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Factors Affecting South Korean Disaster Officials' Readiness to Facilitate Public Participation in Disaster Management Using Smart Technologies

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〈Abstract〉

As the frequency and intensity of catastrophic disasters increase, there is widespread public sentiment that government capacity for disaster response and recovery is fundamentally limited, and that the involvement of civil society and the private sector is ever more vital. That is, in order to strengthen national disaster response capacity, governments need to build disaster systems that are more participatory and function through the channels of civil society, rather than continuing themselves to bear sole responsibility for these "wicked problems."

With the advancement of smart mobile technology and social media, government and society as a whole have been called upon to apply these new information and communication technologies to address the current shortcomings of government-led disaster management. As illustrated in such catastrophic disasters as the 2011 *Tohoku* earthquake and tsunami in Japan, the 2010 Haitian earthquake, and Hurricane Katrina in the United States in 2005, the realization of participatory potential of smart technologies for better disaster response has enabled citizen participation via new smart technologies during disasters and resulted in positive impact on the management of such disasters.

* This study acknowledged that some of the contents of the Korea Institute of Public Administration's '2013 A Study on Risk Perception and Communication via Social Media report' were excerpted and cited.

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In this context, this study focuses on the South Korean context, and aims to analyze Korean government officials' readiness for public participation using smart technologies. On this basis, it aims to offer policy suggestions aimed at promoting smart technology-enabled citizen participation. For this purpose, it proposes a particular model, termed SMART (System, Motivation, Ability, Response, and Technology).

Keywords : Disaster management, Public participation, Disaster officials, Smart technology, Smart model

목 차

Ⅰ. Introduction

The increasing number of recent catastrophic incidents stemming from disasters has prompted a reassessment of the suitability of national disaster and emergency management processes worldwide. As the frequency and intensity of such incidents increase, there is widespread public feeling that governments' disaster response strategies and their capacity to manage such events have reached their limit. As such, in order to strengthen national disaster response capacity, governments need to build more participatory national disaster systems aligned with civil society, rather than bearing sole responsibility for these incidents (Helsloot & Ruitenberg, 2004).

As evidenced in a series of recent cases of disaster management, smart technologies such as smartphones and social media have come to be widely utilized to facilitate communication during disasters. This suggests that there are vital roles for public participation in disaster response. During the 2011 *Tohoku* earthquake and tsunami in Japan, for example, public input via smartphones, tablet PCs, and social networking services (SNSs) played a pivotal role in enabling communication with victims, circulating disaster information, and providing updates on the situation at disaster sites. Where the tsunami destroyed regional telecommunication infrastructure, SNSs on smartphones enabled users to stay connected through networks of contacts. Likewise, during the 2010 earthquake in Haiti, social media platforms such as "Ushahidi" and the use of smart devices by civil volunteers brought about useful collaborative effects in tackling such disasters. These new smart technologies seem to open up new possibilities for engaging the public in government disaster efforts. In this regard, South Korea, acknowledged as the world's most advanced nation in ICT, is no exception. It is well known in the country that citizens who witnessed the 2010 fire at the Wooshin Gold Sweet residential building in Haeundae, *Busan*, uploaded photos from their smartphones; this was quickly publicized nationwide through internet broadcasting site "Afreeca TV". Similarly, when North Korean artillery fired on the South Korean island of *Yeonpyeongdo* in 2010, pictures of this event appeared quickly in daily newspapers and on television news programs; however, these initial pictures were taken not by professional journalists, but by ordinary citizens. In this case, Twitter played a leading role, distributing news faster than established media. As both these cases demonstrate, public participation in the exchange of crisis communication, the circulation of information, and in restoration of sites affected by disaster is crucial for national disaster management capacity, particularly in the current smart technological environment.

The bulk of previous disaster management studies lean towards diagnosing current issues and problems facing governments' disaster management systems, and prescribing possible policy solutions (Oh, 2007; Yoo et al, 2008; Yuh, 2007; Cho & Chai, 2006; Seo & Han, 2013). Those studies that have focused on public participation have been largely theoretical and normative, without much empirical evidence. As for studies that

focus on the nexus of disaster management and new technology, they often follow a technologically deterministic approach, in which new technological solutions in areas such as ubiquitous technology, GIS technology, smart technology, etc., are developed and applied to existing disaster management systems (Choi & Cho, 2006; Lee & Kim, 2009; Cha, 2011; Jeong, 2010; Kwon et al., 2009). These latter studies may fail to capture the dynamic relation between new smart technologies and public participation in disaster management, and underestimate the importance of active public officials' role in production and dissemination of information.

