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Rebirth of Journal of Social-Informatics

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■Birth of the Society of Socio-Informatics

The Society of Socio-Informatics (SSI) for which it had waited for a long time was established in April, 2012.

Our magazine also makes a fresh start as an academic journal of this social information society anew.

The newness of "Socio-informatics" can be considered from three angles. First, the world is understood anew on the basis of a new universal phase by approaching from the basic concept "information", which is beyond the frame of the natural science and social science. Second, the essential dynamism (interactivity) of "information" can analyze continuously from a micro phenomenon to a macroscopic phenomenon. And third, as big concern gathered for social media in the Great East Japan Earthquake and "Spring of Arab", the interaction of sociality of "information" and new technology will be clarified.

Thus, the "socio-informatics" not only can constitute discipline which is important itself, but can play a role of the hub or the platform of already established various learning domains. That is, the socio-informatics will serve as a catalyst which connects various ideas across all boundaries, and will serve as a place that facilitates emergence of new civilization out of the collision of the heterogeneous way of thinking.

■What is "Socio-Informatics"?

"Information" is the key concept of Socio-Informatics.

The attention to "information" appeared according to the world change in the beginning of the 20 th century, and change of a view of the world.

In 1900, Max Planck presented the paradigm of the new physics of the "quantum theory." It was shown clearly that the world was not what is collateralized by "absoluteness of existence" like the classical mechanics of Newton. A physical phenomena are only probabilistic uncertain phenomena for which it moreover depends on an observer.

Then, the concept of "information", which controls uncertainties or entropies, has come to the academic's attention. Wiener defined "Information" as "a name for the content of what is exchanged with the outer world as we adjust to it, and make our adjustment felt upon it" (Wiener, 1950 : 17-8). Based on this definition, Wiener advocated the new concept of "cybernetics" and did

the important contribution important for computer science.

In 1953, James D. Watson and Francis Crick showed clearly that DNA has a double-helical structure. It was the discovery which proves that the information of the gene inherited from animate life to animate life is physically described by DNA.

Baumer, who is a researcher on the history of thought, has expressed a series of such intellectual deployment as “existence to generation” (Baumer, 1977). There are scholars who call it “information theoretical revolution” of a view of the world. As a result, the intellectual paradigm which reexamines the world by using “information” became a big current. Such a paradigm provides the framework to interpret the target system in the following ways:

1. Mutual dependence of components in the system will realize a certain phenomenon.
2. In the form of “information” exchange, the interaction of elements and the environment is carried out, and they depend on each other.
3. The system that comprises these interdependent elements recursively self-recreates.

■The concept of “information” supports various domains

It is obvious that such a framework can apply to various domains, as described in the foregoing paragraph. It is applied to a physical phenomenon, a life process, an information processing system and also other various phenomena.

With this characteristic, an “information” concept offers an analysis axis for the existing learning system, which is different from the traditional.

The modern science has been divided into “natural science” and “human and social science”. The former discovers the universal general law about the object in which recognition and analysis are possible. The target of the latter is phenomena recognized depending on individual subjectivity and feeling. They are considered impossible to be understood by a universal law. However, there is a question also in this matter considered to be too much obvious.

Previously, all scholarship had been called “philosophy” by the Greeks. “Learning which investigates the wisdom and principle about the world or a human being. All truth recognition beyond dogma or an illusion” (in Japanese Dictionary) was connoted by this word. Similarly, “technology” and “art”, which are nowadays considered as in the opposite poles, had been expressed by the same word “art”.

Even in Japan, “Gakumon (scholarship)” means “the whole of the knowledge explained and systematized by the fixed principle, and the method of research etc. which were constituted theoretically”, and human and social science and natural science are not separately-isolated. The Japanese word “Geijutsu (art)” was also used for outstanding “Waza (technical, artistic, or any other craft).”

That is, in the past, the whole world had been thought to be the unified one. However, modern science has reached the new ground level of knowledge according to analytic methodology, and it has progressed by leaps and bounds. In this process, separation of liberal arts and science has also

arisen. And when the progress was reached at a certain point, again the question came out whether this separation is “absolute”.

New knowledge which appeared in the 20th century has shaken the belief that distinction of the subjectivity-objectivity and of life-non-life (organic-inorganic) was obvious, as stated previously. In this way, modern science will need the new view of the world which unifies natural science and humanities-social science again. At this time, it is thought especially that “information” study serves as that key.

Wiener also has described “information”, as follows. “To live effectively is to live with adequate information. Thus, communication and control belong to the essence of man’s inner life, even as they belong to his life in society.” (Wiener, 1950. In these words, a possibility that the existence-phenomenon such as “machine”-“human’s inner life”-“society”, which had been considered to be in another dimension can be generalized as an “information”

Our “Socio-Informatics” is positioned in the base of this very modern science.

The Project "Salvage Memories" On-line — Finding Albums and Photos for the Tsunami Disaster Victims by using Information Technology —

Keywords:
Tsunami, Cleaned and Digitized Captures, Finding Photos, Search System, Using IT

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Abstract

After the earthquake hit on the day of March 11th 2011, a massive tsunami swept away houses, and everything that was inside them. Photo albums were swallowed up and turned to waste.

We began to sort out the photos and prepare them for the photos so that they can be returned to their owners in Yamamoto town. The images were cleaned and digitized captures. The cleaning processes involves the following steps, sweep dirt and rinse photographs with water, classify, reproduce and digitize all of the photos, and find their owners by using the search system, facial recognition system. The purpose of this paper is to describe our project "Salvage Memories", and discuss the two information systems.

1. Introduction

At 2:46 pm on March 11th, a unimaginable earthquake occurred off the Pacific coast of Eastern Japan. After the earthquake hit, a massive tsunami swept away houses, and everything that was inside them. Many port towns throughout Miyagi Prefectures were devastated, countless citizens lost their lives as cars and buildings were washed away and instantly turned into rubble by a wall of black water.

The devastated coastal line was an area with declining population which was aging. The area had many elderly people with disabilities. Many vulnerable people consisted mostly of elderly persons and persons with disabilities faced difficult situation.

The coastal towns were buried in rubble. Cars, clothes, refrigerators, photo albums: everything was swallowed up and turned to waste as people stood speechless. A countless photographs and photo albums which were swept away the tsunami were retrieved and collected.

We began to sort out and prepare the photos to return to their owners in Yamamoto town. Each one was someone’s treasured memory until that somebody wanted to keep. The images were cleaned and digitized captures.

The purpose of this presentation is to discusses and evaluate our project, “Salvage Memories”. It is our hope that the results of this report will contribute to prepare other coastal population against future tsunami.

Figure 1 The downtown area of Yamamoto, Miyagi obliterated by the tsunami

Figure 2 An old woman search for her photos and memories

2. Finding Memories in Worst-hit area, Yamamoto-town

There is an example in Yamamoto-town to illustrate how important it is to salvage photos for tsunami survivors with disabilities and advanced age. Yamato is a town in Miyagi prefecture, Japan.

