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Determinant Factors for Adoption of Government as a Platform in South Korea: Mediating Effects on the Perception of Intelligent Information Technology

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Abstract: This study aims to shed light on determinant factors for the introduction of Government as a Platform (GaaP) by public officers who can be platform providers or main stakeholders in GaaP. It focuses on public officers in 261 Korean public agencies. In order to verify the research model's hypotheses, we take advantage of Structural Equation Modeling and the Technology Acceptance Model. As a first result, concerning the direct effect on GaaP, the quality of open data, the scope of the stakeholders, and attitudes to civic engagement have a positive relationship on the perceived usefulness of Intelligent Information Technology (IIT). Second, in terms of the effect of IIT on GaaP, the perceived usefulness of IIT mediates positively on the intention to adopt GaaP based on the quality of open data, the scope of the stakeholders, and attitudes towards civic engagement. Based on these results, policy implications can be described as follows. Besides managing internal open data, governments should actively mine new open data that can create added value for innovation. They need to create an easily cooperative environment with other stakeholders, especially non-public participants, and governments should encourage public officers to more actively accept and utilize IIT in their jobs.

Keywords: Government as a Platform (GaaP); stakeholder engagement; open data; co-creation; public–private partnerships

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1. Introduction

Usually, Information and Communications Technologies (ICT) has been regarded as one of the most accelerative factors for the fourth industrial revolution. Nowadays, in order to highlight the progressive concept, the term Intelligent Information Technology (IIT), including Artificial Intelligence (AI) and the Internet of Things, cloud computing, big data, and mobile (ICBM), has been widely used [1]. Even if there are double-sided effects from the technologies, the transformation of society is accelerated by new omnipresent digital technologies [2]. Therefore, the emergence of these advanced technologies has affected both the private sector and the public sector.

With the popularization of the internet, developed countries have utilized e-Government as an innovative method that could reinvent public sectors in the early 2000s, following that tendency. Tim O'Reilly, who contributed to popularizing the open-source concept and Web 2.0, initially suggested Government as a Platform (GaaP) that goes beyond the e-Government in his research. Margetts and Naumann mentioned the origin of the notion of GaaP from earlier public management reform initiatives based on Gary Osborne and Ted Gaebler's well-known publication "Reinventing Government" where the mantra was Steering rather than rowing. Government should be an enabler, rather than a first mover or governor. This notion can promote public–private partnerships and voluntary participation [3].

Since the success of the private sector with platform strategies like Apple, Amazon, Google, Facebook, and Netflix, the GaaP literature has suggested benefits from GaaP in various fields, including public services, policy decision making, public value, and even private business [4–16] In terms of public reform, GaaP has been regarded as the next-generation government model for the paradigm shifts in the zero-growth economy, in the crisis in representative democracy, in lower trust in government, and for increases in civic engagement with smart abilities that has dramatically accelerated public transformation.

However, although the need for the introduction of GaaP has arisen, most GaaP studies have focused on concepts, frameworks, and case studies, not descriptive studies that reveal which factors affect the adoption of GaaP. Since there is some misunderstanding about GaaP being merely a sort of advanced e-Government [14], that might explain the lack of explanatory studies on GaaP owing to little recognition of the differences between e-Government and GaaP. Furthermore, GaaP is dependent on active stakeholders who can engage in the public process, and even produce public output themselves (like crowd-sourcing), compared to existing e-Government, which mainly focuses on one-sided public provision [4,14]. This is why the concept of GaaP transcends the concept of e-Government, and researchers should adopt a more cautious approach to examining or analyzing it.

In brief, the environment around GaaP is very complex and more multidimensional than the existing e-Government. Hence, explanatory GaaP research should be conducted to suggest the next government model. This study aims to shed light on determinant factors for GaaP in the public sector. Since the public sector has to implement and manage GaaP as a moderator, we preferentially focus on public officers. Although the participation of various stakeholders would be a critical success factor for GaaP, the public sector should be the primary participant before initially activating it. Because Korea has been regarded as one of the leading ICT-developed countries, according to various global indexes, and nowadays, government is interested in platformization of the public sector with IIT, this study focuses on Korean public officers. We utilized Structural Equation Modeling (SEM) for the research methodology and refer to existing informatization research to establish a framework. The result of the study can draw significant policy implications for governments that consider the introduction of GaaP.

2. Literature Review

2.1. Concept and Literature of GaaP

Because the term platform has been used in various fields (technology, sociology, and economics), there are various definitions and concepts that describe the word [17,18]. Generally, a platform is considered a useful tool that can reduce costs and increase value with a tangible or intangible base connecting providers and users [14]. The apparent opportunity to the public from the rise of the platform approach is the emergence of companies like Apple, Google, Facebook, and so on. The success story of Apple against traditional businesses has passed down in platform strategy cases like a heroic tale. Platform businesses entice both producer and consumer, and then enable high-value exchanges. Crucial factors, including interactions and information that stem from participants of a platform, give platform companies competitive advantages, compared to traditional market leaders [19]. O'Reilly witnessed the success of Apple's platform strategy with the iPhone, and it inspired researchers to reinvent government by introducing the platform strategy in the public sector. This is the origin of GaaP that is related to platform businesses in the private sector.

Following are definitions of GaaP from researchers. O'Reilly mentioned that GaaP allows people inside and outside government to innovate and allows outcomes to evolve through interactions between a government and its citizens [4]. Linders argued that GaaP can enable a government to share its knowledge and IT infrastructure with the public at a near-zero marginal cost in digital data dissemination and computer-based services [5]. Janssen and Estevez mentioned that GaaP can be viewed as a kind of infrastructure used by different actors to develop all kinds of applications and make them available to the public as well as to the government itself [6].

