfaction in EGS value co-creation as a result of providing valuable information to others and helping them solve problems or adopt suggestions, then the public will have increased willingness to participate in EGS value co-creation.

Scholars have explored the enhancement of personal appearance as one of the influence factors in the study of PEI. In studying the willingness to engage in knowledge-sharing behavior in a virtual community, it is argued that the perceived enhancement of reputation or personal appearance due to such behavior will exert influence on the intention [46]. Recognition from others is the other important factor that influences public participation [47]. It is suggested that the willingness of the public to participate in EGS value co-creation will be strongly increased if their knowledge, abilities, problem-solving attitude, prestige, status, and authority are recognized [40].

According to the theory of motivation, individuals participate in an activity to obtain external rewards [46], [48]. When an individual believes that his or her behavior will produce expected results, such an individual is driven by practical motivations. Practical motivations include external rewards such as economic returns. It is believed that economic rewards are important incentives in attracting certain types of users to participate, and one study suggested that monetary and other forms of material rewards are important motivation factors [49], [50]. The present study also suggests that the intention to engage will be strong when the public obtains economic or material rewards for their participation in EGS value co-creation [40].

Therefore, this study believes that self-efficacy (SE), sense of achievement (SA), personal appearance (PA), recognition from others (RO), and external rewards (ER) may influence participation motivation (PM) and PEI. Thus, this study proposes the following hypotheses.

**H5:** SE, SA, PA, RO, and ER have a positive influence on the public's PM.

**H6:** PM has a positive influence on PEI in EGS value co-creation.

This study considers that technology acceptance (TA) will be higher when the public has a higher degree of trust in the government and EGS co-creation platforms [37], [38]. The concept of TA was proposed based on the Technology Acceptance Model (TAM). TAM adapts the Theory of Reasoned Action (TRA) to the field of Information Systems (IS) [51]. Davis developed the TAM, which deals more specifically with the prediction of the acceptability of an information system [52]. The purpose of this model is to predict the acceptability of a tool and to identify the modifications that must be brought to the system in order to make it acceptable to users [53], [54]. This model suggests that the acceptability of an information system is determined by two main factors: perceived usefulness and perceived ease of use [52]. As demonstrated in the Theory of Reasoned Action, the TAM postulates that the use of an information system is determined

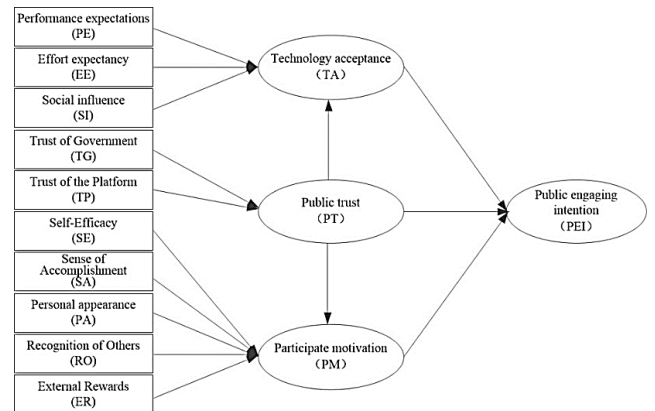


FIGURE 2. PPTP model.

by the behavioral intention [55]. Moreover, trust has been conceptualized as a general belief in an e-vendor that results in behavioral intentions [32], [57]. Gefen *et al.* argued that trust is a central aspect in many transactions because of a deep-seated human need to understand one's social surroundings, that is, to identify what, when, why, and how others behave [55]. So, public trust (PT) in the government and its platforms may allow them to think that participating in value co-creation via the platform can improve personal appearance and gain recognition and external rewards. Thus, the study also raises the following hypotheses.

**H7:** PT has a positive influence on TA of value co-creation platforms.

**H8:** PT has a positive influence on PEI in EGS value co-creation.

#### D. RESEARCH MODEL

The research model is presented in Figure 2 based on the above hypotheses. This study explores the influence effects and paths by analyzing the relationships of three factors, namely, public trust (PT), participation motivation (PM), and technology acceptance (TA), on PEI in EGS value co-creation, which leads to the PPTP model.

## IV. METHODOLOGY AND EMPIRICAL STUDY

### A. DATA COLLECTION

To collect data, we designed the questionnaire in four steps. First, field studies were reviewed (including TAM, TRA, UTAUT, etc.), and a group containing the possible items was developed for evaluating TA, PT, PM, and PEI. Next, small range sampling was executed. Then, the revised and refined constructs were developed, including 12 items dealing with TA (i.e., four for PE, four for EE, four for SI), six for PT (i.e., three for TG, three for TI), 18 items dealing with PM (i.e., four for SE, three for SA, four for PA, four for RO, three for ER), and three for PEI, along with the list of questions or indicators to be used (see Appendix A). Subsequently, Chinese/English translations were done five times to ensure that there were no interpretation differences between them.

Given that EGS value co-creation is still a new concept for the public, we created a questionnaire to collect data, with a detailed explanation in the introduction that was easy for participants to understand. We examined the research model using data collected from respondents who are involved or participating in or have future plans through various channels to participate in EGS value co-creation. Most of these respondents used EGS channels by self-service or in government service centers (offline service windows). The Respondents answered the questions using a 5-point Likert scale with options ranging from 1 (“strongly disagree”) to 5 (“strongly agree”). We also used different gray scales to visually express the importance of the options.

Before the formal survey, 86 people were randomly chosen for the pre-survey. Based on the analysis results, several items were revised that had major differences in internal consistency, mainly eliminating semantic overlap and modifying ambiguities in expression. The survey was conducted nationwide through face-to-face interviews, e-mail, paper questionnaires, and an online survey system. To obtain reliable data, the participants must be reasonably consistent in understanding the dimensions and indicators involved. The questionnaire included detailed descriptions of the goal, interpretations of the high and low scale capabilities, and instructions on how to complete the survey and leave comments and suggestions.

Data was collected for a period of three months (January to March 2017); a total of 339 questionnaires were returned, with 41 considered as invalid after a strict data cleaning process through excluding those with missing values (29), inconsistent responses (12), and modifying some abnormal data. Nine questionnaires were excluded because all the options had the same answers. Finally, 289 were considered valid and used for the following analysis.