What is more, little scholarly research has looked at how governments apply smart technologies to encourage public engagement, and how public officials perceive the application of these technologies. This study tries to fill this void by examining which factors influence "public service readiness" for public participation via smart technology. Specifically, this study examines South Korean disaster authorities' and officials' smart technology usage, perception of and legal obligations towards organizational policy, and actual response to public input. Currently, citizens participating in disaster management, will need support from officials with compliant attitudes when information and communication needs develop(Coursey et al., 2012; Zheng et al., 2014). Such attitudes will allow public participation in disaster management at state and local levels. All of these concerns point to a fundamental question: "To what extent are government disaster officials ready for public participation in disaster management via smart technologies?".

Ⅱ. Literature Review

There is no consensus definition of smart technologies. In this paper, "smart technology" is used to mean any devices that combine hardware and software to provide SNS functionality over wireless internet. Users are allowed access, anytime/anywhere, to information and multimedia (Lyu & Mergel, 2012). Smartphones are a prototypical smart technology.

In January 2016, smartphone users in South Korea accounted for over 82.5% (4.39 million) of total telephone users (5.37 million) (MSIFP, 2016). Combined with various software applications and social networking services, they make it possible for users to network to gather and share information quickly. Social networks collect and disseminate information both online and offline for connected users, so that relevant information can be obtained more swiftly and easily than before (Benkler, 2006).

SNSs or social media include blogging platforms, podcasts, wikis, etc. Historically, communication on disasters has been a largely one-way, top-down process whereby the government informs the public, who are rendered passive information consumers. Now, with smart technology devices, social media users can actively engage in dialogue with government or amongst themselves, in a more horizontal, two-way fashion.

1. Social Media and Disaster Management

Social media's potential for disaster management can be broken down into several aspects. First, SNSs foster rapid information flow—production, acquisition, delivery, and circulation—which can assist disaster management. Second, SNSs offer two-way communication between authorities and the public, with swift access and response. Third, social media can be accessed anywhere, including situations where conventional communications cannot be used, to report on-the-spot news to those outside the affected area, domestically and internationally, as in the *Tohoku* earthquake and tsunami. Fourth, most social media services are free of charge and easy to use, removing a potential barrier associated with some alternatives. Fifth, they support information reliability by linking directly to its source, allowing verification and increasing confidence in this intelligence. Sixth, social media can operate as an alternative communication network if other networks collapse.

Additionally, social media embedded in smart technology offers new approaches to information production/sharing, frequently initiated by grassroots individuals and organizations and based upon voluntary participation, rather than top-down mobilization led by giant telecommunications companies that monopolize resources and regulations.

2. Factors Influencing Disaster Officials' Readiness for Public Engagement

Theories addressing public predispositions regarding e-participation are often rooted in the participants' (e.g., usually, the public's) point of view, not that of the accepters (usually, government officials). A number of studies have looked to list both internal (personal)and external (environmental)factors they see as affecting public participation using new ICTs (Komito, 2005; Lowndes et al., 2006a, 2006b; Macintosh & Whyte, 2008). Stoker (2004) maintains that deep-seated socioeconomic and institutional factors are clearly at work shaping and constraining people's attitudes and capacities. Considering both internal and external factors, he suggests an all-encompassing "CLEAR" framework, which asserts that public participation is the most successful when the public "can do," or have the sources and knowledge to participate; "like to," or tend to plan to, enhance their participation; are "enabled to" participate by supporting regulations; are "asked to" participate, that is, when participation is requested and officials show a willingness to listen to their situation; and are "responded to," or feel that their opinions are considered by others.

However, the CLEAR model is a generic one, applicable in any social context; thus, some modification is necessary to make it more suited for the new ICT environment. Based upon CLEAR, Lyu (2008) thus proposes an 'eCLEAR' model that reflects the distinctive features of e-participation and its medium, that is, the internet. Here, 'can do' means ICT literacy along with political attentiveness and resources; 'like to' involves the public's interpretation of civil identity and obligation; 'enabled to' refers to broader socioeconomic and institutional aspects of government-initiated e-participation practices; 'asked to' is based on public awareness of e-participation; and 'responded to' refers to individual participants' internal political efficacy.

Yet, the eCLEAR reflects key factors influencing participation only from citizens' perspective, not from that of public servants. Helsloot and Ruitenberg (2004) argue that the level of citizen responses to disasters varies depending on the capacity of government agencies and authorities to integrate those responses quickly and effectively

