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## The Implications of Providing Voice-Based Chatbots in Public Service for Digital Inclusion and Public Communication

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### Abstract

Provision of voice-based chatbot public services by the government and public sectors is a means to realize digital inclusion in ICT society by ensuring information accessibility for the socially vulnerable. This paper presented five experts with information on artificial intelligence based on interviews on the relevance and utility, efficiency, accessibility, and openness of related technologies in providing public services and voice-based services. Moreover, a small online survey confirms that citizens' attitudes, perceptions, and expectations of public institutions ahead of voice-based service provision are positive. Then the technical aspects of the voice-based chatbot is discussed, defining its significance and necessity in public service, and the implications of the considerations of the use of voice-based services are drawn out. As an aspect of public communication for open government facilitating digital inclusion, the chatbot voice-based service in public service entails the practice of social values, affording the socially vulnerable opportunities to participate in intelligent government, to strengthen information accessibility, and to guarantee and strengthen human rights and basic rights.

■ **Keywords** : voice-Chatbot, public communication, digital inclusion, the socially vulnerable, information accessibility, intelligence government

### Introduction

Since the COVID-19 pandemic began in 2019, there has been wide-

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spread expansion and growth in activities and events within the virtual world. As society moves rapidly to digital, the social acceptance of digital communication technology is forming around the concept of the “personalized network” (Wellman, 2001). However, this vaguely encompasses the complex, sometimes conflicting values of personalization and networking. While personalization entails disintegration and diversification, networking entails aggregation and connection. The problem is that we need to think about how we are living in this contradictory situation of dismantling and reshaping, and whether this is proceeding adequately by embracing the socially vulnerable from the perspective of equity and equality. Government administrative services are continuing to innovate in form by combining technologies and networks developed from e-government for use in intelligent government in ICT society. Artificial intelligence (AI) technology is widely used in various industries to improve qualitative support for decision-making and problem-solving through the exploration of various types of mechanical intelligence, including natural language understanding, robotics, expert systems, neural networks, and machine learning (Song, 2021). The pandemic has also become a catalyst for business innovation: 76% of companies are planning long-term IT changes, and they are still introducing and providing various AI tech services such as big data, cloud, blockchain, IoT (Internet of Things), and open API. Due to recent AI advances and abundant data provision, chatbots have been adopted by government agencies and have begun to be applied to quite complex tasks in various fields such as laws, taxes, social welfare and civil complaints, and housing finance (Business Insider, 2016). For example, among government tasks, AI applications are found to be suitable in six types: artificial intelligence resource allocation, large-scale data set sharing, lack of manpower, procedures and simple iterations, various data collection and summary, and future prediction (Mehr, 2017; Song, 2021). The use of AI apps in the public sector yields benefits such as reducing costs and work burdens, improving productivity, creating new employment opportunities, resolving resource allocation problems, providing public services, and enhancing civic sat-

isfaction (William, Schatsky, & Viechnicki, 2017). AI chatbots<sup>1)</sup> are a representative citizen-friendly model, and securing various channels for public communication progress between the government and citizens for which chatbots serve as the introduction to administrative services as emotional secretaries, which are the totally advanced technologies, has great significance. It is possible to communicate with citizens 24 hours a day and provide personalized services, so the system is being quickly introduced and established in the government and public sectors. Our small survey on the convenience of such affordances as interworking with existing smart devices and mixing voice services found that citizens' attitudes are very open and expectations are high (see Section 3.2). In particular, the term "conversational commerce" is already being implemented in various ways in business and industry, especially in the financial sector, through applications. For example, users do not have difficulty gaining access in real life to needed products through recommendations of products to suit their needs or tastes through chatbots (Tuzovic, 2018). Voice consultants such as Amazon's Alexa or Google Assistant can be used on designated devices or regular smartphones, making it available to numerous extended users. More than 28 million so-called "smart speakers" were reported worldwide in the third quarter of 2019 alone (Canalys, 2019).

Conversational interfaces use natural language to interact with applications, which presupposes that they will have great potential for civil services and lower barriers to interaction with governments. The open government aims to focus on providing citizen-centered services in a form that easily accesses, utilizes, and shares information provided by the public sector, improves citizens' participation in public sector activities, and reflects their intentions. The main issues of open government are transparency, participation, and cooperation to create participatory and cooperative dialogue (Wirtz & Birkeyer, 2015). Voice-based services using natural language serves to strengthen and protect the human and basic rights of social vulnerables and can function as public communication channels for realizing open government. Public communication<sup>2)</sup> between citizens

and governments uses everyday language to enable government departments and institutions to provide, share, disclose, and utilize desired information smoothly and quickly, and engage their opinions in the policy-making process, enabling cooperation between governments and citizens (Song, 2021). The issue of the universality of digital technology, that is, citizens' access to digital technology, should be considered to maintain citizens' economic, geographic, and psychological equity in digital government. In particular, promoting the participation of social vulnerabilities is a key task of intelligent government that should be realized. This paper discusses how voice-based services using natural language can serve as a public communication channel for realizing open government by helping strengthen human rights and basic rights, digital inclusion, and the protection of information accessibilities by bridging the information gap of the socially vulnerable. This study is aimed at 1. determining the reasons for introducing voice service chatbots for the socially disadvantaged, 2. identifying the considerations for preparing a voice-based service platform for public sectors, 3. offering policy suggestions for the social vulnerable, and 4. drawing out the appropriate implications.

## **Voice Chatbot Usages in Governments Worldwide and the Definition of the Digital Divide of the Socially Vulnerable**

### **Global Government Status Using Chatbot's Voice-Based Services**

For many years, government agencies globally have provided voice-based chatbots services to provide rapid information and smooth communication from government to citizens (Table1). It has been stated that this is to improve service delivery effectiveness and the efficiency of internal manpower management (VSOFTE Consulting, 2018).

As shown in Table 1 above, various public administrative services are provided by governments around the world. While seeking to improve civic services and government functions, the public sector is providing convenient and detailed automation services. Examples of chatbot usages

Table 1

*Global Government Voice Chatbot Usage*

Department of Homeland Security	EMMA	Guided and informed by U.S. Citizenship and Immigration Services (English Voice Service) the Mississippi State Government
the Mississippi State Government	MISSI	- Enter concerns through voice input via Amazon's voice assistant Alexa - Provide residents with information on places to visit and events such as public services and taxes, medical services, public transportation, family services, employment opportunities
San Francisco	PAIGE government	San Francisco's procurement chatbot application for internal workers keeps employees out of all the busy processes of government procurement.
Kansas City	OpenData KC	Kansas City's open data portal is developed to help people find details about the city in one location. Interacting with people and providing immediate information to prevent people from wasting their time passing through the portal.
Government of Los Angeles	LACity Alexa	Launched LA City, a voice-enabled application for Amazon Alexa devices. Through this, the user may request information on events/news occurring in the city. General administration
General administration	Mrs. Landingham	Guides new employees through a complete in-house onboarding process, such as filling out forms and organizing deliberations
Dubai Government	Rammas	- The first government chatbot application launched on the Google AI platform - Provides the ability to process people's requests (claims and payments) 24 hours a day, process data, and make more accurate decisions
Government of Singapore	Gov.sg	Information about government agencies, news, press releases, people, and policies can be easily found and complaints about the negligence of all public services can be raised and tracked. Chatbots extract information from government-only portals already set up for public use
the London Government	TravelBot	Bus arrival, route status, service update (bus/railway), map information provided
Australian Government	Alex	Australian IRS chatbots support mainly services related to taxation, property rights, income and deductions, filing declarations, and tax-related people and business issues This service saves time and creates a better experience of navigating information by going directly to the content you are looking for.
Government of Bonn City, Germany	Botty Bonn	To help people with all urban problems and other administrative informati
India Maharashtra Government	PMC	- Provide registration, online services, tax returns, health issues, finances, and driver's license information - Chatbot applications provide up-to-date information on analytical data (e.g., health data) across all public services - More transparency between government agencies and people