**B. DEMOGRAPHICS AND DESCRIPTIVE STATISTIC**

Out of the 289 respondents, approximately 48% were male and 52% were female; 94.5% had undergraduate and above diplomas. In terms of area and position coverage, the respondents were from 15 provinces and three municipalities (e.g., Beijing, Shanghai, Tianjin). A total of 251 respondents were aged 18 to 35, accounting for 88.2%. The detailed demographic background of the respondents is shown in Table 2.

This study also collected information about the participation tendency and behavior of the respondents in EGS value co-creation from the questionnaire, including participation methods and activities (See Table 3).

**C. RELIABILITY AND VALIDITY TESTING OF THE MODE**

The models were tested through SEM using SPSS/PC version 21.0 and AMOS version 21.0. Given that instruments were not fully examined in previous works, we tested the instruments using two independent stages in accordance with [57]. First-order confirmatory factor analysis (CFA) and hierarchical CFA (HCFA) were applied to appraise the measurement model. Structural equation analysis was used

**TABLE 2. Demographic Background of Subjects (n = 289).**

Statistical characteristics	Categories	N	Percentage	Accumulated percentage
Gender	Male	138	47.8%	47.8%
	Female	151	52.2%	100%
Age	<18	4	1.4%	1.4%
	18-25	155	53.6%	55%
	26-35	96	33.2%	88.2%
	36-45	15	5.2%	93.4%
	46-55	12	4.2%	97.6%
	>55	7	2.4%	100%
Education level	Junior college and below	16	5.5%	5.5%
	Bachelor’s degree	117	40.5%	46%
	Master’s degree	144	49.8%	95.8%
	Doctor’s degree	12	4.2%	100%

**TABLE 3. Participation tendency and behavior in EGS value co-creation (n = 289).**

Statistical items	Categories	N	Percentage
Preferred ways of participation	Writing letters or using the phone	93	32.2%
	Official emails	154	53.3%
	The government portal websites	194	67.1%
	Microblogs or WeChat, APP	209	72.3%
	Directly reflecting the relevant departments	47	16.3%
Activities involved	No information	17	5.9%
	Reposting information released by government websites, microblogs, and WeChat	259	89.6%
	Offering real time traffic information or violations via microblogs and WeChat	3	1.0%
	Raising opinions and suggestions on the process improvement	7	2.4%
	Reflecting problems related to citizen life	16	5.5%
	Raising opinions and suggestions on policy formulation and improvement	1	0.3%

to appraise the structural model. In statistics, CFA is used to test whether measures of a construct are consistent with a researcher’s understanding of the nature of that construct (or factor) and whether the data fit a hypothesized measurement model [57], [58].

**1) RELIABILITY TESTING**

The reliability test mainly examines the inner consistency of the construct to investigate whether the same set of questions in the questionnaire are the measures of the same concept [57]. Therefore, this study applies internal consistency analysis and adopts Cronbach’s  $\alpha$  to evaluate the consistency and stability of the questionnaire items [57], [59]. The reliability coefficient of the construct is shown in Table 4, which shows that the Cronbach’s  $\alpha$  of each measurement exceeds 0.8 and the overall construct of Cronbach’s  $\alpha$  is 0.942. The results show that the measurement items in the questionnaire have high consistency and stability, and the construct indicates acceptable reliability for all latent variables (factors).

**2) VALIDITY TESTING**

Validity testing is a measure of the effectiveness of the questionnaire data, which refers to the degree to which

**TABLE 4.** Participation tendency and behavior in EGS value co-creation (n = 289).

Factor	Item	Std. factor loading ( <i>p</i> )	Cronbach's $\alpha$	KMO	Factors explained variance	<i>R</i> <sup>2</sup>	CR	AVE
Performance Expectancy (PE)	PE1	0.752 <sup>(a)</sup>	0.858	0.811	70.512	0.566	0.864	0.615
	PE2	0.859 <sup>(***)</sup>				0.738		
	PE3	0.835 <sup>(***)</sup>				0.697		
	PE4	0.678 <sup>(***)</sup>				0.460		
Effort Expectancy (EE)	EE1	0.785 <sup>(a)</sup>	0.871	0.811	72.267	0.616	0.873	0.631
	EE2	0.785 <sup>(***)</sup>				0.616		
	EE3	0.830 <sup>(***)</sup>				0.689		
	EE4	0.777 <sup>(***)</sup>				0.604		
Social Influence (SI)	SI1	0.863 <sup>(a)</sup>	0.877	0.781	73.190	0.745	0.879	0.645
	SI2	0.863 <sup>(***)</sup>				0.745		
	SI3	0.717 <sup>(***)</sup>				0.514		
	SI4	0.760 <sup>(***)</sup>				0.578		
Self-Efficacy (SE)	SE1	0.738 <sup>(a)</sup>	0.810	0.767	63.818	0.545	0.811	0.518
	SE2	0.706 <sup>(***)</sup>				0.498		
	SE3	0.751 <sup>(***)</sup>				0.564		
	SE4	0.682 <sup>(***)</sup>				0.465		
Sense of Accomplishment (SA)	SA1	0.891 <sup>(a)</sup>	0.887	0.742	81.628	0.794	0.888	0.726
	SA2	0.840 <sup>(***)</sup>				0.706		
	SA3	0.824 <sup>(***)</sup>				0.679		
Personal Appearance (PA)	PA1	0.774 <sup>(a)</sup>	0.900	0.812	76.929	0.599	0.902	0.696
	PA2	0.875 <sup>(***)</sup>				0.766		
	PA3	0.859 <sup>(***)</sup>				0.738		
	PA4	0.826 <sup>(***)</sup>				0.682		
Recognition of Others (RO)	RO1	0.867 <sup>(a)</sup>	0.879	0.826	73.839	0.752	0.884	0.655
	RO2	0.824 <sup>(***)</sup>				0.679		
	RO3	0.799 <sup>(***)</sup>				0.638		
	RO4	0.743 <sup>(***)</sup>				0.552		
External Rewards (ER)	ER1	0.722 <sup>(a)</sup>	0.876	0.711	80.190	0.521	0.881	0.713
	ER2	0.910 <sup>(***)</sup>				0.828		
	ER3	0.889 <sup>(***)</sup>				0.790		
Trust of Government (TG)	TG1	0.795 <sup>(a)</sup>	0.874	0.738	79.993	0.632	0.875	0.700
	TG2	0.881 <sup>(***)</sup>				0.776		
	TG3	0.832 <sup>(***)</sup>				0.692		
Trust of the Internet (TI)	TI1	0.871 <sup>(a)</sup>	0.853	0.718	77.305	0.759	0.856	0.666
	TI2	0.749 <sup>(***)</sup>				0.561		
	TI3	0.823 <sup>(***)</sup>				0.677		
Engaging Intention (EI)	EI1	0.881 <sup>(a)</sup>	0.899	0.742	83.384	0.776	0.902	0.754
	EI2	0.811 <sup>(***)</sup>				0.658		
	EI3	0.910 <sup>(***)</sup>				0.828		
Total	-	-	0.942	-	77.131	0.896	-	-