into a coordinated effort to deal with disasters. Therefore, there is yet another modification needed: we must identify the key participatory factors for acceptors. Scholars have started to study this topic, but empirical studies are still few. Most of them have focused on exploring the factors that influence public officers' attitudes toward public participation (Yang, 2005; Yang & Callahan, 2007) based upon the recognition that "the more positive the attitudes of officials toward citizen participation are, the better the power redistribution" and "[t]he more supportive the officials are of participation, the more trusting and efficacious the citizens will be" (Kweit & Kweit, 1981). Yang (2005) further argues that government officials' attitude and efforts towards public involvement in the administrative process are largely influenced by their belief in citizens' competency (knowledge, skills and judgments), honesty (integrity), and benevolence. According to Panagiotopoulos et al. (2013), aside from government officials' attitude and motivation, public participation also relies on concrete aspects of government responsiveness such as providing information and responding to public input. Other influencing factors could relate to activities initiated by government to encourage citizen participation in administrative decision-making and managerial processes (Yang & Callahan, 2007). Given that government activities are generally described and regulated by law, organizational regulations, guidelines and working manuals, etc., Scherer and Wimmer (2012) argue that the success of innovative e-participation depends heavily on organizational planning and the mechanism for incorporating such initiatives into the different stages of the policy life-cycle. It has also been pointed out that especially with the proliferation of e-participation technologies in government organizations, public officials' readiness for or acceptance of public participation is closely related to their capacity for using such technologies, which directly impacts their actual use of them to engage the public (Feeney & Welch, 2012).

This study tries to link these influencing factors clearly with public service readiness towards public participation in disaster management via smart technology. The model proposed here is based upon the following five-fold factor typology: system, motivation, ability, response, and technology. This typology, termed SMART, can act as an index of government readiness to accommodate a role of public participation through smart

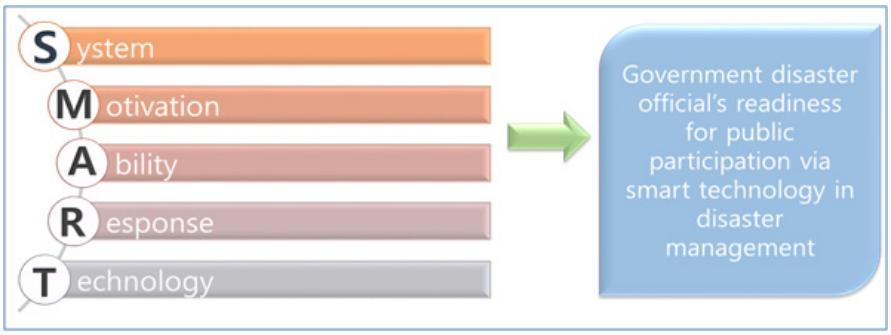
technologies in disaster management.

The first factor in SMART, system (S), refers to conditions on the government side that are made manifest through legal regulations, organizational rules and policies, and manuals aimed at encouraging public participation, equivalent to eCLEAR's 'enabled to' factor. This first factor embraces three layers of institutional design of the mechanism of participation depending on the degree of practicality and clarity of rules and guidelines defining government practices towards public participation through smart technologies. Second, the motivational factor (M), which is equivalent to the 'like to' factor in eCLEAR, focuses on government disaster officials' perceptions of public participation, the use of new smart technology in disaster activities, and the benefits of these. Third, the ability component (A), correlating with 'can do' in the previous models, includes ICT literacy, in particular regarding smart technology and use of social media applications, at both individual and organizational levels. Fourth, the response factor (R), 'responded to' in eCLEAR, incorporates person-hours dedicated to public participation via smart technology, government disaster officials' response to public input, and their willingness to provide disaster-related information to the public. Fifth, the technology factor (T) measures the actual usage of smartphones in disaster situations and the proportion of disaster information obtained from smart technologies. Dropping 'asked to', which involves public awareness of e-participation, this study thus looks not only into attitudes but also to a degree into disaster authorities and officials' intensity of use of smart technology.

Ⅲ. Empirical Analysis and Results

1. Smart Model

The level of public participation via smart technologies in disaster management can be evaluated by looking at government's degree of readiness according to the five SMART dimensions (see Figure 1).



〈Figure 1〉 Smart Model (modified from Lyu(2008)'s eCLEAR model)

First of all, for both central and local government agencies charged with disaster management, this study examines the availability of proper systematic mechanisms for smart technology usage (including internet access), cooperative processes for active participation, and regulation of offline instruments that civil society can utilize when contributing to disaster management. Second, this study looks into whether these agencies possess the motivation or willingness to interact with the public and the proclivity to encourage local communities and/or individuals to participate in disaster management. Third, it assesses the ability of relevant government departments and disaster officials to use smart technology in their official positions. Fourth, it examines government response factors in order to ascertain if there are personnel equipped to respond to public participation in disaster management, such as public information generation and dissemination. Generally speaking, any answer from government to individual disaster-related inquiries is considered a 'response'. Finally, a comparison with existing communication channels is performed to verify whether smart technologies are utilized in these interactions with public participants.

2. Demographic Characteristics of the Participants

Empirical analysis was carried out among public officers responsible for disaster management at both central and local government levels. From August 20 to 31, 2013, the survey was taken by 216 government officers. The results were as below.

