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Use of Twitter as an Instrument for Disseminating Public Information in Providing Public Goods and Roles of e-Government: Evidence from Japanese Prefectures

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Abstract*—Now internet is an important channel to disseminate public information by local governments. In recent years, many local governments have started to use social networking services, on which public information is automatically pushed on residents' client applications on their devices. Local governments disseminate various kinds of information, tourism information, disaster information, management of local governments, and so on. Although local governments must disseminate information efficiently, the different of effect by information has not been analyzed. The purpose of this research is to reveal actual conditions that local governments disseminate information on social networking service. This research analyzed various parameters by correlation analysis and content by morphological analysis. And we extracted words retweeted by residents and found the trend of popular words and features by regions.

Index Terms— **e-Government, public goods, social networking service, yardstick competition.**

I. BACKGROUND

Many studies have shown that local governments have certain advantages over the central government in providing public goods and services. Tiebout [1] indicated that **"**voting with feet" leads to optimal provision of local public goods, or in other words, residents can emigrate from one municipality to another in order to maximize utility. Since then, Tiebout hypothesis has been used as a theoretical base for decentralizing the responsibilities of providing public goods, although it requires extreme or unrealistic prior conditions - including perfect information and "free mobility" of the residents. Oates [2] directed his attention to the difference in the local need for public goods among jurisdictions, and indicated that if there is an aggregate surplus of its residents toward the supply of public goods, a decentralized local government supplies differentiated public goods in accordance with local needs is preferred over a centralized government, which provides a uniform amount of public goods for each district (Oates' Decentralization Theorem). The information predominance of local governments over the central government plays a key role in the provision of differentiated public goods in accordance with local needs. Seabright [3], on the other hand, constructed a "yardstick competition" model of incomplete contracts under asymmetric information by introducing the factor of local government election, and indicated that the voting behaviors of residents ensure the ultimate efforts of local governments towards providing better local public goods through residents vote after evaluating their public goods in comparison with those of neighboring jurisdictions. Inter-governmental competition results in equilibrium in a manner similar to the equilibrium brought about by yardstick competition among public utility enterprises. Therefore, yardstick competition can be expected to depict a more realistic inter-governmental competition. However, since individual choice of private and public goods is excluded in Seabright's model, the efficiency of the yardstick equilibrium has not been discussed. Nishigaki, Higashi, and Nishimoto [4] introduced residents' consumption choice and taxation pattern into the yardstick competition model and examined the efficiency of local public goods provision under yardstick competition and indicated the inefficiency of yardstick equilibrium. Furthermore, they pointed out the importance of delivering policy information by the government together with an understanding of residents' "voice" in order to improve the efficiency. In this paper, we will, first, develop a brief explanation of the yardstick competition and the property of Nash equilibrium. For the empirical significance of the yardstick competition, Nishigaki, Higashi, Wong and Nishimoto [5] conducted a preliminary statistical analysis using Japanese prefecture level data, and found some evidence which support the existence of yardstick competition among prefectural governments.

II. SOCIAL NETWORKING SERVICE AS AN E-GOVERNMENT

To examine the roles and effectiveness of e-Government utilization to improve the efficiency of yardstick equilibrium, we focused on delivering information through social networking service (SNS) by local governments, and researched the importance of disclosing and delivering policy information to its residents. Since local governments provide many kinds of public goods and services, not all residents know well about those services or how much benefits they can get from the services. People who know about the services and use them may be satisfied with the government, but there are some people who are not informed about the services may not use them, hence dissatisfied with the government. Therefore, there may be a big difference of satisfaction about the quality of services between the people who know about

