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# The Role of ICT and Mass Media in Post-disaster Restoration and Recovery Progress – A Case of the Great East Japan Earthquake

Hitoshi MITOMO\*  
Tokio OTSUKA\*\*  
Stefan Y. JEON\*\*\*  
John W. CHENG\*\*\*\*

\*Graduate School of Asia-Pacific Studies, Waseda University; mitomo@waseda.jp  
Bldg. 19, 1-21-1 Nishi-Waseda, Shinjuku-ku, Tokyo 169-0051, Japan.

\*\*Faculty of English and IT Management, Shumei University; Tokio.otsuka@gmail.com  
Daigaku-cho, Yachiyo City, Chiba 276-0003, Japan.

\*\*\*Institute of Asia-Pacific Studies, Waseda University; garomin21@gmail.com  
Bldg. 19, 1-21-1 Nishi-Waseda, Shinjuku-ku, Tokyo 169-0051, Japan.

\*\*\*\* Graduate School of Asia-Pacific Studies, Waseda University; cwljwc@akane.waseda.jp  
Bldg. 19, 1-21-1 Nishi-Waseda, Shinjuku-ku, Tokyo 169-0051, Japan.

## Abstract

The aim of this study is to investigate how the use of Information and Communication Technology (ICT) and mass media can motivate people in the disaster area to recover from the Great East Japan Earthquake with empirical data. Both ICT and mass media have played an important role after the disaster. While ICT has provided an effective way for information collection and dissemination, at the same time, the mass media has provided a reliable information source. Therefore, in order to examine the effects from the perspective of both the ICT and mass media, two different models are used. The first model examines the role of online civic participation driven by the use of ICT and mass media to see if it can create benefits offline from the perspective of social capital development. The second model investigates the effects of the use ICT and mass media on people's perception on the disaster and their intension on future recovery actions from the perspective of the cultivation theory from mass media studies.

The data is collected in March 2013 using an Internet survey with more than 2000 samples from the three prefectures (Fukushima, Iwate and Miyagi) that were directly hit by the disaster. The empirical results of both models have demonstrated a consistent pattern, that the use of ICT and mass media can create positive effects in post-disaster recovery. The results of the first model have shown that the use of both mass media (informative television programmes) and ICT (Web 2.0 applications) can encourage online civic participation, which in turn mediates their positive effects on the development of offline social capital components that are important for post-disaster recovery. On the other hand, the results of the second model have found that even in the disaster area where many have experienced the disaster directly, the use of ICT (Internet) and in particular mass media (press and broadcast) have a profound effect on their perception on the disaster over their actual experience from the disaster, which has increased their intension to take actions on recovery.

The findings of this study provide some important implications for NGOs and governments that are searching for different means to enhance the post-disaster recovery efficiency by providing insights on how the utilisation of ICT and mass media can create positive influences to people in the disaster area in a complementary way.

## **Acknowledgements**

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## 1. Introduction

On March 11<sup>th</sup>, 2011, the north-eastern coast of Japan was hit by the Great East Japan Earthquake<sup>1</sup>, one of the most severe natural disasters in recent history. It has caused devastating damages to the north-eastern coastal region in particular in the Fukushima, Iwate and Miyagi prefectures<sup>2</sup>. Now, more than two years have passed after the disaster, the mindset of the people in the disaster area is shifting to the post-disaster recovery stage<sup>3</sup>. Information provided by the mass media and ICT has considered to play an important role to raise the spirits of those that are struggling to recover from the disaster. That is, by being repeatedly expose to information relating to the disaster and recovery, people could create a common belief that they should move forward, get over the difficulties and recover from the disaster even stronger than before. For instance, information provided by the mass media can be very influential as specific information with irrelevant contents discarded can be distributed to the public to create a very concentrated impact, on the other hand, information provided by ICT such as social networking services (SNS) are also very important because people can obtain the specific information according to their own interests and needs in a distributed way.

A study by Mitomo et al. (2012) has investigated the effects of the mass media and ICT on people's after-disaster action across Japan (excluded the disaster area) after the Great East Japan Earthquake, in which they have found that one of the distinct features of the disaster with respect to the role of ICT and mass media is that they can motivate people to take immediate post-disaster reactions such as information collection, countermeasures against possible aftermaths and altruistic actions. These actions were induced by the vibrant and abundant information about the disaster from both the mass media and ICT. In their study, they have defined this effect as the "Pythagorean Effect" which represents the phenomenon that people's perceived reality about the disaster could be altered by the information from the mass media and ICT, this perceived reality can motivate them to take immediate post-disaster actions.

Based on their findings, this study further investigates the effects of the use of both mass media and ICT on post-disaster recovery focusing on the disaster area. Reports (e.g., MIC, 2011; 2012) have found that both ICT and mass media have played important roles after the disaster, while ICT has provided a new way for information collection and dissemination, at the same time, the mass media has provided a reliable information source. Therefore, in order to examine the effects from the perspective of both ICT and mass media, two different models are used in this study.

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<sup>1</sup> The M9.0 undersea earthquake, the subsequent tsunami and aftershocks that cost more than 15,000 lives and 16.9 trillion yen of damages (Japan Reconstruction Agency, 2013). Hereafter referred to as "the disaster".

