

Covariance Structure Analysis of GIS Use Motivation at the Kumagaya Uchiwa Festival

Shintaro Goto

Abstract

The purpose of this study is to analyze the characteristics of Web GIS (Geographic Information System) users of the festival float location system that was implemented at the traditional Kumagaya Uchiwa Festival in Saitama Prefecture, Japan. We will clarify the factors which contributed to the appearance of regional expectations and effects brought about by Web GIS. There were not any significant associations between the users of this system; the only common attribute among them was their sex. The results of the analysis were derived from the relationships between factors; from attributes such as age; actions such as the willingness to put out the information on the Internet by Web GIS; and regional effects such as the improvement of security. The expectations concerning regional effects realized by Web GIS use were much more influenced by the willingness to put out the information on the Internet than by the frequent use of it. We also found that the willingness to put out the information on the Internet by Web GIS was influenced by age.

Introduction

The results of the proliferation of cell phones and the Internet is that now most person-to-person (point-to-point) communications occur in cyberspace. Common Internet communication tools used to be the electronic conference room and bulletin board applications, but now blogs and SNS (Social Networking Service) are taking their place. Each community formed by such means was expected to contribute and stimulate their particular region. It is thought that GIS (Geographic Information System) would be used to help

people express their concerns for, as well as promote, their region (area). GIS is a tool that visualizes information, thereby prompting interest in regions to form links between people (points) and the region (area).

The use of GIS as a tool for sharing critical information has been observed during disasters and other emergencies (Goto et al., 1997; Goto, 1998; Goto, 2004). Following the Great East Japan Earthquake of March 2011, GIS was used to share vital information. For example, it was used to validate specific information such as instructions for support personnel sent to the disaster region as well as the confirmation of the status of survivors. It was also used then in 2011 to release the results in detailed report format along with maps using the “Great East Japan Earthquake/Restoration Support Platform created by everyone” (sinsai.info). Additionally, in 2011, the “ALL311: Great East Japan Earthquake Joint Support Platform” was launched and used to release maps needed to clarify the state of damage or to support volunteer rescuers. This was a program from the National Research Institute for Earth Science and Disaster Resilience (<http://www.bosai.go.jp/e/>), which is an organization that collects, prepares, and sends out trustworthy information regarding disaster response, restoration, and recovery. Additionally, GIS is commonly used to collect and disseminate regional activity information (Sakai et al., 2005, Sakai & Goto; 2005; Tsuboi et al., 2007; Nakagawa et al., 2007) as well as a tool to link individual people with their regions.

In more recent years, Twitter and other social media have become communication tools. They have also attracted attention as ways of supplementing existing communication methods during the Great East Japan Earthquake. For example, Twitter has been used for various forms of communication such as situational documentation, opinions, and conversations regarding Twitter postings. Furthermore, it offers services which display a user’s location on a map in response to submissions accompanying provided location information; cases of use in parallel with spatial information are also available. During the Great East Japan Earthquake, these features were used to send damage information and to confirm the safety and status of people. Similar to day-to-day use at it has used as an effective information-sharing tool during emergencies. For example, regional governments released hazard maps based on GIS, but it still is important to encourage the day-to-day use of GIS so that it can be used effectively for emergencies.

GIS is an excellent way to visualize location information because it represents spatial information on maps. In particular, it can be used to control

each natural feature in layer units as well as superimpose multiple layers to prepare maps adapted to each user's purpose. Additionally, commonalities are embedded in a regional society, and visualizing these to the greatest possible degree is counted on for contributing to consensus formation or local information discovery. In this way, GIS has functions that permit for a high and wide clarification of regional information. For example, it can confirm a user's surroundings in addition to objects of their interest. It can discover relationships between connected information and so on, and will probably permit its use as a tool to link people with their region.

While GIS is being expanded for purposes outside of its standard footprint, an effort is being undertaken to popularize it at the national government level via the 2010 "GIS Action Program" from the Commission for the Promotion of the Utilization of Geographical Spatial Information (<http://www.cas.go.jp/jp/seisaku/sokuitiri/index.html>). This involves the standardizing and improving of spatial information and metadata. They are building and publicly releasing a digital clearing house to simplify the acquisition of this data as well as developing the Electronic National Land Web System that will be compatible with Web GIS. There will be no charge for the high-quality administrative GIS services and the seminars given to popularize the program and enlighten the public. Through these efforts, it will improve the environmental aspect of GIS use which will in turn promote its further implementation. Outside of this progress, a further challenge remains: the study of the methods of how to encourage the spontaneous and continuous use of GIS by citizens in the course of their daily lives and regional activities.