50% of the town was flooded when the tsunami came after the earthquake hit.

The tsunami not only swept the harbor away, but also many houses, cars, trains, as well as

people. 632 people died out of the town's population of 16,700, 1 still missing, and 2,217 buildings were completely destroyed, 1,083 buildings half destroyed, and 1,138 buildings were partially destroyed (Sep 7. 2012).

Numbers don't tell what it is like to lose their loved ones all of a sudden and not being able to see them again to tell a joke or even to apologize or just to say thank you anymore. And all the photos we have here today were in people's homes. There are still 1,000 families who lost their homes and still having to live in temporary shelters today.

As the search for survivors ended and attention turned to the clean-up mission, the Self-Defense forces, firemen, and policemen who were in Tohoku to help survivors began to pick up photos they found in the mud, and to store them in an elementary school gymnasium in Yamamoto. They were not asked to do it, nor did they have a clear sense of their objective. Perhaps they were just desperate to find something in of the rubble that could be saved. Over time, the gymnasium began to fill up with salvaged photographs. Two months after the earthquake hit, our group called the "Memory Salvage Project" began to sort out the photos and prepare them to return to their owners.

Each of these images, kept in a drawers or cabinet, was someone's treasured memory until that fateful day. The photographs here were also taken to immortalize a moment shared with family, friends, and community members. The depth of emotion might vary from one to the other, but each one captures a point in time that somebody wanted to memorialize.

Figure 3 Washing photos by the volunteers.

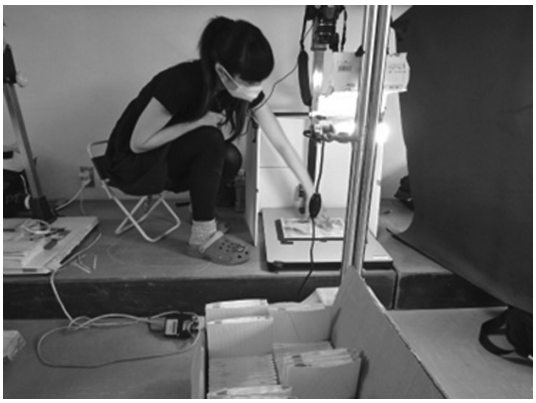


Figure 4 Digitized images by using digital cameras.

3. The Project "Salvage Memories"

The Project "Salvage Memory" was started by a team of young researchers from The Japan Society for Socio-Information Studies (JSIS-BJK). JSIS-BJK comes from a workshop that was entrusted with a mission to promote young academics studies among the young researchers.

Our first purpose for going to temporary shelters was to support the elderly and disabled survivors by setting up computers and internet access, but this project began when some victims asked us to clean photos which were swept away by the tsunami.

The people who were working on the early stage of the project were professors, college students and volunteers, but as the project got known through twitter and blogs, many people who specialize in photography, professional photographers, and private companies from various fields started to join the project as well.

The photo images were cleaned and digitized by our volunteers who came from Tokyo and other parts of Japan. The images varied in condition, from relatively clean to damage beyond recognition. The process involves the following steps.

1) Sweep dirt and rinse photographs

The dirt was cleaned off the photo albums with a cloth. The surface of individual photos was washed using a brush with water.

2) Classifying

Washed photos were hung to dry using laundry pins. The photographs and photo albums were numbered, sorted, and enumerated after being washed.

3) Reproduce and digitize the photographs

The digital images of photos were made by using digital cameras. The photos whose images had been digitized are being stored, waiting to be discovered by their owners.

4) Find its owners by using the digital search system

The digital images were processed by the college students as part of their class-room activities or by the volunteers. The processed data were archived enabling a search using key words.

Many people came from all over Japan to participate in this process. More than 500 people volunteered for this project, and 680 photo albums and 12,000 photographs have been returned to their owners by using the data which took 3 months to build.

Figure 5 The top page of search system

Figure 6 Elderly persons who are searching images

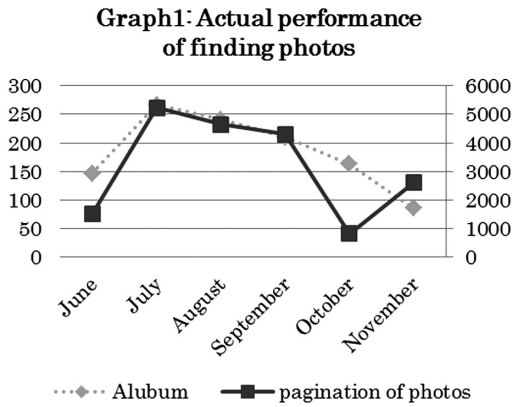
4. Conclusion

We are continuing to look for owners of the photographs by providing a space at a town office where people can come to look for their photos as well as by visiting temporary shelters

to find their owners many of whom are elderly persons and persons with disabilities. The search system is proving to be effective in uniting photos with their owners.

The following graph (Graph 1) illustrates the actual performance of finding photos. It was confirmed that our search system would provide high performance. The photos and albums were treasured memory of survivors who are still faced difficult situation but enter the first stages of recovery.

The method of our project "Salvage Memories" will be very helpful in preparing all coastal population against tsunami. The people who could "salvage" their memories can find a way forward. We plan to walk along with them so that we can help these people achieve the challenging goal of reconstruction of their community by using On-line technology.



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Evaluation of an Anonymity Measure as an Index of Voting Privacy

Key words:
anonymity metric, electronic voting, privacy, entropy, combinatorial approach

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Abstract

A key issue in secret voting and many other kinds of private communications is ensuring the anonymity of individuals. Researchers in Information Studies have been aiming to establish metrics of anonymity to enhance the protection of privacy in information and communication systems. Many related papers, however, focus on so-called connection anonymity. Little research can be found for metrics of voting privacy, except for the entropy-based approach of Endo et al. (2007, 2008). This study illustrates and evaluates an unknown anonymity measure presented by Iwai (2003) in the field of Japanese mathematical sociology. The metric utilizes a combinatorial approach and has some advantageous aspects over the approach of Endo et al. (2007, 2008) as a metric that measures the degree of preventing the identification of particular voters. Although, in general, Edman et al. (2007) is recognized as the first study that demonstrated a combinatorial approach to defining an anonymity measure, the main idea is shared by the earlier research of Iwai (2003). Even now, the mathematical representation forms in the older research seem to be more suitable for measuring anonymity in voting contexts.

1. Introduction

The anonymity of individuals has been a key issue in secret voting and many other kinds of private communications. With the Internet providing increasingly newer opportunities for secret information exchange, there are still many concerns about the protection of anonymity in information and communication systems.