Source: Author (2022), based on <https://blog.vsoftconsulting.com/blog/15-governments-agencies-that-use-chatbots>

in the public sector are as follows (Mehr, 2017): 1) Answering citizens' questions, visits, and inquiries through an automated AI-based customer support system that performs such functions as representing life events, business events, and public services; 2) providing guidelines for searching documents (including legal documents) and completing forms for citizens; 3) receiving citizens' opinions; 4) translating government information; 5) drafting documents (Song, 2021); and 6) protecting security and predicting criminal activities (Song, 2022). Chatbots incorporate a "supervised learning" algorithm that allows them to continuously learn from interactions with humans and improve the accuracy of the responses they provide, so that they actually become smarter. In addition, "transparency bot" aims to increase transparency in government information development and provision by monitoring and reporting government actors' participation in Wikipedia on social media.

### **Definition of the Concept of the Digital Divide for the Vulnerable**

Generally speaking, a vulnerable group is an individual or class that finds it difficult to maintain its current economic status when faced with social risks (young people in the job search after graduation, middle-aged people unable to get a job after early retirement), which are inevitable in the course of employment or economic activity or in the face of unexpected accidents (disease, industrial accidents, unemployment, etc.; Kim, 2014). Social minorities refer to those who have relatively limited opportunities for social participation compared to other classes due to economic, physical, and other conditions, and are more likely to be excluded from opportunities to receive equal benefits as members of a society without state public intervention. They tend to be culturally alienated due to social, economic, and physical conditions, and thus form a socially vulnerable class in our society (Kim, 2006). The class is more vulnerable to issues of access, capabilities, and utilization of ICT than ordinary citizens due to their physical, regional, economic, and social conditions, including the illiterate, elderly, and farmers and fishermen who lack educa-

tion (Lee, 2019). The technical difficulties in accessing economic, legal, social, and government support due to the inability to read or write about many means and media provided by ICT society are generally referred to as a phenomenon in which access to knowledge and information differs by economic class, gender, and age (Min, 2011). If the information divide results from inconvenience caused by the inability to use ICT, failure to use information can spread to economic, social, and cultural gaps and lead to various inequalities (Joo, 2018). The lack of information capabilities does not lead to a digital virtuous cycle of information utilization, application, and beneficiary, which promotes deepening inequality (Table 2). Therefore, in order to realize the digital inclusion and digital virtuous cycle of the intelligent information society, pan-government policy promotion, social consideration, and agreement are needed to bridge and alleviate the digital divided of the vulnerable (see Table 2).

Table 2  
*Definition the Concept of Digital Divide by Period*

The stage of change.	Introduction period.	Taking a leap forward	The saturation period.	The Oversaturation Period
Types of digital divide	access divide	usage divide	divide steaming from the quality of use	divide guaranteeing of the fundamental human right
Term	Initial information divide	First information divide	The 2 <sup>nd</sup> information divide	The 3rd information divide.
Explanation	The difference between those who are accessible and those who are not.	The difference between a user and a non-user.	Differences between users and users.	The difference between the socially vulnerable and the non-vulnerable.

Source: Reconfigure Author(2022) reference to Min (2011)

### **Public Service and Digital Inclusion in Non-Face-to-Face Society**

COVID-19 has caused dynamic society to disappear. Personal hygiene has become of paramount important and face-to-face private and

official meetings have decreased. Media, work, and education suited to the hyper-personalization era take place at home through high-speed, ultra-advanced devices, and most life styles revolve around small apps on the display screens of smartphones or computers. In this era of the New Normal, untact is causing us to face a turning point in the familiar forms of life (Song, 2022). It is time to think about efficient ways to increase non-face-to-face communication between humans and machines with AI. The acceleration of the digital transformation is alienating the socially vulnerable, such as the elderly, low-incomers, and disabled, and there is a serious digital divide between the level of informatization and digital capabilities (Bae, 2021). Therefore, social responsibility is more required in the transition to the ‘untact’ era. For example, the financial sector is developing a “finance for the elderly, the disabled, multicultural, and the illiterate” program at commercial banks. We are trying to meet the needs of enthusiastic social contribution activities such as smartphone and mobile banking app usage education, free Wi-Fi installation, reading big letters of our app and 24-hour chat service etc. that meet rapid changes in the financial environment. This is why many social and public sectors should focus more on ways to bridge the financial digital information gap and strengthen countermeasures, judging that the increase in non-face-to-face services (digital humans, kiosk, etc.) will dampen the activities of the underprivileged. (Song, 2022). Among the wide assortment of Artificial Intelligence technologies, chatbots have seen a significant uptake by public agencies. Chatbots are deployed across a range of public services ranging from immigration, law enforcement, health, and transportation to utilities and numerous others (Mehr, 2017; Wirtz et al., 2019). They emulate conversations with humans using natural language processing capabilities, enabling them to recognise requests and facilitate text-based or voice-based dialogues (Abu Shawar & Atwell, 2007) to respond to service enquiries and predict user behavior based on previous inquiries of a similar nature. Variations of chatbot interfaces are driven by the user’s device of access (e.g., mobile phone, laptop) and the platform (e.g., messaging app, Web page) that supports the chatbot

(Makasi, 2020).

On January 13, 2022, the Ministry of Science and ICT held a public hearing on the enactment of the Digital Inclusion Act and stressed the need for legislation. The Digital Inclusion Act, which consists of a total of 6 chapters and 35 articles, stipulates the state's responsibility to bridge the digital divide. The main provision is that the government will diagnose the level of digital competency of the entire nation and establish a digital competency center to provide education. Representative Kang Byung-won, who proposed the bill, said that as the non-face-to-face culture spreads due to COVID-19, digital transformation has accelerated, and the purpose of the digital inclusion law is to allow all citizens, including the low-income, disabled, and elderly, to enjoy sufficient benefits. Since 2021, the Ministry of Science and ICT has striven to build digital infrastructure by opening digital learning centers and installing public Wi-Fi on city buses and subways. However, despite the government's political efforts, the level of competence of the disabled, the elderly, the low-income, and the farmers, who are defined as vulnerable with respect to information compared to the general public, was low.