Additionally, studies of GIS activity at the regional level have shown its usefulness for activities related to community creation (Takeyama and Nakase, 2005; Tanaka and Uchihira, 2008), as well as for residents and administrative bodies to exchange views (Oba, 2005). These studies evaluated the utilization of GIS systems at event sites such as experimental operations which showed the effects of and functional challenges facing such systems. These are important initiatives in that they evaluate the results of citizens using GIS. The one challenge in the future is for citizens to use GIS in their daily lives instead of only in circumstantial events. Our goal then is to conduct studies to find out what elements we should focus our analysis on in order to spread the use of GIS.

This study clarifies the relationships of user attributes by evaluating the implementation and functionality of a system employing Web GIS in

transmitting parade float locations during the Kumagaya Uchiwa Festival, which is held in Kumagaya City, Saitama Prefecture.

Furthermore, we think that there are widespread opportunities for GIS outside of the festival experience. There are opportunities for GIS in varieties of regional situations. Therefore, we must spread awareness that GIS is a technology that can be effective for regional societies. So, along with organizing factors that contribute to the spread of GIS, this study is also intent on analyzing and studying the structure of relationships concerning the following question.

How are expectations of effects on a region such as regional activation or increasing interest in the region (“regional effects”) manifest in light of the relationships between the use of spatial information that is distributed by Web GIS with users’ attributes?

1. Outline of the survey

The Kumagaya Uchiwa Festival is a lively summer event held at the end of July. Floats representing twelve districts parade through the streets. It is held in the Northern Kanto Region and it attracts about 750,000 visitors over its three-day period. A Web-based system displaying the present locations of every float was constructed and announced for this festival.

A questionnaire was conducted at two places—inside the grounds of JR Kumagaya Station and at the Community Plaza, the center of the festival—during the festival which took place from July 20 to 22, 2007. Visitors to the festival were asked at random to fill in a questionnaire by themselves. They received assistance only if they needed some clarifications. The major items were “frequency of visit”; “reason for visit”; “age (20s, 30s, 40s etc.)”; “address”; “sex”; whether or not they had used the float location confirmation system; their assessment of how easy it was to use and of its usefulness; and “frequency of use of, expectations of, and evaluation of usefulness of Web GIS.” A total of 265 responses were received. Table 1 shows the basic attributes of the persons who responded to the questionnaire. In regard to the “frequency of use of, expectations of and evaluation of usefulness of Web GIS,” they were asked about “maps that can be used from a cell phone or PC,” which is the definition of Web GIS for this paper.

In 2006, the provision of information about the present locations of floats using Web GIS at the festival was publicized at the time of a proving test of the system. This was the year before this questionnaire, and the announcement was well-received. Then in the beginning of 2007 the results of the proving test were incorporated into preparations for the festival and the questionnaire was conducted assuming that it would be important to evaluate the state of use of and usefulness of GIS in this way.

Additionally, a study was done to analyze the relationship between people's expectations of whether or not distributing regional information through Web GIS could promote the region. Another topic of this study was whether or not it would improve the safety and feeling of security of its residents with consideration to their individual attributes such as their age or their Web GIS usage behavior. The "region" is "an area where daily life and daily activities are conducted centered on residential districts."

Table 1—*Basic Attributes of Respondents*

	Item	Number	Percentage
Sex	Male	127	48.7%
	Female	134	51.3%
	No answer	4	-
Age	20s or younger	58	22.3%
	30s	50	19.2%
	40s	41	15.8%
	50s	55	21.2%
	60s	46	17.7%
	70s or older	10	3.9%
	No answer	5	-
Length of Residence (years)	Less than 5	62	23.6%
	5 or longer, less than 10	34	12.9%
	11 or longer, less than 20	56	21.3%
	21 or longer	111	42.2%
	No answer	2	-

2. Structure and evaluation of the float location information system

2.1 Outline of the float location information system

For this study the float location information system that uses Web GIS to transmit the present locations of 12 floats as they parade through the streets was constructed and then announced. Based on the results of the questionnaire, trends in use of this system and evaluations of the system were studied. Two versions of this system were put forth. The first was a PC browser system which permitted people to check on the present locations of the floats from their homes. The other was an application based on a QR code which allowed them to confirm the present locations of floats by using the Internet on their cell phones while at the festival. The two systems were announced in the official festival pamphlets and on a custom banner on the official festival web page. Additionally, when the systems were introduced, the job of providing devices and dealing with their specific problems was handled by a collaboration of concerned organizations. These groups in charge of these tasks had close links to the Kumagata Gion-kai, which is the organization that manages the festival. They are assisted in their festival management through the mutual provision of ideas by industry, academia, government, and the people. The PC browser system was built by preparing a large 40+ inch TV screen with PC connectivity. It was then installed in an open space facing the exit gate at JR Kumagaya Station during the festival. This system displayed the current locations of the floats in an effort to increase awareness of the system and induce visitors' interest in using it.