As part of the efforts to enhance the protection of privacy, researchers in Information Studies have been trying to form metrics of anonymity. The notion of anonymity set by Chaum (1981) and the two entropy-based metrics presented by Serjantov and Danezis (2002) and Díaz el al. (2002) are well known examples. The combinatorial anonymity metric by Edman et al. (2007) has recently been recognized as a major new approach.

Many related papers, however, focus on so-called connection anonymity, which involves hiding source and destination identities during data transfer in a system.[1] A metric for connection anonymity contributes to various private communication system studies, but it is sometimes inadequate in systems for secret voting (as illustrated later in 5.2), where anonymity is related to hiding the identities of the data source at the destination. In voting, there is also the characteristic that part of the information, with regard to data contents, will be open to the public. (Typically, the result of the vote count is to be disclosed.) The latter type of anonymity is called voting anonymity in this paper. For a metric of voting anonymity, little similar metric research is known, except Endo et al. (2007, 2008), which utilized an entropy-based approach to define anonymity in small-scale voting.

This study illustrates and evaluates an unknown anonymity measure presented by Iwai (2003) in the field of Japanese mathematical sociology. The metric has been unknown, as the research was conducted independently from other information studies and in the very different context of the social sciences. Moreover, as the research focused on a comparison between its metric and another "anonymity" notion in social choice theory,[2] sufficient illustration of the nature of the metric and its evaluation as an information study are lacking. This paper demonstrates the mathematical nature of the metric, provides comparisons with other typical metrics proposed in other information studies, and presents a discussion about its potential application.

This paper shows that the metric of Iwai (2003) utilizes a combinatorial approach to measure voting anonymity, and that it has some advantages as a metric that measures the degree of preventing the identification of particular voters compared to the entropy-based approach of Endo et al. (2007, 2008), and the other combinatorial approach of Edman et al. (2007).

The rest of this paper is structured as follows: Section 2 provides a short outline of major related works in measuring anonymity. Section 3 gives the basic criteria for evaluating a metric of voting anonymity in this paper. Section 4 illustrates the measure presented by Iwai (2003) and provides the informational mathematical nature of the metric. Section 5 presents comparison studies with other typical metrics and, in Section 6, discussion about its potential application is presented.

2. Related Works

This section provides a short outline of major related works in measuring anonymity. As mentioned above, most of these have focused on connection anonymity.

As a first common approach, Chaum (1981) introduced the notion of an anonymity set, which is a set of all participants who could have initiated an action (especially participants who are likely to be the sender or recipient of a particular message). The metric is the cardinality of the anonymity set S. Assuming a uniform probability distribution, the probability that any individual i turns out to be the initiator is simply defined as follows:

$$P(i) = \frac{1}{|S|} \tag{1}$$

Serjantov and Danezis (2002), however, showed that simply measuring the size of an anonymity set is inadequate for a set of users with non-uniform probabilities of having performed an action. Based on the information theoretic concept of entropy, they defined an effective anonymity set size as follows:

$$S = -\sum_{u=1}^{n} p_u \log_2(p_u) \tag{2}$$

Here, n is the number of users in the anonymity set, and p_u is the probability that a user u had the role of sender or recipient for a particular message.

Díaz et al. (2002) independently proposed a similar entropy-based metric which they call the degree of anonymity. They defined the degree of anonymity d as follows:

$$d = \frac{H(X)}{H_M} \tag{3}$$

Here, H(X) is as S and H_M is the maximum entropy of the system, which is equal to $\log_2(n)$. By dividing H(X) by H_M, d is normalized to the range [0, 1].

Tóth et al. (2004b) critically analyzed the two entropy-based metrics and showed that non-desirable systems can be evaluated as near optimal according to the measures. From the perspective of individual users, they argued that the appropriate metric for measuring local anonymity should be based on, with respect to a particular message, the maximum probability with which an attacker can assign it to a sender or recipient.[3)]

As shown in this argument, the definition of anonymity can vary even within a connection anonymity scheme, reflecting differences among the focuses of researchers.[4)] The metric presented by Tóth et al. is one goal based on their emphasis on the perspective of individual users.

Edman et al. (2007), on the other hand, presented a system-wide metric that measures the amount of information needed by an observer to reveal the communication pattern as a whole. The metric is based on the calculus of the permanent of a matrix, and the result is equivalent to the combination number between the inputs and outputs (see 5.2). They argued that existing information-theoretic metrics typically consider the anonymity of the system from the perspective of a single user or message, and that their combinatorial approach can serve as a complementary tool and help to identify the properties of a system that other metrics might not. (See also Gierlichs et al. (2008) and Bagai et al. (2011)).

3. Evaluation Criteria

The concept of anonymity tends to have multiple aspects. This section examines the typical aspects of voting anonymity and provides the basic criteria for evaluating a metric of it in this paper. Firstly, a simple entropy-based metric approach is considered carefully.[5)]

One of the aspects involved with voting anonymity would be that it creates difficulty for estimating what vote each voter casted [Aspect A]. If we focus on this, one of the most natural approaches to evaluate voting anonymity is to employ a simple entropy-based metric, as how a voter voted can be estimated by examining the vote shares (for example, if 80% of voters voted supportively in a confidence vote, the content of each voter's vote is expected to be supportive with 80% certainty) and the value of entropy reflects the randomness of the voting pattern.

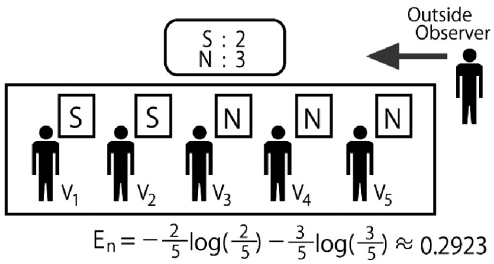


Figure 1 Simple Entropy-Based Metric for Voting Anonymity

Figure 1 is an illustration of this approach, where five voters (V_1, V_2, ..., V_5) conducted a secret vote. Each voter is making a choice between S (supportive vote) and N (negative vote). Two voted S, and three voted N. If the results were revealed, the level of anonymity can be obtained as 0.2923 with a simple entropy calculation, as described in the figure.[6)] (The base of any logarithm is 10 and the anonymity level calculated by this approach is denoted with En in this paper.) The result of this entropy-based calculation turns out to be highest when the vote result is nearest to the draw among alternatives. It turns out to be zero when all voters voted for S (N), where it is obvious to outside observers that everyone voted S (N). As there is no difference among votes that are casted for an alternative, the need for a separate calculation of probability for each vote does not exist. (The problem with the entropy-based metric discussed in Tóth et al. (2004b) is avoided in voting anonymity.)