According to the 2020 survey of the vulnerable class of information released by the Ministry of Science and ICT last year, the level of capability, an indicator of the basic ability to use computers and mobile devices, was 60.3%. This means the level of the vulnerable class when the level of the general public is 100. Even in the "utilization" index, which measures the degree of quantitative and qualitative utilization of computers, mobile devices, and the Internet, the level of the information vulnerable class was only 74.8% (Digitaldaily, 2022).

## **Research Method and Results**

### **Research Method**

Five experts on interviewing conducted interviews to learn how to utilize a voice-based chatbot civic service to increase its accessibility to vulnerable groups and citizens, and the attendant challenges and

opportunities. Five experts in charge of developing AI-related tasks in realizing interactive interfaces and services were asked to answer by e-mail between August and December 2020 due to COVID-19. The composition of the survey question was extracted by considering the application plans of voice-based public services based on the usage cases of public sectors in the ease of information accessibility of the vulnerable classes (see 2.1). The survey had several categories defined as follows: Technology as the installed voiced based chatbot, Efficiency as the degree to which the chatbot facilitates service delivery while minimizing the cost and resources required (Meynhardt, 2009), Effectiveness as the degree to which the chatbot produces an outcome that is supposed to be produced (attaining the goal of using the chatbot) given the resources invested when it is used in delivering a service (Andrews, 2018), and Openness & Accessibility. Openness is the degree to which chatbots transparently disclose their identity to users before a service interaction starts and provide the rationale (to users or their representatives such as customer advocacy groups) for decision-making when delivering a service (Andersen et al., 2012). Accessibility is limited by that the term “information accessibility” means ensuring that information and communication services provided through application software installed on websites and mobile communication terminal devices are easily available (Seoul Metropolitan Government Ordinance No. 7232, 2019).

The online survey examined whether citizens were receptive to being provided voice-based services. Interview participants were drawn from Seoul, Gyeonggi, Busan, Daejeon, and Ulsan. Opportunities to promote access to intelligent public administration services, such as requirements and challenges from the perspective of technology, law, or organization, were elicited, and specific ideas for potential applications and voice-based civil services were also requested from the perspective of publicity. The description of the answer is 1) Technical matters include the technical characteristics of each business entity in the answer, which may be unique business confidentiality of each company or may not be common or priority for all business entities. The answers were extremely personal, so

they could not be considered representative, and all of them were anonymously considered because they could not be promoted mutually beneficial voice technology by affecting other sectors. 2) The respondent's personal information has limitations in disclosing various personal information, so only general related information is notified. 3) It is notified that only general answers that can be grouped in common are effectively classified and entered, excluding the interviewer's unusual answers or extremely personal thoughts. There were still many limitations in information-sharing on common topics (hierarchical approval lines, lack of accumulated data, privacy problems etc.) that were classified based on the responses and statements of interviewees through research analysis methods and clustered technologies, requirements, and applications.

Table 3

*Interview Participants and Common Questions*

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**1. Classification of experts interviewed**

- P1 Software Project Developer
- P2 Director of Software Design
- P3 Local Government Artificial Intelligence-based Policy Officer
- P4 Technology Innovation Center researcher
- P5 AI magazine contributor

**2. Common question.**

- Q1. as Definition, What's a voice robot?
  - Q2. as Technology advantages, What technology is used for voice bots?
  - Q3. as Efficiency, Why do you need voice chatbot service for citizens ?
  - Q4. as Effectiveness, Why should the government introduce voice chatbots public service?
  - Q5. as Openness and Accessibility, If the government introduces voice-based services, what points can be useful including AI Technicals?
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Q1. Definition: P1, The voice bot is a chatbot in which a virtual secretary has a voice (audio option, interactive interface). In other words, the interaction is much more dynamic and immediate because it can talk like a virtual assistant instead of writing. It should be considered that people are much calmer when speaking than when writing. P2, It is intelligent assistant with using natural language. It is a natural language understanding (NLU)-based voice channel for communication that oper-

ates by converting voice into text format. P5, it is an interactive interface that uses apps, messaging platforms, social networks, or chat solutions for conversation.

Q2. Technology Advantages: P1, The technology used varies depending on the type of voice bot available, and some include more steps than others depending on what you are trying to do, but the process of the oral-to-written transition is relatively simple. When the bot receives audio input and converts it into text, AI processes it. For example, after converting audio files into text in real time using Google's Speech-to-Text tool, natural language processing and deep learning techniques are run to read and analyze the stimuli, and then perform knowledge-based processing. When everything is analyzed, the answer is found and sent to the user. P2, Identifying the key markers of the speech and concluding the best response to the conversation or query, the TTS (text voice conversion) engine completes the interaction by converting the response into audio or voice. It is trained to complete the entire speech understanding and response process, which is almost human-like, and a speech assistant is an intelligent communication method. P4, It can be easily integrated without additional channels in partnership with the Google Cloud Contact Center. P5, The interactive secretary automatically tracks scheduled tasks, networks with other chatbots, and improves the ability to process client queries. Voicebots are being developed to provide a wide range of simple answers to basic questions, smooth and beneficial support, and are trying to significantly minimize the time it takes to handle questions.

Q3. Efficiency: P1, P3, P4, and P5. ① In interaction with citizens, it can be provided at a high speed without the need to write or click any more buttons. ② People are not as careful when they speak as when they write. As a result, this carelessness leads to a new request/question method, which can rapidly increase the amount of knowledge-based data, increasing diversity in command analysis, thereby improving deep learning. ③ Increasing the efficiency of the bot allows public officials to focus on dealing with more complex problems and eventually improves the quality of services they provide to citizens. ④ The use of voice makes

it a means of social inclusion, as it is easily accessible to people who are unable to write, are unfamiliar with using technology, or are those with disabilities, the elderly, other cultures, and farmers and fishermen. ⑤ Customer satisfaction can be increased by providing more options to promote interaction with citizens. P2. ① Voice is the most natural communication mode and is easy to use, making it the most preferred communication mode. ② In the latest smart devices, voice bots are a natural alternative to existing devices rather than conventional touch tone methods. ③ A wide range of customer services can be provided through the knowledge base and back to personalized services. It can also be integrated with numerous smart speakers such as Alexa and Google Home.

Q4. Effectiveness: It provides P1, P2, and P3 citizens with more personalized, intelligent, and insightful interactions in the following major areas. ① Provide a highly personalized service experience that provides timely and appropriate information to citizens. ② Use advanced machine learning models to enable smart matching to connect the best agents to each citizen's interaction. ③ Use strong AI technology to create smart interactions. ④ Integrated, authorized agents are authorized through AI-based guidelines for content and proposed tasks to help expedite public service processes. ⑤ It reduces complexity in simple business operations for both citizens and public institutions. P4. Public institutions can use chatbots to connect with citizens, engage various stakeholders to solve social problems, and use a powerful tool called sophisticated chatbots to provide citizens with personalized solutions, receive immediate feedback, and collect information in real time. Real-time citizen response measurements are possible, and the use of chatbots can automate work to enable labor movement and contribute to narrowing the digital information divided.