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

<sup>a</sup>A parameter fixed at 1.0 in the original solution. t-value for item factor loadings are indicated in parentheses.

the questionnaire can reflect the measurement goals and intentions [59]. In this study, content and structure validity were examined. Content validity mainly measures whether the item can represent the content to be measured [59]. Structure validity refers to the degree by measurement tools of the internal structure of the characteristics and concepts of the theoretical hypothesis [57]. The study applied exploratory factor analysis (EFA) and confirmatory factor analysis (CFA) to analyze the structure validity. KMO and Bartlett's test for the scale is tested in this study. The results are shown in Table 4. The results show that the KMO values of any latent variables exceed 0.7, and Bartlett's tests are all significant. Principal component analysis was used to extract

factors; 11 factors were extracted (see Table 4), which explain 77.131% of the total variables. The analysis results demonstrate that the design of the questionnaire items is good and appropriate.

CFA was used to perform structure validity analysis, including convergent validity and discriminate validity. Convergent validity is usually tested with Cronbach's  $\alpha$  (see Table 4) and composite reliability (CR). The results of the validity analysis are listed in Table 4. The standard factor loading of observed variables exceeds the standard of 0.5, and the CR value is higher than 0.8, which indicates that both the convergent and discriminate validity of the questionnaire meet the test standard. The average variance extracted



**TABLE 5. Fitness test results of the structural model (n = 289).**

Fit indices	Absolute fitness index			Incremental fitness index				Simple fitness index			
	RMR	RMSEA	GFI	NFI	RFI	IFI	TLI	CFI	$\chi^2/df$	PGFI	PNFI
Reference values	<0.05	<0.08	>0.8	>0.8	>0.8	>0.8	>0.8	>0.8	1-2	>0.5	>0.5
Test results	0.048	0.051	0.830	0.856	0.843	0.932	0.926	0.932	1.753	0.724	0.786

**TABLE 6. Correlation coefficient and square root of AVE matrix (n = 289).**

	EI	RE	PA	ER	TG	TP	SA	SE	SI	EE	PE
<b>EI</b>	<b>0.868</b>										
<b>RE</b>	0.503	<b>0.809</b>									
<b>PA</b>	0.391	0.770	<b>0.834</b>								
<b>ER</b>	0.318	0.465	0.460	<b>0.844</b>							
<b>TG</b>	0.570	0.504	0.540	0.393	<b>0.837</b>						
<b>TP</b>	0.360	0.348	0.288	0.304	0.636	<b>0.816</b>					
<b>SA</b>	0.435	0.399	0.216	0.259	0.184	0.223	<b>0.852</b>				
<b>SE</b>	0.541	0.555	0.482	0.328	0.352	0.367	0.626	<b>0.720</b>			
<b>SI</b>	0.619	0.399	0.268	0.207	0.403	0.243	0.582	0.603	<b>0.803</b>		
<b>EE</b>	0.427	0.284	0.264	0.167	0.363	0.432	0.436	0.498	0.508	<b>0.794</b>	
<b>PE</b>	0.366	0.363	0.308	0.249	0.268	0.234	0.472	0.499	0.480	0.436	<b>0.784</b>

**TABLE 7. Result of path analysis (n = 289).**

Path	Std. structure coefficient ( <i>p</i> )	<i>T</i> -value	Hypothesis test result
Public trust → Technology acceptance	0.552(***)	5.545	Support
Public trust → Public engaging intention	0.221(*)	2.403	Support
Public trust → Participation motivation	0.661(***)	5.696	Support
Technology acceptance → Public engaging intention	0.498(***)	5.665	Support
Participation motivation → Public engaging intention	0.161(*)	1.949	Support

(AVE) of the observed variables shows that the observed variables all passed the test of discriminate validity (see Table 5) [57]–[59]. In conclusion, the questionnaire used in the study has good structural validity.

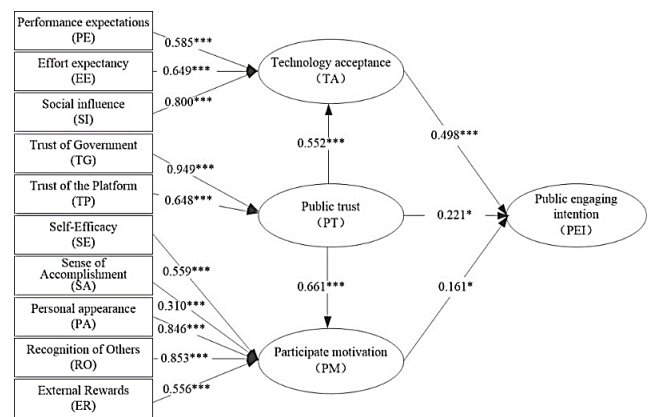
**D. STRUCTURAL MODEL TESTING**

Absolute fitness, incremental fitness, and simple fitness indexes were chosen to test the goodness of fit of the structural model using HCFA. The absolute fitness indexes include GFI, RMR, and RMSEA; the incremental fitness indexes include NFI, CFI, RFI, IFI, and TLI; the simple fitness indexes include PGFI, PCFI, and  $\chi^2/df$ . The fitness indexes of this model are shown in Table 6. The fit measures and parameters indicate that the structural model exhibited adequately fits the observed data.

**E. HYPOTHESES TESTING**

Path analysis of the structural model was conducted using AMOS with maximum likelihood estimation. The standardized regression coefficients of each variable are shown in Figure 3. The standardized regression coefficient, standard error, t-value, and p-value of each variable are shown in Table 7.