The PC browser system used Portable Site GPS made by I-O Data Device Inc. to obtain present locations of floats. It periodically used the email functions of cell phones connected to GPS to automatically transmit the email input with latitudes and longitudes. The transmission of present locations of floats to clients by Web GIS was done using Electronic National Land provided by the Geographical Survey Institute. *Figure 1* shows a display screen of the PC browser float location information system.



Fig.1 PC Browser System display screen. (Background map uses “Electronic National Land” from the Geographical Survey Institute).

Figure 2 shows the float present position display screen of this system.



Fig.2 Cell phone system display screen (Nakagawa et al., 2007) from Doko-iruka Service.

2.2 System use trends and evaluation of the system

The results of the analysis of the access data showed that about 20,000 page-views per day were recorded by both systems, indicating a high degree of interest.

The results of totaling the answers to the questionnaire confirmed that 30 of the people in the entire sample used the system. Table 2 shows the system usage rate according to a comparison of people using the system by basic attribute with the numbers of people with similar ones. Respondents who did not answer questions about their use or non-use of the system were omitted.

Table 2—*Number of Users of the System by Basic Attributes and Usage Rates*

	Item	Number	Usage rate
Sex	Male	20	17.9%
	Female	10	8.8%
Age	20s or younger	4	8.5%
	30s	4	9.3%
	40s	9	24.3%
	50s	6	13.3%
	60s	7	16.7%
	70s or older	0	0.0%
Reason for visit	Advertised	1	4.8%
	Friend/acquaintance	4	10.0%
	Tradition	11	13.3%
	Hometown	12	18.2%
	Present resident	8	16.7%
Number of visits	1st	3	4.8%
	2nd to 5th	12	17.1%
	6th to 10th	2	8.7%
	11 th or more	13	18.1%

The results of verifying independence based on the χ^2 distribution of the relationship between attributes and system use show that by sex, the usage rate of men was, at a significant level of 5%, significantly higher than that of women. In regard to age, no significant difference was observed, but the usage rate of people in their 40s or older was higher than that of young people in their 30s and younger.

There was no significant difference between reasons for visits and system use; the highest usage rate was found for the attribute giving “hometown” as reason for a visit. This was followed by the attributes giving “present

residence” and “tradition.”

Although significant differences by frequency of visits were not seen, a high usage rate appeared among visitors who visited 11 times or more. High use was also clearly shown among visitors who visited from 2-5 times.

Next, evaluations of ease of use and usefulness by actual users of the system was studied. Table 3 shows the results of the cross-analysis.

Table 3—Evaluations of the PC and Cell Phone Systems by Actual Users

Machine	Item	Low evaluation		Medium evaluation		High evaluation	
		Number	%	Number	%	Number	%
PC	Ease of use	2	11.1%	5	27.8%	11	61.1%
	Usefulness	0	0.0%	3	30.0%	7	70.0%
Mobile	Ease of use	1	5.6%	12	66.7%	5	27.8%
	Usefulness	3	42.9%	1	14.3%	3	42.9%

No significant difference was shown by verification of independence based on the χ^2 distribution, but judging from the table, both ease of use and usefulness were evaluated highly by a larger percentage of the PC browser system users than the cell phone system users. Regarding this, although 18 of the 30 subjects were cell phone users, as a result of interviewing them during the survey, it can be pointed out that the evaluations of usefulness among them tend to be slightly lower because of their concern about fees etc. required for connection, operation, etc.

Then we looked at the relationship of the frequency of use of Web GIS in the respondents' daily lives. The frequency was obtained based on responses selected from: “I don't think so (subjective evaluation: low),” “Can't say either way (subjective evaluation: medium),” or “I think so (subjective evaluation: high). These choices were offered as possible answers to the question, “Do you or do you not usually use it often?” which was positioned under the previous question: “What do you think of sightseeing maps, gourmet restaurant maps, event maps, crime prevention maps, and other maps you can access and use from your cell phone or PC?” No significant differences were seen in the relationship between frequency of daily use of Web GIS and the use or non-use of the system, but a tendency was found for the system usage rate to be higher among respondents who use Web GIS often in their daily lives (subjective evaluation) than respondents who infrequently use it (Table 4).