The main common point between e-Government and GaaP is that it is heavily related to informatization. GaaP researchers have agreed with the usefulness of ICT as the main infrastructure for GaaP. Due to the origin of the term platform used in computing fields, sometimes GaaP has been considered the same as an integrated information system. However, GaaP has differences compared to e-Government. First, there is a tremendous technical gap between initial e-Government and GaaP. IIT in GaaP can do more and better than ICT of existing e-Government. AI that is the representative IIT can handle from low skilled work, including paperwork and response to citizen complaints to advanced knowledge work like policy decision making [20,21]. Second, e-Government and GaaP commonly pursue civic participation in the public process, but civic participation in GaaP is more active than that civic participation in e-Government. Usually, civic participation in e-Government has been restricted by suggesting opinion regardless of its practical impact on the public process. However, according to the platform strategy, citizens as equal partners with the public sector create public services and policies based on their demands. GaaP studies have presented how GaaP can transform the public sector, and detailed which impacts can be given involving any benefits. GaaP is a key factor to enable better service delivery, reform the civil service, and reinvent procurement for the digital age [22]. The OECD emphasized that GaaP can contribute to developing a problem-solving mindset, collaborative approaches, and increased citizen engagement through crowdsourcing knowledge, enabling spaces for collaboration, and for digital innovation and public value co-creation [23]. Malhotra et al. argued that GaaP can improve decision-making through more effective citizen participation, representation, and expression [24]. Cordella and Paletti mentioned that GaaP can enable innovative and open production processes, which enhances the value that public services generate and deliver. In addition, GaaP preserves a level of centralized control to provide services that satisfy social expectations in aggregate, and thus, delivers public value [11]. These benefits from GaaP ultimately contribute to increased trust in government, so it can establish a virtuous circle for public processes through the favorable support of citizens.

One of the main reasons many public administrations among ICT-developed countries have recently paid attention to GaaP is cloud computing. The main infrastructure for GaaP is an integrated system that can embrace a separate system for each public agency. Owing to limitations in technical developments, initial GaaP studies could not suggest a concept of GaaP that works. However, cloud computing allows a government to realize GaaP beyond the ideal concept. By using the cloud, governments can easily integrate various public information systems, and can establish a more effective and responsive platform for external stakeholders.

Furthermore, IITs like AI, big data, and blockchain can support specific public platform applications. On the one hand, the adoption by global enterprises of private cloud computing involving Infrastructure as a Service (IaaS), Platform as a Service (PaaS), and Software as a Service (SaaS) has arisen as a strong alternative for governments owing to limitations in budgets and self-development. It can handle the chronic issues of the public sector, including provider-driven centralization, slow decision-making, and low responsiveness to paradigm shifts [25,26]. Lv et al. described a public platform based on cloud computing involving IaaS, PaaS, and SaaS in Figure 1 [27]. Besides, blockchain is a powerful technology that can promote direct democracy, civic engagement, and empowerment of citizens in public administration [28]. Now that development of a physical infrastructure for GaaP is satisfied, we should examine the actors in GaaP. This is the reason authors have focused on the main factors in the adoption of GaaP.

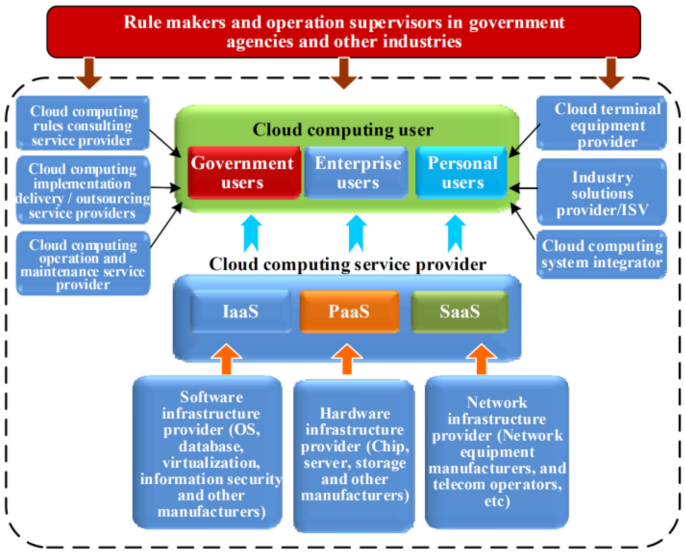

Figure 1. Concept of a public platform based on cloud computing. Source: Lv et al. [27].

Table 1 shows a list of GaaP literature. These authors described the types of research and main contents of each GaaP research. Types of studies are based on exploratory research, descriptive research, and explanatory research. Exploratory research is used in new areas of inquiry to suggest initial ideas about that phenomenon or problem. Descriptive research makes careful observations and provides detailed documentation of a phenomenon of interest. Explanatory research proposes explanations for the observed phenomena, problems, or behaviors [29].

According to an examination of the GaaP literature, most GaaP studies fall under exploratory research that suggests concepts or frameworks and deals with cases. However, we did not find explanatory research for GaaP that focuses on determinant factors affecting the introduction of GaaP. Because of the lack of explanatory research on GaaP, it is hard to suggest which governments should adopt GaaP in the public sector. This study began due to the biased research trend in GaaP that is mostly inclined towards exploratory research.

Although we cannot refer to empirical research of GaaP, we found main factors that can be used as determinant factors for GaaP from the previous GaaP literature. First, advanced technologies have been considered as the main infrastructure of GaaP [4–8,11–16]. Since O'Reilly mentioned web 2.0 for GaaP, most researchers have emphasized the usefulness of new technologies to gather stakeholders regardless of physical limitations. Moreover, new technologies like IIT can gather and process data, create new services, and support decision-making in the public process. Second, open data can converge external stakeholders and sustain GaaP [4,8,13–15]. In GaaP, open data is raw materials for creating public services, policies, and even new business. So, the purpose of releasing public data is mainly value creation rather than improvement of transparency. Thirds, the improvement of stakeholder engagement is the main platform strategy [4–7,11–13]. Because the vital driver of GaaP comes from horizontal cooperation among the public sector and private sector, GaaP should embrace more external stakeholders who can contribute to creating innovative output. Hence, GaaP researchers have emphasized open structure in technical and organizational aspects to converge stakeholders on GaaP.

Table 1. Literature covering GaaP research.