According to the empirical analysis (see Figure 3 and Table 7), the standardized path coefficients between technology acceptance (TA) and performance expectancy (PE), effort expectancy (EE), and social influence (SI) are 0.585,



**FIGURE 3. Path coefficient of the hypothesized structural mode.**

0.649, and 0.800, respectively. Thus, H1 is supported. The path coefficients between public trust (PT) and trust of the government (TG) and trust of the Internet (TI) are 0.949 and 0.648, respectively, which shows that H3 is supported. The path coefficients between participation motivation (PM) and self-efficacy (SE), sense of accomplishment (SA), personal appearance (PA), recognition of others (RO), and external rewards (ER) are 0.559, 0.310, 0.846, 0.853, and 0.556, respectively, which indicate that H5 is also supported. A comparison of path analysis results with the reference standard shows that H2, H4, H6, H7, and H8 are supported.

## V. DISCUSSION AND SUGGESTIONS

### A. DISCUSSION

The results of the empirical study show that public trust has a positive influence on the PEI in EGS value co-creation ( $\beta = 0.221$ ,  $p < 0.05$ ), which means the higher the trust that the public perceives, the stronger the value co-creation engaging intention. Public trust is decided based on trust of the government and trust of the channels adopted for value co-creation. Therefore, the public will have the confidence to participate in interaction with the government when they perceive that the government's attitude toward value co-creation is positive. Likewise, trust in the security and reliability of the platforms will be high, and the public will have strong willingness to participate in EGS value co-creation when they are assured that their personal information and privacy security can be effectively guaranteed in the process of information interaction and the information they provide can be delivered accurately, completely, and in timely manner [1]. Therefore, the government should take effective measures to improve public trust in the government and value co-creation platforms. The following measures might be effective, for example, anonymous participation (if they are willing) and more transparent engagement processes to eliminate participant concerns.

Technology acceptance has a significant positive impact on PEI ( $\beta = 0.498$ ,  $p < 0.001$ ), which means the greater the public acceptance of value co-creation technology, especially mobile platforms such as government microblogs, WeChat accounts, or APPs, the stronger their engaging intention. The technology acceptance of platforms is affected by performance and effort expectancy and social influence [32]. Therefore, when the public feels that their participation in value co-creation through the platforms can improve the performance of government services, such as an optimized process of the transaction service or services to meet personalized needs, the public will be willing to participate in value co-creation. The ease of use of EGS value co-creation directly affects the efforts needed in the process. That means when platforms are designed to be easy to operate and the process is simple to use, the public willingness to participate in value co-creation will be positive. Whether the public provides information to the government to create value together via platforms is affected by the surroundings, and thus the encouragement of value co-creation behavior from the government and effective media promotion and "example effects" from those who contribute to value co-creation will all enhance PEI. Therefore, the government should create multiple aspects that combine different ways to improve public technology acceptance of the platforms through improving the interface and process design and reducing the technological complexity.

PEI is also influenced by self-efficacy, sense of accomplishment, personal appearance, recognition, and external rewards. According to the results, participation motivation has a positive influence on PEI ( $\beta = 0.161$ ,  $p < 0.1$ ), but its influence degree is not strong compared with other

factors. The following reasons were obtained through random interviews:

- *In mainland China, most EGS value co-creation channels are relatively inconvenient, and governments have tried to open interaction channels like forms of mayor's email box, electronic community (i.e., mobile APP), and bulletin board systems (BBS). However, the public is not willing to interact with EGS agencies because of the absence of criteria for evaluating participation contribution and suitable incentive policies.*
- *With the development of the open government data (OGD) initiatives, some provincial governments, such as Guangdong, Zhejiang, and Shanghai, have organized application and innovation competitions to encourage citizens and businesses to utilize OGD resources. However, because of the absence of periodical organizations and incentive mechanisms, the public received no reward when participating in most of the EGS-based value co-creation activities.*

The structural model analysis indicates that public trust has a significant positive influence on the technology acceptance of value co-creation platforms ( $\beta = 0.552$ ,  $p < 0.001$ ). In the process, the government usually acts as a sponsor of value co-creation activities, develops a system suitable for value co-creation, or provides platforms for communication activities. Therefore, trust in the government would impact public acceptance of value co-creation platforms. When the public has high trust in the provided platforms, they are willing to use the platforms to provide information, explore problems, propose advice, and design solutions. Similarly, when the public has high trust in the security and stability of platforms, they will think that the platforms are reliable and be more willing to use them as mentioned above.

In addition, results show that public trust has a significant positive influence on public participation motivation ( $\beta = 0.661$ ,  $p < 0.001$ ). Value co-creation activities are usually initiated by the government and public participation is in terms of co-operators, collaborators, and co-designers of the service [1], [12], [18]. The higher the public trust in the government and platforms, the stronger the public perception is, i.e. participating in value co-creation via the platform can improve personal appearance and gain recognition and external rewards for participants.

### B. SUGGESTION

Based on the literature review and results discussion, this study suggests the following guidelines.

#### 1) IMPROVING PUBLIC TRUST TO PROMOTE PUBLIC PARTICIPATION IN EGS VALUE CO-CREATION

To promote public participation, it might be a useful to disseminate application scenarios in EGS value co-creation. Such scenarios could enhance public understanding of EGS value co-creation and the government's positive attitude toward improving public participation. One approach is to motivate the public to identify existing problems in

government services and request feedback on their service experience through opinions and suggestions. This could create a closer connection between the government and the public and help identify new solution mechanisms. Governments can also advertise the whole procedure in a transparent manner using real-life examples to explain about improvements made based on their opinions and suggestions. These efforts will obviously enhance public confidence in the initiative and allow the public to observe how the government treats the information, problems, and suggestions. When the public believes that their conceptions, recommendations, and suggestions are likely to be adopted, their engaging intention towards EGS value co-creation will be heightened.

Furthermore, it is necessary for the government to expand and improve the value co-creation feedback process in terms of improving the quality, efficiency, and diversity of the feedback sources. Research shows that some platforms do not provide a progress tracking function after the information is submitted. That means that the public cannot track progress on their feedback and concerns in a timely manner. This issue leads to ambiguity on whether their problems, opinions, and suggestions have been handled seriously. It also develops uncertainty about trust in the government. On the contrary, if the public can follow the progress of their information and obtain timely responses and feedback through the routine information feedback mechanism and process, the public will think that the information is taken seriously and have more confidence in the future. Thus, public participation in EGS value co-creation would continue to increase.