Table 4—*Frequency of use of Web GIS in Daily Lives by Users and Non-Users of the System*

	Subjective evaluation	Users		Non-users	
		Number	Percentage	Number	Percentage
Frequency of use of Web GIS in daily life	Low	7	10.1%	62	89.9%
	Medium	11	12.6%	76	87.4%
	High	12	18.2%	54	81.8%

Among the reasons for non-users not using the system the responses “Didn’t know about it” (76.9%) and “Seemed difficult to operate” (13.9%) were often expressed. This shows that inducing use by advance advertising is a methodological challenge. Among non-users of the system, 129 (61.7%) “want to use it” the next time, but the percentage who answered “Don’t know” remained high at 68 (32.5%). We believe that in publicizing the convenience of using the system, it will be necessary to present incentives by adding information such as histories of the floats or city traffic regulations in the city to the present positions of the floats.

3. Regional Stimulation Effects of Using Web GIS

3.1 Expectations of regional stimulation effects of Web GIS

The implementation of Web GIS to regional citizens’ activities is expected to promote and stimulate understanding of the region by visualizing its information. The system functions as a hub that strengthens the relationship between the people and their region. It is also expected to promote the dissemination of information by residents, share regional information and contribute to safety as well as security. In recent years, GIS has come into use for exchanging information about environmental protection activities; raising of children; sharing of information about regional safety; and presumably, it can become a device which forms links between “people and their region” and between “actual space and information space.”

In order for this study to find out what kind of expectations visitors have of Web GIS not just at traditional events, but on its value in their daily lives, a cross-analysis of the users and the non-users of the float location information system was done with “expectations of regional stimulation effects (=regional stimulation)” and “expectations of increasing interest in and concern

with the region effects (=interest in the region)” as the indices (Figure 3).

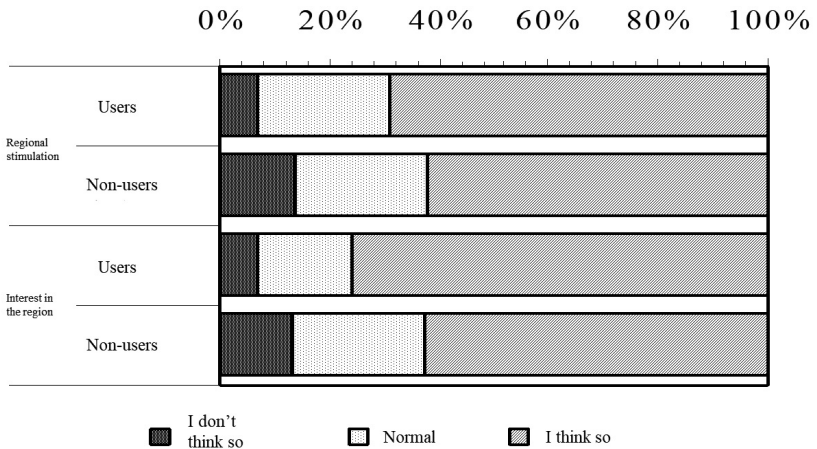


Fig.3 Regional effects anticipated by users/non-users
 $p > 0.05$ (No significant difference).

The question concerning expectations of regional effects asked whether or not using spatial information through Web GIS would or would not have effects on regions where it is used. Three possible answers were “I don’t think so,” “I think so,” and “normal (cannot say either way).” As a follow-up, familiar examples of the use of Web GIS were cited after the question. The respondents were asked what they thought of sightseeing maps, gourmet restaurant maps, event maps, crime prevention maps, and other maps they could access and use from their cell phone or PC. This clearly showed how GIS is used in a variety of situations, which made the respondents aware that Web GIS can be utilized in other ways other than the float location information system.

The figure shows that both users and non-users of the system expressed high expectations of stimulation of interest in the region. The results of the χ^2 verification of independence did not show any difference between them at a significance level of 5%. For this reason, regardless of use or non-use of the system, Web GIS can become a device for stimulating a region or garnering interest in the region.