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them and people who do not. It is difficult to give all the residents full information fairly and properly, and hence publicity work should be done efficiently and effectively to promote such awareness. Local governments' websites are one of the promising information delivering systems. This is used as a channel which can provide information to residents effectively. All the local governments have been constructing websites and almost all the websites now are made available online. However, information delivering by local governments through websites certainly has some problems. In order to get information, residents have to be motivated to access to those sites. Also, they would not know whether the information is updated unless they access the site and sometimes they might be disappointed because the information is not updated yet. In addition to the existing means of information delivering using websites, SNS such as Twitter and Facebook, which are seen as a more advance means of information delivering, are increasingly used by many local governments these days. Once residents register to the social media channels, information is sent automatically to the register's client application. In other words, residents do not have to access to websites to get new information because information is now being push to them through their applications. This system is seen as an effective communication media. The increase number of users opening SNS account does not necessarily means that there is an increase number of local governments' SNS users who wants to receive information about public goods and services. The number of SNS users will not increase unless local government provides needed or fascinating information to its residents. In order to increase their SNS's users, they need to use various creative ideas to attract residents' interests. For instance, they should consider carefully about not only the contents of information but also the way of writing or expression of a piece of information to attract residents' attentions. Local governments deliver various kinds of information. Sharing information of disasters rapidly is one of the things which people pay attention to these days. Also, information about the local government's services, events and administrations are some of the typical basic information that people would like to see too. There are however some local governments' attempts in providing information using SNS but it does not work because they have not succeeded in sending attractive information. Some of the factors that impede the uptake of SNS as a means of information delivery by local governments is due to human factors e.g. depend on the person's know-how skills on managing and providing quality SNS services. From around 2010, as the SNS phenomenon began to spread, a governmental committee broadcasted a budget screening conference on the Internet. Thereafter, committees of prefectural governments and assemblies began live streaming on the Internet. Broadcasting committees' discussions facilitates transparency in their processes and decisions, and provides an opportunity for residents to voice their opinions. Such an environment creates a suitable tension among committee members and residents. At that time, Twitter was known as a tool not only for providing committee schedules or notices but also for broadcasting members' discussions during meetings. Twitter can be used to diffuse the status of the committee and to record members' comments. It reveals aspects and processes of governing that residents seldom are exposed to and may promote agreement between governments and residents. Kuzma,J. [6] researched 50 Asian government utilization of three social networking sites, Facebook, Twitter and YouTube. The result of research shows that 19 of 50 governments (38 percent) use Twitter, 52 percent have a presence on Facebook and 34 percent use YouTube. And percentage of pages for government ministries is also shown. Almost of web 2.0 sites tend only to disseminate information, education and tourism services. He indicates that there is a lack of strategic direction in governmental approach to services that are implemented and concludes government agencies should alter their management attitudes towards web 2.0 tools. Analyzed data is only if the governments have account and what kind of accounts are. Snead,J.T [7] listed the status of using various SNS by government agencies in U.S. Total tweets, followers and listed count of agencies' twitter accounts are shown. And it shows mixing different kind of media, for example movies and voices, effects follower increase. Sandoval-almazan,R [8] showed the rate of variability of subscribers count of SNS accounts in Mexican State websites during 2008 to 2010. He indicated that followers count on Twitter and friends count on Facebook have grown much on some accounts but the reason is not researched.

There is, according to our knowledge, no study about what kind of information delivery meets residents' needs or attracts residents' attentions. There is also lack of study about the effective use of SNS in local government in delivering information to the public.

III. RESEARCH METHOD

In this paper, we conduct a morphological analysis on the contents of the information delivery and categorized those words that are often used by the local governments. Then we segregate these information into two categories, namely, attractive information and non-attractive information, and doing as such it will help to identify problems associated to those non-attractive information delivery, and to find solutions to improve information delivery system. Twitter and Facebook are the most popular SNS in Japan. We will focus on SNS - Twitter to measure residents' interests by counting the number of re-tweet. Twitter is chosen because it is used more often than Facebook by the local governments and residents in Japan. Re-tweet is used when the users feel that the information is worth sharing and want to tell their followers about the news. Therefore, counting the number of re-tweet means that counting the information which residents want to tell other people, and this is why we will use re-tweet