Personal information and privacy should be protected in compliance with laws and regulations to promote public participation. With the increase of internet security risks, the adoption of information and privacy protection technology, such as Adaptive Security Architecture (ASA), will improve public trust in the government and value co-creation platforms [37], [40]. For many government agencies, it is also urgent to formulate or amend the current laws and regulations on cybersecurity, which in turn creates a trusted network environment. Furthermore, the public should be informed how the platforms and infrastructures are operated, protected, and maintained by opening up the operation and maintenance organizations (e.g., the city information center), which can also enhance the sense of trust.

## 2) IMPROVING TECHNOLOGY ACCEPTANCE SCHEMAS IN THE PUBLIC TO CO-CREATE EGS VALUE

In mainland China, EGS co-creation still mainly depends on government information infrastructures, such as government microblogs, APPs, etc. The convenience and usability of those platforms are helpful in enabling the public to accept EGS and emerging technology, such as big data and artificial intelligence (AI) [35]. Hence, the characteristics of users of different ages and cultural levels should be considered when the co-creation platforms are designed, and the interaction technologies should ensure the public can conveniently and easily adopt and use the platforms. For example, the design

of co-creation platforms should make the interface concise and easy, thereby enabling the public to clearly understand logging in and navigation. Information should be provided on how to correctly participate in EGS value co-creation, i.e., multilingual support, voice guidance, and even virtual reality videos should be provided to help the public understand the participation process.

Moreover, it is critical to advertise successful cases and their implications in value co-creation to improve the public's acceptance and create an expectation that participation can lead to improved service experience. When participants feel that involvement has brought real efficiency into the system, their engaging intention will be strong and their willingness to participate will increase.

A variety of different types of value co-creation participation channels are important in facilitating interaction with the government in different situations.

## 3) MOTIVATING CITIZENS TO PARTICIPATE IN EGS VALUE CO-CREATION

It is important to motivate the public to identify/realize their own capabilities and increase their self-efficacy confidence to participate in EGS value co-creation activities. Different keywords can be used to attract the public to use the interactive EGS value co-creation portals. It is further suggested to increase the transparency of activities to help participants understand the rules and rewards. The public can easily obtain information offered by the government to enhance their confidence to participate in the activities. Instant feedback will encourage the public and create confidence, self-efficacy, and willingness to participate.

Additionally, the government can motivate the public to participate in value co-creation by giving different types of motivational bonuses and rewards, e.g., participants can be rewarded with some corresponding scores if they publish information, participate in questionnaires, and provide suggestions through platforms. In addition to the virtual rewards, monetary rewards such as telephone bill payment and cash coupons can be given to participants. Moreover, the government can sponsor data application competitions offering monetary rewards and prizes or awarding honorary titles and certificates to attract the public to participate in EGS value co-creation.

## VI. CONCLUSION

The new perspective of value creation helps governments better understand the public from the demand side and extends the EGS value-creating span and channels. Public participation in EGS and EGS value co-creation becomes convenient, feasible, conductible, and valuable, especially with the development and adoption of social media, big data, and artificial intelligence (AI) technologies. This study adopted a combination of qualitative and quantitative research methods using the normative process of an empirical study of the impact factors of PEI in EGS value co-creation. A 14-factor HCFA structural model (i.e., PPTP) was constructed to describe

public engaging behaviors. This model could explain 77.13% of the variance in public engagement in EGS value co-creation activities. Moreover, path analysis interpreted how the public would accept and adopt EGS value co-creation platforms and channels through some incentive mechanisms in government e-service operation. This study also introduced some management suggestions to help promote the effective implementation of EGS and the wide distribution of value co-creation concepts and activities. The results provided a comprehensive picture to understand the new paradigm of public service and administration in the era of increasing dominance of users (the public).

The study proposed some suggestions to improve public trust, platform acceptance, and participation in EGS value co-creation. However, the study has some limitations, one of which is related to the non-response bias normally associated with surveys. Determining how respondents differ from non-respondents is possible. First, although the respondents were indiscriminately selected from 33 regions in mainland China and overseas, non-response might occur under certain circumstances, which could result in measurement bias. Second, the research that combines the theory of technology acceptance, trust theory, and motivation theory identified the influence factors of public participation in EGS value co-creation. In addition to the factors examined in the study, many other factors might influence public willingness toward EGS value co-creation, which this study did not consider. Finally, "value co-creation" is still a new concept in marketing science, and according to demographic statistics, some of the respondents might be unfamiliar with the concept because they do not have a marketing background. Thus, respondents might not have accurately understood the relations between Internet efficiency, technology adoption, humanization design, and co-created value. Therefore, personal experience with EGS value co-creation might be a deviation, which could further influence the results of the survey.

## APPENDIX A

### THE CONSTRUCTS (FIVE-POINT LIKERT SCALE)

#### A. PERFORMANCE EXPECTATIONS (PE)

PE1: I can get timely and useful information through real-time information sharing on the EGS platforms (including government websites, WeChat accounts, microblogs, and apps).

PE2: If I make suggestions on the problems in the current EGS process, I will experience better EGS than I am now.

PE3: If I make suggestions about the problems in the current EGS process, I can get better EGS experiences.

PE4: If I provide my own ideas and opinions during the drafting of policies through the EGS platforms, the policies will be closer to my wishes.

#### B. EFFORT EXPECTANCY (EE)

EE1: It is easy to learn the methods of the EGS value co-creation.

EE2: I can quickly grasp the participation skills of the EGS value co-creation.

EE3: It is simple to participate in the EGS value co-creation.

EE4: Participating in the EGS value co-creation will not cost me much time and effort.

#### C. SOCIAL INFLUENCE (SI)

SI1: The government encourages the public to provide information, identify problems, and make recommendations through the EGS platforms.

SI2: Mass media encourages public participation in providing information, identifying problems, and making suggestions through the EGS.

SI3: The people around are all interacting with the government by providing information, spotting problems, and making recommendations on the EGS.

SI4: People around me suggest that I interact with the government about the EGS.

#### D. TRUST OF GOVERNMENT (TG)

TG1: I think the government wants the public to provide information, identify problems, and make recommendations about EGS.