3.2 Determinant analysis of regional effects of Web GIS

The results concerning the float location information system showed no trends in use according to specific attributes aside from sex. They revealed that people have expectations of regional effects of Web GIS regardless of whether or not they used the float location information system. As this shows, no trends indicating a relationship of the state of use of this system under the specified conditions with feelings of expectations of regional effects were found, but it is necessary to study relational structures that will contribute to generalizations based on attributes and usage behavior focused on the regional effects of Web GIS whose range of acceptance has broadened in recent years.

Therefore, assuming that in order to encourage residents to use GIS, it will be necessary to make them aware that it is a technology that can impact regional society. Factors that stimulate expectations about how using Web GIS will improve regional effectiveness should be studied. Here, the relationships between individual attributes, Web GIS usage behavior, and regional effects are analyzed using covariance structure analysis in an effort to perform an overall interpretation of the relationships found between each of these items.

For this analysis, variables were set for the hypothesis that individual attributes which were age, residence history, and sex impact Web GIS usage behavior. Additionally, the contents of this behavior are expressed as feelings of expectations that using it will have regional effects. Table 5 shows the contents of observable variables used for the model.

Figure 4 shows a model representing the relationships between individual attributes, Web GIS usage behavior, and the expectations of regional effects of its use.

In modeling by the covariance structure analysis, the following assumptions were used and paths were set between variables. Factors that lead to the use of PCs and cellular. Age, residence history, and sex were set as variables concerning individual attributes. “GIS daily use frequency (frequency of daily use of Web GIS)” and “information put out willingness (willingness to put out information by Web GIS)” were set as variables concerning Web GIS usage behavior. “Improving convenience (improving convenience of behavior),” “stimulation improvement (improving stimulation of the region),” “safety and security (improving feelings of safety and security),” and “interest in the region (improving interest in and concern with the region) were set

as variables concerning the latent variable, which was the variable concerning expectations of regional effects.

Table 5—*Variables and Contents of Questions*

Items	Contents	Evaluation criteria
Variables concerning individual attributes	Age	Eight 10-year periods ranging from teens (1) to 80s (8).
	History of residence in the region (residence history)	4 levels: 5 years (1), 6–0 years (2), 11–20 years (3), 21 years and longer (4)
	Sex	Two levels: male (0) and female (1) (dummy variable with male as the standard)
Variables concerning Web GIS usage behavior	<p>What do you think about the following items related to maps such as tourism maps, gourmet food maps, event maps, and crime prevention maps that you can use with your cell phone or PC?</p> <ul style="list-style-type: none"> • I use them often in my daily life (frequency of daily use of GIS). • I want to put out information myself (willingness to put out information). 	<p>Three levels: I don't think so (1), Cannot say either way (2), I think so (3)</p>
Variables concerning effects of Web GIS on the region (regional effects)	<p>What do you think about the following items related to maps such as tourism maps, gourmet food maps, event maps, and crime prevention maps that you can use with your cell phone or PC?</p> <ul style="list-style-type: none"> • Will increase interest in or concern with the region (interest in the region). • Will improve feelings of safety and security (Safety-security). • Will stimulate exchanges between the city and people (improving stimulation). • Behavior becomes more convenient (improvement of convenience). 	<p>Three levels: I don't think so (1), Cannot say either way (2), I think so (3)</p>

(Of all 265 responses, 240 used as valid responses)

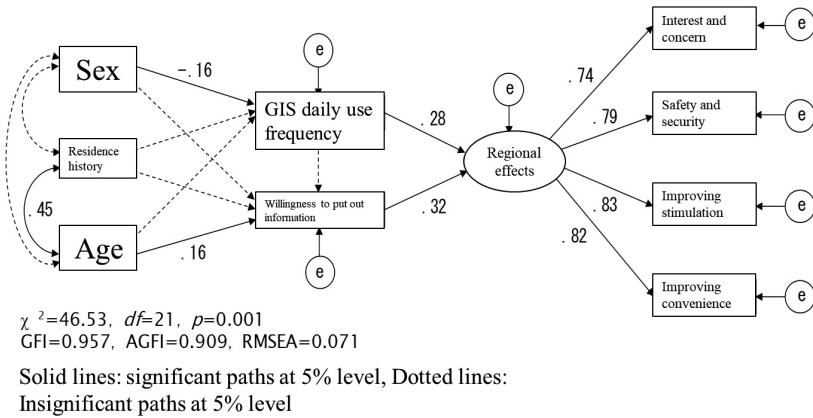


Fig.4 Determinants of expectations of regional effects of Web GIS.