However, a simple entropy-based metric does not reflect some critical aspects of voting anonymity. Let us take a simple example of a confidence vote in a dictatorial country. If some voters cast non-confidence votes on a government policy, the most critical privacy issue would be preventing the identification of who the supportive and negative voters are. If we focus on the aspect of preventing the identification of particular voters [Aspect B], the simple entropy-based metric presents some drawbacks, as in the following comparative cases:

i) Larger voter size and same vote share

The two cases of voting A and B in Figure 2 are equal in vote share, but the voter size of the latter is larger. En levels for both voting are the same ($En_a = En_b$). However, there may be a difference in the actual level of privacy. Voter $V_{A,2}$ may feel less anonymous to outside observers than $V_{B,6}$.

ii) Larger voter size and same minority number

The two cases of voting A and C in Figure 2 are the same as with the number of negative voters, but the voter size of the latter is larger. The En level of voting C is less than that of voting A ($En_c < En_a$). However, voter $V_{A,2}$ may feel less anonymous to outside observers than $V_{C,10}$.

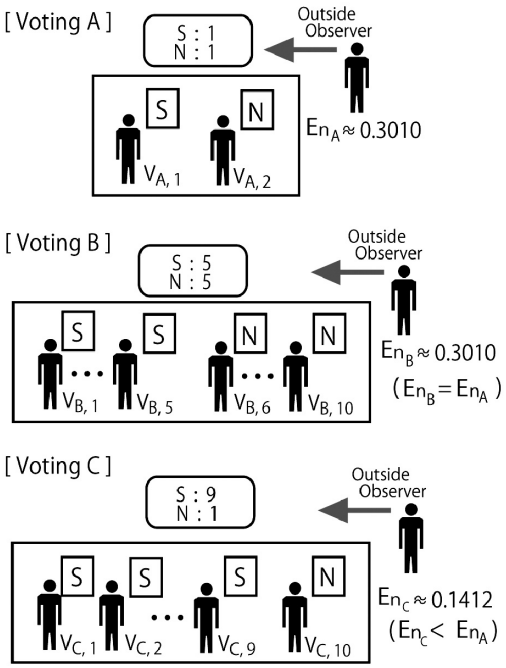


Figure 2 Drawbacks in Measuring Anonymity with a Simple Entropy-Based Metric

In the above examples, one reason why $V_{A,2}$ is expected to feel less anonymous to outside observers than $V_{B,6}$ or $V_{C,10}$ can be explained as that it easily becomes obvious that the only negative vote is voted by $V_{A,2}$ when a single voter of $V_{A,1}$ is proved to be supportive. (To find that a negative vote is voted by $V_{B,6}$ or $V_{C,10}$, any information of other single voter's vote is not sufficient.) If we focus on Aspect B, $V_{B,6}$ and $V_{C,10}$ are regarded as participating in more secured voting[7].

This paper focuses on Aspect B. From the viewpoints discussed above, the anonymity levels of Voting B and C should be higher than that of Voting A. These are the requirements in designing a metric for voting anonymity in this paper.

4. A Metric of Anonymity in a Voting Context

This section illustrates the anonymity metric presented by Iwai (2003) and gives the informational mathematical nature of it.

4.1 Basic Design of the Metric

The research of Iwai (2003), under the translated Japanese title "Formalization of the Concept of Anonymity in Voting Behavior", proposed a metric to measure voting anonymity. The original argument starts by commenting that the anonymity concept in social choice theory does not reflect voter privacy. This section will omit this part and simply follow the arguments for designing the metric.

The research proposed a measurement technique to evaluate the level of voting anonymity by summation of informational values of all voters' votes. The informational value of each vote is evaluated as -log(generation probability), following the concept of self-information in the information theory of Shannon (1948).

Figure 3 demonstrates the calculation of the sum of self-information for a vote illustrated in Figure 1. In this example, each piece of self-information is added in order from V_1 to V_5. When V_1 and V_2 are to be known as supportive in this order, the proportion of supportive voters are 2/5 and 1/4 respectively, and the calculus described in the figure is based on these numbers. After the votes by V_1 and V_2 are

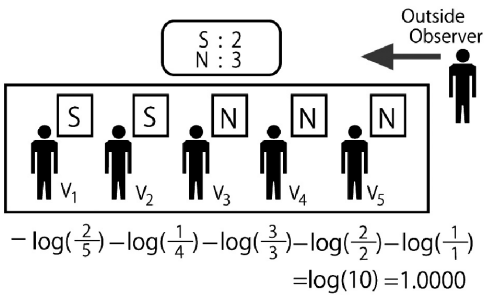


Figure 3 Basic Calculation of Iwai (2003)

known, it is obvious that the remaining members are all negative. Reflecting this fact, each of the three following terms equals zero.

The sum obtained in this procedure is independent of the order of calculation.[8] Actually, the calculation only needs the number of total voters and supporters (or opponents). In general, if the number of total voters and supporters are N and M, respectively, the anonymity level of voting for an outside observer is defined as follows:

$$\log \frac{N!}{M!(N-M)!} \tag{4}$$

Similarly, the anonymity level of voting for a supporter and an opponent, respectively, is defined as follows:

$$\log \frac{(N-1)!}{(M-1)!(N-M)!} \tag{5}$$

$$\log \frac{(N-1)!}{M!(N-M-1)!} \tag{6}$$

If unanimity appeared in the result, the score would be zero. The score turns out to be the highest when the vote result is nearest to the draw. These are common characteristics in a simple entropy-based metric.

Iwai (2003) also argued the metric could possibly measure the "remaining anonymity" when some voters actually declare their votes. But, the merit of avoiding an entropy-based metric in designing the formulae defined in (4), (5), and (6) was not clearly discussed.

4.2 Mathematical Nature of the Metric

Firstly, we introduce the notation AL to refer to the anonymity level of the metric of Iwai (2003) and generalize its definition for convenience.

The antilogarithms of the formulae (4), (5), and (6) are combination numbers calculated from the numbers of votes. AL can be redefined as

$$AL = \log(C) \tag{7}$$

where C is the combination number to be calculated as the number of ways of dividing inputs (votes that have not been revealed or declared) into output categories (alternatives) under the condition which reflects the voting result (A condition is typically that each output category should have a particular number of inputs or an obtained number of votes). The AL score equals the sum of the related self-information values.

The formula (4) can be rewritten as

$$AL = \log({}_N C_M) \tag{8}$$

Similarly, the formulae (5) and (6) can be rewritten as (9) and (10), respectively:

$$AL = \log({}_{N-1} C_{M-1}) \tag{9}$$

$$AL = \log({}_{N-1} C_{N-M-1}) \tag{10}$$

In the remainder of this paper, this measure is referred to as the metric of the basic combinatorial approach (in contrast to the combinatorial approach of Edman et al., which utilizes the permanent calculation of an adjacency matrix

and normalization), or just as the BC metric.[9)]

Now, the BC metric can be characterized as a metric that measures the degree of preventing the identification of particular voters, which was discussed in the last section. That is to say, the BC metric measures the degree of difficulty in dividing voters into particular categories (alternatives). Figure 4 demonstrates the calculation of the BC metric for each voting illustrated in Figure 2. Actually, the scores for voting B and C turn out to be higher than that of voting A. Generally, if the vote share is the same, the AL of a voting with a larger vote size is higher than the AL of a voting with a smaller vote size ($\log({}_{aN}C_{aM}) > \log({}_{N}C_{M})$, when $a>1$). If the number of minorities is the same, the AL of a voting with a larger vote size is higher than the AL of a voting with a smaller vote size ($\log({}_{N+a}C_{M}) > \log({}_{N}C_{M})$, when $a \geq 1$). The requirements in designing a metric for voting anonymity in this paper are satisfied.