TG2: I think the opinions and suggestions of the public about the EGS will be taken seriously.

TG3: I think the government will improve the EGS based on the questions and suggestions of the public.

#### E. TRUST OF THE PLATFORM (TP)

TP1: It is safe to use the EGS platform and not threaten my personal information.

TP2: My intentions can be accurately transformed through the EGS platform.

TP3: With the EGS platform, my reputation, and money will not suffer.

#### F. SELF-EFFICACY (SE)

SE1: I think the information I provide and share using the EGS platform is valuable to others.

SE2: I think I can clearly express my viewpoints using the EGS platform.

SE3: I think the suggestion I provided using the EGS platform is helpful to the others.

SE4: I believe I have enough knowledge and skills to participate in value co-creation.

#### G. SENSE OF ACCOMPLISHMENT (SA)

SA1: When my information is useful to others, there is a sense of accomplishment in my heart.

SA2: When my suggestion was adopted, there is a sense of accomplishment in my heart.

SA3: When my information and suggestions can help others solve problems, there is a sense of accomplishment in my heart.

## H. PERSONAL APPEARANCE (PA)

PA1: By participating in EGS value co-creation, I can enhance my personal influence.

PA2: By participating in EGS value co-creation, I can enhance the authority of individuals.

PA3: By participating in EGS value co-creation, I can get a high status.

PA4: By participating in EGS value co-creation, I can get a better reputation.

## I. RECOGNITION OF OTHERS (RO)

RO1: By participating in EGS value co-creation, I can get other people's knowledge of my level of recognition.

RO2: By participating in EGS value co-creation, I can get other people's recognition of my ability to solve problems.

RO3: By participating in EGS value co-creation, I can get other people's recognition of my skill level.

RO4: By participating in EGS value co-creation, I can get other people's recognition of others' reputation for me.

## J. EXTERNAL REWARDS (ER)

ER1: By participating in EGS value co-creation, I can get points, titles, and other honorary rewards.

ER2: By participating in EGS value co-creation, I can redeem points or direct physical reward.

ER3: By participating in EGS value co-creation, I am able to get money rewards such as cash or phone bill, either directly or through redemption.

## K. PUBLIC ENGAGING INTENTION (PEI)

EI1: I am willing to learn how to participate in EGS value co-creation activities.

EI2: I am willing to try to participate in EGS value co-creation activities.

EI3: I would recommend that people around me participate in EGS value co-creation activities.

## REFERENCES

- [1] S. Nambisan and P. Nambisan, "Engaging citizens in co-creation in public services," *IBM Center Bus. Government*, p. 53, 2013.
- [2] G. Hu, W. Pan, H. Lin, K. Kang, and M. L. Best, "Study on the framework of e-government services capability: An empirical investigation," *Soc. Sci. Comput. Rev.*, vol. 32, no. 1, pp. 56–73, Feb. 2014.
- [3] G. Hu, H. Lin, and W. Pan, "Conceptualizing and examining e-government service capability: A review and empirical study," *J. Amer. Soc. Inf. Sci. Technol.*, vol. 64, no. 11, pp. 2379–2395, 2013.
- [4] O. Ibrahim and A. Subbiah, "Value co-creation process: A case of e-services for G2C in Malaysia," *Eur. J. Soc. Sci.*, vol. 19, no. 3, pp. 443–449, 2011.
- [5] R. Díaz-Díaz and D. Pérez-González, *Implementation of Social Media Concepts for E-Government: Case Study of a Social Media Tool for Value co-Creation and Citizen Participation*. Philadelphia, PA, USA: IGI Global, 2016.
- [6] J. Feller, P. Finnegan, and O. Nilsson, "Open innovation and public administration: Transformational typologies and business model impacts," *Eur. J. Soc. Sys.*, vol. 20, no. 3, pp. 358–374, 2011.
- [7] C. Grönroos and P. Voima, "Critical service logic: Making sense of value creation and co-creation," *J. Acad. Marketing Sci.*, vol. 41, no. 2, pp. 133–150, Mar. 2013.
- [8] K. Osei-Frimpong, A. Wilson, and F. Lemke, "Patient co-creation activities in healthcare service delivery at the micro level: The influence of Online access to healthcare information," *Technol. Forecast. Soc. Change*, vol. 126, pp. 14–27, Jan. 2018.
- [9] M. Saleemi, M. Anjum, and M. Rehman, "eServices classification, trends, and analysis: A systematic mapping study," *IEEE Access*, vol. 5, pp. 26104–26123, 2017.
- [10] L. Zhuhadar, E. Thrasher, S. Marklin, and P. O. de Pablos, "The next wave of innovation—Review of smart cities intelligent operation systems," *Comput. Hum. Behav.*, vol. 66, pp. 273–281, Jan. 2017.
- [11] K. Xie, Y. Wu, J. Xiao, and Q. Hu, "Value co-creation between firms and customers: The role of big data-based cooperative assets," *Inform. Manage.*, vol. 53, no. 8, pp. 1034–1048, Dec. 2016.
- [12] W. Si and G. Hu, "E-government services value co-creation: Implementation content, process and resource elements," *J. Intell.*, vol. 37, no. 1, pp. 132–139, 2018.
- [13] P. T. Jaeger and K. M. Thompson, "Social information behavior and the democratic process: Information poverty, normative behavior, and electronic government in the United States," *Libr. Inform. Sci. Res.*, vol. 26, no. 1, pp. 94–107, 2004.
- [14] L. Ma, J. Chung, and S. Thorson, "E-government in china: Bringing economic development through administrative reform," *Government Inf. Quart.*, vol. 22, no. 1, pp. 20–37, 2005.
- [15] S. L. Vargo and R. F. Lusch, "Evolving to a new dominant logic for marketing," *J. Marketing*, vol. 68, no. 1, pp. 1–17, Jan. 2004.
- [16] C. K. Prahalad and V. Ramaswamy, "Co-creation experiences: The next practice in value creation," *J. Interact. Marketing*, vol. 18, no. 3, pp. 5–14, 2004.
- [17] X. Wu and F. Liu, "An analysis of the motivation of customer participation value co-creation in the we-media: A study based on content marketing," *Open J. Bus. Manag.*, vol. 06, no. 3, pp. 749–760, Mar. 2018.
- [18] C. Xie, R. P. Bagozzi, and S. V. Troye, "Trying to prosume: Toward a theory of consumers as co-creators of value," *J. Acad. Marketing Sci.*, vol. 36, no. 1, pp. 109–122, Mar. 2008.
- [19] C. R. Greer, R. F. Lusch, and S. L. Vargo, "A service perspective. Key managerial insights from service-dominant (S-D) logic," *Organ. Dyn.*, vol. 45, no. 1, pp. 28–38, 2016.
- [20] I. Adeleke and A. AbdulRahman, "Co-creation of value: Applying the paradigm to government e-service," in *Proc. Int. Conf. Res. Innov. Inf. Syst.*, Nov. 2011, pp. 1–6.
- [21] T. Vartiainen and T. Tuunanen, "Value co-creation and co-destruction in an IS artifact: Contradictions of geocaching," in *Proc. 49th Hawaii Int. Conf. Syst. Sci. (HICSS)*, Jan. 2016, pp. 1266–1275.
- [22] E. Uppström and C.-M. Lönn, "Explaining value co-creation and co-destruction in e-government using boundary object theory," *Government Inf. Quart.*, vol. 34, no. 3, pp. 406–420, Sep. 2017.
- [23] L. F. Luna-Reyes, S. Picazo-Vela, D. E. Luna, and J. R. Gil-Garcia, "Creating public value through digital government: Lessons on inter-organizational collaboration and information technologies," in *Proc. Hawaii Int. Conf. Syst. Sci.*, Jan. 2016, pp. 2840–2849.
- [24] Singapore. (2016). *Egov Masterplans*. [Online]. Available: <https://www.tech.gov.sg/media/corporate-publications/egov-masterplans>
- [25] L. D. W. Thomas, E. Autio, and D. M. Gann, "Architectural leverage: Putting platforms in context," *Acad. Manage. Perspect.*, vol. 28, no. 2, pp. 198–219, Jan. 2014.
- [26] L. Damodaran, W. Olphert, and P. Balatsoukas, "Democratizing local e-government: The role of virtual dialogue," in *Proc. 2nd Int. Conf. Theory Pract. Electron. Governance*, Dec. 2008, pp. 388–393.
- [27] Z.-J. Chen, D. Vogel, and Z.-H. Wang, "How to satisfy citizens? using mobile government to reengineer fair government processes," *Decis. Support Syst.*, vol. 82, pp. 47–57, Feb. 2016.
- [28] *UN E-Government Surveys: Gearing e-Government to Support Transformation Towards Sustainable and Resilient Societies*. New York, NY, USA: United Nations, 2018.
- [29] D. Linders, "From e-government to we-government: Defining a typology for citizen coproduction in the age of social media," *Government Inf. Quart.*, vol. 29, no. 4, pp. 446–454, Oct. 2012.
- [30] S. Jing, L. Han, and G. Hu, "Open government data development velocity index: A research based on assessment of provincial open government data portals in China," *J. Intell.*, no. 11, pp. 156–163, 2018.
- [31] Y.-S. Wang, Y.-H. Hung, and S. Chou, "Acceptance of e-government service: A validation of the UTAUT," in *Proc. 5th WSEAS Int. Conf. E-Activities*, Nov. 2006, pp. 165–170.
- [32] V. Venkatesh, M. G. Morris, G. B. Davis, and F. D. Davis, "User acceptance of information technology: Toward a unified view," *MIS Quart.*, vol. 27, no. 3, pp. 425–478, Sep. 2003.