Q5. Openness and Accessibility: P3, Bots provide consistent results on a regular basis for the provision of general information by public institutions without sleeping or taking a break, communicating with customers and improving citizens' participation. P2, Digital Twin will pro-

vide a single interface for recognition and operational control of jurisdiction in the future. ② Blockchain has the potential to innovate government services by providing transparent records of government transactions and reducing friction between public and private sector ecosystems. It can change many government functions, including identity, voting, public records, and the regulatory supervision of procurement and supply chain risks. ③ Interactive platform functions are needed for data exchange. It creates valuable data streaming for public and individual users and allows data collaboration between governments, industries, and citizens. ④ It uses technologies, including the Internet of Things (IoT) and AI, to provide new ways of working, reserve resources, reserve and coordinate facility services, and provide improved experiences such as information sharing and collaboration.

### **Online Survey**

In all, 112 ordinary citizens(respondents) from 20s to 60s were asked to an online survey agency to conduct a survey in 2020 concerning the premise that “providing AI (Artificial Intelligence) voice-based chatbot services by government agencies is necessary for citizens to communicate with the government.” With a total of 10 questions, only citizens’ attitudes and intentions toward artificial intelligence voice-based chatbot services were checked with simple questions about Personal (6 questions) and Social (4 questions) Factors. We expected there to be enough sub-questions or variables for each question, but a deeper investigation would not touch on matters deeply related to the thesis that this paper argues, so we will discuss further questions or variables for the experiment later. In terms of technology, acceptance was considered the important variable, only the age group was checked except for the levels of education or gender, (the groups were numbered 0: those in their 20s (2 persons), 1: those in their 30s (8 persons), 2: those in their 40s (34 persons), 3: those in their 50s (39 persons), and 4: those in their 60s (29 persons). A five-point Likert scale ranging from 0 to 4 of *Very not*

*good, Not good, Normal, Good, and Very good* was used.

1. In the matter of Personal Usages, the following questions were rated: Q1. I am confident in understanding and using AI voice services in government agencies. Q2. AI speakers are suitable for use by government agencies. Q3. AI speakers are innovative for government agencies. Q4. Using AI voice-based chatbot service is very interesting and fun. Q5. If I use AI speakers in government agencies, the use of government agencies will be more useful to me. Q6. If I use AI speakers in government agencies, it will be more convenient for me to use them.

Personal level survey results(see above No. 1.) : 33.9% of those responding to Q1 said that they can make positive decisions about their capabilities and use them for their own purposes without any difficulty in using the technology. 28.6% said yes, 17% said yes, indicating that the technology's positive effects are much higher. The Q2 for value suitability is 41.1%, 28.6%, and 16.1%, indicating that the relationship between the recipient and the technology also has a very positive perception. For value innovative, 32.8% of Normal 32.1% Good, and 20.5% Very Good indicating that they have a very positive attitude toward interest in new products or services. In terms of interest in use Q4, which measures the degree of satisfaction and interest in the behavior they use, were 34.8% Normal, 30.4% Good, 25.9% Very Good and very little about 1% of the total was Not Good. Therefore, it seems that most of the survey questions are interested in voice AI services. For Q5 and Q6, the results for the responses regarding acceptance showed that the government had a positive perception of and attitude toward the use of AI voice-based chatbot services at a comprehensive personal level, including 37.5% Good and 35.7% Very Goods in terms of personal convenience and usefulness.

2. In the matter of Social Usages, the following questions were asked: Q7. The use of AI speakers in government agencies should be aligned as a social flow and phenomenon. Q8. The use of AI speakers by government agencies reflects the social image of our society and should be used. Q9. If AI speakers are used by government agencies, the use of government agencies will be more socially useful for everyone. Q10. If AI speakers are used by government agencies, the use of government agencies will be more socially convenient for everyone.

Social level survey results(see above No. 2): For social conformity, Q7 is 33.9% Normal for subjective norms, 31.3% for Good, and 20.5% Very Good. Thus, the influence of social sympathy on individuals is beneficial and positive, and for social image, Q8, is 36.6% Normal, 25.9% Good, and 21.4% Very Good, so they seem to have a positive perception of technology acceptance as the degree to which their social status or image within the social system is increased or strengthened The responses to Q9 are 36.6% Good, 29.5% Normal, and 17.9% Very Good. Finally, for Q10, social convenience is 38.3% Good, 27.7% Normal, and 18.1% Very Good, indicating that citizens maintain a very positive perception and attitude that the overall social level of utility and convenience is high.

## **Results**

The preliminary survey of ordinary citizens found that voice-based chatbot services generally had positive expectations for personal usages and satisfaction of many people, and were considered excellent in terms of their usefulness, utility, convenience, and validity for government use. In social conformity as subjective norms, individuals showed a beneficial and positive attitude to social sympathy, maintaining positive perceptions of technology acceptance reflecting the social image and social status

reinforced. As a result, Both of aspects have similarly reacted positively and constructively to the rest for usefulness, utility, convenience, and validity.

In interviews with the group of experts, P1, P2, P5 stated that the voice-based chatbot service is an interactive interface that combines text and speech based on natural language understanding to serve as a virtual assistant through speech recognition. P5 stated that the interactive assistant automatically tracks scheduled tasks and improves the ability to handle client queries by networking with other chatbots. Chatbots can move from simply being able to answer basic questions to providing seamless and beneficial support to all types of users, dramatically minimizing the time it takes to solve questions. Therefore, P1 and P2 responded that they could quickly interact with the needs and needs of citizens, and that they were helpful to the elderly, the disabled, and the illiterate. As a result, P4 stated that first, institutions are delegating ordinary and everyday tasks to chatbots to reduce employee workload and response time, and second, public institutions are using chatbots to connect with citizens and engage various stakeholders to solve social problems. Third, public institutions can use chatbots to receive immediate feedback, understand citizens' perspectives on problems, and gather information in real time to hear citizens' voices about the problems faced by local communities. Chatbots are also likely to experience similar trends and will continue to learn how to adopt and use these new tools. P8 and P5 describe the field of use of voice service introduction by government agencies, and bots can communicate and interact with customers because they can provide consistent results 24 hours a day. ① The digital twin will provide a single interface for future jurisdiction awareness and operational control. ② Blockchain provides transparent and authoritative records of government transactions, reduces friction between the public and private sector ecosystems, and allows innovations in government services such as regulatory oversight of identity, voting, public records, and procurement and supply chain risks. ③ An interactive platform function for data exchange for commercial and social benefits is possible that creates valuable data

streams for public and private users and allows data collaboration between governments, industries, and citizens. ④ Technologies such as the Internet of Things (IoT) and AI can be used to provide new ways of working, reserve resources, schedule and coordinate facility services, share information, and collaborate. ⑤ Applications include industrial and process-specific situations, such as employees who use digital pens that interact directly with backend processing systems beyond productivity gains, or patients monitored remotely through wearable interfaces at home to improve treatment.

As a result, the interviews found that as an intelligent virtual assistant using voice interfaces, chatbots are technically more convenient in saving time and providing verbal services rather than writing sentences. They greatly contribute to enhancing the utility of citizens' interactions and providing social digital inclusion, which helps bridge the information gaps among the socially vulnerable. In terms of effectiveness, the system functions by ensuring that information is integrated and strengthened through machine learning and deep learning to provide personalized services, help make decisions quickly and easily in solving social problems, and maximize the availabilities of labor. It can be integrated with all AI technologies in openness and accessibility to provide new services, and provides stronger technology to prevent crimes or protect personal information through regulation, perception, or prediction, and affording means to protect the socially vulnerable.