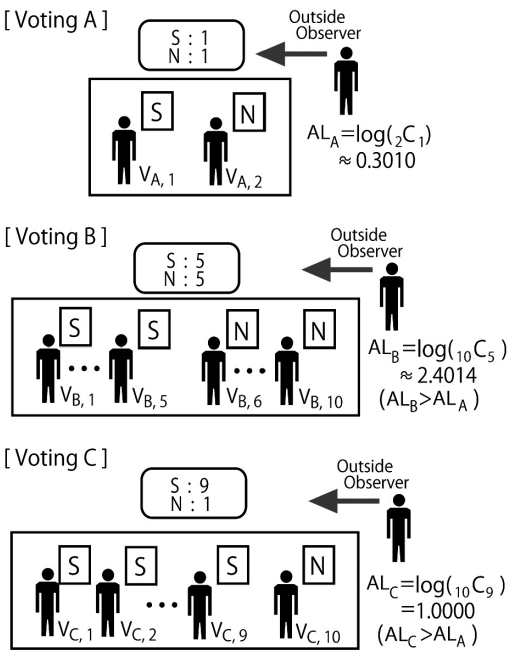


Figure 4 Anonymity Measuring with the BC Metric

Finally, the formulae listed above can have other representational forms corresponding to voting scenarios. For example, when voting with n-multiple alternatives, The formula (8) can be

$$A = \log({}_{N}C_{r1} \times {}_{N-r1}C_{r2} \times \ldots \times {}_{N-r1-r2-\cdots-r(n-2)}C_{r(n-1)}) \quad (11)$$

where N is the number of total voters and each of r1, r2,..., r(n-1) is the number of votes for the alternative 1, 2,..., n-1, respectively. As another example, in a scenario where only the election winner is disclosed without the number of votes for each alternative being disclosed, the formula can be described as

$$A = \log(\sum_{0 \leq i < N/2} ({}_{N}C_{i})) \quad (12)$$

where i is assumed to be an integer.

The metric can be applied to various votes with different voter sizes and/or different vote shares. We can compare the anonymity levels of different vote cases consistently in the sense of preventing the identification of particular voters.

5. Comparison Study

This section compares the basic combinatorial (BC) metric with other typical metrics. 5.1 compares it with the entropy-based metric for voting presented by Endo et al. (2007) and 5.2 compares it with another combinatorial metric presented by Edman et al. (2007).

5.1 Comparison with a Preceding Metric of Voting Anonymity

Especially focusing on the topic (i) “Larger

voter size and same vote share" in Section 3, the following argument shows that the metric presented by Endo et al. (2007, 2008) is not about Aspect B or preventing the identification of particular voters.

Endo et al. (2007, 2008) considered voting privacy in small-scale voting and compared s1), a conventional voting scheme where the number of votes for each candidate is disclosed at the end of voting, with s2), a new voting scheme where only the election winner is disclosed without the number of votes for each candidate being disclosed. They demonstrated how the latter scheme contributes to keeping the anonymity level when compared with the former scheme. But what we focus on is the entropy-based anonymity metric they defined in the research.

Figure 5 is an illustration of the setting. The total number of voters is I. There are two candidates, C1 and C2, and both have supporters who are sure to vote for their favorite candidates. The number of supporters for C1 and C2 are e_1 and e_2, respectively. Both e_1 and e_2 are less than half of I. The number of neutral members is n.

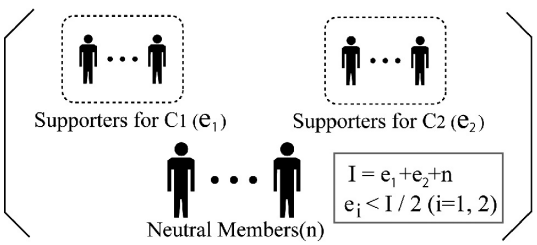


Figure 5 A Model of Small Voting in Endo et al. (2007, 2008)

The following is mainly based on the description of Endo et al. (2008). They define three sets of events in the model as follows: $\mathbb{X}$={Vote for C1, Vote for C2}, $\mathbb{Y}$={Draw, C1 wins, C2 wins}, $\mathbb{Z}$={0, 1, ..., I}. Where $\mathbb{X}$ represents the event of the voting result randomly selected from those of the neutral members, $\mathbb{Y}$ represents the event of all the cases of the voting results, and $\mathbb{Z}$ represents the event of all the cases of the number of votes for C1. And they explain that these events are equal to sets of probability variables of X={1, 2}, Y={0, 1, 2}, and Z={0, 1, ..., I}.

Based on this setting, the anonymity for the s1) scheme is formalized as H(X|Z) which is the entropy where the number of votes for each candidate is disclosed. Similarly, the anonymity for the s2) scheme is formalized as H(X|Y), which is the entropy where only the election winner (or no winner, i.e., a draw) is disclosed without the number of votes for each candidate being disclosed.

For example, Endo et al. showed H(X|Z) has the following form:[10]

$$H(X \mid Z) = -\sum_{z=e_1}^{I-e_2} \frac{{}_{n}C_{z}}{\alpha(e_1)} \{L(\frac{z-e_1}{n}) + L(\frac{I-z-e_2}{n})\} \quad (13)$$

where the following definitions are employed:

$$\alpha(v) = \sum_{i=v}^{n} {}_{n}C_{i} \quad (14)$$

$$L(v) = v \log v \quad (15)$$

Although Endo el al. employed conditional entropy, not simple entropy, their definition of anonymity inherits the same problem discussed in topic (i) of Section 3. A draw voting of two voters is treated equally with a draw voting of more voters. To see this problem clearly, some decomposition of calculus would be adequate.

Figure 6 is an illustration of this. (a) is H(X|Z)

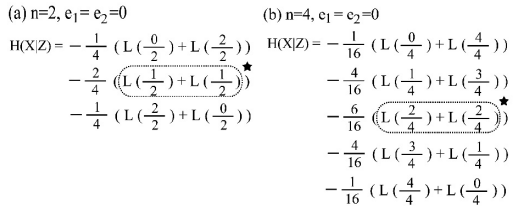


Figure 6 Problem Areas in Anonymity Measuring with a Conditional Entropy Based Metric

calculus under the condition of n=2, and e_1=e_2= 0; (b) is the same under the condition of n=4, and e_1=e_2=0. Note that H(X|Z) is the expectation value of H(X|Z=z) over all possible values of z, not an exact entropy value of H(X|Z=z) where z has a particular value in Z. In the calculation of expectation values in Figure 6, both of the two parts marked with stars that are for the draw cases, have the same value. This anonymity definition does not distinguish between the various draw cases.