Researcher(s)	Type of Research	Main Contents
O'Reilly [4]	Exploratory	- Proposes a GaaP concept based on a computer architecture and platform business, with policy suggestions on how to implement a platform strategy in government
Linders [5]	Exploratory	- Suggests three categories of citizen co-production models in public service based on the GaaP concept
Janssen and Estevez [6]	Exploratory	- Proposes lean government that can reduce costs and enable innovation and interaction among stakeholders as a GaaP model; suggests key factors of lean government
Bygstad and D'Silva [7]	Exploratory	- Describes a series of processes that existing government transformed into GaaP from a historical and architectural perspective, applying a Norwegian GaaP called *Altinn*.
Brown et al. [8]	Exploratory	- Develops the Platform Appraisal Framework (PAF), which comprises three GaaP approaches, including organizational form, market dynamics, and architectural structure, applying PAF to UK government cases to evaluate GaaP during two specific periods
Cordella and Paletti [11]	Exploratory	- Describes how GaaP can contribute to improving public value through documents from an Italian GaaP
Mukhopadhyay et al. [12]	Exploratory	- Draws on GaaP theory for the Aadhaar biometric identity platform of the Indian government in order to show how GaaP factors have positive impacts on the scalability of e-Government services
McBride et al. [13]	Exploratory research	- Proposing six factors that comprise open government data platform of co-created public services from US Chicago's food safety inspection forecasting model case by using semi-structured interviews to stakeholders
Seo and Myeong [14]	Exploratory	- Draws on key factors for building GaaP with the AHP methodology, suggesting policy implications for implementing GaaP in the public sector
Bonina and Eaton [15]	Exploratory	- Compare case of open government data platform in Buenos Aires, Mexico City and Montevideo
Huang and Li [16]	Exploratory	- Propose design of GaaP with big data and describe how the big data platform can improve government management with deep learning algorithm

2.2. Theoretical Background for the Research Model

As stated above, few explanatory types of research have revealed which factors can affect the introduction of GaaP. Accordingly, authors have referred to trends in the literature that cope with factors for the introduction of informatization in the public sector in order to establish a research framework. Following are the reasons why we utilized the acceptance of informatization in public sector. First, it targeted public officials who are the main actors of the public sector. Because of the same research targets who have same background, we can refer to research model for public sector. Second, informatization of acceptance is related to innovative tool like GaaP. Mostly, public sector is prone to avoid innovative things including new institution and even new technology like information systems and websites due to conservative tendencies. So, the informatization researchers of public sector have been interested in how public officials to be more innovative people who are open to

new things without any resistance. Because concept of GaaP involves progressive feature, the existing studies of informatization could give us inspiration in terms of promoter of GaaP. Although GaaP can adjust the balance of power between public and private, the role of the public sector is essential to building and sustaining platform ecosystems. Especially in the initial stages of GaaP implementation, the public sector should create and renovate public infrastructures that can be the basis of GaaP [4]. In addition, it is necessary to draw stakeholders into GaaP with incentives, and some regulations are required to prevent adverse effects from excessive openness of GaaP [8,12]. Because public officers are eventually accountable for these issues in the maintenance of GaaP, it is important to determine the attitudes toward GaaP from the public official's point of view.

Informatization usage studies fall into two categories. The first approach focuses on user acceptance of technology (through user intentions, behaviors, and satisfaction) as a dependent variable, like the Theory of Reasoned Action (TRA), the Theory of Planned Behavior (TPB), and the Technology Acceptance Model (TAM). The second approach utilizes contextual factors from implementation success or performance from ICT use. It considers various influential factors, including technological factors, political and institutional factors, organizational and managerial factors, and individual factors [30]. Researchers who want to shed light on determinant factors for new technology or innovations have referred to and exploited TAM for each research purpose. Table 2 lists empirical research on the acceptance of informatization, focusing on public officers. Although there is already a tremendous amount of research into technology acceptance, we examined the recent research as much as possible, focusing on the time period after the mid-2010s in order to reflect the latest research trends [30–38].

Table 2. Empirical research on the acceptance of informatization in the public sector.

Researchers	Informatization Subject	Research Subjects	Significant Factors on Acceptance of Informatization
Eom et al. [30]	Smart work	1048 public employees in South Korea	<Significant factors from intention to use> - Cost commuting (+), Expected work productivity and efficiency (+), Job unsuitability (−) - Cost of business trips (+), Institutional technological support (+), Job unsuitability (−), Expected isolation and lack of communication (−)
Stefanovic et al. [31]	e-Government systems	154 public employees in Serbia	<Significant factors from intention to use> - Information quality (+), System quality (+), Service quality (+)
Alraja [32]	e-Government	209 public employees in Oman	<Significant factors from intention to adopt e-Government> - Social influence (+), Facilitating conditions (+)
Zahid & Haji Din [33]	e-Government services	296 employees of public universities in Pakistan	<Significant factors from intention to use e-Government > - Attitude (+), Subjective norms (+), Perceived behavioral control (+), Trust (+)
Ameen et al. [34]	Online social network in public sector	401 public employees in the UAE	<Significant factors from usage> - Performance expectancy (+), Effort expectancy (+), Social influence (+), Facilitating conditions (+)
Alyoubi and Yamin [35]	Information system	358 public employees in Saudi Arabia	<Significant factors from intention to adopt technology> - Performance expectancy (+), Effort expectancy (+), Social influence (+), Facilitating conditions (+), Innovation valance (+), Task characteristics (+), Technology characteristics (+)
Mhina et al. [36]	Web 2.0 and social media for work-related purposes	600 public employees in Tanzania	<Significant factors from intention to use e-Government > - Social influence (+), Attitude (+), Perceived confidentiality risks (−)
Valsamidis et al. [37]	Tax information system	150 public municipal employees in Greece	<Significant factors from intention to use system> - Control (+), Complexity (+), Compatibility (+), Information quality (+), System quality (+), Trust (+)
Rai et al. [38]	G2G system	234 public employees in Nepal	<Significant factors from intention to use system> - Attitude (+), Facilitating conditions (+), Commitment from leadership (+), Transparency (+)

Note: (+) positive effect, (−) negative effect.

As shown in Table 2, the most recent acceptance of informatization studies was conducted in developing countries, because developing countries have applied e-Government in the public sector, and even some developing countries still have difficulty adopting e-Government due to technical and organizational factors. From the aspects of research frameworks, most studies have used a similar framework based on the existing user acceptance model involving the Unified Theory of Acceptance and Use of Technology (UTAUT) [32–36,38]. This study is closest to the user acceptance approach, because GaaP is currently not embedded in the public sector. However, existing user acceptance models have limitations on reflecting new paradigms like the fourth industrial revolution. This study follows a combined approach—the combined user acceptance model and the contextual factors model [30]—to enhance the theoretical framework and consider more influential factors in the new paradigm.

3. Research Design

3.1. Research Framework and Hypothesis

In this study, the base research framework depends on a Technology Acceptance Model that comprises relationships with the independent variable, a mediated variable, and a dependent variable. However, we adopt contextual factors to reflect a new paradigm instead of existing variables in the TAM. GaaP is related to an information system that has been a dependent variable in the existing user acceptance–model literature, and innovative technologies like IIT contribute to the sustainability and success of GaaP [4,6,9]. However, it involves other components, like stakeholder engagement, co-creation, open data, autonomous ecosystems, and creative output [11–13]. Because of these considerations, the authors utilized a modified TAM, involving contextual factors. Figure 2 shows the research model.