<sup>2</sup> Hereafter referred to as "the disaster area".

<sup>3</sup> The disaster management process can be divided into three main stages; 1, the pre-disaster stage which focuses on preparedness, 2, the response stage that covers immediate disaster response and 3, the post-disaster recovery stage that includes the ongoing activities for infrastructure restoration, social and economic recovery and rehabilitation (Todd & Todd, 2011).

First of all, after the disaster, ICT (e.g., SNS) has played a significant role and enabled many different types of post-disaster recovery initiatives online (Slater et al., 2012; Aizu, 2011), however, previous studies (e.g., Gil de Zúñiga et al., 2007; 2011) have questioned if online civic activities can actually lead to offline actions, therefore, the first model examines the role of online civic participation from the perspective of social capital development, in particular, its role as the mediator between the use of ICT and mass media and the development of social capital elements that are important for post-disaster recovery. On the other hand, although Japan is one of the most advanced ICT countries in the world, people in the disaster area might not be benefited from ICT as much as others in big cities because the disaster area is traditionally agriculture based with an aging population (Tanaka, et al. 2012). Furthermore, reports (e.g., Kimura, 2011; MIC, 2011) have found that mass media such as television, radio and newspaper are still considered as the most trusted and important information source after the disaster, hence, the second model uses the cultivation theory from mass media studies to investigate the effects of the use of ICT and media on people's perception on the disaster and recovery and subsequently on their intention to take recovery actions.

### **1.1 The role of ICT in post-disaster recovery**

One of the most remarkable aspects of the Great East Japan Earthquake is the role ICT has played after the disaster, ICT such as SNS and mobile Internet has provided the vital communication platform for many people in Japan and across the world to obtain and share critical information (Aizu, 2011; Appleby, 2013). In particular Web 2.0 applications such as SNS, blogs and video streaming websites have enabled people to efficiently create, collect and disseminate information to support different kinds of post-disaster recovery activity. In fact, recent studies (e.g., Rainie, et al., 2012; 2011) have found that SNS has become a feature of political and civic engagement and Internet users are more likely to be active in civic activities than non-Internet users, and other studies (e.g., Gil de Zúñiga, et al., 2007; Kobayashi, et al., 2006) have found the use of these applications can increase the level of civic engagement both online and offline.

As suggested by Shah et al. (2005) based the communication mediation model, although the use of media can encourage civic participation, however, most of the effects are indirect and are mediated by activities such as civic communications and interactive civic messaging, they have pointed out that it is because that these activities can increase people's opportunity to expose to civic resources and to obtain knowledge and understandings on civic issues, which in turn will motivate them to participate in civic activities offline.

Therefore, in order to examine the role of online civic participation in post-disaster recovery, the first model assumes that the use of both mass media (television, in particular informative programmes like news, current affairs) and ICT (Web 2.0 applications, e.g., SNS, blog etc.) can encourage offline participation with online civic participation as the mediator. Furthermore, it also assumes that through online civic participation, the use of media can also foster the development of social capitals as found in recent studies (e.g., Ellison, et al., 2007; 2011; Kittilson & Dalton, 2010).

### **1.1.1 Social capital in post-disaster recovery**

Social capital is a widely adopted concept in social and political science, it is defined as “the features of social organisation, such as trust, norms, and networks that can improve the efficiency of society by facilitating coordinated actions” (Putnam, 1993, p. 167). In the application of post-disaster recovery, studies on previous disasters have found that it is one of the most important factors contributing to the recovery efficiency, in particular, social capital elements such as bonding trust towards the local community and bridging networks to external communities can increase the level of collective actions as well as bring in extra resources and supports, as a result, communities that have a higher level of social capital have recovered faster than those with lower (e.g, Aldrich, 2012; Nakagawa & Shaw, 2004).

## **1.2 The role of mass media in post-disaster recovery**

While the use of ICT has gained much attentions after the disaster, however, it also affected by problems such as information distortion (Slater et al., 2012). On the other hand, after the disaster, reports have found that the mass media (e.g., newspaper, television) is still regarded as the most trusted information sources (Kimura, 2011; MIC, 2011; 2012), furthermore, Tanaka, et al. (2012) have pointed out that although short lasting, the mass media has a strong influence on the people’s participation in post-disaster recovery, as they have found that the number of volunteers and the amount of donations going to the disaster area were positively related to the frequency of disaster reports being shown on television.

Furthermore, in crisis situations such as major natural disaster, people will obtain information from different media sources to make judgement of the reality, while some people might be able to make judgement based on their previous experiences and knowledge, however, for those that do not have such experience and/or knowledge, they can only rely on the information provided by the media. In respect to the effects of the media on people’s perceived reality, one of the most widely adopted theories is the cultivation theory from mass media studies.

### **1.2.1 Cultivation Theory**

The cultivation theory (Gerbner et al., 1979; 1980) suggests that people’s perceived social reality can be “cultivated” by the media, in particular their perceptions on danger and risk, for example, the violent content on television can affect people’s perception on the level of danger in their neighbourhood (Morgan, 1983). Two major types of effect are suggested by the theory, namely the mainstream effect and the resonance effect.