〈Table 1〉 Results of survey respondents (disaster management staffs)

Types		Number of cases (people)	Percentage (%)
Total		(216)	100.0
Institute	Metropolitan council	(34)	15.7
	Foundation council	(182)	84.3
Region	Seoul	(14)	6.5
	Busan	(20)	9.3
	Daegu	(14)	6.5
	Incheon	(14)	6.5
	Gwangju	(4)	1.9
	Daejun	(9)	4.2
	Ulsan	(7)	3.2
	Kyunggi	(29)	13.4
	Kangwon	(22)	10.2
	Chungbuk	(12)	5.6
	Chungnam	(13)	6.0
	Chonbuk	(11)	5.1
	Chonnam	(6)	2.8
	Kyungpook	(22)	10.2
	Kyungnam	(13)	6.0
	Jeju	(6)	2.8
Series	Administration	(120)	55.6
	Technician	(94)	43.5
	Others	(2)	0.9
Term Period	Under 3 months	(16)	7.4
	6 months	(36)	16.7
	1 year	(71)	32.9
	2 years	(48)	22.2
	Above 3 years	(45)	20.8
Types of disaster	Flood	(209)	96.8
	Earthquake/Tsunami	(155)	71.8
	Heat wave/Drought	(176)	81.5
	Fire/Explosion/Collapse	(121)	56.0
	Traffic accidents	(46)	21.3
	Safety accidents	(63)	29.2
	Industrial accidents	(34)	15.7

3. Results

1) System

In terms of government's institutional arrangements regarding public participation via smart technology, 74.1% of respondents agreed with the significance (fairly important

+ very important) of civil participation in disaster management; only 9.3% found it not that important. This result also demonstrates that there is no difference with respect to the characteristics or regional location of respondents. Regarding the issue of legal provisions or frameworks enacting public participation in disaster management, 73.6% of respondents say they are in place, whereas 19.4% feel they are not. There is also variation in terms of the type of disaster. For instance, institutional arrangements accommodating public engagement in response to floods, earthquakes, tsunamis, heat waves, and so forth seem to be better developed than those for human-made safety hazards such as traffic accidents (46%), security accidents (63%) and industrial and occupational hazards (58.8%). Next, regarding specifications of public participation in organizational manuals and documents, respondents state that their organization has a working manual for disaster officials setting out public participation as a goal in each phase of the disaster management cycle. As for the presence of specific 'smart technology-led participation channels' and related work manuals for disaster officials, they were rare, especially for the phase of recovery (25%) in comparison to prevention (38%), preparedness (44%), and response (36.1%).

2) Motivation

In all, 71.7% of respondents replied that public participation in disaster management is useful (47.2% fairly positive + 24.5% very positive), while 9.3% think it is not. The longer a particular officer has been involved in disaster management, the greater their tendency to perceive public participation in disaster management as a positive: 84.4% of officials with more than 3 years' disaster management service hold positive views on public participation compared to those with under 3 years (77.1% of those with 2 years' service, 69% with 1 year service, 61.1% with 6 months' service, and 56.3% of those with less than 3 months' service). The primary reasons for negative views of public participation in disaster relief are 'increasing administrative burden and cost' (85%) and 'potential conflict of responsibility for disaster relief' (85%). These are closely followed by 'safety accidents due to layperson involvement' (70%), 'inaccurate information dissemination' (65%) and others. The rationale for more positive views

toward public participation in disaster relief was most often based on the belief that local people living near disaster sites tend to have better knowledge of their local environment and circumstances (76%), followed by the observation that it 'encourages the public's awareness of disaster prevention' (70.9%), allows officials to 'respond better to increasing needs when tackling disaster conditions through obtaining human and other resource support from civil society' (68.9%), 'bolsters government's national capacity-building by including local know-how, experience, and good practices from within civil society' (65.8%), 'strengthens disaster prevention and mitigation via increased public participation' (65.8%), 'invigorating private cooperative networks at normal times' (60.7%) and 'reducing disaster workload' (38.3%).

Regarding social media, 45.8% indicate that it is not widely used in participatory disaster management. The main reasons for this underutilization are, in order, 'ambiguity of roles and responsibility for government disaster authorities and non-governmental disaster relief organizations' (66.7%), 'lack of budget' (60.6%), 'lack of incentives for public participation' (58.6%), and 'lack of legal systems that enact public participation' (51.5%). Other responses, such as 'disaster officials' negative perception towards participatory disaster management' (24.2%), 'skepticism regarding the effectiveness of participatory disaster management' (44%), or 'lack of experience working with the public' (24.2%), are relatively low. Based upon disaster officials' previous experience of participatory disaster relief, 56.6% mention that public participation is helpful in disaster management. Respondents who belong to the upper levels of government are found to have more positive opinions of public participation (64.7%) than those at lower levels (53.8%).

3) Ability

In all, 35.6% of respondents mention that they are not proficient with smart technology, while only 3.7% of respondents said they are confident employing it. The primary reasons are that officials have 'little appreciation of and/or strategy when applying smart technology for disaster relief' (38.9%), followed by, in order, the belief that there may be 'potential inefficiencies caused by adopting smart technology for

disaster relief' (34.7%), that 'disaster officials maintain negative perceptions towards the adverse effects caused through the use of smart technology' (29.2%), and there is an 'impossibility or dispensability when utilizing smart technology due to organizational rules and the specific nature of disaster tasks' (19.4%).