The relationship of individual attributes with Web GIS usage behavior was examined using Internet Overview Statistical Collection from the Ministry of Internal Affairs and Communications (Institute for Information and Communications Policy, 2015, Revised). It was shown that the individual Internet usage rate by age period in 2004 was, in the age groups from teens to 40s, higher than 80%, which is far higher than among people in other age groups. GIS introduces the behavior using a PC or a cell phone, so it is assumed that degree of mastery of and low resistance to machine operation according to age are related to frequency of daily use of GIS. Regarding sex, males (usage rate of 75.1%) show a usage rate 11 points higher than that of females (usage rate 64.0%), so it is assumed that similarly, sex is related to daily use of GIS. Additionally, regional SNS has begun to attract interest as a way to distribute regional information using PCs or cell phones. However, when the “Handbook on the use of resident participation systems –Regional SNS public individual certification compatible electronic questionnaire system–” (Reference document 2. Outline of corroborative experiment, <http://www.soumu.go.jp/denshijiti/ict/pdf/index.html>) is examined, it shows that among regional SNS in the corroborative experiment districts—Chiyoda Ward in Tokyo and Nagaoka city in Niigata Prefecture—the percentages by age group of SNS registrants are less than 3% among people in their teens and in their 60s or older. It is 20% or higher among people from their 20s to their 40s, and even 10% among those in their 50s, which shows that age-based

gaps in SNS registration exist. For this reason, it is thought that the behavior—putting out information about one’s region using Web GIS—is related to age. While a relationship with residence history is not reported, it is thought that the longer a person’s residence history, the greater that person’s concern with their region of residence. This impacts their behavior of putting out information. Furthermore, it is reported that more men than women are users of regional SNS, and it is thought that collecting and putting out regional information using the Internet is also related to sex. Based on this, we set the impact on the variables, “Frequency of daily use of GIS” and “Willingness to put out information” which present Web GIS usage behavior according to the individual attribute variables of age, residence history, and sex.

Regarding the two variables related to Web GIS usage behavior, it is thought that by putting out information by Web GIS as part of our life experience—using GIS—subsequently, the more a person uses GIS in his or her daily life, the lower that person’s resistance to using GIS becomes. Conversely, the stronger the person’s awareness of the convenience of GIS, it is hypothesized that willingness to put out information is impacted, and a path is set from “Frequency of daily use of GIS” to “willingness to put out information.”

Regarding expectations of “regional effects,” considering examples of acceptance of Web GIS in recent years, four variables have been added to the set. They are “improving convenience (improving convenience of behavior),” “safety and security (improving safety and security),” “improving stimulation (improving stimulation of the region),” and “interest and concern (improving interest in and concern with the region).”

Regarding the relationship of Web GIS usage behavior with “regional effects,” because of the goal of measuring expectations of regional effects of GIS, it is assumed that more Web GIS is used in daily life. Therefore, the greater the awareness of the convenience of GIS, the greater the expectations of regional effects from the use of it. Assuming that there are more people who are willing to personally put out regional information in hopes of increasing interest in their region, the greater people’s expectations of regional effects of GIS will be. Furthermore, the impact on “regional effects” of “frequency of daily use of GIS” and “willingness to put out information” was set.

Figure 4 represents the results of the analysis. Coefficients which appear on significant paths represent standard solutions. In this model, GFI and AGFI are 0.957 and 0.909 respectively, which shows high fidelity. Additionally,

RMSEA (*Root Mean Square Error of Approximation*) that indicates the gap between distribution of a model and actual distribution has reached 0.071. This number exceeds 0.05, which is the criterion for the adaptation standard value. Nevertheless, a value that is not higher than 0.1 whose applicability is considered poor was obtained, so it can be said that it represents a degree of fidelity. In the verification based on the χ^2 value, at the 5% level, the model is abandoned and good fidelity was not shown. But for the χ^2 value, the larger the number of samples, the more likely the model will be abandoned. In this analysis, there were 200 samples, which is considered to be a medium quantity of examples. It was thought that the model was discarded, but the other fidelity indices were good, so it was judged that this model is suitable (Asano et al., 2005).

We believe the causal relationship between variables is considered to be based on analysis results, and so we found in the relationship between individual attributes and Web GIS usage behavior, the path from “sex” to “daily use of GIS” shows a negative result of (-0.16). Additionally, the more men there are, the higher the frequency of daily use of GIS. Additionally, the variable that impacts “willingness to put out information” is age, and its path coefficient shows a positive relationship (0.16) so it can be concluded that as age increases, willingness to put out information using Web GIS increases.