The mainstream effect suggests that because of the wide reaching power of the mass media, the more people receive the same information from the media, the more likely they will believe in it, and subsequently it will form a common “mainstream” perception among them. On the other hand, the resonance effect points out that when people receive some information from the media that is similar to their own situation and experience, they will pay more attention to the media and “resonate” with their own experience to create an even stronger perception on that information.

Therefore, in order to examine the effects from the use of ICT and mass media from the perspective of the mass media studies, the second model assumes that for the people in the disaster area, their perception on the disaster and recovery is affected by the mainstream effect as media are widely used as well as the resonance effect because many of them have experienced the disaster directly, in addition, it also assumes the trust towards the media will also have an important influence on their perception. Furthermore, based on the findings by Mitomo et al. (2012), it also anticipates their perception on the disaster and recovery will influence their intention to take future actions for post-disaster recovery.

## 2. Theoretical model 1 – online civic participation and social capital development

The first model examines the effects of the use of mass media (informative television programmes) and ICT (Web 2.0 applications) on offline civic participation and social capital elements with online civic participation as the mediator. The model (figure 1) is constructed based on the communication mediation model put forward by Shah et al. (2005), the model consists of 6 latent variables; 1) the viewing of informative television programmes, 2) the use of Web 2.0 applications, 3) the level of online civic participation, 4) the level of offline civic participation, 5) the level of bonding trust and 6) the size of bridging networks, the latent variables and their corresponding observed variables are listed in table 1.