Regarding the effectiveness of smart technology in encouraging public participation in disaster management, 58.3% of respondents lean towards a positive viewpoint, while 11.6% of respondent do not believe smart technology to have a positive effect. Depending on the type of disaster, the potential uses of smart technology are thought to be diverse. Smart technology is expected to have a more positive effect during certain kinds of disasters, such as 'traffic accidents' (65.2%), 'security accidents' (65.1%) and 'industrial disaster/occupational disease' (64.7%), than other types of disasters. Regarding which characteristics of smart technologies are most likely to have an encouraging impact on public participation, 'immediacy' (80.6%) is suggested, followed by 'in-location (disaster site accessibility)' (75.9%), and 'two-way communication' (61.6%). On the other hand, 'an alternative communication channel' (53.2%) and 'utilization of private communication network' (50.0%) are relatively underrated.

In terms of uses of smart technology at each phase of disaster management, the largest number of respondents mentions that 'it is utilized at the prevention stage to provide advance notice about disaster safety' (75.5%). At the preparedness stage, it is used mainly to 'provide information regarding disaster and safety' (55.6%), while at the response stage, it is typically used for 'public announcements of disaster events' (69.4%) and for 'supporting volunteer activities onsite' (59.7%).

4) Response

Over half of the respondents (60.2%) claimed that organizational policy that could enable public participation in disaster management strategies has yet to be implemented. However, 82.4% of respondents from low-level, local government offices state that their organization is well prepared to respond to the need for public participation, while only 17.6% of upper-level government authorities state that they have the same level of preparedness. Reasons for not being able to incorporate public participation in disaster

management are as follows: 'lack of budget' (78.5%), 'lack of personnel who deal with participation via smart technology' (76.9%), 'inadequate policy for incorporating public engagement' (50.8%) and 'lack of leader's commitment' (willpower) (33.1%). The main role of lack of budget was more often mentioned by low-level government authorities (80.4%) compared to those in upper levels (69.6%).

In the event of a disaster, 56% of respondents expressed the intention to respond to public feedback, with only 5.1% saying they would not accept public participation with respect to disaster response. This implies that special consideration should be given to the possibility of a discrepancy between how government disaster officials perceives and responds to public participation and how the public perceives government disaster officials' responsiveness to public involvement in disaster management.

5) Technology

According to the results of this survey, disaster officials primarily use smartphones (100%) for information dissemination and sharing. However, SNS usage (38.4%) is much lower than that of other information communication channels (61.6%). Among SNS programs utilized for disaster and safety communication with the public, KakaoTalk (43.6%), MSN Messenger (44.4%), Twitter (24.8%), and Facebook (21.1%) are used, in order of preference. Over half of respondents (55.6%) state that they obtain disaster information via smart technologies. In terms of the types of disaster, respondents were most likely to use smart technologies to obtain information on 'public security accidents' (65.5%), followed by 'industrial accidents/occupational hazards' (64.7%). Those who trust disaster information obtained via smart technology stand at 50.0%, while 4.6% of respondents do not trust disaster information obtained via smart technology. In addition, 54.9% of respondents who use smartphones are more likely to trust disaster information acquired by smart technologies than non-smartphone users, of whom only 35.2% have confidence in disaster information acquired via smart technologies. Yet, the current official guidelines and working manuals are relatively focused on complex disasters, leaving more common disasters like traffic and security accidents under-served.

4. Correlation

Next, this study looks to ascertain the degree of interrelationship between the SMART variables by testing their interdependence (see Table 2). After conducting correlation analysis, it is first shown that, among the sub-factors of system (S), the existence of a manual (i.e., guidelines and procedures) that facilitates public participation via smart technology (S2) has a positive correlation with organizational ability vis-à-vis smart technologies (A1, .202**) and the individual ability of smart technologies (A2, .216**). However, a legal framework for participation in disaster management (S1) shows a negative correlation with organizational ability of smart technologies (-.149*), and no correlation with other factors such as motivation (M), response (R), and technology (T). Hence, a more formal legal framework has little effect on the compliance of government disaster-related officials with regard to public participation in disaster management than organizational manuals, guidelines, and procedures. Such manuals or guidelines, being more specific and relevant, may help establish public participation better.

The presence of 'smart participatory channels and related procedures' (S3) shows a strong correlation with various motivation (M), ability (A), and response (R) factors: positive perceptions of disaster officials towards public participation (M1, .211**), expectations for smart technology (that may contribute to the broadening of public participation) (M3, .213**), the presence of personnel whose responsibility is responding to public participation (R1, .165*), and willingness to provide information about public participation (R3, .158*). S3 also displays a certain level of correlation with disaster authorities' smart technology availability (.407**) and individual disaster officials (.279**). Thus, we can conclude that S3 helps secure public participation. Interestingly, legal frameworks (S1) and organizational guidelines and procedures (S2) seem to have little relationship with the response (R) and motivational (M) factors.