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number as an index. This research examines how Japan's prefectural governments currently use Twitter, and suggests how they may use it more effectively. We begin by reviewing the features of communicating via Twitter. Twitter is a real-time informational and social network that enables users to send and receive text and visual messages via a website interface, SMS, or mobile devices. Users include individuals and organizations of all types that establish an electronic identity. Registered Twitter users can read and post messages, while unregistered users may only receive them. The basic information unit is a statement containing no more than 140 characters called a "tweet" because its brevity resembles the tweet of bird. Tweets from various accounts are displayed on the timeline of users receiving them, called "followers." Once sent, Tweets appear on all followers' screens simultaneously. Recipients can forward tweets to others, a practice referred to as "retweeting." Thus, Twitter account holders that provide information which many followers find interesting or valuable will attract more followers. Besides following one or many accounts, users may register their accounts to lists that display tweets on another timeline, and can be accessed when users wish to see them. Twitter users collect information by becoming followers of particular accounts and registering their own accounts to a list. The question arises whether Twitter is suitable for prefectural governments that wish to communicate with residents. If so, what type of information interests residents sufficiently for them to retweet it? How does the number of followers change? What type of information affects the number of followers and the list count? Do prefectural governments with larger populations have more Twitter followers? Does policy information reach residents? The Twitter accounts used in this research include accounts held by each prefecture and their public relations sections, accounts made for regional vitalization, and accounts which can be searched by public institutions' Twitter account searching system called "GABATTER <http://govtter.openlabs.go.jp>". However, accounts which are held by institutions such as the prefectural museums and libraries are not included in this research, since their delivering information rarely related to local policy. In this research, we only choose 47 accounts held by prefectural publicity section or section delivering policy information for our research. We gathered parameters for each account 10 times during each weekend from June 9 to August 10, 2013. In each account, we calculated the numbers of tweet, followers, followings, lists, re-tweet per a follower and all text of tweet. In addition, we identified words which are used many times on each account and calculate how often these words are used on the information delivery contents. Also, we distinguished between re-tweeted tweets and non-re-tweeted tweets, and to find those frequently used words on each account. This research will help local governments to identify features of interesting and non-interesting tweets' contents and to identify ways to improve the delivery of the content using SNS. Alongside population data for each prefecture, we collected information concerning the five parameters below and texts of all tweets on Twitter. The Twitter Application Programming Interface (API) permits gathering only the 20 most recently tweeted texts and retweets. Fig.1 shows the image of our research method. Parameters in this investigation are the below.

* Follower Count

This parameter indicates the number of registered users signed up to each prefecture's Twitter account (i.e., users who receive its information on their timelines). Twitter accounts with many followers have potential for disseminating information widely. However, some accounts acquire followers through "follow back" from users who follow other accounts. In such cases, followers do not always read the tweets. Accordingly, accounts with many followers do not necessarily have substantial potential to provide information.

* Following Count

This parameter indicates the number of users registered by the prefectures account to acquire information provided by the account. Generally, prefectural accounts provide information and do not need to gather residents' general tweets. Thus, most accounts do not follow people's accounts.

* List Count

This parameter indicates the number of registered users who have subscribed to lists to receive tweets from the prefecture's account. It differs from the follower count in that it tallies the number of users registered to a list that they create to receive tweets concerning specific themes. This parameter overcomes the difficulty in deriving an accurate follower count through "follow back." The list count offers an accessible, accurate count of users who want to acquire information.

* Tweet Count

This parameter indicates the total number of tweets each prefecture has disseminated from the time the account was created to the present moment. A large tweet count indicates that the prefecture provides information frequently.

* Retweet Count

This parameter indicates the number of tweets forwarded by users who receive the prefecture's tweet on their timelines or by subscribing to a list. Retweeting indicates that users regard a tweet as interesting or valuable. Retweet count is therefore regarded as the most important index for measuring users' perceived value of a tweet's subject. We counted how often particular words appeared and were retweeted by gathering and analyzing the content of messages tweeted from the prefectures' accounts. Their analysis revealed the subjects that elicited interest from followers. We developed a Java™ program to gather account data directly from the Twitter web server via API.

The programming environments are depicted below.

Development environment: Eclipse 4.2
Java version: Java EE 6
Twitter API for Java version: Twitter4j 1.1
Engine for morphological analysis: Kuromoji

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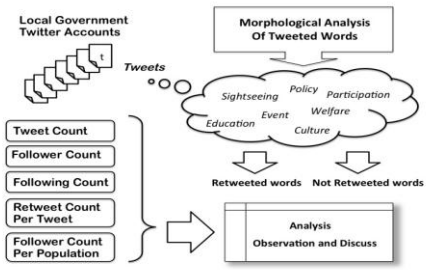