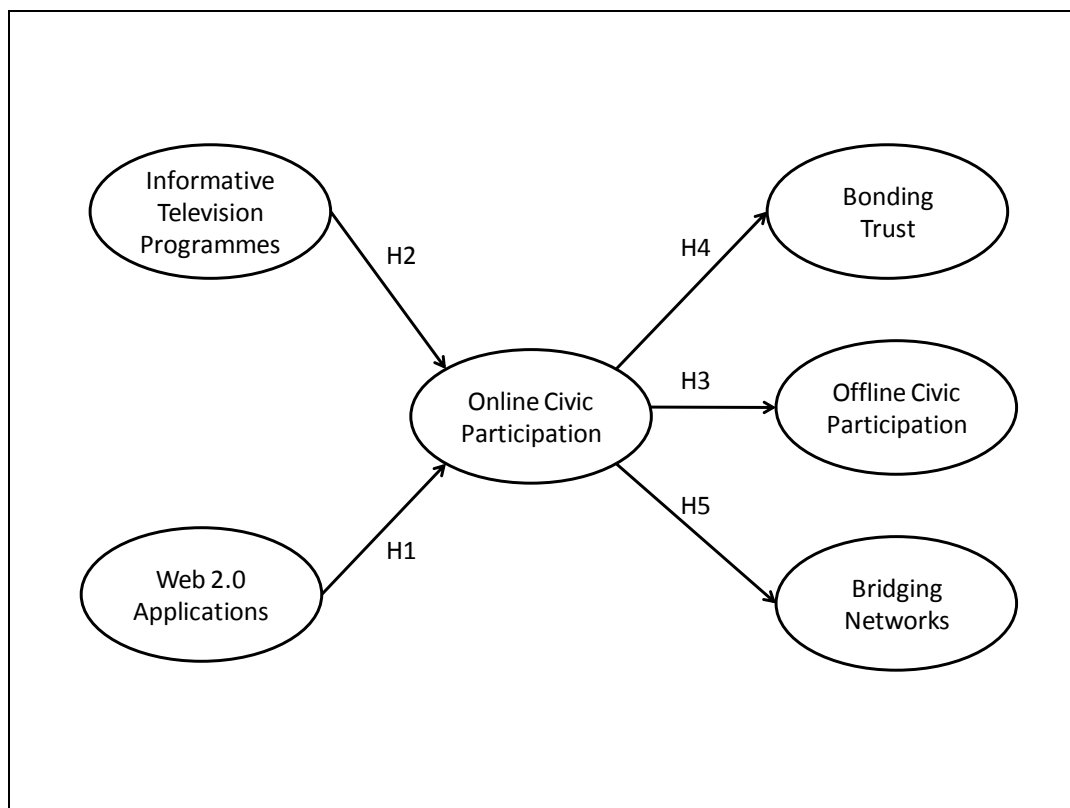


Figure 1, model 1 – online civic participation and social capital development

			Code
Latent	1	Viewing of informative TV programmes	
Observed	1.1	News / Weather	NEW
	1.2	Current Affairs	CUA
	1.3	Educational / Documentary / Scientific	DOC
	1.4	Finance/Business	FIN
Latent	2	Use of Web 2.0 applications	
Observed	2.1	Social Network Services	SNS
	2.2	Forum / BBS / Discussion Group	BLG
	2.3	Blog / Unofficial Homepage / Personal Homepage	BBS
	2.4	Streaming Video Site	STV
Latent	3	Online Civic Participation - Recovery related	
Observed	3.1	Share latest Information/News	OnSR
	3.2	Express own opinions on Recovery	OnEX
	3.3	Discuss with family and friends	OnFF
	3.4	Encourage others to take action	OnEN
	3.5	Make donations online / purchase goods from damage area	OnDN
	3.6	Participate and organise volunteering works	OnVR
Latent	4	Offline Civic Participation - Recovery related	
Observed	4.1	Joined Volunteering	OfVR
	4.2	Joined earthquake recovery related charity activities	OfCH
	4.3	Encouraged others to support the Earthquake recovery	OfEN
	4.4	Requested the Government authorities and NGOS to support the Earthquake Recovery	OfRE
Latent	5	Bonding Trust - Recovery related	
Observed	5.1	Local government (city government, the municipal authorities etc.)	TrLG
	5.2	Local communities (Neighbourhood associations, NPOs, disaster prevention group etc.)	TrLC
Latent	6	Bridging Network - Recovery related	
Observed	6.1	Contacts in numbers of Institutional organisations (i) Central Gov, ii) Local Gov, iii) Local Community, iv) Police / Fire dept / SDF)	BrIO
	6.2	Contacts in numbers of Non-Government organisations (i) NGOs, ii) Private Companies, iii) Utilities Companies, iv) Universities)	BrNG

Table 1, variables of model 1 – online civic participation and social capital development

The model anticipates that the use of the media will encourage online civic participation, which in turn will create positive effect on different social capital elements, hence,

- Hypothesis 1: The use of Web 2.0 applications has a positive effect on the level of online civic participation.
- Hypothesis 2: The viewing of informative television programmes has a positive effect on online civic participation.
- Hypothesis 3: Online civic participation has a positive effect on offline civic participation.
- Hypothesis 4: Online civic participation has a positive effect on the level of bonding trust.
- Hypothesis 5: Online civic participation has a positive effect on the size of bridging networks.

Regarding the mediation effect of online civic participation on the use on Web 2.0 applications, since both are on the same media (the Internet), it is assumed that it will fully mediate the effect. On the other hand, for the mediation effect of online civic participation on the viewing



of informative television programmes, because they are on a different media, it is assumed that it will only partially mediate the effect, therefore,

- Hypothesis 6: Online civic participation fully mediates the effect of the use of Web 2.0 applications on offline civic participation.
- Hypothesis 7: Online civic participation fully mediates the effect of the use of Web 2.0 applications on the level of bonding trust.
- Hypothesis 8: Online civic participation fully mediates the effect of the use of Web 2.0 applications on the size of bridging networks.
- Hypothesis 9: Online civic participation partially mediates the effect of the viewing of informative television programmes on offline civic participation.
- Hypothesis 10: Online civic participation partially mediates the effect of the viewing of informative television programmes on the level of bonding trust.
- Hypothesis 11: Online civic participation partially mediates the effect of the viewing of informative television programmes on the size of bridging networks.

### **3. Theoretical model 2 – perception on the disaster and recovery and intension on recovery actions**

The second model investigates the effects from the use of ICT and mass media on people's perception on the disaster and recovery and their intension on taking recovery actions, the model (figure 2) is developed based on the cultivation theory with of 8 latent variables; 1) usage of media, 2) trust towards the media, 3) disaster damages suffered, 4) perception on the disaster and recovery, 5) Intension: actions in real communities, 6) Intension: actions in virtual communities, 7) Intension: altruistic actions and 8) Intension: preparations for potential future disaster. The latent variables and their corresponding observed variables are listed in table 2.