Second, motivational factors seem to have a high correlation with response factors. A positive perception on the part of disaster officials towards public participation (M1) has been closely correlated with an active response to inputs from the public (R2,

.204**). M1 also has a close correlation with disaster officials' willingness to provide disaster information to the public (R3, .166*). There also appears to be a high correlation (.496**) between disaster officials' (positive) opinion that 'public participation can contribute to more effective disaster management' (M2) and the expectation that 'smart technology can encourage public participation' (M3). M2 further has a close correlation with the establishment of special personnel dedicated to public participation (R1, .226**), an active response to public input (R2, .491**), and the provision of disaster information to the public (R3, .293**). Notable is that the opinion of disaster officials that "public participation would contribute to effective disaster management" (M2) demonstrates correlations with smart technology use by disaster authorities (A1, .344**), the obtaining of disaster information using smart technology (T1, .235**), and confidence among disaster officials in disaster information acquired via smart technology (T2, .368**).

The expectation by disaster officials that 'smart technology would facilitate public participation' (M3) displays strong correlations with almost all factors within the SMART typology. It shows high correlation with the presence of accessible smart participatory channels and related working manuals and procedures (S3, .213**), smart technology competence by disaster authorities (A1, .294**), smart technology competence among disaster officials (A2, .324**), the acquisition of disaster information via smart technology (T1, .234**), and disaster officials' degree of trust of information acquired in this fashion (T2, .408**). Furthermore, there is also a strong correlation between disaster officials' responsiveness to public input (R2, .229) and their willingness to provide disaster information to the public (R3, .186**).

Third, the ability factor (A) can be broken down into two sub-factors, namely smart technology competence at the organizational level (A1) and at the individual level (A2). The organizational capability to use smart technology displays various degrees of correlation with almost all factors in SMART. However, individual disaster officials' smart technology ability, in particular their usage of SNS, shows little relation to their motivation and response factors. This implies that smart technology competency among disaster authorities regarding specific disaster-related tasks and exercises tends to have

more impact on disaster officials' motivational and responsive factors. Additionally, as one may expect, the ability factors show high correlation with technology factors.

Finally, as noted earlier, disaster officials' responses to public input into their disaster management systems seem to have a close relation with their motivational factors. Fifth, also as mentioned previously, technological factors seem to have a high correlation with the abilities of government disaster authorities and officials. It is worth mentioning, too, that disaster officials' smart technology use for the purpose of public participation (T1) and their confidence in disaster information acquired via smart technology (T2) display high correlations with their willingness to provide disaster information to the public (R3, .205**, .218**).

〈Table 2〉 Correlation analysis

	S1	S2	S3	M1	M2	M3	A1	A2	R1	R2	R3	T1	T2	T3
S1	1	-.441**	-.014	-.012	.000	-.030	-.149*	-.038	.028	.035	.041	-.103	-.101	-.034
S2		1	.220**	.032	.096	.109	.202**	.216**	.076	.020	.070	.086	.160	.038
S3			1	.211**	.053	.213**	.407**	.279**	.165*	-.005	.158*	.113	.190	.132
M1				1	.499**	.415**	.282**	.080	.070	.204**	.166*	.084	.095	.208**
M2					1	.496**	.344**	.065	.226**	.491**	.293**	.235**	.234*	.368**
M3						1	.294**	.324**	.157*	.229**	.186**	.234**	.309**	.408**
A1							1	.180*	.239**	.271**	.314**	.320**	.440**	.321**
A2								1	.117	.021	.095	.320**	.373**	.295**
R1									1	.266**	.118	.253**	.012	.202**
R2										1	.222**	.171*	.197*	.259**
R3											1	.205**	.163	.218**
T1												1	.c	.288**
T2													1	.731**
T3														1

*. Correlation is significant at the 0.05 level (2-tailed).

**. Correlation is significant at the 0.01 level (2-tailed).

5. Regression analysis

Following the above correlation analysis, this study then conducted a regression analysis among the SMART model variables, with level of government readiness for

smart technology-led participatory disaster management as a dependent variable, administrative division and job category as control variables, and SMART factors as independent variables.

According to the analysis, as the level of smart technology competence among government disaster organizations increases, the level of public participation using smart technology is also found to increase, with statistical significance at the 10% level. If there is a designated person or team for responding to public input via smart technology, public participation using smart technology is found to be higher, with a significance level of 5%. The result also shows that the greater the degree to which government disaster officers use smart technology when seeking certain information connected to their disaster-related tasks, the greater the increase in public participation via smart technology (confidence level of 10%).