- [33] Y. Liang, G. Qi, K. Wei, and J. Chen, "Exploring the determinant and influence mechanism of e-Government cloud adoption in government agencies in China," *Government Inf. Quart.*, vol. 34, no. 3, pp. 481–495, Sep. 2017.
- [34] M. Alshehri, S. Drew, T. Alhussain, and R. Alghamdi, "The effects of website quality on adoption of e-government service: An empirical study applying UTAUT model using SEM," in *Proc. 23rd Aust. Conf. Inform. Sys.*, 2012, pp. 1–13.
- [35] A. A. Oni, S. Oni, V. Mbarika, and C. K. Ayo, "Empirical study of user acceptance of online political participation: Integrating civic voluntarism model and theory of reasoned action," *Government Inf. Quart.*, vol. 34, no. 2, pp. 317–328, Apr. 2017.
- [36] J. B. Rotter, "Generalized Expectancies for Interpersonal Trust," *Amer. Psychol.*, vol. 26, no. 5, pp. 443–452, 1971.
- [37] T. S. H. Teo, S. C. Srivastava, and L. Jiang, "Trust and electronic government success: An empirical study," *J. Manage. Inf. Syst.*, vol. 25, no. 3, pp. 99–132, 2008.
- [38] K. P. Gupta, P. Bhaskar, and S. Singh, "Critical factors influencing e-government adoption in India: An investigation of the citizens' perspectives," *J. Inf. Technol. Res.*, vol. 9, no. 4, pp. 28–44, Oct. 2016.
- [39] Y.-H. Tan and W. Thoen, "Electronic contract drafting based on risk and trust assessment," *Int. J. Electron. Commerce*, vol. 7, no. 4, pp. 55–71, 2003.
- [40] L. Alzahrani, W. Al-Karaghoul, and V. Weerakkody, "Analysing the critical factors influencing trust in e-government adoption from citizens' perspective: A systematic review and a conceptual framework," *Int. Bus. Rev.*, vol. 26, no. 1, pp. 164–175, Feb. 2017.
- [41] A. Luqman, X. Cao, A. Ali, A. Masood, and L. Yu, "Empirical investigation of Facebook discontinues usage intentions based on SOR paradigm," *Comput. Hum. Behav.*, vol. 70, pp. 544–555, May 2017.
- [42] P. A. Pavlou, "Consumer acceptance of electronic commerce: Integrating trust and risk with the technology acceptance model," *Int. J. Electron. Commer.*, vol. 7, no. 3, pp. 101–134, Apr. 2003.
- [43] K. J. Hole, "Building trust in e-government services," *Computer*, vol. 49, no. 1, pp. 66–74, Jan. 2016.
- [44] Y. Chen and J. Xie, "Cross-market network effect with asymmetric customer loyalty: Implications for competitive advantage," *Marketing Sci.*, vol. 26, no. 1, pp. 52–66, Jan. 2007.
- [45] J. Yousefian, "The effect of role clarity and self-efficacy on customer value co-creation: The case of fitness centres," Sep. 2015.
- [46] D. Roberts, M. Hughes, and K. Kertbo, "Exploring consumers' motivations to engage in innovation through co-creation activities," *Eur. J. Marketing*, vol. 48, no. 1, pp. 147–169, 2014.
- [47] J. Füller, "Refining virtual co-creation from a consumer perspective," *California Manage. Rev.* vol. 52, pp. 98–122, Feb. 2010.
- [48] L. Jinyang, "Knowledge sharing in virtual communities: A social exchange theory perspective," *J. Ind. Eng. Manage.*, vol. 8, no. 1, pp. 170–183, 2015.
- [49] W. Ebner, J. M. Leimeister, and H. Krcmar, "Community engineering for innovations: The ideas competition as a method to nurture a virtual community for innovations," *R D Manage.* vol. 39, no. 4, pp. 342–356, Sep. 2009.
- [50] J. Füller, "Why consumers engage in virtual new product developments initiated by producers," *North Amer. Adv.*, vol. 33, pp. 639–646, 2006.
- [51] B. H. Wixom and P. A. Todd, "A theoretical integration of user satisfaction and technology acceptance," *Inf. Syst. Res.*, vol. 16, no. 1, pp. 85–102, May 2005.
- [52] F. D. Davis, "Perceived usefulness, perceived ease of use, and user acceptance of information technology," *MIS Quart.*, vol. 13, no. 3, pp. 319–339, Sep. 1989.
- [53] P. K. Y. Chau, "An empirical assessment of a modified technology acceptance model," *J. MIS*, vol. 13, no. 2, pp. 185–204, 1996.
- [54] A. L. Lederer, D. J. Maupin, M. P. Sena, and Y. Zhuang, "The technology acceptance model and the world wide Web," *Decis. Support Syst.*, vol. 29, no. 3, pp. 269–282, Oct. 2000.
- [55] D. Gefen, E. Karahanna, and D. W. Straub, "Trust and TAM in Online shopping: An integrated model," *MIS Quart.*, vol. 27, no. 1, pp. 51–90, Mar. 2003.
- [56] D. Gefen and D. W. Straub, "The relative importance of perceived ease of use in IS adoption: A study of e-commerce adoption," *J. Assoc. Inf. Syst.*, vol. 1, no. 8, pp. 1–30, Oct. 2000.
- [57] R. P. McDonald and M. H. R. Ho, "Principles and practice in reporting structural equation analyses," *Psychol. Methods*, vol. 7, no. 1, pp. 64–82, 2002.
- [58] P. M. Bentler, "Comparative fit indexes in structural models," *Psychol. Bull.*, vol. 107, no. 2, pp. 238–246, Mar. 1990.
- [59] N. O'Rourke and L. Hatcher, *A Step-by-Step Approach to Using SAS for Factor Analysis and Structural Equation Modeling*, 2nd ed. Cary, NC, USA: SAS Institutex, 2015.