The problem with the topic of (ii) "Larger voter size and same minority number" in Section 3 can be found similarly with decomposition of calculus. Although the representation form is different from the simple entropy-based metric, this metric is also recognized as one type of anonymity measure that focuses on estimating what vote each voter casted, or Aspect A.

The proposed conditional entropy-based metric itself is valid and consistent within its framework. However, in measuring the degree of Aspect B, the BC metric has more advantageous aspects. Note that it is also possible to compare the s1) and s2) schemes with the BC metric. The anonymity level and its expectation value in the s2) scheme can be obtained by arranging and utilizing the formula (12).

5.2 Comparison with Another Combinatorial Approach to Measuring Anonymity

Edman et al. (2007) is known for its combinatorial approach to defining an anonymity measure. Although it is introduced in the connection anonymity context, the definition can be recognized as one form of the formula (7). This section compares it with the BC metric, and shows the latter is more adequate in measuring the degree of Aspect B or preventing the identification of particular voters.

Edman et al. (2007) considered messages as inputs and outputs of an anonymous network and modeled this system as a bipartite graph which can be represented by a matrix.

Figure 7 is the illustration of the framework of the research. (a) Let the inputs and the outputs of an anonymity network be denoted by the set S={s_i} and T={t_i}, respectively. (b) Given a set of possible associations between inputs and outputs, a bipartite graph G=(V1, V2, E) is constructed to represent the system, where V1=S, V2=T, and E is the set of edges representing all possible (s_i,t_j) mappings. (c) Graph G can also be represented by its adjacency matrix A, where the elements $a_{i,j}$ of the matrix are 1 if the edge linking s_i and t_j exists in G, and 0 if it does not exist.

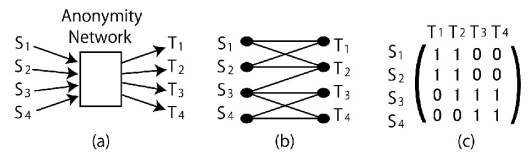


Figure 7 A Model of an Anonymous Network in Edman et. al. (2007)

Although there are many possible one-to-one relations between inputs and outputs in general (i.e., many cases of perfect matching on the as-

sociated bipartite graph G), only one of them is the true relation. In order to measure the anonymity provided by the system, Edman et al. proposed counting the number of possible perfect matches in G, which is equivalent to computing the permanent per(A) of the adjacency matrix A.

They define the system's anonymity level as

$$d(A)=\begin{cases}0 & if\ n=1\\ \dfrac{\log(per(A))}{\log(n!)} & if\ n>1\end{cases} \qquad (16)$$

where n is the number of messages. If only one perfect match is possible, the anonymity level provided by the network system is zero. The denominator log(n!) is for normalization. An anonymous network gets the highest score of 1 when the system is represented as a fully connected graph, as the permanent of a matrix A whose entries are all 1 is per(A)=n!. [11)]

The antilogarithm of the numerator log(per (A)) is the combination number of all possible perfect matches in G. Mathematically, it can be recognized as one form of the formula (7). In this sense, the definition of the anonymity metric is similar to that of the BC metric. For example, log(per(A)) for an adjacency matrix A whose entries are all 1 is equal to the formula (11) under the condition of N=n and r1=r2=...= r(n-1)=1.

The adjacency matrix-based approach, however, seems to have two types of limitations: one is found when applying it to voting schemes, and the other is found in both voting and message-sending schemes.

First, the use of an adjacency matrix is not suitable for the voting privacy problem, as different votes for one alternative should be treated equally in a voting scheme, while each column has to be separately treated in the matrix framework. Let us take the simple example of Figure 1 and map a set of five voters to S={s_i} and a set of five votes to T={t_i}. As each of the voters has the possibility of having casted any of the votes, all of the entries of adjacency matrix A have to be 1. It is difficult to represent the fact that two voted S and three voted N.

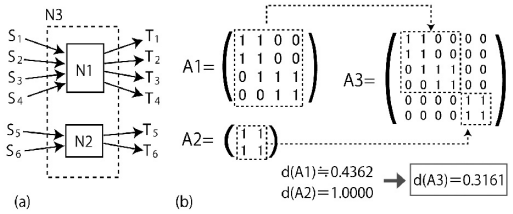


Figure 8 A Problem in Permanent-Based Anonymity Calculation

Second, use of the denominator for normalization is harmful in some cases, as it violates the property of additivity in information theory. The normalization method would work when the calculus is continuously applied to one system where inputs and outputs are unchanged and only E in G can be different. But, it may lead to paradoxical results when applied to the comparison of different systems.

The following is an illustration of this problem. Suppose that there are two anonymous networks, N1 and N2, as shown in (a) of Figure 8, and that their adjacency matrixes, A1 and A2, are as shown in (b). The anonymity levels of these networks are calculated as d(A1)≈0.4362 and d(A2)=1. Now, if we regard N1 and N2 as one anonymous system N3, then we can recalculate the anonymity level with the corresponding adjacency matrix A3, as shown in (c). The result is d(A3)≈0.3161, which is confusing, as the score is smaller than both of the originals, d(A1) and d(A2).

On the other hand, if we focus on the numerator log(per(A)), which can be counted as one form of the formula (7) in the BC metric, we find that log(per(A1))≈0.602, log(per(A2)) ≈0.301, and log(per(A3)) ≈0.903. The last term equals the sum of the preceding two terms. As N3 is a unified network of N1 and N2, this result would be more acceptable.

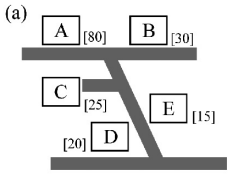
As shown above, the mathematical representation forms of the BC metric seem to be more suitable, especially for measuring anonymity in voting contexts. The BC metric of voting anonymity in this paper keeps the property of additivity. Based on the utilization of this property, the next section illustrates an electronic voting system as a potential application.

6. Potential Application

This section discusses the potential application of the BC metric, using a problem of vote count districts as an example.

In some voting, the vote count is separately operated in distributed districts. Only the total numbers are used to determine the final result. However, voters often wish to know the results of the counts in each district. The disclosure in districts may increase the possibility of violation of voting privacy. As the level of anonymity can be radically different among districts, disclosure is also concerned with the "equality" among districts. In designing voting, there is a potential problem between i) disclosure of the vote result in districts and ii) maintaining the privacy of voters and the "equality" among districts.