〈Table 3〉 Regression results

		Nonstandard coefficient		Standard coefficient	*t*	*P*
		B	Standard error	Beta	*t*	*P*
Independent Variable	(Constant)	0.866	0.414		2.090	0.038
S	S1	-.0.013	0.093	-0.011	-0.143	0.887
	S2	-0.052	0.125	-0.032	-0.413	0.680
	S3	0.030	0.071	0.028	0.416	0.678
M	M1	0.065	0.071	0.069	0.906	0.366
	M2	-0.103	0.095	-0.101	-1.082	0.281
	M3	0.066	0.076	0.069	0.868	0.386
A	A1	0.162	0.068	0.178	2.388	0.018*
	A2	-0.015	0.037	-0.028	-0.399	0.690
R	R1	0.162	0.056	0.194	2.868	0.005**
	R2	0.023	0.077	0.022	0.298	0.766
	R3	0.108	0.075	0.098	1.436	0.153
T	T1	0.329	0.123	0.193	2.667	0.008*
	T2	0.055	0.089	0.045	0.613	0.541
control variable 1	Administrative division (lower-level local autonomy=1, upper-level local autonomy=0)	-0.042	0.149	-0.018	-0.280	0.779
control variable 2	Job category (technician=1, general administrator=0)	0.070	0.111	0.041	0.626	0.532

Ⅳ. Discussion

As seen in the correlation analysis of the SMART factors above, a number of findings can be elucidated. First, the five components are closely interlinked as they have a mutual influence. System factors may well operate as influential conditions when high motivation, competency, and responsiveness to smart technology-led public participation are present among disaster officials.

Disaster officials' positive opinion on public participation presents a statistically significant relation not only with system factors but also with disaster authorities' smart technology competency, their technology usage for obtaining disaster information, and their confidence in disaster information accessed via smart technology. In particular, the motivational factors show significant statistical relations with the responsive factors, as disaster officials' positive perception towards public participation affects both their response to public participation via smart technology and their willingness to provide disaster information to the public. Motivational factors show statistically significant relations with all other factors; this implies that the higher the motivation government officials possess, the greater their (effective) ability, and thus the higher their utilization of smart technologies. However, disaster officials' motivation to help foster public participation in disaster management using smart technology can be decreased by their concern with resulting increasing workload, inaccurate information, administrative cost, and possible conflicts over responsibility when things go wrong.

As for ability factors, organizational level competency with smart technology seems to have significant influence on other factors, while individual competency with smart technology shows little relation with motivation and response factors. Officials whose organizations have a higher level of ability to use smart technology tend to believe in the participatory potential of smart technology, and they may use it more frequently in their overall duties, including responding to public participation. In particular, the ability and technology factors demonstrate a strong correlation. However, a significant number of disaster officials are not competent in using smart technologies. As we saw

earlier, only 50% of respondents believe in information obtained via smart technology, suggesting that a sort of information filtering system or a fact-checking system is necessary to verify the accuracy or reliability of the information. Through the development and implementation of the system, it is expected that the government will be able to control rumors and false information that could negatively affect the positive attitude or responsiveness of disaster management officials to civil engagement; this implies that there is an urgent need for education and training to build disaster officials' smart technology capacity. In addition, the fact that disaster officials tend to trust disaster information obtained via smart technology means that information filtering systems need to be developed to control rumors and inappropriate sources of information that may cause controversy and confusion and affect disaster officials' participatory motivation and responsiveness.

As mentioned earlier, response factors show several statistically significant relations with system, motivation, and ability factors, but they show little statistical relation with the technology factors. This implies that government disaster officials' intent and capacity for public participation, rather than technology deployment, precondition their responsiveness towards public participation. It is also worth mentioning that disaster officials' responsiveness seems to be constrained by lack of personnel, largely due to budget concerns. Local disaster authorities, often the first responders for on-site recovery, seem to be particularly unprepared for smart technology–based public participation due to lack of budget and personnel. Thus, there may be a need for the Korean government at local and national levels to allocate more resources in this regard. The consequences of unresponsiveness may result in a greater disaster than would otherwise have been the case. In this regard, employing smart technology to reduce the likelihood of such a catastrophe becomes even more important.

Per the above correlation analysis, it proves problematical to define causal relationship among the five SMART factors; that is, the SMART framework presents a set of mutual interrelationships among all five factors, and it is somewhat challenging to ascertain which elements impact disaster management more in terms of smart technology–led public participation. This also presents difficulties when seeking to prioritize specific

areas or formulating policies.

However, the regression analysis did show that organizational competency in smart technology for disaster management encouraged the level of smart technology usage for participatory disaster management. In addition, securing greater resources for related personnel can lead to more public participation. It was also found that those organizations using smart technology for the acquisition of disaster-related information from the public on a daily basis do tend to value and encourage more public participation.