## **Considerations of Government Agencies with Voiced Chatbot Service**

### **Trials of Voiced Chatbots for Public Services in Korea**

With the proliferation of the powerful hardware and soft-computing techniques, an era of AI-based services has emerged in recent years. AI services have witnessed a new industrial revolution across the globe. Today, AI is becoming part of real life. With the evolution of technologies of deep learning and big data, decision-making, data analysis, and smart

assistance services that integrate the information from different divisions have also come into use in government and the public sector. Chatbot using artificial intelligence may ease the human life in knowing real-time news or collecting information, suggestions, and recommendations, and making reservations and preparation in advance (see Figure 1). The voice recognition technology of AI chatbots in cloud computing is rapidly evolving through deep learning, which functions to strengthen access between citizen and government, thus promoting government transparency and preventing corruption, which are recognized as essential functions for the role (Song, 2022). Since November 2021, the government has been expecting to create new values and improve efficiency based on public intelligent information systems by Corp. Sorizaba providing voice recognition AI services that apply voice synthesis technology to AI voice recognition solutions of integrated management systems (ITBiz, 2020).

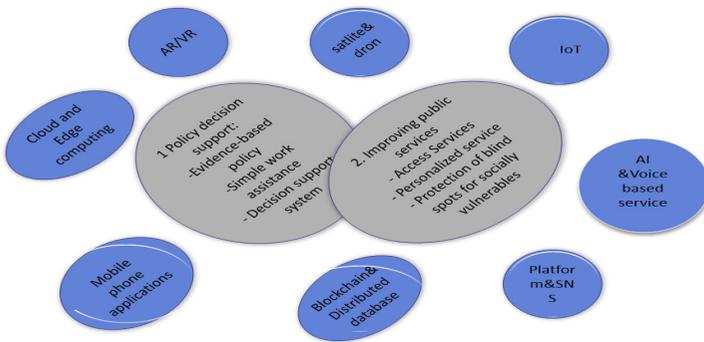


Figure 1. Development of the digital ecosystem supporting government system. Source: Author (2022)

Here we discuss some trials in Korea governments and public sectors (see Figure 2). In 2020, the Ministry of Public Administration and Security announced that AI can automatically complete difficult and complicated forms of complaints and provide direction regarding the public services citizens want, when they simply speak. In particular, Jeju Island will provide these services by selecting about 30 types of documents

issued with high frequencies to the social vulnerable first, particularly those who have difficulty with such documents. Daejeon City and Gyeonggi Province will introduce “Smart Mirror,” a safety inspection service using a combination of smart glasses and IoT technologies, and an AI that allows citizen with disabilities to receive various forms of information quickly and accurately. By learning sign language movements, information can be provided in sign language for the hearing impaired, and voice guidance for the visually impaired is also possible (Song, 2022). Pol-Bot technology is being developed for application in 182 police complaint call centers (182 call centers): 112 is for calls that require emergency police dispatch, while 182 is for police complaints and advice not related to crimes, while Polbot handles traffic fines, fines, unmanned crackdowns, penalties, suspension, traffic accident investigations, misdemeanor crime amounts, and missing reports. It has developed a voice-conversation-based chatbot dedicated to 182 call centers with ETRI, the National Police Agency, and domestic AI companies (Song, 2022). Similarly, the “Civil Complaint Government 365” service in Korea is an interactive civil complaint counseling service provided by six administrative agencies (National Police Agency, Korea Customs Service, Military Manpower Administration, Forest Service, Ministry of Unification, Ministry of Public Officials Pension Service). The interactive civil service (National Secretary “Gubbi”) provided by public institutions (Public Officials Pension Service) opened in May of this year and provided chatbot services to KT GiGA Genie Internet subscribers as an AI speaker in 2021 through a cloud-based system (E-Daily, 2020). Collaboration between humans and AI is particularly emphasized in the decision-making area. In an environment where the pace of change and



Figure 2. Chatbot-mediated public service delivery levels.

Source: Masaki et al, 2020

uncertainty are increasing, the frequency and complexity of decisions made by companies and individuals will increase, so the need for artificial intelligence in decision-making will increase (Lee et al., 2021).

### **Considerations when Designing Voice-Based Services**

In order to improve the quality and the convenience of administrative services, institutions are emerging that provide counseling services after working hours using voice-based chatbot services in real-time. Despite the remarkable development of AI technology, concerns remain over the possibility of service levels falling short of expectations or making wrong decisions due to misunderstandings in natural language and data processing in each sector. In terms of technology, there are not only difficulties in ontology generation, knowledge data construction, and big data, but also in non-technical perspectives that lack a venue or opportunity for discussion and academic knowledge exchange (Song, 2021).

If so, it is necessary to find out all the considerations to be taken into account for the socially vulnerable to realize the provision of accessible interactive public services. First, the human-computer interface method has developed greatly since computing technology was introduced. Its foundation evolved from text to graphics, and a graphic-based interface (GUI) was developed that provided a form of mouse clicking or finger touching a specific application icon, followed by a voice recognition-based interface (VUI; Samsung Electronics Newsroom, 2017). Therefore, speech recognition technology converts a person's voice into text data form suitable for purposes and target classes. In order to increase the accuracy of speech recognition in the voice input process, a pre-processing technology that filters out noise and unnecessary data from data collected by a recording device is also used. Voice interfaces using technology should be designed to meet the following requirements (see Figure 3).

First, short and accurate answers from each voice assistant are important to easily achieve the user's purpose of use, taking into account

the cognitive limitations of citizens' education level, disability, and age level. When the conversation is long or there are more than three requirements in the process of answering, specific fatigue with the voice assistant may stand out (Korea Creative Content Agency, 2011).

Second, speech recognition differs from past interface methods (where specific instructions or icons were connected to specific apps) in several respects. Voice recognition-based devices should be able to understand user commands through natural language processes and recognition first. In other words, it should be possible to accurately convert the recognized voice into a command while the sound can be recognized as human speech. Based on the recognized command, it is then necessary to invoke a corresponding function or service connection operation (Samsung Electronics Newsroom, 2017). Voice interfaces are largely made in the order of language understanding, conversation processing, and response generation (see Figure 3). Language understanding refers to the process of analyzing a user's speech and converting it into a machine-intelligible semantic structure, and creating a semantic structure of a system response by applying an appropriate dialogue model is called a dialogue process (Samjeong Economist, 2020). This is a priority to be addressed in establishing knowledge-based services such as process

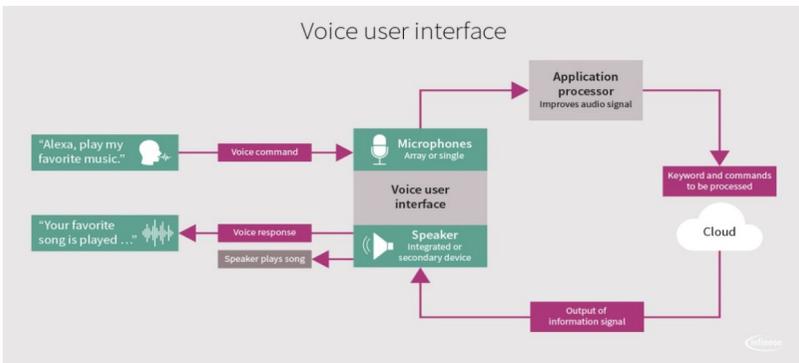


Figure 3. Voice recognition interface-based service configuration.