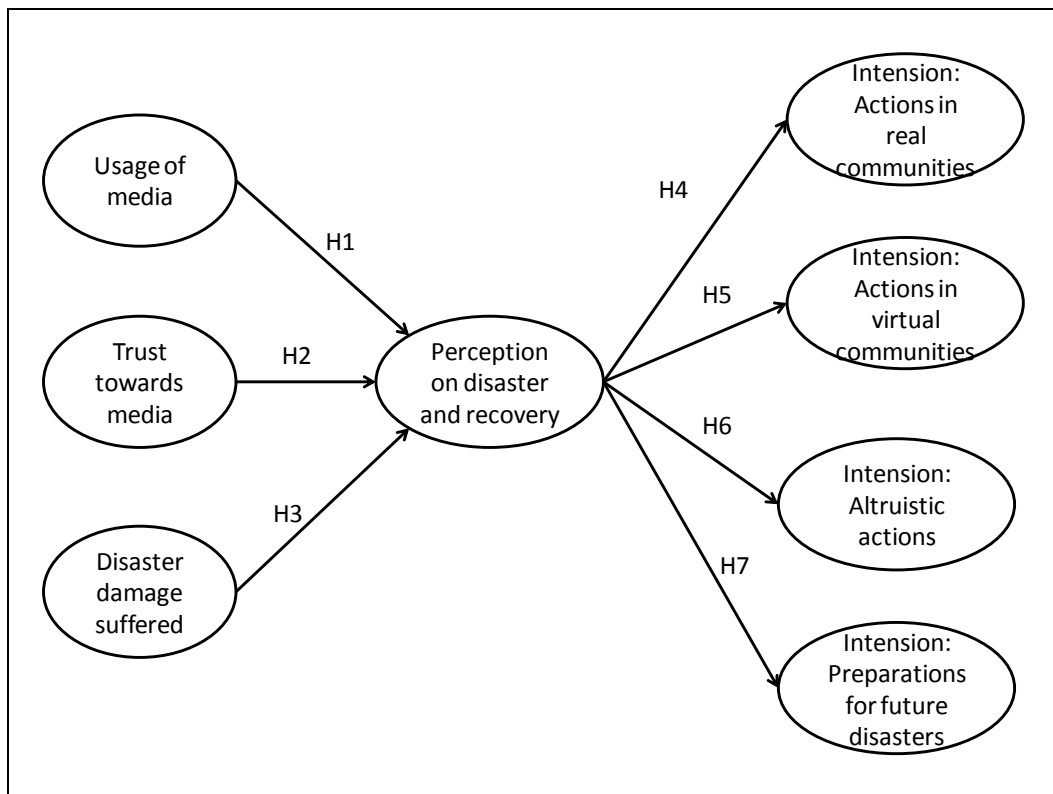


Figure 2, model 2 – perception on the disaster and recovery and intension on recovery actions

			Code
Latent	1	Usage of media	
Observed	1.1	Boardcast Media (radio, television etc.)	
	1.2	Print Media (newspaper, magazines etc.)	
	1.3	Internet Media (homepages, SNS etc.)	
Latent	2	Trust towards media	
Observed	2.1	Boardcast Media (radio, television etc.)	
	2.2	Print Media (newspaper, magazines etc.)	
	2.3	Internet Media (homepages, SNS etc.)	
Latent	3	Disaster damages suffered	
Observed	3.1	Human damage (injury, death, missing etc.)	
	3.2	Physical damage (house etc.)	
	3.3	Finanical damage (lost of job etc.)	
Latent	4	Preception on disaster and recovery	
	4.1	Concerns (sum of the followings 5 observed variables)	
Observed	4.1.1	Concerns about the disaster area	
	4.1.2	Concerns about the situration of disaster victims	
	4.1.3	Concerns about the finanical status of disaster victims	
	4.1.4	Concerns about the safety of disaster victims	
	4.1.5	Concerns about the feelings of disaster victims	
	4.2	Bond with society (sum of the followings 5 observed variables)	
Observed	4.2.1	Consider what I can do to help	
	4.2.2	Feeling heartwarming by the vouteering works by others	
	4.2.3	Desire to support recovery related charity event	
	4.2.4	Feeling the strong bond with society	
	4.2.5	Feeling the strong bond with family	
	4.3	Anxieties on future disaster (sum of the followings 2 observed variables)	
Observed	4.3.1	Worry about future disaster	
	4.3.2	The need to prepare for future disaster	
Latent	5	Future recovery actions intension	
Latent	5.1	Intension: Actions in real communities	
Observed	5.1.1	To search for more information related to recovery status	E1
	5.1.2	To discuss with family on recovery related information	E2
	5.1.3	To discuss with friends on recovery related information	E3
	5.1.4	To discuss with colleagues on recovery related information	E4
Latent	5.2	Intension: Actions in virtual communities	
Observed	5.2.1	To upload recovery related information on homepage or blogs	E5
	5.2.2	To upload recovery related information on SNS	E6
Latent	5.3	Intension: Altruistic actions	
Observed	5.3.1	To make donations	E7
	5.3.2	To encourage others to make donations	E8
	5.3.3	To support volunteering works	E9
	5.3.4	To encourage others to support volunteering works	E10
	5.3.5	To join recovery related charity events	E11
Latent	5.4	Intension: Preparations for future disasters	
Observed	5.4.1	To prepare supplies and tools for future disasters	E12
	5.4.2	To search for plans for future disasters	E13
	5.4.3	To learn more about safety measures for future disasters	E14

Table 2, variables of model 2 – on the disaster and recovery and intension on recovery actions

According to the mainstream effect from the cultivation theory, it is assumed that the more the people receive the disaster and recovery related information from the media, the more likely they will sympathise and believe in the information from the media, furthermore, it anticipates that their perception is also affected by their level of trusts towards the media, hence,

- Hypothesis 1: The usage of media has a positive influence on the perception on the disaster and recovery.
- Hypothesis 2: The trust towards the media has a positive influence on the perception on the disaster and recovery.

Based on the resonance effect, in this case, people will resonate their experience from the disaster with the related information from the use of ICT and mass media and create a stronger perception, therefore

- Hypothesis 3: The damage suffered from the disaster has a positive influence on the perception on the disaster and recovery.

Regarding the effect of people's perception on the disaster and recovery, according to the study by Mitomo et al. (2012), after the disaster, both the media and the actual experience can trigger people to take actions related to the disaster, therefore,

- Hypothesis 4: the perception on the disaster and recovery has a positive influence on the intension to take recovery actions in real communities.
- Hypothesis 5: the perception on the disaster and recovery has a positive influence on the intension to take recovery actions in virtual communities.
- Hypothesis 6: the perception on the disaster and recovery has a positive influence on the intension to take altruistic actions.
- Hypothesis 7: the perception on the disaster and recovery has a positive influence on the intension to make preparations for future disasters.