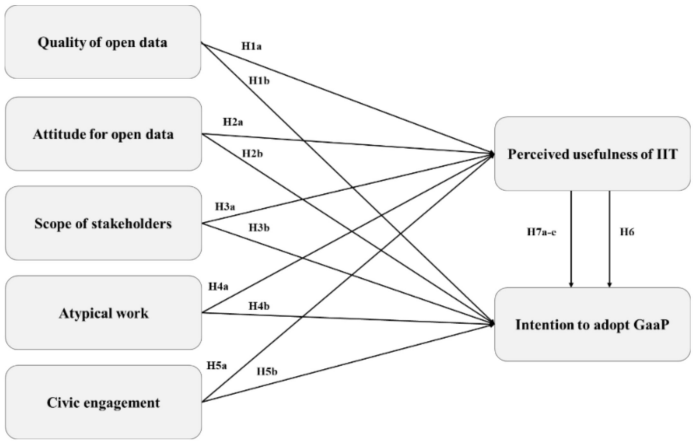

Figure 2. The proposed research model.

GaaP researchers have emphasized that open data can contribute to gathering stakeholders and creating outcomes [4,13,14]. Quality of open data (QO) has been widely used to determine acceptance of information systems, web platforms, and e-Government. In this paper, QO is defined as the degree to which public officers perceive that data from their organization has high quality, including the value of its use, accuracy, and reliability. If data quality in a public agency is inferior, it would hinder sharing data via Open Government Data (OGD) initiatives and from participating in public platforms of the government, like websites and social media [39]. Previous studies with empirical research proved that the quality of data has a positive effect [31,40–42]. Based on findings in the literature and logical consequence, we draw the hypotheses below.

Hypothesis 1a (H1a). *QO has a positive effect on the perceived usefulness of IIT.*

Hypothesis 1b (H1b). *QO has a positive effect on the intention to adopt GaaP.*

The second variable from open data is the attitude towards open data (AO). In this paper, AO is defined as the degree to which public officers perceive that they agree with an OGD initiative, and see its positive impact. OGD initiatives stem from public officers who recognize that open data could contribute to economic growth and innovation [43]. It means that OGD has begun as a position of the provider who produces and releases public data. However, even leading open-data countries have had difficulties implementing an OGD initiative due to technical and organizational factors [44]. However, one of the main barriers to OGD is the traditional characteristics of the public sector, like enforcing regulations and systemic inflexibility. These institutional barriers cause resistance to new paradigms, which is related to risk-averse cultures [45]. For instance, public agencies could sometimes use restrictions under the law to prohibit releasing public data [46]. Hence, positive AO can be a key factor for successful OGD initiatives and new government models like GaaP. Yang and Wu verified that a positive perception of open data positively affects releasing open data with empirical research [47]. Based on the literature and logical consequence, we also draw the following hypotheses.

Hypothesis 2a (H2a). *AO has a positive effect on the perceived usefulness of IIT.*

Hypothesis 2b (H2b). *AO has a positive effect on the intention to adopt GaaP.*

In this paper, scope of stakeholders (SS) is defined as the degree to which public officers perceive their job is intertwined with other stakeholders in public and non-public sectors. One of the main issues in a platform strategy is how to attract more stakeholders to the platform [4,19]. From the aspect of job characteristics, we focus on the SS with regard to public officials' jobs. Because GaaP can facilitate the accessibility and cooperation of other stakeholders by adopting an openness architecture, including technical and organizational aspects [12,14], it assumes that GaaP can contribute to dealing with high SS on the job. With GaaP, it eases the interchange of ideas and the sharing of information among stakeholders related to cooperation on the job [2,9]. The existing literature supports the idea that inclusion of a broad range of stakeholders can mediate different opinions, fostering acceptance of the e-Government system, and even successful adoption of the system [48,49]. You et al. proved that more cooperation with stakeholders results in beneficial effects [50]. Based on the literature, we also put forward these hypotheses:

Hypothesis 3a (H3a). *SS has a positive effect on the perceived usefulness of IIT.*

Hypothesis 3b (H3b). *SS has a positive effect on the intention to adopt GaaP.*

In this study, atypical work (AW) is defined as the degree to which public officers perceive their job as hard to standardize. In order to discuss atypical work, we need to focus on a similar antonym of the term formalization. From organizational aspects, formalization is defined as the degree to which jobs within the organization are standardized, and includes the extent to which employee behavior is guided by rules and procedures [51,52]. Generally, formalization is an explicit rule or procedure considered a hindrance factor in terms of autonomy, flexibility, and other innovative things that allow members to find new alternatives related to reinventing an organization [53,54]. In addition, advanced technologies like IIT have nowadays proved their abilities in atypical situations. For example, the Southern Nevada Health District in the U.S.A. used machine learning that analyzed Twitter text data related to food illness to inspect restaurants [55]. Since AW means the job has flexible and changeable characteristics that can neutralize the organization's manual, a GaaP that can disrupt a legacy work process with high receptivity to change will offer appropriate alternatives.

Hypothesis 4a (H4a). *AW has a positive effect on the perceived usefulness of IIT.*

Hypothesis 4b (H4b). *AW has a positive effect on the intention to adopt GaaP.*

As we stated above, the potential in GaaP stems from the network effect of more stakeholder engagement on the platform [19]. Participants in the public sector must keep an especially open mind to engagement and co-creation with external stakeholders involving citizens [12,14]. Public officers should keep an open mind to engagement and co-creation with external stakeholders [14]. Those authors utilized the term *citizen* instead of *stakeholder* due to their familiarity with public officers. In this paper, civic engagement (CE) is defined as the degree to which public officers perceive that CE is beneficial and should be increased. In the public sector, CE has the following three kinds of impact. First, CE can lead to fulfilling the needs of citizens. Second, through CE, consensus can be built on government goals, service priorities, good performance, and fiscal commitment. Third, trust in governmental decision-making can be improved when CE is high [56]. Previous studies proved that positive CE is associated positively with e-Government systems related to strong citizens [57–59]. Based on the literature and logical consequence, we suggest the following hypotheses:

Hypothesis 5a (H5a). *CE has a positive effect on the perceived usefulness of IIT.*

Hypothesis 5b (H5b). *CE has a positive effect on the intention to adopt GaaP.*

In this paper, the perception of IIT (PI) and its perceived *usefulness* is defined as the degree to which public officers perceive that IIT could contribute to helping their work, including general tasks and communications with citizens. Perceived usefulness, or the attitude towards using technology, has been used in representative studies that adopted the user acceptance model [60–62]. O'Reilly suggested GaaP as a next-generation model for Web 2.0, which was state-of-the-art technology at that time [4]. Accordingly, many GaaP case studies have focused on the integrated information system or website as an empirical GaaP implementation [3,8,11,12]. Therefore, although there is no empirical evidence that PI is positively related to adopting GaaP, we assume that PI can contribute to adopting GaaP based on the literature. In terms of the mediating effect of PI, although perceived usefulness has usually been used as an independent variable for behavioral intention regarding technology, some of the empirical literature has shown that perceived usefulness could mediate perceived ease of use on behavioral intentions towards technology [63,64]. Despite the lack of empirical evidence for a mediating effect from PI, previous studies supported the idea that PI could support such a relationship among variables. Based on the literature and logical consequence, we draw the hypotheses below:

Hypothesis 6 (H6). *PI has a positive effect on the intention to adopt GaaP.*

Hypotheses 7a–e (H7a–e). *PI positively mediates the relationship between the independent variables (QO, AO, SS, AW, and CE) and dependent variable IG.*

3.2. Data Collection and Research Method

Raw data were collected with the support of Embrain, a Korean research company, from 18 June to 26 June 2020 via online survey system. The questionnaires were distributed to 9699 online panels of who had indicated they work in the public sector. A total of 267 questionnaires from public officers in Korean government agencies were retrieved, but only 261 were used because six included unreliable responses. Table 3 shows a demographic profile of the respondents. Usually, at least 200 samples are considered acceptable for SEM [65]. The sample size of this study sufficiently gratified the rule. Table 4 provides descriptive statistics of the variables, including mean values for the measured items.

Table 3. Demographic profile of survey respondents.

Items	Index	Frequency	Percentage
Gender	Male	101	38.7
	Female	160	61.3
Type of organization	Central government	93	35.6
	Local government	168	64.4
Age	20s	60	23
	30s	115	44.1
	40s	57	21.8
	50s and above	29	11.1
Job tenure	Less than 5 years	103	39.5
	5 to 9 years	61	23.4
	10 to 14 years	34	13
	15 to 19 years	20	7.7
	More than 20 years	43	16.5
Job grade	8–9	113	43.3
	6–7	127	48.7
	Above 5	21	8

Table 4. Descriptive statistics of the variables.

	N	Min	Max	Mean	S.D
QO	261	1	5	3.57	0.64
AO	261	1.33	5	3.52	0.69
SS	261	1.33	5	3.35	0.79
AW	261	1	5	3.10	0.80
CE	261	1	5	3.63	0.72
PI	261	1.67	5	3.81	0.67
IG	261	1.33	5	3.73	0.65

In order to verify the research hypothesis, we took advantage of SEM, which involves a measurement model and a path model and is used to evaluate the validity of substantive theories with empirical data. SEM can shed light on the relationships among latent constructs indicated by multiple measures [66]. SEM has long been utilized to explain causal relationships among research variables for adopting technology like information systems and e-Government. In terms of measurement, all research variables in this study were evaluated on a five-point Likert scale ranging from Strongly disagree (1) to Strongly agree (5). The measurement items of each variable are shown in the Appendix A.

3.3. Reliability and Validity of Measurement, and the Model Fit

Before analyzing the empirical test, we conducted Confirmatory Factor Analysis (CFA) and a Cronbach's Alpha (CA) test to verify the reliability and validity of the measurements in this study, as seen in Table 5. CA has been widely used as a measure of reliability to verify internal consistency. The recommended measures exceed a 0.60 threshold [67]. CA for all items showed at least 0.7, which exceeds the threshold suggested by DeVellis. In the results of CFA, standardized factor loadings for all items were more than 0.5, and all coefficients are significant. Average Variance Extracted (AVE) should exceed at least 0.5, and Composite Reliability (CR) is acceptable if it is more than 0.7 [68]. Both values for each of the measurements are sufficiently satisfying. All measurements of each variable are acceptable based on the results of CFA.

Table 5. Reliability and validity test results.

Items	Standardized Factor Loading	Measurement Error	AVE	CR	CA
QO	0.663 0.912 0.884	0.324 0.08 0.115	0.798	0.921	0.851
AO	0.863 0.872 0.814	0.157 0.155 0.172	0.817	0.931	0.886
SS	0.545 0.783 0.814	0.517 0.424 0.322	0.555	0.784	0.748
AW	0.719 0.801 0.691	0.391 0.343 0.524	0.565	0.795	0.782
CE	0.854 0.898 0.852	0.159 0.128 0.173	0.831	0.936	0.902
PI	0.811 0.911 0.888	0.168 0.09 0.12	0.858	0.947	0.902
IG	0.78 0.775 0.805	0.199 0.206 0.24	0.742	0.896	0.827

With respect to the fit of the research model, normed $\chi 2$ CMIN/DF (1.690), GFI (0.908), Standardized RMR (0.0549), AGFI (0.874), NFI (0.914), TLI (0.953), CFI (0.962), and RMSEA (0.052) are all sufficiently acceptable and are in accordance with recommended values. Owing to the goodness of fit from the test results, we carried out SEM for GaaP without modifying the existing research model.

4. Empirical analysis

4.1. Verification for Structural Model

Table 6 shows the results of SEM for GaaP. Overall, QO shows the most substantial influence for each dependent variable, compared to the other factors. High quality in the data (or information) has been considered a critical factor that allows members to adopt the information system [69]. Usually, data quality comes from a specific information system, which was the dependent variable in previous studies. Because QO is strongly related to the public organization as a stakeholder of GaaP, the finding supports previous studies.