The path coefficient from Web GIS usage behavior to “regional effects” is 0.28 for “frequency of daily use of GIS”, and it is 0.32 for “willingness to put out information.” Both numbers indicate positive relationships, showing that the higher the frequency of daily use of GIS and the higher the willingness to put out information by Web GIS, the greater the expectations for the regional effects of it. The higher the frequency of daily use of GIS, the more people feel the benefits of using it for spatial information, and the higher people’s willingness to put out information by Web GIS. The stronger the determination of residents to encourage interest in their region by putting out information, the more they will feel the benefits of the use of GIS as a method in which they can visualize the attractiveness of the region and as well as the challenges it faces. Finally, this means that they will manifest expectations that it will be possible for use of Web GIS to improve regional effects.

Regarding “regional effects,” all of the observable variables which were set show almost equal high-positive correlations. Notably, “improving convenience” and “improving stimulation” obtained results which surpassed the parameter value of 0.8.

For these reasons, the more men involved, the higher the frequency of daily use of GIS and the higher their age; the greater their willingness to use Web GIS to put out information. This result suggests a relationship that increases expectations of regional effects of GIS. This fact can be said to show that individual attributes impact Web GIS usage behavior, and that multiplies feelings of expectations for regional effects.

Focusing on the two variables concerning Web GIS usage behavior can reveal that although neither necessarily obtain a high parameter to improve regional effects, “willingness to put out information” has a greater impact than “frequency of daily use of GIS.” Although it is hypothesized that at the present time, the spread of PCs and cell phones are expanding the daily use of Web GIS, it is thought that in order to strengthen people’s expectation of regional effects of this system it will be important to, for example, introduce literacy and education opportunities that will support the “putting out of information.”

Therefore, expectations of regional effects of Web GIS use are manifest through its usage behavior according to individual attributes, and of these, the impact of willingness to independently put out information on Web GIS is greatest. Willingness to put out information is a behavior impacted by age, and providing opportunities to put out information jointly by using SNS and GIS as is seen in regional SNS. Encouraging the willingness to put out information by introducing opportunities for education concerning this matter to residents who, as they age, are increasingly willing to put out regional information using Web GIS will presumably be one method that demonstrates how GIS technology can effectively contribute to a region.

4. Conclusions and Challenges

This study evaluated the state of use, usefulness, and ease of use of a system that releases the present locations of traditional festival floats using Web GIS. Next, a relational structure analysis as well as a study of the relationship of people’s individual attributes with usage behavior of Web GIS was conducted. Web GIS is coming into wide use and is being improved to find out how expectations of regional effects of this system are manifest.

The study clarified the following points.

- 1) The relationship between the use and non-use of the system that confirms

the present locations of floats during the festival. The basic attributes of respondents to the questionnaire did not reveal any significant relationships except in the category of sex. This was evaluated under the limited conditions of a regional festival, but it is thought that it was accepted by a wide range of people in addition to those with specific attributes who showed interest in this system.

2) The PC browser system was evaluated as easier to use and more useful than the cell phone system. The cell phone system was evaluated as less useful because of the concern with the plan charges that must be paid for its connection and operation.

3) It was confirmed that regardless of whether or not they used this system, people held high expectations that the use of Web GIS would improve regional awareness and stimulate interest in and concern for the region. This finding has suggested that Web GIS can gain potential as a device with regional effects.

4) It was confirmed that among the variables set for the study model, among Web GIS usage behaviors, the “willingness to put out information” is significantly impacted by age.” It can be stated that this shows the possibility that advancing age increases people’s willingness to put out information by Web GIS and brings about the expectations that GIS is a technology that can have effects on regional societies. Additionally, we think that in order to strengthen people’s willingness to put out information, it will be important to create opportunities to put out regional information and to create mechanisms to make this happen—for example, by improving support systems.

SNS that enables communication with other users who mutually disseminate information on the Internet or the use of GIS on blogs are considered as ways to put out information about Web GIS usage behavior. Nevertheless, a future challenge that must be tackled in order to strengthen people’s willingness to put out information is to study ways to handle regional information. Ways of letting citizens feel affection for their region or consider how it can be improved for example must be examined. This will focus their attention on and strengthen their interest in the region. It will probably also be necessary to study specific methodologies that introduce information dissemination educational opportunities, such as building a support system which includes seminars regarding the use of such systems. Another future challenge will be to verify if improving people’s expectations of GIS affecting their region by promoting willingness to put out information could contribute to the wider

use of GIS.