## 4. Results

Both models use the same data set collected from an Internet based panel survey conducted in March 2013<sup>4</sup> with an online questionnaire in Japanese, 2064<sup>5</sup> responses from the disaster area (Iwate 22%, Fukushima 27% and Miyagi 51%) are collected. Among the respondents, 50.2% are male and 49.8% are female<sup>6</sup>, the median annual income is in the <2 million yen

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<sup>4</sup> by Macromill, Inc., a leading online research company in Japan.

<sup>5</sup> In data screening, 12 unengaged observations were identified and removed from the sample.

<sup>6</sup> 48.8% of the total population of Japan were male and 51.2% were females in 2010 according to the Population Census (MIC, 2010).

range<sup>7</sup>, the average age is 43<sup>8</sup>. Among them 80% has suffered some level of damages<sup>9</sup> from the disaster to either themselves or to people around them. 95% owns a television set and 85% has access to fixed line and/or wireless Internet.

#### 4.1 Result analysis – Model 1 Online civic participation and social capital development

The first model is analysed with structural equation modelling<sup>10</sup>; the overall result of model and the variable coefficients are shown in figure 3. The model fits indicators (RMSEA=0.064, CFI=0.896, GFI=0.918) show the model is statistically acceptable.

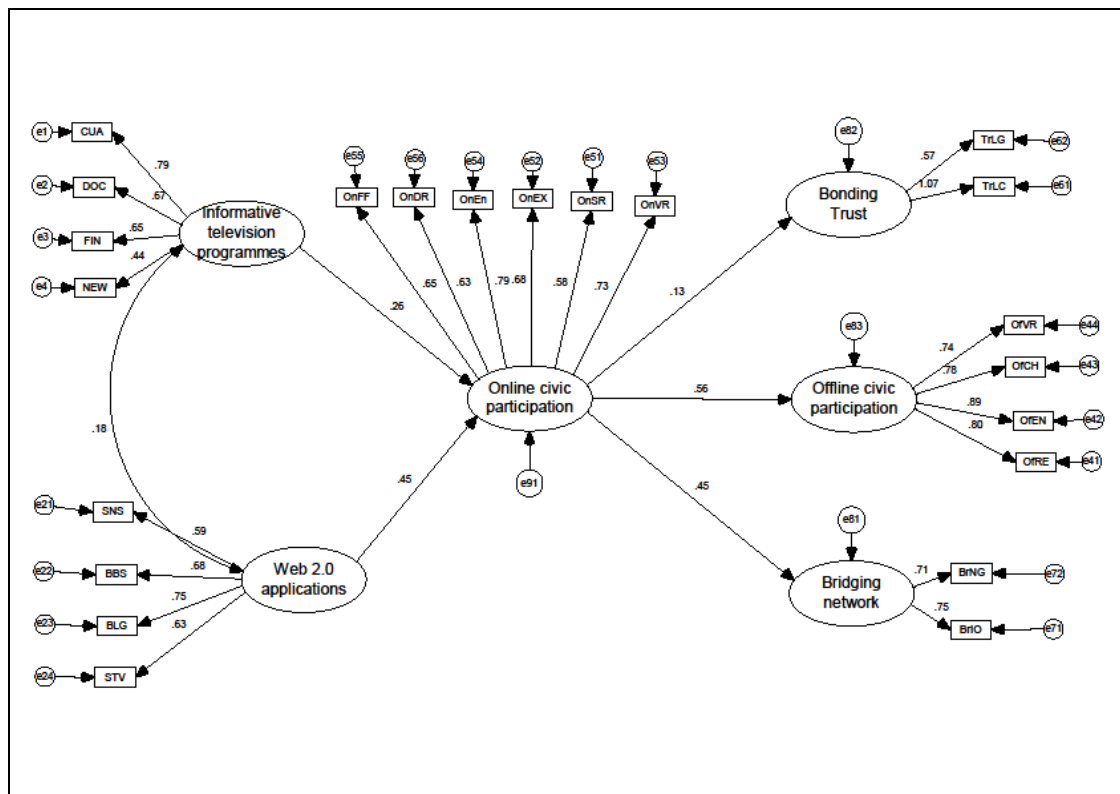


Figure 3, Structural Equation Modelling Results of Model 1

Hypotheses 1 and 2 are tested by examining the corresponding beta coefficient and significance between the use of Web 2.0 applications (0.45/0.001), viewing of information television programmes (0.26/0.001) and online civic participation. The results show that both

<sup>7</sup> The medium annual income for a regular employee in Japan was in the 3-3.99 million yen range in 2007 according to the Employment Status Survey (MIC, 2007).

<sup>8</sup> The average age of the total population of Japan was 43.3 in 2010 according to the Population Census (MIC, 2010). The average age in these three prefectures was 46 in 2011 (Deguchi, 2011).

<sup>9</sup> Include physical damage (e.g., injury), property damage (e.g., house) and financial damage (e.g., lost of job, significantly reduce of income), Indirect damages (e.g., inconveniences caused by lost of lifeline, lack of supplies) are excluded.

<sup>10</sup> With SPSS and AMOS

of them have a significant and positive effect on online civic participation and hence, both hypotheses 1 and 2 are supported, that the use of Web 2.0 applications and informative television programmes can encourage people to participate in civic activities online to support the recovery with the use of Web 2.0 applications having a stronger effects.