To cope with this problem, there might be a way to design an electronic voting system that utilizes the BC metric. An example scenario and an illustration of an appropriate system design are as follows:



(b)

	Supportive	Negative	Total
A	55	25	80
B	5	25	30
C	15	10	25
D	10	10	20
E	2	13	15
Total	87	83	170

Figure 9 Rezoning of Land and Voting

[Example Scenario] A local government planned a rezoning of land. There are five communities titled A, B, C, D, and E in the area. The map is shown in Figure 9 (a). The numbers in brackets to the side of each community are the number of residents. The communities agreed to vote on whether to accept the government plan. People are interested in the voting results of each community, but they also wish to be guaranteed a determined level of anonymity (V_{AL} in the below) and a determined level of similarity of the score (or "equality") among the communities (V_{CV} below). For this purpose, they used an electronic voting system that can count the votes for each community separately, but can also hide the details of the result by merging some of the voting units (districts) automatically, if necessary.

Now, the voting results of each community are as shown in Figure 9 (b) (the numbers are just stored in the system and have not yet been opened), and the algorithm that is to be employed for the above purpose is as follows:

(1) Define S1 as the set of all remaining voting units and set the value of the flag F1 as 0.
(2) Define S2 as the set of all remaining voting

units whose AL_s, AL_n, or AL is less than the threshold value V_{AL}. (AL_s, AL_n, and AL refer to the AL score for supportive voters, negative voters, and outside observers, respectively.)

(3) Set the value of F1 as 1 if the coefficient of variation for the AL scores of all voting units is more than the threshold value V_{CV}.

(4) If S2 is not empty, take the voting unit with the lowest AL among S2 (naming it as VU_x) and unify it with the voting unit with the lowest AL among S1 - $\{VU_x\}$. Else if F1 is 1, take the voting unit with the lowest AL among S1 (naming it as VU_y) and unify it with the voting unit with the lowest AL among S1 - $\{VU_y\}$.

(5) Repeat (1), (2), (3), and (4) until S2 is empty and F1 is zero.

In the above, S2 is the set for finding problems in keeping the anonymity level, and F1 is the flag for finding a problem in keeping the similarity among districts. Setting the threshold values of V_{AL} and V_{CV} can be arbitrary, but $V_{AL}= \log({}_{20}C_{10})$ and V_{CV} =0.500 would be reasonable assignments.

Figure 10 is an illustration under this setting. The left-hand numbers of each cell correspond to voter numbers. The right-hand numbers of the cells in columns of Supportive, Negative, and Total are the scores of AL_s, AL_n, and AL, respectively. Each table is sorted with AL values. The numbers under each table are the coefficient of variation for each stage. Each underline indicates that the value violates a condition.

As shown in Stage 3 of Figure 10, three voting units are left in the end. Two of them are unified units. Only the numbers of obtained votes in the table for Stage 3 are to be opened (BC metric values and CV value are to be deleted automatically). When the result is disclosed, no violation of any predefined condition is observed and voters can know to some degree the details of the vote count.

Stage 1

	Supportive		Negative		Total	
A	55	20.398	25	20.055	80	20.560
C	15	6.293	10	6.116	25	6.514
D	10	4.966	10	4.966	20	5.267
B	5	4.376	25	5.075	30	5.154
E	2	1.146	13	1.959	15	2.021
					CV:	0.822

Stage 2

	Supportive		Negative		Total	
A	55	20.398	25	20.055	80	20.560
B+E	7	6.849	38	7.583	45	7.657
C	15	6.293	10	6.116	25	6.514
D	10	4.966	10	4.966	20	5.267
					CV:	0.616

Stage 3

	Supportive		Negative		Total	
A	55	20.398	25	20.055	80	20.560
C+D	25	12.246	20	12.149	45	12.501
B+E	7	6.849	38	7.583	45	7.657
					CV:	0.392

Figure 10 An Example of the Unification Process of Vote-Counting Units

The process of the electronic voting system discussed above includes addition and other calculus of the BC metric values. Without the property of additivity, development of this type of application could not be achieved. The BC metric is consistent with the framework of information theory and the characteristic is expected to be helpful in applying it to a variety of new types of application development.

7. Concluding Remarks

This study illustrated an unknown anonymity measure for voting privacy by Iwai (2003) and evaluated it by demonstrating the mathematical nature of the metric, comparing it with other typical metrics, and discussing its potential application.

The metric utilizes a combinatorial approach and has some advantageous aspects over the approach of Endo et al. (2007, 2008) as a metric that measures the degree of preventing the identification of particular voters. In general, Edman et al. (2007) is recognized as the first study that demonstrated a combinatorial approach to defining an anonymity measure. But, the main idea is shared by the earlier research of Iwai (2003), and even now, the mathematical representation forms in the old research seem to be more suitable for measuring anonymity in voting contexts.

Notice that each of the anonymity metrics discussed in this paper is basically valid and consistent within their own frameworks. In measuring the degree of preventing the identification of particular voters, however, the BC metric seems to have more advantageous aspects.

Although there is great potential to utilize the BC metric in new system designs, the electronic voting system illustrated in Section 6 is expected to be one of the most promising applications. To check its efficacy, a prototype system with a more detailed design needs to be developed and experiments undertaken. These are tasks for the next stage of this study.

Acknowledgments

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Notes

1) The term “connection anonymity” is introduced by Díaz et al. (2002), where it is contrasted with data anonymity which is concerned with “filtering any identifying information out of the data that is exchanged in a particular application.” Notice that the voting anonymity to be introduced below in this paper is different from data anonymity, although both are related to the evaluation of the contents of transferred data.
2) Iwai (2003) focused on the anonymity concepts discussed in Chapter 5 of Sen (1970). This concept, which is actually about equality among individuals rather than their privacy, was originally presented by May (1952).
3) Their key notions of source-hiding and destination-hiding in the research are first introduced in Tóth and Hornák (2004a).
4) See also Andersson and Lundin (2008), which examined a set of state-of-the-art anonymity metrics. In the research, Andersson and Lundin showed none of the studied metrics fulfill all criteria they defined.
5) The entropy-based metric of Endo et al. (2007, 2008) includes utilization of conditional entropy. The details of the research are described in 5.1. Firstly, this section focuses on simple entropy. To clearly distin-

guish it from the conditional entropy-based metric of Endo et al., the term "simple entropy-based metric" is used in this paper.

6) This calculation reflects the level of anonymity from the viewpoint of an outside observer. Anonymity levels from the viewpoints of a supportive voter and a negative voter can be calculated similarly. These viewpoints are also important and will be discussed formally in later sections.