Source: <https://www.infineon.com/cms/en/applications/consumer/smart-speaker/>

integration, information exchange and sharing, and the limitations of the laws and regulations of each ministry.

Third, the interconnection with other information systems is crucial (David et al, 2016). For example, the mobile payments system is changing by combining POS (point of sale information management system) solutions with business back office platforms, and establishing an application programming interface (API)-based personal information analysis and management ecosystem. Trends and changes like these are in response to the observation of falling profitability in traditional payment methods, and payment companies in advanced countries are sharing customer information through open banking and API-based solutions and making efforts to generate profits using them. The back office system is a procedure that consumers and suppliers must recognize as a process of co-creating value, and it is possible only when a comprehensive legal framework and strategic cooperation of each platform operator are guaranteed.

Fourth, the integration with voice support services (Amazon Alexa, Google Assistant, Microsoft Cortna, Apple Siri, etc.) used in users' daily lives can be needed to enable. The value chain of the voice AI market allows it to lead to the base technology, voice AI platform, hardware with voice recognition functions, and services available to users (Samjeong Economic Research Institute, 2020). For example, during breakfast, we often receive the weather forecast for the day through voice support services. In order to increase the convenience of public NURIJIB, which means a website in original Korean, that are frequently and irregularly visited, basic services such as mortgage loans, pensions, guarantee requirements, or inquiries will be installed so that they can be used without a separate custom extension.

Fifth, strengthening accessibility to the social vulnerable, which is weaknesses revealed by e-government, is an important requirement in implementing digital civic services. A public institution emphasizes the functional role of the corporation in ensuring equal social opportunities through effective and practical policies and financial support, especially in terms of social consideration and social distribution for the vulnerable.

Therefore, it is predicted that it will provide an environment that naturally controls digital devices with human senses, actions, and cognitive abilities so that people with severe disabilities and severely ill patients can be guaranteed the right to access data and protect personal information. With the development of artificial intelligence sensor technology, the interface that is attracting attention is NUI (Natural User Interface)<sup>4)</sup>, as it allows users' actions to be directly input through communication (like human) methods. It is developing into an AI, multi-touch, and largely augmented reality (AR; Kim, 2020).

Sixth, as a personal information processing problem, handling and protecting information-related privacy is an important topic in the AI era. The need for the user's authentication is natural for several advanced digital government services that include information whose confidentiality is crucial to privacy protection. The two-step authentication technique after voice recognition by combining a cryptographic method containing a personal pin and an individual's unique voice characteristics displays each prompt that verifies an authentication request with a user authentication app if authentication is required using the user's personal device. In addition, if "Biotech + Certificate (PKI)" is combined and used as speaker authentication technology, authentication procedures based on voice authenticity (Choi, 2021) can be implemented. In the case of public institution users, they can verify their identity using their personal taxpayer number. This is sufficient to be used in various governmental services because the possibility of abuse is very limited (Joint Related Ministries, 2020).

Seventh, this task involves understanding the standard language of speech recognition. For example, to receive directions provided by the app, one can say the starting point and destination in a local dialect. Since the vocabulary is limited, this raises concerns about whether even local dialects can be understood. The voice conversation interface <Figure 3> of the voice recognition-based service recognizes voice with a customized voice recognition engine. P1 believes that although understanding local dialects is an important requirement for accessibility and acceptance

of various classes and local citizens, it will have little relevance to the financial, private, and government services below in that they are expected to use the standard language. In addition, considering that about 70% of local dialect speakers can accurately recognize standard language, and that financial and administrative languages are the standard language, they may have difficulty with some special jargon, but this is not recognized as a problem.

Eighth, there is a need for API<sup>5)</sup> (now open API Korean government is operating Open API in PubicData portal.) to link and integrate the data of government ministries and public institutions and to access information. It is imperative to realize more sophisticated interactive services and to resolve problems of information distribution and the lack of linkage in procedural access to information systems related to public data through third-party applications. In fact, various public data and related information systems have been established and operated by government ministries, individual departments, and public institutions, but it is often difficult to utilize such information. Standardization of information systems and data is necessary in terms of data linkage, due to the disclosure of such problems as not being able to use useful information in the past during business processing if information is disclosed and disappears due to the fragmentation of information systems.

### **Policy Suggestions to Mediate Voice-Based Services for Digital Inclusion**

The artificial intelligence-based conversational chatbot platform continues to develop, designed on purposes and expected to interact with the public in multiple languages, analyse sentiments and intent, and collect and analyze data to provide users a personalized experience. The platform should be able to provide assistance with general tasks, including but not limited to making use of government services and gaining access to functions such as registration, login, reset password, department service relation information, event information, (and) new launches like requests

for proposal documents. The chatbot should be able to turn speech into a textual input and turn text into speech. Platforms should also have other deep learning capabilities, which can be used by platforms for discovery and recommendation of eligible schemes and services to the users of bots/applications. Users should be recommended the best-suited schemes and services available in the government domain based on their profile as well.

### **Provisions for Customized Public Services of Users**

First of all, by combining blockchain technology and voice-based services, official documents are requested using vast amounts of public data (Deloitte, 2019). In terms of the structure and security of distributing and storing public data disclosed in the blockchain, all blockchain participants can share and own information. For example, citizens are asked for basic personal documents when they want to apply for a lease loan. Official documents such as employment certificates, family certificates, lease agreements, and health insurance fact-finding certificates must be submitted to other institutions or companies from time to time. Currently, the digital government is strengthening user authentication and innovating public and private services with safe and convenient digital identification online and offline through mobile identification cards with a system that recognizes personal information through the voice (Joint Relevant Ministries, 2020).

Second, it provides information search and counseling on related loan screening methods, laws or taxes, rates, bond transfer, and guarantee insurance (ICTPC, 2018). Robot automation system and voice-based chatbot services provide information including daily laws or local housing finance corporations for citizens, such as those related to taxes and specific problems or policies. If citizens have to access the data storage after voice recognition to determine whether or not they are eligible for certain services such as health insurance reduction or housing subscriptions, then the expected cost of related services can be provided to users through

voice output. Most civil service services had different patterns of processes. It is expected that the pattern of complaint handling can be divided into several groups via machine learning classification techniques using various data generated in the complaint handling process. If this is systematized, civil petition processing can be automated according to the classification according to the characteristics (Lee, 2019).

Third, it uses big data and the Internet of Things (IoT) to notify citizens' information collected through algorithms or provide personalized services for reminders (ICTPC, 2018). In the future, the government plans to introduce a personalized "national secretary" system that supports applications to processing. For example, "○○○ is eligible for principal repayment this year," "Your child ○○○ is eligible for a national scholarship application and can apply until x month x x month," and "You can apply for a home loan." It will be serviced through a private messenger app or AI speaker by inserting basic functions into the "Government 24" and opening them with an open API.