Hypotheses 3, 4 and 5 are tested by examining the corresponding beta coefficient and significance between online civic participation and offline civic participation (0.55/0.001), bonding trust (0.13/0.001) and bridging networks (0.44/0.001), the results have shown that online civic participation has a significant and positive effect on all 3 variables, therefore, hypotheses 3, 4 and 5 are also supported. In another word, online civic participation can increase offline civic participation and social capital elements such as bonding trust and bridging networks, however, it is worth noting that the effect on bonding trust is not as strong as the other two.

For hypotheses 6 to 11, the mediator's (online civic participation) mediation effects are tested by comparing the significance of beta coefficient between the independent variables (the use of Web 2.0 applications and informative television programmes) and the dependent variables (offline civic participation, bonding trust and bridging networks) directly without the mediator, directly with the mediator and indirectly with the mediator (Cheung & Lau, 2008). The results<sup>11</sup> are summarised in table 3.

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<sup>11</sup> Obtained with 2000 bias-corrected bootstrap re-samples.

Hypothesis	Mediating path	Significance (Direct without Mediator)	Significance (Direct with Mediator)	Significance (Indirect with Mediator)	Significance (Mediation Type)	Result
H6	offline civic participation <- online civic participation<- Web 2.0 applications	0.001	0.195	0.001	Full	Supported
H7	bonding trust <- Online civic participation<- Web 2.0 applications	0.236	0.915	0.030	Indirect	Not Supported
H8	bridging networks <- online civic participation<- Web 2.0 applications	0.001	0.162	0.001	Full	Supported
H9	offline civic participation <- online civic participation<- informative television programmes	0.001	0.008	0.030	Partial	Supported
H10	bonding trust <- online civic participation<- informative television programmes	0.001	0.001	0.001	Partial	Supported
H11	bridging networks <- online civic participation<- informative television programmes	0.001	0.034	0.001	Partial	Supported

Table 3, Mediation effects of Online Civic Participation

For the mediation effect of online civic participation on the use of Web 2.0 applications, the results show that it fully mediates the effect of the use of Web 2.0 applications on bridging networks as well as offline civic participation, however, it only indirectly mediates the effect of the use of Web 2.0 applications on bonding trust. This indicates that the use of Web 2.0 applications has no significant direct effect on bonding trust with or without the mediator. Hence, hypotheses 6 and 8 are supported but hypothesis 7 is not.

On the other hand, for the mediation effect of online civic participation on the viewing of informative television programmes, the results show that it partially mediates the positive effects on all three dependent variables. Hence, hypotheses 9, 10 and 11 are supported.

## 4.2 Result analysis – Model 2 Perception on the disaster and recovery and intension on recovery actions

The second model is analysed using structural equation modelling<sup>12</sup>; the overall result of model and the variable coefficients are shown in figure 4. The model fits indicators (RMSEA=0.072, CFI=0.897, GFI=0.874) show that the model is statistically acceptable.