Fig.1 Image of Research Method

III. RESULTS AND OBSERVATION

A. Overall trend of Twitter parameters

We analyzed the parameters gathered from prefectures' accounts and revealed trends among prefectures by correlation analysis. There is a moderately positive correlation between the total tweet count and the follower count, as there is for the total tweet count and the list count. Regardless of tweet subject, prefectures acquire followers or attract lists by tweeting frequently. Accounts that tweet repeatedly flood users' timelines; therefore, users who follow many accounts register those that tweet frequently to a list rather than receive them directly. This is confirmed by the findings of this research: the tweet count's correlation with the list count is slightly higher than its correlation with the follower count. The correlation coefficients between total tweet count and follower count or list count are moderate. It is thought that tweet subject affect the follower count and list count more than the total tweet count. Second, we examined the retweet count as a measure of the value that recipients' place on the subject of tweets and other parameters. The retweet count and follower count are strongly correlated, as are the retweet count and the list count. The correlation between the retweet count and the follower count is greater than that for the list count. Accounts whose tweets are frequently retweeted attract more followers and appear on more users' lists, magnifying the number of users the account reaches. Prefectures that seek to maximize their exposure can take advantage of this general feature of Twitter. Third, prefecture-specific parameters are analyzed. We compared each prefecture's population and the per capita number of users who follow its Twitter account. Highly populated prefectures presumably acquire many followers and their Twitter accounts have a higher number of retweets, but what features are shared by prefectures with many followers per capita?

Prefecture	Account	Follower/ Population
Iwate	@pref_iwate	105.61
Aomori	@AomoriPref	74.24
Kochi	@pref_kochi	61.50
Akita	@pref_akita	60.14
Ibaraki	@ibaraki_kouhou	54.20

Table 1. Top 5 accounts acquired many account per prefecture's population

As expected, results reveal a moderate correlation between prefecture population and follower count, as well as that between population and the list count. The number of followers per capita and the list count are strongly correlated. Moreover, moderate correlations exist between the per capita follower count and the follower count, the total tweet count, and the retweet count. Highly populated prefectures acquire many followers and listings not only because their population is greater but also because they tweet actively and provide information that residents find interesting or valuable. Because prefectural staff select the content of each tweet and disseminate it, prefectures with more staff are more likely to provide information via Twitter. Moreover, larger prefectures are more progressive in informatization, and seemingly employ many workers with high information literacy. Many prefectures that provide information on their websites also provide real-time information via Twitter. Therefore, we compared Twitter parameters with the results of a website evaluation. Results indicated no correlation between Twitter parameters and usability, accessibility and feedback. Contents completeness and the follower count, list count, and total tweet count are weakly correlated, but the website evaluation revealed no correlation between contents completeness and population. Among Twitter accounts, however, contents completeness and the rate of increase in the follower count and list count are moderately and negatively correlated. This finding suggests that informationally progressive prefectures with many followers and listings are reaching constituents and have difficulty increasing their number of followers and listings.

B. Examples of Effective Tweet Contents

We analyzed the contents of tweets from prefectural accounts with remarkable features as shown in Table 1. We discuss the correlation of the per capita follower count with selected parameters. Iwate Prefecture (@pref_iwate) ranks first, with 44,000 followers among a population of 1.36 million, a rate of 3.4% compared with the overall prefectural average of 0.3%. This is followed by Aomori Prefecture (@Aomori_pref) with 1.6%, Kochi Prefecture (@pref_kochi) with 1.0%, and Akita Prefecture (@pref_akita) with 0.9%. Iwate Prefecture ranks third in total tweet count (818), following Aomori (1,271) and Fukui Prefectures (@fukuibrand) (833) as shown in Table 2. It also ranks third in number of retweets (607.4), following Tokyo Prefecture (@tocho_koho) with 767 and Kyoto Prefecture (@KyotoPrefPR) with 631.1 as shown in Table 3. These rankings suggest high quantity and quality of tweeted content from these prefectures. If this is so, what subject does Iwate Prefecture—the prefecture with the most followers per capita—tweet? Morphological analysis of its tweets reveals repeated instances of the words "disaster" and "hard rain." That is, Iwate Prefecture disseminates flood and disaster warnings and related information such as damage reports and traffic conditions.

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Prefecture	Account	Total Tweet Count
Aomori	@AomoriPref	1271
Fukui	@fukuibrand	833
Iwate	@pref_iwate	816
Hokkaido	@PrefHokkaido	726
Tochigi	@pref_tochigi	517