Regarding the relationship between QO and PI, advanced ICT can improve the quality of open data with analysis and processing. For this reason, public officers who have an awareness of high QO from their organization can take a favorable position for IIT. Although SS had no significant effect on GaaP, SEM proved that SS relates positively to PI. The finding is intertwined with previous studies, which revealed that a high SS could influence the adoption of an electronic system [48,49]. ICT contributes to connecting various stakeholders and to cooperation [14]. Thus, it can be inferred that public officers who perceive a high SS in their job will agree with the usefulness of advanced ICT to do their job smoothly and effectively. For CE, the result partially supports previous studies that deal with the relationship between CE and adoption of e-Government systems, due only to a significant effect from PI [58,59]. Good CE can be considered an active and open perception in the public sector. Hence, it can be inferred that public officers who pursue active administration that comes from the concept of a proactive administrator, and administrators who act actively and creatively for citizens, are inclined to agree on the usefulness of advanced ICT [70,71]. Finally, in terms of PI, the findings prove that ICT

is strongly related to GaaP that utilizes ICT as the main infrastructure and substantially supports the success of e-government [14].

Table 6. The results from direct effects.

Hypothesis	Path	Estimate	CR	SE	Hypothesis Test
1a	QO → PI	0.341 ***	4.934	0.061	Supported
1b	QO → IG	0.214 **	2.738	0.068	Supported
2a	AO → PI	0.086	1.019	0.082	Rejected
2b	AO → IG	0.043	0.483	0.086	Rejected
3a	SS → PI	0.282 **	3.135	0.064	Supported
3b	SS → IG	0.098	1.004	0.069	Rejected
4a	AW → PI	−0.165	−1.844	0.073	Rejected
4b	AW → IG	0.054	0.564	0.077	Rejected
5a	CE → PI	0.241 **	2.738	0.073	Supported
5b	CE → IG	0.138	1.476	0.077	Rejected
6	PI → IG	0.286 ***	3.435	0.082	Supported

Note: Estimates reflect standardized regression weights. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

4.2. Verification for Mediating Effect

Table 7 shows the standardized indirect effects of PI for the five research variables through bootstrapping (10,000 times) in terms of mediating effect. The result of the model with mediating variables shows that QO, SS, and CE have positive and indirect effects on the intention to adopt GaaP with PI. Significantly, SS and CE have no significant direct effect on adopting GaaP. However, the indirect effect of the two variables shows a significant positive effect, which proved the mediating effect of PI. On one hand, due to significant indirect and direct effects, the results prove that PI partially mediates the relationship between QO and IG. The results partially support previous empirical studies that revealed a positive mediating effect of perceived usefulness on behavior based on the TAM approach [60,61,63,64]. The results show the mediating effect of IIT on SS and CE, which means that IIT can support and promote relationships with other stakeholders who are key success factors for GaaP. Figure 3 shows the results of the research model, including direct effects and mediating effects.

Table 7. The results of mediating effects.

Hypothesis	Path	Standardized Indirect Effects	95% Confidence Interval		Hypothesis Test
			Lower	Upper	
H7a	QO → PI → IG	0.098 ***	0.40	0.180	Supported
H7b	AO → PI → IG	0.025	−0.19	0.90	Rejected
H7c	SS → PI → IG	0.081 **	0.19	0.156	Supported
H7d	AW → PI → IG	−0.047	−0.131	0.001	Rejected
H7e	CE → PI → IG	0.069 **	0.25	0.177	Supported

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

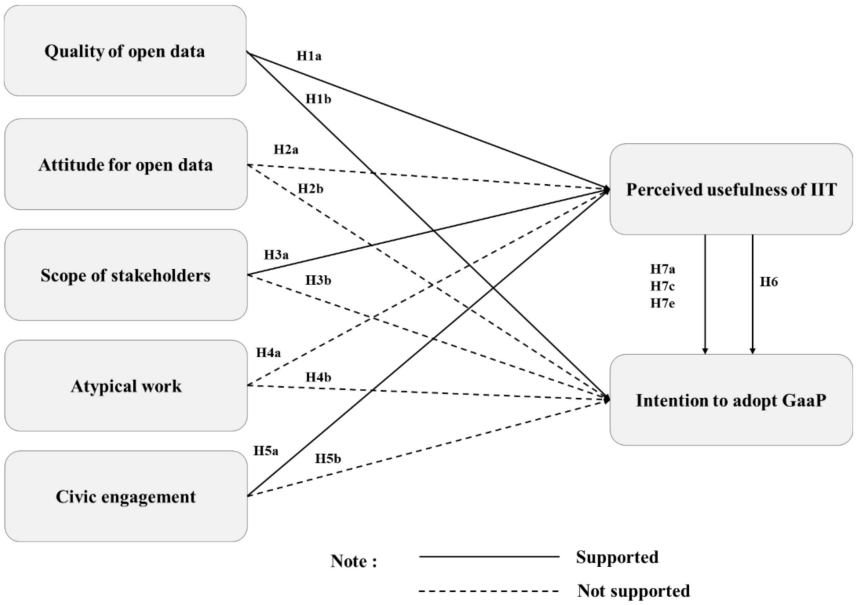

Figure 3. Results from the research model.

5. Conclusions and Policy Implication

This study aims to shed light on determinant factors for the introduction of GaaP on public officers who can be platform providers or main stakeholders in GaaP. Above all, given the rapid paradigm shifts, including the fourth industrial revolution, GaaP researchers have encouraged participants in government to learn from platform businesses that create an ecosystem for stakeholders with technical and organizational innovations and that take market share away from traditional businesses [3,4,8,9].

This paper has following differences compared to the previous GaaP literature.

First, it conducted empirical test for GaaP in spite of lack of empirical research of GaaP. There have been many empirical informatization studies like a sort of e-Government. Especially, recent empirical informatization studies usually aim to countries in initial level of e-Government. It means that nowadays, high developed e-Government countries that pursue beyond e-Government like GaaP are out of empirical research target by other researchers who believe the countries have already promoters for GaaP. However, it is wrong approach based on misunderstanding that it is equal mechanism between e-Government and GaaP.

Second, we verified empirically the main factors of GaaP drawing from the previous GaaP literature. Because previous GaaP studies have described determinant factors without empirical test, there are limitations in terms of giving practical implications for adopting GaaP by public sector. Now that we revealed the determinant factors for GaaP, policy makers are likely to refer to the results compared to other studies because of strong empirical evidence. We made an effort to reflect new trends of ICT and governance into the research variables compared to previous informatization studies. It can contribute to searching new variables of informatization research. This study has the following differences compared to the previous GaaP literature.