**GUANGWEI HU** received the Ph.D. degree from the School of Economic and Management, Southeast University, China. He spent eight years as a practicing IT professional, including serving as a CIO with Anyuan Co., Ltd. He is currently a Professor of MIS with the School of Information Management, Nanjing University, China. He has published in the *Journal of American Society for Information Science and Technology (JASIST)*, *Government Information Quarterly (GIQ)*, *International Review of Administrative Sciences (IRAS)*, *Social Sciences of Computer Review (SSCR)*, the *International Journal of Electronic Governance*, and various conference proceedings, such as Conference of Information Science and Management Engineering, Computer Science and Service System and Computational and Information Sciences. His research interests include MIS, E-Gov, and service management.



**JIAQI YAN** received the Ph.D. degree in information systems from the City University of Hong Kong, and the joint Ph.D. degree in management science and engineering from the University of Science and Technology of China. He is currently an Associate Professor and the Director of the Peertech Blockchain Research Lab, School of Information Management, Nanjing University. He has published papers in *ACM Transactions on Management Information Systems*, *Decision Support Systems*, *Information and Management*, *Future Generation Computer Systems*, the *IEEE TRANSACTIONS ON SYSTEMS, MAN, AND CYBERNETICS: SYSTEMS*, the *Journal of Information Systems*, *Expert Systems with Applications*, *Knowledge-Based Systems*, *Financial Innovations*, and various conference proceedings such as ICIS and HICSS. His research interests include business intelligence, smart supply chain, blockchain, E-government, financial innovation, and risk management.

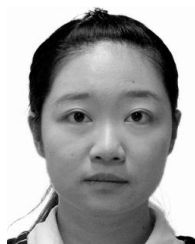


**WENWEN PAN** is currently pursuing the Ph.D. degree with the School of Information Management, Nanjing University. She is currently an Associate Professor with the School of Management, Nanjing University of Posts and Telecommunications. She has published in *Government Information Quarterly (GIQ)*, the *Journal of Electronic Commerce in Organizations*, the *International Journal of Hybrid Information Technology*, *International Review of Administrative Sciences (IRAS)*, the *Journal of Modern Management Science in China (JMMSC)*, and *The Electronic Library (TEL)*. Her research interests include E-government, E-business, and MIS.



**SOHAIL RAZA CHOHAN** received the master's and M.S. degrees in information technology from Bahauddin Zakariya University, Multan, Pakistan, in 2004 and 2013, respectively. He is currently pursuing the Ph.D. degree in information management with Nanjing University, Nanjing, China. From 2006 to 2008, he was a Lecturer with Bahauddin Zakariya University. He joined G. C. University, Faisalabad, Pakistan, as a Lecturer from 2008 to 2009. From 2009 to 2015, he was also a Lecturer

with the University of Education, Lahore, Pakistan, where he is currently serving as an Assistant Professor in information technology. His research interests include E-government, information management, big data, artificial intelligence, and MIS.



**LIU LIU** received the MLIS degree from the School of Information Management, Nanjing University, China. She is currently a Researcher with the Institute of Government Data Resources, Nanjing University, and also with the Liaowang Institute of China. She also paid close attention to the application of the theory of value co-creation in e-gov field. She has published in the *Journal of E-Government in China* and the *Journal of Intelligence*. Her current research interests include

E-gov, information service, and information behavior.

• • •