Table 2. Top 5 accounts delivering many tweets

During such events the number of followers increases. The word *manga* (cartoon) appears frequently during the surveyed period, reflecting several notices for an event involving a cartoonist associated with Iwate Prefecture. By actively providing information about events in the prefecture, Iwate's Twitter account seems to be an important tool for residents. Tokyo has the highest retweet count. During the surveyed period, it frequently tweeted information about cultural and sporting events that elicited residents' interests. Many tweets concerned Tokyo's candidature to host the 2020 Olympic Games and television programs supported by the prefecture. Given the large number of retweets, the account serves as an information portal to Tokyo Prefecture. It is likely that Tokyo Prefecture rated highly because its tweets featured broader information about Tokyo, and not merely disaster information. Findings indicate that as Tokyo has a considerable population, and its tweets are frequently retweeted. Kyoto mainly tweets notices informing residents of daily events. However, notices about severe weather conditions from Kyoto Local Meteorological Observatory are retweeted many times, increasing the number of followers. By tweeting real-time information applicable to most residents, residents seem to feel involved. Multiple tweets draw residents' attention and encourage retweeting. Although Aomori tweets the most among all surveyed accounts and has the second-highest per capita follower count, its retweet count is particularly low. Unlike other prefectures, it does not tweet about events or disaster information. Rather, it disseminates information about prefectural policies such as industrial development, employment of the disabled, medical treatment, and regulations. The fact that Aomori's tweets are rarely retweeted indicates that residents are indifferent to the prefecture's extensive effort to provide policy information. Although Fukui tweets primarily about events and not policies, its retweets are few. Aomori and Fukui address different subjects, but the content of their tweets—headings and URLs for news—are similar. Their followers perceive no human touch in the prefectures' tweets that might attract them to unfamiliar information. Even if similar contents are tweeted, followers' respond differently to the tweets' writing style and word choice, as reflected in the retweet count. However, from a different perspective, although Saitama Prefecture (@pref_saitama) tweets policy information in the form of serious subject, its tweet is retweeted many times. It count follows that of Iwate. It tweets headlines from the governor's blog describing not only policy information and event information but also each policy. The content style is expressed with friendliness to the followers, just like talking to. So the followers feel sympathy and close to.

Prefecture	Account	Retweet Count
Tokyo	@tocho_koho	767.0
Kyoto	@KyotoPrefPR	631.1
Iwate	@pref_iwate	607.4
Saitama	@pref_saitama	571.9
Ibaraki	@ibaraki_kouhou	259.5

Table 3. Top 5 accounts acquired many retweets

IV. CONCLUSION

Some prefectural Twitter accounts appeal to many residents. We now offer suggestions to improve the general success of Twitter among prefectures. Results indicate that accounts are more successful if they provide necessary information applicable to most residents. This point is confirmed by users' retweets to warning information about weather conditions. However, public and private meteorological agencies, not prefectural governments, are the source of weather information. Therefore, what type of information should prefectural governments provide via Twitter? This research reveals that residents follow prefectural accounts that routinely provide information about sporting and cultural events. However, the primary purposes of providing information via SNS are to promote residents' understanding of local policies, and to promote e-participation in the government. Therefore, what information should prefectural governments tweet to raise residents' awareness of their policies? Unfortunately, this research indicates that tweets concerning policy information do not attract followers. Saitama Prefecture has achieved the best success in reaching residents via Twitter; it primarily provides information about routine various kinds of events and policy information presented in an accessible vocabulary. Its political content is limited to tweets featuring only headlines and links to the governor's blog. Twitter's 140-character limitation makes it difficult to present extensive policy information; therefore, many tweets contain appropriate links. Mixing Twitter and other media increases the accessibility by residents and the appeal of disseminated content. The retweet count and follower count may be sound standards for evaluating prefectural governments' Twitter accounts, but large numbers of retweets and followers are not always good. We suggest that Twitter be utilized as a tool to disseminate policy information and promote understanding between residents and prefectural governments. From the view point of the competition among prefectures, we found a feature in using Twitter by comparison among regions. There are forty-seven prefectures in Japan, which are grouped to eight regions. Hokkaido and Tohoku region, the

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northern-easternmost, evaluated as the best on the parameter of Total tweet count and follower count per population and the second on follower count and listed count. Hokkaido and Tohoku region includes Hokkaido, Aomori, Miyagi, Iwate, Akita, Yamagata, and Fukushima. On the other hand the regions located in the western evaluated low. It means prefectures in Hokkaido and Tohoku region actively disseminates information and stimulate among prefectures. It seems that the reason is disaster preparedness due to the experience of Great East Japan earthquake on March 11, 2011. When it happened, it was found that Twitter was useful for both governments and residents as an alternative method to telephone, TV, and radio because of devastated infrastructure. After that Twitter is recognized as a strong media when disaster happens. As the previous discussion suggests, prefectures are mainly expected to disseminate disaster warning and event information. So prefectures should attract residents by event information, acquire followers, and disseminate disaster warning on case of emergency. Also in order to implement openness and transparency of government, disseminating policy information should be incorporated in them with friendly impression to reach residents. It will foster atmosphere of relationship of local government and residents.

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