Fourth, the government can use MyData to search, store, and distribute personal information held by public institutions to facilitate the convenience and implementation of citizens' data sovereignty. For example, when applying for policy funds for small business owners, 20 types of required documents can be submitted as MyData service for use for the credit management and asset management of citizens, or loaned to financial institutions as MyData (Joint Related Ministries, 2020).

### **Enhancing Personal Security for the Vulnerable**

Just like any new technologies, chatbots come with cyber-security risks. For this reason, it is very important to know the security practices that are commonly implemented when working with chatbots. For the most part, chatbots do not present security issues that have not already been discovered and properly mitigated. The era of big data enables information collection, processing, storage, and utilization, spurring efforts to secure regulations on "global data security" as the decoupling/coupling phenomenon of customer value chain is accelerating in non-face-to-face

society (Financial News, 2020). That phenomenon requires regulations on the unauthorized use, occupancy, and utilization of stored domestic and foreign big data. In particular, there is considerable concern that it will be abused by exposure to phishing crimes (including smishing, voice phishing, and farming). Therefore, through intelligent monitoring systems and location information systems using artificial intelligence technology, the preventive role can be increased by monitoring, recognizing, and analyzing the circumstances of the socially vulnerable to protect them from such crimes or risks, as all work processes are stored in digital form in a platform-based cloud and audit traces are left (Jeong, 2021). There are also Data Trusts, in which the trustee manages the data and data rights of individuals and groups. In order to introduce the concept of data trust, the role of data trust agencies is important in setting processable information by different stakeholders and using data safely without excessively violating the rights of data subjects. trusted by the settlor. Authorization must be based on accurate processes, the number of consignors and data through various incentives and performance sharing that can facilitate data consumers' engagement rather than simply "protecting" data (Jang, 2022). In other words, socially vulnerable groups are easily targeted for crimes in which personal information is stolen and exposed to crimes, property losses, and physical threats, and the difficulties they face in financial transactions, public administration, and welfare services are increasing. Therefore, preventive measures can be taken by linking the police and financial authorities with intelligent monitoring systems by recognizing and analyzing voice instability in identification such as monitoring and voice biometric authentication based on the database of big data in financial transactions. In addition, it is particularly necessary to share and cooperate with financial institutions by strengthening security policies to compensate for weaknesses of vulnerable groups in the non-face-to-face era.

### **Policy Supports**

Citizens' use of AI requires trust and social consensus by establish-

ing a legal safety net in terms of data processing problems, exposure and utilization of personal information, and social resistance and conflicts due to the replacement of manpower by AI. I thus offer suggestions on this point.

First, it is necessary to reorganize and enact appropriate laws and systems. The Three Data Laws, including the Personal Information Protection Act, the Information and Communication Act, and the Credit Information Protection Act (2020.8.5), as well as the Framework Act on Intelligent Information Society and the Electronic Government Act (tentative name; Korea Institute of Public Administration, 2019) for enhancing public communication from AI chatbot's functions must be enacted. In addition, the development of AI ethics and guidelines is more urgent than anything else. Responsible AI must be implemented publicly through the adoption of Ethical Standards of AI (Song, 2022). In addition, it is necessary to promote and strengthen the self-regulation of large platform companies.

Second is the establishment of a governance infrastructure of the (public-private partnership type based on a cloud platform. It is necessary to quickly introduce a cloud system that can utilize AI technology in all public institutions, including the government. This can increase productivity, efficiency, and accountability and reduce costs.

Third, private companies should identify their needs and prepare tax benefits and funding and incentive systems to foster and promote big data businesses (NIA, 2017).

Fourth, expand the scope of research as a basic academic and strengthen AI education (STEPI, 2018), democratic citizen digital literacy education and data expert training are comprehensively needed. The power to respond to the many side effects that will occur due to the introduction and expansion of artificial intelligence should be strengthened to make the AI artificial intelligence for all citizens. Critical thinking and cultivating social responsibility can cultivate ethical judgment or self-aware communication skills and the evaluation of text that promotes and incites dangerous information, biased or ideological thinking, and conflicts.

## **Implications of Overcoming the Digital Divide with Voice-Based Public Services**

First of all, the introduction of voice-based service chatbots to support the socially vulnerable will have a profound effect on the change in the structure of the civil service organization and decision-making structure. The vertical command system (top-down) makes it difficult to perform and inefficient for work delivery. Intelligent government models formed based on data require cooperation and the exchange of information from each department, and integrated information services cannot be provided by decentralized departments. Therefore, organizational change will contribute more to our society than anything else to providing an efficient voice-based service with rich data base, simplified procedures, and horizontal and neutral organizational decision-making.

Second, from the standpoint of digital inclusion, information accessibility means guaranteeing the human rights and basic rights of the socially vulnerable. The Open Data Strategy (ODS), which is being promoted mainly in the EU, holds that such institutions as big data and open government data, should be considered to have started from expanding information access rights as basic rights rather than as serving to activate big data or markets. It should be seen that Korea also started with the expansion of the right to access information as a basic right to broadly guarantee the right to use public data. Korea has also implemented the Act on the Provision and Promotion of Public Data, and the right to access information to Open APIs means “the right to freedom of information or the basic right to know” similar to the European Parliament’s “recommendation on access to information and freedom of information” or the 2013 EU (Ahn, 2013).

Third, constructing voice-based chatbots serves to ease the knowledge and information gap of the socially vulnerable and to guarantee the human rights of the disabled. The development of digital technology, which spurred the advent of an information society, has created a new communication environment that provides more information to many peo-

ple and spreads various cultural experiences. However, for the socially vulnerable with physical disabilities or economic difficulties, these environmental changes also have a negative aspect that they can act as barriers to normal social participation rather than an opportunity to improve their quality of life (Lee, 2008). For example, as the function of broadcasting media expands, concerns are raised that broadcasting media may intensify the isolation and alienation of the disabled who are restricted from using such media (Song, 2003). Behind the progress of the information society, the gap between the rich and the poor has widened depending on the production, ownership, and accessibility of knowledge information, widening social polarization and resulting in mass production of the underprivileged (Lee, 2008). This term is most commonly used to refer to the distribution or utilization of information inequality in the information divided and the digital divided society. The “digital divide” means the gap between opportunities to use information and communication in a digital environment and the ability to use it (Song, 2003). At the center of the problem are the disabled, especially those among the socially vulnerable. It is highly likely that the disabled will be excluded from various forms of social participation as they become alienated from means of communication or information acquisition. Social alienation arising from the lack of means and methods such as channels provided by digital media or devices is a problem that society must overcome in the future.