First, it conducted an empirical test for GaaP despite the lack of empirical research of GaaP. There have been many empirical informatization studies like a sort of e-Government. Especially, recent empirical informatization studies usually aim at countries in an initial level of e-Government. It means that nowadays, high developed e-Government countries that pursue beyond e-Government like GaaP are out of empirical research target by other researchers who believe the countries have already promoters for GaaP. However, it might be wrong based on the misunderstanding that it is a similar mechanism between e-Government and GaaP.

Second, we empirically verified the main factors of GaaP, drawing from the previous GaaP literature. Because previous GaaP studies have described determinant factors without empirical tests, there are limitations in giving practical implications for adopting GaaP by the public sector. Now that we revealed the determinant factors for GaaP, policymakers are likely to refer to the results compared to other studies because of strong empirical evidence. Furthermore, we made an effort to reflect new trends of ICT and governance into the research variables compared to previous informatization studies. It can contribute to searching for new variables of informatization research.

The research findings can be condensed as follows.

First, concerning the direct effect on adopting GaaP, the quality of open data, the scope of the stakeholders, and attitudes to civic engagement have a positive relationship on the perceived usefulness of IIT. The quality of open data and the perceived usefulness of IIT have a significant positive impact on the intention to adopt GaaP. Second, in terms of the mediating effect from the perceived usefulness of IIT for GaaP, IIT's perceived usefulness mediates positively the quality of open data, the scope of the stakeholders, and the attitude towards civic engagement on the intention to adopt GaaP. Mainly because the scope of stakeholders and attitudes towards civic engagement have no significant direct effect on the dependent variable, our findings show a mediation effect from the perceived usefulness of IIT on two of the variables. Overall, public officers recognize that the primary key factors for GaaP mainly belong to technical aspects, like data and advanced technology, which is the primary physical infrastructure of GaaP. However, the factors involving stakeholders of GaaP should be mainly considered facilitating, according to the study's results. Although technological factors can contribute to realizing GaaP in the initial stages, only various stakeholders who have autogenous power to make an ecosystem can sustain and develop GaaP in the long term [6,14].

Based on these results, the policy implications can be described as follows.

First, the quality of open data shows the highest influential impact on GaaP, compared to other factors. QO proved that Open Government Data can promote the introduction of GaaP. OGD concepts came from former US president Barack Obama's administration, allowing citizens to access and use public data. In the 2015 Open Government Partnership global summit, an open data charter including six principles was officially announced [72], and by 2020, 22 countries and 51 city or local governments had accepted the open data charter. The OGD trends have been moving towards publish with purpose, based on demands for openness by default. Once the open data environment is sufficiently mature, it encourages other stakeholders to use public data to create added value and to use them for problem-solving. As a result, public organizations focus on mining high-value open data, not just on opening data on their own [73]. The OGD trends show why the quality of open data is a primary factor in GaaP. According to Janssen et al., data quality is one of the main barriers for both sides to using public data, including data providers and data users. Significantly, some data providers from public organizations agreed that the public provides non–value-added data [6]. Hence, the quality of data should be evaluated by satisfying users' needs, not just technical or organizational guidelines. Since 2020, many countries worldwide have been suffering from the SARS-CoV-2 novel coronavirus disease (COVID-19). However, some countries counter infectious diseases by releasing open data, including statistics on the infected, guidelines for dealing with COVID-19, clinic locations, and even clinical data. The rapid increase in confirmed cases in mid-February 2020 caused a severe mask shortage in Korea. So, the Korean government announced a public distribution system for masks—only designated sellers (most of the pharmacies) could provide masks, but in limited numbers per person. However, this initially caused problems between consumers and sellers due to a lack of inventory. In order to deal with the conflict, the Korean government released an open API of mask inventory from the open data portal in mid-March 2020. With those data, app developers created a mask inventory application that could show the locations of mask sellers and the mask inventories for each seller. The app could alleviate problematic issues related to buying a mask [74]. The Korean case shows how important open data can

contribute to solving policy issues, and demonstrates why the government should focus on user-demanded open data as a priority. Accordingly, in terms of improving the quality of open data, governments should actively mine new open data to create added value for innovations, besides managing internal open data.

Second, we need to make an easily cooperative environment with other stakeholders, especially non-public participants. Since new public management and governance were introduced in public organizations, many governments have changed their delivery systems from provider-oriented into user-oriented services. Components of e-Government have supported the new paradigm in the public sector with e-participation and e-democracy. Even if the trend allows governments to consider or work with citizens when they plan public services and policy, the role of citizens has been restricted to offering opinions in the public process. However, in the new paradigm involving the fourth industrial revolution and digital transformation nowadays, because various public issues have been evolving in more complex and multi-dimensional ways, governments have to cooperate with external stakeholders as horizontal partners [8,11,12,14]. In GaaP, stakeholders are not only consumers but are also inputs of GaaP, since their participation creates value for other participants [75]. Although the new trend encourages the public sector to accept stakeholder engagement, some hindrance factors stem from the organizational or cultural context in the public sector involving structures and processes that are incompatible with the process of co-creation, the lack of open attitudes to citizen participation, and risk aversion [13,76,77]). Because of that, in order to encourage public officers to accept stakeholder engagement in the public process, we need to show them the pros of stakeholder engagement that can contribute to solving public issues on a public platform. One of the well-known GaaP cases is Challenge.gov, which was established by the US General Services Administration (GSA). It is a sort of crowdsourcing platform that provides cash prizes or other incentives when solutions suggested by citizens are selected to address various federal government issues. Although there have been many public platforms for citizens in many governments, Challenge.gov is more active than existing platforms due to a stakeholder-driven approach that is not just offering opinions. Challenge.gov posts issues described in detail by federal agencies, and it offers high cash rewards in the hundreds of thousands of dollars. The attributes enable more stakeholders in various fields to participate in the platform, ultimately making an effort to effectively handle federal agencies' issues. The Korean government benchmarked the success of Challenge.gov and established Challenge Korea, a citizen-driven public platform. In 2020, it posted a contested topic that dealt with how to more effectively and safely distribute masks to alienated groups in the COVID-19 situation by offering a cash prize. Even though no proposal was accepted in the policy process, thousands of citizens participated in the contest, despite the short period of time and lack of promotion. Accordingly, the government should provide more opportunities to cooperate with government or non-government stakeholders in order to understand each other and sympathize with the benefits of collaboration.