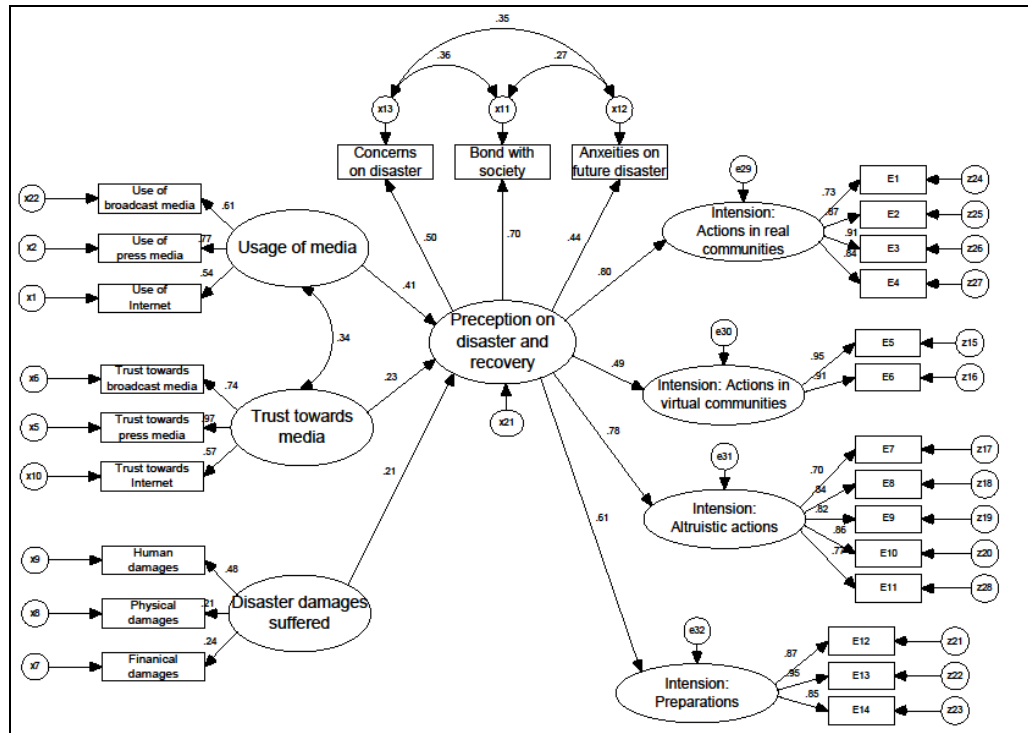


Figure 4, Structural Equation Modelling Results of Model 2

Hypotheses 1, 2 and 3 are tested by examining the corresponding beta coefficient and significance between the usage of media (0.41/0.001), trust towards the media (0.23/0.001) and disaster damages suffered (0.21/0.001) on the perception on the disaster and recovery. The results indicate that all three factors have a significant and positive effect on the perception on the disaster and recovery, hence, hypotheses 1, 2 and 3 are supported. In another word, the more people use the media (mainstream effect), the higher levels of trust they have towards the media and the disaster damages they have suffered (resonance effect) have positively affected their perception on the disaster and recovery which is composed of 1) concerns on the disaster damages, 2) bonds within the society and 3) anxieties of potential future disaster. However, it is worth noting that although positive, the influence from the disaster damages suffered is lower than the two media related factors (usage and trust). Furthermore, among the three types of media, the print media has the strongest influence on the media usage as well as trust towards the media, followed by the broadcast media and the Internet, this indicates that the mass media has a stronger influence than the Internet in terms

<sup>12</sup> With SPSS and AMOS



of the influence on people's perception, and the effect from the media is stronger than from their disaster experience.

Hypotheses 4, 5, 6 and 7 are tested by examining the corresponding beta coefficient and significance between the perception on the disaster and recovery on the intention to take recovery actions in real communities (0.80/0.001), the intention to take recovery actions in virtual communities (0.49/0.001), the intention to take altruistic actions (0.78/0.001) and the intention to make preparations for potential future disasters (0.61/0.001), the significant and positive effects between their corresponding links support hypothesis 4, 5, 6 and 7. Among the three main factors affecting the perception on the disaster and recovery, bonds within the society (0.70) has the strongest influence followed by concerns on the disaster damages (0.50) and anxieties of future disaster (0.44).

## 5. Discussion

This paper extends on the study by Mitomo et al. (2012) by focusing on the people in the disaster area which they have not included in their study, in addition, two different models with different perspectives are adopted in order to provide a more comprehensive view on the effects from the perspective of both the mass media and ICT.

The first model, from the perspective of social capital development and online civic participation has shown that the use of both the mass media (e.g., television) and ICT (e.g., Web 2.0 applications) can encourage online civic participation, which in turn can create positive influences on the development of social capital elements such as bonding trust, bridging network as well as civic participation offline that are important to the recovery efficiency. This finding is particularly important because of ICT's capability to reduce geographical gap and information cost, that by enabling more people to participate in the civic activities online, it can increase the scale of the civic community and also link up the disaster area with the rest of the country. At the same time, the results also show that on top of the use of Web 2.0 applications, the use of mass media like informative television programmes still has a significant and positive influence on online civic participation, which partially mediates their positive effects on social capital development offline.

The findings of the second model have provided further insights from the perspective of the mass media using on the cultivation theory, the results have shown that despite the fact that 80% of the respondents has reported either themselves or someone around them have suffered some kind of damage from the disaster, nonetheless, the media still has a stronger influence on their perception on the disaster over their actual experience, this is inline with the findings by Mitomo et al. (2012) that the media has a strong influence on people's perception on the reality and sometimes it could even be stronger than the actual experience. Nonetheless, although not as strong as the mass media (press and broadcast), the Internet still has some significant positive influence on people's perception on the disaster and recovery.

Considering the results of both models that the use of both ICT and mass media appear to work positively in parallel with each other in the case of post-disaster recovery, the findings of this study have provided some important implications for government authorities, NGOs and local communities that are working hard to support the recovery in the disaster area by providing insights on how the utilisation of mass media and ICT can create positive influences to motivate people to take recovery actions in a complementary way.

## **6. Conclusion**

In summary, the results of this paper has extended the findings from the study by Mitomo et al. (2012), the results from the two models with different perspective have shown a consistent pattern that strengthen the finding that the use of ICT and mass media can create positive effects on post-disaster recovery in a complementary way. The first model that focuses on online civic participation and social capital development offline has shown that on top of the direct positive influence from the use of ICT (web 2.0 applications), the mass media (informative television programmes) also has a significant and positive effect partially mediated by online civic participation. On the other hand, the second model based on the cultivation theory from mass media studies has shown that the Internet, although not as strong, it still has a positive and significant influence in parallel with the mass media (press and broadcast) on people's perception on the disaster and recovery over their actual experience and subsequently increases their intension on taking recovery actions.

Nonetheless, there are some limitations to this study and the results should be taken with care, firstly, is the causal ambiguity as the data was collected from a single cross-sectional survey and secondly is the potential sample bias as the data was collected with only a single instrument (Internet survey). Therefore, further investigations with other methods such as time series data and/or interviews will be considered to continue the investigation on the effects from ICT and mass media in post-disaster recovery.

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