Fourth, it is necessary to prepare measures for personal information and cybersecurity and strengthened digital privacy policies. The greatest vulnerability of AI technologies is hacking. There are various authentication methods such as passwords, PINs, smartphones, biometric authentication, text authentication, and QR authentication, but a “Digital Identity” service authentication method that requires user identification and designation as a consistent government policy is needed (Choi, 2021). The Public Key Infrastructure (PKI), a technology that encrypts and signs biometric information such as fingerprints so that they may be safely used by registered users, was set as ITU’s international standard in 1989 and is in use worldwide (p. 185). It is necessary to design a combination

of speaker authentication and PKI technology to ensure protection because the disabled are exposed to crimes where people who illegally use their information for their own profit, and measures for multicultural families are expected to ease linguistic barriers, the greatest restriction on government use. In addition, autonomous efforts to make regular inspections mandatory are required. The Personal Information Commission (2021) announced six principles of AI-related personal information protection and stated that it is mandatory to prepare and implement response procedures for information subject notification, leakage report, and damage relief support in the process of AI service operation (Table 5).

Table 5

*Six Principles of AI-Related Personal Information Protection*

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1. Legality: The basis for processing, such as the collection, use, and provision of personal information, must be legal and clear.
  2. Humanity: Securely process and manage personal information.
  3. Transparency: Personal information processing details are disclosed to make it easier for the data subject to understand.
  4. Participation: It has a communication system for personal information processing and guarantees the rights of information subjects are guaranteed.
  5. Responsibility: Clarify the management responsibility for processing personal information.
  6. Fairness: Minimize the occurrence of social discrimination, bias, etc. by processing personal information according to the purpose of collection.
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Source: The Personal Information Commission (2021)

Lastly, the establishment of digital governance is creating a new means for various stakeholder groups to participate at a low cost through the development of intelligent information technology and SNS (Jeong, 2021). Therefore, with the progress of digital informatization, information human rights are being examined (Hwang & Lee, 2004). In particular, guaranteeing the right to access to information is essential as part of the digital inclusion policy of the socially underprivileged. Being alienated from information directly affects job choice and narrows the scope of economic opportunities, leading to economic poverty. Today, the use of information and information technology is the most important basic

living factor and a medium for enjoying all legal interests and basic rights of individuals, meaning that bridging the information gap secures prerequisites for realizing basic rights (Hong, 2009). Various digital literacy education should also be conducted in various ways to promote the inclusive use of digital governance and digital technology for the social vulnerable, and it seems urgent to prepare corresponding laws and systems.

## **Conclusion**

This paper examined the following on the premise that public institutions, which aim to promote citizens' welfare and contribute to minimizing the digital divide for the vulnerable, provide voice-based public services to citizens. First, it was confirmed through a small random online survey that citizens' attitudes and expectations for public institutions ahead of voice-based services were maintained, and interviews with experts with knowledge of AI elicited challenges facing public institutions and governments in strengthening information accessibility. Second, all matters to be considered when establishing voice-based chatbots were investigated in connection with measures to be applied and utilized by public sectors, and third, the implications of voice-based services in terms of public communication and open government services were examined. This is significant in that it provides an opportunity and a foothold for a wider range of citizens to realize their participation in intelligent governments and to practice social consideration and inclusion through strengthening and guaranteeing human rights, basic rights, and information accessibility for socially vulnerable groups.

The interviews confirmed that as an intelligent virtual assistant using voice interfaces, chatbots are technically more convenient to save time and provide services by providing verbal services than written methods, which enhances citizens' interaction in utility and affords social digital inclusion, which helps bridge the information gaps among the socially vulnerable. In terms of effectiveness, information is integrated and

strengthened through machine learning and deep learning to provide personalized services, help make decisions quickly and easily in solving social problems, and facilitate the use of labor. It can integrate with all AI technologies in openness and accessibility to provide new services, and provides stronger technology to prevent crime or protect personal information through regulation, perception, or prediction, as well as other means to protect the socially vulnerable.

This paper discussed how voice-based public services using natural language can constitute a public communication channel for realizing open government by strengthening human rights and basic rights, digital inclusion, and the protection of information access by bridging the information gap of the socially vulnerable. The government plans to inform the public services in areas close to civic life, including the effective response to the post COVID-19 era, and ensure social, economic, geographic, and psychological equity in the digital government. In particular, inducing participation of the social vulnerable is a key task of intelligent government that should be realized. Providing such communication for immigrants, the elderly, low-incomers, and rural people who lack education in natural language using a voice interface helps solve complex problems in the civil service easily. Various considerations in preparing a voice-based public service platform are the prerequisites such as the mutual interconnections of the sectors, NLU, API, and value chains. Policy suggestions are listed for provisions for customized services of users to enhance the personal security of the vulnerable. First, the laws and systems should be reorganized and appropriate measures enacted. Second, the establishment of a governance infrastructure based on a cloud platform is necessary. Third, private companies should identify their needs and prepare tax benefits and funding and incentive systems to foster and promote big data businesses. Fourth, the scope of research as a basic academic pursuit should be expanded and education on AI should be strengthened, including digital literacy. Lastly, the implications of voice-based public services for public communication and open government for the socially vulnerable on information accessibility for digital

inclusion against the digital divide, and their ability to further basic human rights were adduced. This research had the major limitation that it was difficult to find information on the technical and functional aspects of voice-based services, such as academic literature on the integration of the public sector and AI, or research reports from government and related agencies. It was even more difficult to obtain data due to insufficient data management and accumulation, and it is believed that more developmental studies will emerge only when active guidelines for disclosure and utilization of public data are presented.

In the future, I would like to continue to research social and humanistic influences such as cloud nationality and digital citizenship in line with the 4th industrial revolution, and further consider how to deliver policies effectively and develop channels. The development of comprehensive public communication channels can lead to more transparent government organizations as by streamlining decision-making, overcoming the harmful effects of bureaucratic organizations with risks of wrong decision-making, dismantling rigid organizational culture, and reducing the burden on civil servants. In addition, the information technology society using digital technology should never neglect the maintenance of laws and systems for personal privacy and cybersecurity, which should be built and designed around citizens who are not biased toward the government and public institutions in data storage, utilization, and management. AI and the “untacted” governmental system impact our lives directly and provide various standards for assessing the quality of life of citizens dreaming and aiming for a bright and sound future. Efforts on the part of all of us to minimize the marginalized class in the process of implementing intelligent governments are very natural, and we hope that higher administrative services and a stepping stone for a positive paradigm shift can be provided.

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- 1) Machine learning algorithms, process automation, image recognition software, and voice recognition interfaces, including chatbots.
  - 2) Public communication between citizens and public sectors uses natural language to facilitate the provision, sharing, disclosure, and utilization of desired information quickly without obstacles and disturbance. And it can be to engage citizen's opinion in the policy-making process. Those cooperation works interactively(Song, 2021).
  - 4) In computing, a natural user interface, or NUI, or natural interface is a user interface that is effectively invisible, and remains invisible as the user continuously learns increasingly complex interactions. The word "natural" is used because most computer interfaces use artificial control devices whose operation has to be learned. Examples include voice assistants, such as Alexa and Siri, touch and multitouch interactions on today's mobile phones and tablets, but also touch interfaces invisibly integrated into the textiles furnitures (wikipedia).
  - 5) This is the interface for programming the application to utilize the functions provided by any operating system or programming language. it is a stepping stone to connect operating systems and programming languages with application

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