Third, governments should encourage public officers to more actively accept and utilize IIT in jobs involving internal administrative work, development of public services and public policy, and communication with other stakeholders. IIT increases the demand for openness and participation, and requires more responsibility, accountability, and transparency from all actors in society [2]. Owing to recognition of the usefulness of IIT, many ICT-developed countries have announced their plans with IIT, like the AI Sector Deal by the U.K. government, the American AI Initiative by the US government, Society 5.0 by the Japanese government, and the Digital New Deal by the Korean government, which show how IIT can improve efficiency and quality of life. The Administrative Conference of the United States (ACUS) published a report in February 2020 titled U.S. Government by Algorithm: Artificial Intelligence in Federal Administrative Agencies. According to the report, almost half of federal agencies (64 agencies, or 45%, from among 145 agencies in the research target) have experimented with AI or machine learning [78]. In order to foster the trend towards IIT adoption in the public sector, it is necessary to accommodate various components (like education, training,

institutional improvement, and even restructuring of the public sector) due to the resistance against, and distrust of IIT. Eom et al. emphasized that managers who intend to adopt smart work should consider both the benefits and the disadvantages [30]. This implies that it is imperative to reduce the disadvantages of IIT when it comes to its adoption. Even though the GaaP literature has already mentioned the importance of IIT as a main infrastructure that can bring together various stakeholders and that can provide a tool to create innovative outcomes [4,5,14], governments that erroneously regard IIT as an omnipotent tool should avoid the biased approach of centered technological determinism.

Since O'Reilly, the recent trends of GaaP studies have focused on how to realize GaaP in the real world. One side has focused on technical aspects like integrated systems, online platforms, and open data [6–8,11–13,15,16]. Since the norm 'platform' comes from computing architecture and technical aspect consists of a physical basis that can be easily observed, many GaaP researchers have adopted this approach for analyzing GaaP cases. Nowadays, because of the rapid development of technologies, this approach focuses on how new technologies can be implemented in the public process and how new technologies improve the public process. Another side has focused on stakeholder aspects like civic engagement and governance [5,14,79]. It is similar to electronic participation (e-participation) in e-Government. However, stakeholders in GaaP can create various outcomes that can bring innovations based on their ecosystem regardless of fields compared to e-participation, which is mainly restricted to the political aspect. So, this approach has focused on gathering more stakeholders on GaaP and how to improve the quality of stakeholder engagement. Up to the present time, many GaaP studies have been inclined to technical aspects compared to stakeholder aspects. In order to facilitate GaaP study and improve the applicability of GaaP to the public sector, GaaP research on stakeholder approach should be more increased in multidimensional aspect.

On the other hand, although we emphasized the benefits of GaaP, GaaP cannot be the omnipotent tool for public issues and even harm society without careful considerations. Following are the important issues when the government adopts GaaP.

First, the monopoly power of the platform might influence GaaP. Although monopolistic power has been permitted in the public sector, government and participants have an unbalanced relationship. So, the government might exploit the platform to get legitimacy and acceptance of the public process or intervene in the private sector as a superficially horizontal partner. However, due to the monopolistic power of GaaP, stakeholders cannot exclude the public platform. In this case, stakeholders might be degraded to merely the rubber-stamp of the public process. Therefore, it needs to adopt an institutional guarantee against abuse of platform power by the government.

Second, the digital divide has remained even in the fourth industrial revolution age. Stakeholders can easily access GaaP in order to engage in public agendas by ICT tool. However, the distribution of accessibility of the tool and information literacy is not equal to all citizens. As a result, the opinion of alienate groups who have difficulty utilizing ICT could be excluded, and biased public services and policy can be created regardless of their demands. Unless government corrects this inequality, GaaP could aggravate social integration due to the increasing social gap of engagement in the public process.

Thirds, the government could easily get more information with IIT used in GaaP. For example, big data draw meaning patterns form meaningless data like unstructured data including behavioral data and SNS message. This data can contribute to improving the quality of public services and policy in the public process. In addition, the government can easily collect information of stakeholders who participate in GaaP since all behaviors of stakeholders can be accumulated as digital records. However, it might make the government be an omnipotent institute that can be aware of everything. Inevitably, it leads to the issue of privacy and suppression by countries like Big brother.

6. Limitation of Research

This study aimed to find the determinant factors for the adoption of GaaP in the public sector. We can suggest the following limitations of this paper. First, due to the lack of

descriptive studies, we inevitably referred to existing empirical informatization studies to build a research framework. Mostly, TAM and other related models provide us with the inspiration for this study. However, because GaaP cannot be restricted by informatization, the existing research model might not sufficiently describe how public officials participate in GaaP initiatives.

Second, we drew determinant factors of GaaP from the GaaP literature which designates the factors as an important facilitator for GaaP. However, as we already mentioned, there is not enough empirical evidence that could support our research. We made hypotheses mostly depending on logical inference by the GaaP literature. So, the variables used in this paper should need additional verification by other researchers to make an elaborate research model.

Third, the research target is limited by a specific country South Korea. Because of the limitations of various costs for the research, we focused on public officials in the Korean government. GaaP initiatives might be subject to various contextual backgrounds, including economic, social, and political factors. In addition, because the Korean government is already known as one of the highly ICT leading countries, this research model cannot guarantee the equivalent result for public officials in other countries especially, early ICT adopted countries. Hence, in the future, it needs a comparative study of the GaaP adoption model at the national level to generalize the research model.

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Appendix A. Measurement Items

Variable	Measurement Items
Open data quality	(1) Open data from my institute is useful (2) Open data from my institute is accurate (3) Open data from my institute is reliable
Attitude for open data	(1) Scope of release of open data should be expanded to citizen (2) Open data initiative can improve trust in government (3) Open data can contribute to making added value in private sector
Scope of stakeholders	(1) My job requires cooperation with other organizations (or other departments) (2) My job is strongly related to external stakeholders (citizen, enterprise, NGO, and so on) (3) Opinions from the outside is one of the main parts in my job
Atypical work	(1) MY job requires flexibility depending on the situation (2) My job requires new idea (3) My job is hard to be manualized
Civic engagement	(1) Civic engagement should be increased (2) Civic engagement on public process can contribute making better policy alternative and public service (3) Communication channel to citizen should be increased
Perceived usefulness of IIT	(1) IIT is useful for job (2) IIT is useful for decision making process (3) IIT is useful for communication with citizen
Intention to adopt GaaP	(1) GaaP accords with national policy direction (2) In order to build GaaP, it needs to prepare overall organizational plan (3) GaaP should be introduced as soon as possible

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