Cell phones are versatile as Internet service use terminals and can be used not only for Web GIS but for SNS or blogs. They offer a way for people to immediately post information about discoveries they make in their own towns to Web GIS or to SNS, etc. and can be used to build GIS utilization environments that make daily life feel like a series of special events. Cell phones serve to strengthen people's willingness to use these methods, but evaluations of the cell phone use version of this system revealed concerns with plan fees and operability, so it is probably necessary to study the hardware environment for GIS use. On the other hand, according to the Communication Use Trends Survey Report (Ministry of Internal Affairs and Communications, 2008), a survey conducted in 2008—the same year as this study—found that 14.3% (n = 7,233 people) accessed individual websites or blogs with cell phones during the previous one year period. A 2009 survey found that this site access figure had increased by two points in two years to 16.2% (n = 9,410), showing a rising trend in the percentage of those who used cell phones to access websites thought to charge heavier plan fees than email. Also it is expected that the promotion of environments that reduce concerns about plan charges and operability will appear as, for example, cell phone service providers offer fixed-plan rates services and devices that can be connected to the Internet through wireless LAN. Soon, cell phones with intuitive interfaces permitting users to operate them by directly touching buttons displayed on their screens will arrive.

References

- Asano H., Suzuki T., & Takaya, K. (2005). *Introduction: Truth of Covariance Structure Analysis*. Kodansha.
- Goto S., Kitagawa J., Takeuchi W., Oyama H., & Higashi Y. (1997). Study of GIS on the Internet during a disaster –application to the heavy oil spill accident by the Nakhodka. *Proceedings of 1997 Conference of the Japan Society of Photogrammetry and Remote Sensing*, 75–78.
- Goto, S. (2004). Front line of Web-GIS. *Monthly Kaiyo*, 36(5), 355–59.
- Goto, S. (1999). Construction of Oil-Spill Warning System based on Remote Sensing/ Numerical Model and Its application to the Natural Resource Damage Assessment and Restoration System. *Proceedings of International Symposium on Remote*

- Sensing*, 243–48.
- Sakai, T., Goto, S., & Kawamura, H. (2005). Case of the application of GIS to a full survey of water quality of the Arakawa River. *Proceedings of 2005 Conference of the Japan Society of Photogrammetry and Remote Sensing*, 217–220.
- Institute for Information and Communications Policy. (2015). Internet Overview Statistical Collection. Retrieved from: <http://www.soumu.go.jp/iicp/chousakennyu/data/research/survey/telecom/2006/2006-1-01-2.pdf>
- Ministry of Internal Affairs and Communication. (2008). Communications use trends and survey report. Retrieved from http://www.soumu.go.jp/johotsusintokei/statistics/pdf/HR200700_001.pdf & http://www.soumu.go.jp/johotsusintokei/statistics/pdf/HR200900_001.pdf
- Nakagawa, M., Sakai T., Goto S., & Tsuboi, S. (2007). Study of the use of GIS at a regional traditional event – case of its application at the Kumagaya Uchiwa Festival. *Proceedings of the Second National Conference of the Japan Personal Computer Application Technology Society*, 9–12.
- Oba, T. (2005). Experimental exchange of views between citizens and administration by electronic conferencing using Web-GIS. *GIS—theory and application*, 13(1), 99–196.
- Sakai, T., & Goto, S. (2005, July). Application of GIS to citizens’ activities. *Global Environment Research*, 79–85.
- Secretariat of the Stable GIS Utilization Project. (2007). Okabe A., & Imai O. (Eds.). Kokon, S. GIS and resident participation.
- Takeyama H. & Nakase, I. (2005). Building and studying the effects of a consciousness-raising system related to city planning based on GPS equipped cell phones and Web-GIS. Shinshu Elementary School, Collected Papers on Urban Planning, 40(3). 199–204.
- Tanaka T. & Uchihira, T. (2008). Study of the use of GPS equipped mobile GIS for resident-participation type city planning inspections –Through practice in the Muko District of Amagasaki City. *Collected technical reports of the Architectural Institute of Japan*, 14(27), 199–204.
- Tsuboi S., Sakai T., & Goto S. (2007). Study of citations of and willingness to use GIS in a regional traditional event: Taking the float location information system at the Kumagaya Uchiwa Festival as a sample case. *Proceedings of the Second National Conference of the Japan Personal Computer Application Technology Society*, 13–16.