Overall, these results seem to indicate that educational training aimed at enhancing the smart-technological ability and comfort of disaster officers at an organizational level is the single most important element in encouraging them to utilize smart technology to facilitate public participation.

Ⅴ. Conclusion

The aim of this study was to identify the key factors influencing disaster officials' participatory readiness, and thereby inform them how best to develop organizational and institutional conditions supporting public e-participation and motivate them to do so.

Overall, the evidence presented here suggests that the participatory potential of smart technologies far exceeds the reality of what has been accomplished so far. The survey findings reveal that the Korean public's participation in disaster management using smart technologies has by and large been affected by several factors conceptualized here as SMART. The findings seem broadly positive about Korea disaster officials' attitudes towards public engagement and their confidence in the participatory potential of smart technology and in the appropriateness of present structures. Yet, the participatory potential of these positive attributes seems to be undermined by disaster officials' low competency with smart technology, lack of financial and human resources, and lack of organizational commitment to smart technology-led participation. Government agencies should not take these resource constraints lightly, and must set out clear strategies for

securing necessary resources for their smart participation initiatives.

As a final implication, there is an urgent need for government disaster authorities to understand smart technologies *per se:* how they can be used, for what purposes, and so on. Smart technology public engagement is unfamiliar territory, and governments generally lack experience and knowledge in implementing smart technologies As discussed earlier, the least prepared for the introduction of smart technologies into disaster management were the disaster-related officials who were unable to use smart technologies in disaster-safety areas.

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【요 약】

재난안전 실무자의 스마트 재난관리 준비도에 영향을 미치는 요인에 관한 실증 연구 – 스마트 기술을 활용한 재난관리 민간참여 중심으로 –

류현숙 · 김학경

최근 대형복합 재난 및 테러 등 발생으로 국가위기 및 재난관리의 중요성이 한층 증가되고 있으며, 재난 및 안전사고 강도와 빈도가 높아짐에 따라 정부의 재난 대응과 복구능력만으로는 한계가 있다는 인식이 확산되기 시작했다. 즉, 범사회적 재난안전 관리의 역량 강화 및 복원력 제고를 위해서는 국가 위주의 재난안전 관리가 아닌, 민간영역과 · 지역사회와의 협력적 체계를 구축이 필수적이라는 것이다. 특히, 최근 스마트 정보통신기술을 이용한 재난 및 안전사고 대응 사례들을 볼 때, 새로운 스마트 모바일 기기를 활용한 민간의 참여확대가 현실적으로 가능해졌음을 알 수 있다. 실제 국가 재난 및 안전관리 체계를 효율적으로 구축하기 위해서는 스마트 정보통신기술의 접목이 필수적이며, 특히 최근 스마트앱 사회연결망서비스(SNS) 등의 등장 및 이용 영향으로 기존 '명령과 통제' 방식의 재난 및 안전관리에도 변화가 요구되기 시작했다.

해외에서의 스마트 기술 기반 시민참여 사례로는 지난 2010년 아이티 대지진 당시 재난복구에 시민과 민간기업의 자발적 참여를 이끈 크라우드 소싱 플랫폼 우샤히디(Ushahidi) 사례, 2011년 3월 일본 대지진과 지진해일 발생 시 트위터, 페이스북 등과 같은 SNS 등을 통한 생사확인 등의 위기소통 사례, 2011년 5월 미국 조플린 토네이도 발생 시 페이스북 사이트를 통한 시민주도 실종자 찾기 및 생사확인 그리고 긴급구조와 지원 사례 등이 있다. 국내에서는 2010년 부산해운대 오피스텔 화재 발생 시 시민의 동영상 촬영 및 뉴스 제공, 2012년 대풍 볼라벤 북상시 SNS를 통한 시민주도 정보 공유 및 확산, 2014년 세월호 참사 당시 카톡 등 SNS를 통한 생사확인 및 구조현황 공유 등 다양한 스마트 기기와 소셜 미디어를 활용한 민간참여 확대가 재난 및 안전관리에 가져오는 시너지 효과를 볼 수 있었다.

이러한 맥락에서 본 연구는 스마트 기기를 활용한 민간참여에 대해 한국정부 재난안전 실무자가 느끼는 인식 및 기존 재난 및 안전관리에 스마트 민간참여를 수용할 수 있는

준비도(readiness)를 실증 조사해 분석하고자 한다. 스마트 민간참여 확대에 대비한 정부 재난관리 조직과 실무자의 준비 수준을 종합적으로 분석하기 위해 본 연구는 SMART 모델(System, Motivation, Ability, Response, Technology)을 제시한다. SMART 모델에 따라 재난안전 실무자의 법제도(System), 동기(Motivation), Ability(역량), 반응(Response), 및 기술(Technology) 등 5개 영역별 준비 수준을 측정, 분석해 향후 정책적 함의를 도출하고자 하였다.

주제어: 재난관리, 민간참여, 재난안전 실무자, 스마트 기술, 스마트 모델