7) There might be a critical comment that $V_{C,1}$ is less anonymous than $V_{A,1}$, as supportive voters are the majority in voting C, and it is likely for an outside observer to guess that $V_{C,1}$ is supportive. However, this view is based on the concept of Aspect A. If we focus on Aspect B, it should be noticed that the vote of $V_{C,1}$ cannot be proved to be supportive unless $V_{C,10}$ is found to have casted a negative vote. (Even after confessions from all the other eight voters in voting C, $V_{C,1}$ still remains as uncertain as $V_{A,1}$ with regard to his or her vote.)

8) For example, if the order of calculation was different, as V_3(N), V_1(S), V_4(N), V_2(S), V_5(N), the adding process would be changed as -log(3/5) -log(2/4) -log(2/3) -log(1/2) -log(1/1), but the result remains the same as log(10).

9) Notice that addition of related self-information values always derives a logarithm of a combination number, which reflects the degree of difficulty of guessing the internal structure of any target system. Although this paper is especially interested in voting anonymity and introduced the BC metric in a voting context, the notion of addition of self-information values itself can be valid in other anonymity contexts, too.

10) The number of combinations of voting results for neutral members is

$$\sum_{i=0}^{n} {}_{n}C_{i} ,$$

and it is expected that each combination is an equally likely event in Endo et al. (2008). For this, the formulae (13) and (14) include combination notations. However, the definition of anonymity is basically entropy-based.

11) See section II of Edman et al. (2007) for details of the calculation of the permanent.

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Development of digital science museum based on visitors' memories

Keywords:
museum, digital museum, digital content, memory, archive

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Abstract

The five major functions of a museum are collection, preservation, exhibition, research, and education. Previously, museums concentrated primarily on collecting objects and exhibiting them effectively. Recently, however, the focus has shifted to what the visitor is doing in the museum, the so-called "museum experience." It has become clearer that a visitor not only learns in a museum, but has various individual experiences. In this study, we use Falk's theory of "making of meaning" in a museum to investigate museum experiences at the Nagoya City Science Museum. We develop a digital museum, the "Digital Time Capsule," which uses visitor recollections of their interaction with the museum.

1. Introduction

In recent years, museums have expanded their functions from not only exhibiting the "past," but to also researching the "present" through collaboration with the public. For example, "Workshop: Research of Sagami River History" at the Hiratsuka City Museum and "Field Reporter" at the Lake Biwa Museum undertook the unique approach of having the public research and report on the nature or culture of a local area with a curator. In addition, museums now address not only objects, but concepts such as social trends and emotions. For example, "YOU! The Experience" at the Museum of Science and Industry in Chicago, U.S.A., tries to describe human thinking and emotion by assembling visitor messages. These trials thus change the one-way relation of "exhibition - inspection" and produce a new relationship between the museum and visitor. This means that the museum is tapping various resources, such as local culture, nature, and people, as precious assets and the possibilities of the museum are therefore expanded.

Such endeavors have increased worldwide as museums investigate "the visitor's experience in the museum." That is, the museum is forced to consider what the visitor wants to experience rather than the museum wants to exhibit.

In this study, we focus on visitor museum experiences and develop a digital museum called the "Digital Time Capsule" using visitor recollections. Specifically, the "Digital Time Capsule" contains recollections about the Nagoya City Science Museum, which demolished and rebuilt its Science and Technology Building and Astronomy Building in September 2010.

This new undertaking addresses visitor recollections because many museum studies have not yet investigated the museum experience. However, it remains very important to focus on not only the exhibition, but also visitor experiences in order to get the whole picture of a museum.

2. Museum experience and memory

2.1 Value of memories

In recent years, the value of memories has been recognized and there has been a move to archive them. The "Memory of the World" and the "Memoro Project" are examples. The "Memory of the World," a project of the United Nations Educational, Scientific and Cultural Organization (UNESCO), began in 1997. Its goal is the protection and preservation of recorded inheritances, including social values that had an important influence on history, such as nature, incidents, places, and people. "The Diary of Anne Frank" is an example. The "Memoro Project" started in Italy in 2007. This project interviews people born before 1950, and collects and exhibits video clips on the Internet. The purpose of this project is to pass down to the younger generations information on customs, traditions, the meaning of life, etc., through experiences, dreams, and events.

Currently, a new approach has been developed that records memories of visitors to the museum. As an example, at the Mitsuo Aida Museum and the Museum Meijimura, comments or photographs of visitors are collected and made available to the public on the Internet. By doing this, visitors can appreciate art from new viewpoints through the comments of

other visitors or can appreciate exhibitions more deeply by empathizing with others' memories.

2.2 Museum experience based on context

John H. Falk, a specialist in museum studies, has analyzed the "making of meaning" in a museum and proposed the following three viewpoints:

1. "Personal context:" material related to personal interests, motivations, etc.
2. "Sociocultural context:" material related to culture, immediate environment, conversation, etc.
3. "Physical context:" material related to exhibitions, exhibit room space, atmosphere, etc.

In personal context, when visitors learn something, their understanding passes through the lens of their own knowledge, past experience, interests, etc. The "lens" or context varies with each individual. Therefore, the amount of information, depth of understanding, or strength of impression varies according to each personal context.

In the sociocultural context, a visitor is affected by family, friends, or the company with whom they visit. Therefore, such interaction has a large influence on the museum experience, e.g., conversation based on the person's background (hometown, family, pet, or school) or the person's role at the time (mother, student).

With physical context, a visitor is affected according to the physical context, such as the exhibitions, building, atmosphere, smell, or noise. The physical context plays a great role in how a visitor acts and what a visitor looks at or learns in the museum.

According to Falk, visitor experience is influenced not only by one context, but also by the interaction that changes continuously among the three contexts. That is, there are just as many experiences as there are visits.

In this way, a visitor's experience is not one-way, such as with "exhibition (museum) - inspection (visitor)," on which curators have previously focused. The visitor experience is a process that "personalizes" the museum based on the visitor's interests or impressions.

In this study, we develop a digital museum based on not only physical context, but also personal and sociocultural contexts. As a result, it is possible to express a complete image of the museum in virtual space.

3. Analysis of recollections in the "Digital Time Capsule"

In this study, we use Falk's theory of three contexts to thoroughly analyze the background factors of the visitors' experience at the Nagoya City Science Museum. Concretely speaking, we collected 303 museum recollections; each recollection was analyzed and seven keywords for the recollections were noted as follows:

〈personal context〉
learn: learning, exhibition, knowledge, etc.
enjoy: amusement, laughing, amazement, etc.
relax: peace, healing, encouragement, etc.
〈sociocultural context〉
love: love, family, friends, etc.
wish: wishes, dreams, hope, etc.

〈physical context〉
visit: visits, school trips, participation, etc.
create: staff, curators, volunteers, etc.

The following are examples of recollections classified based on these keywords.

〈personal context: learn〉
When I was in elementary school, I put my wallet into an exhibition about X-rays. I remember clearly that the form of a coin was visible, but my wallet was not. It was so amazing (age: 40s).
〈personal context: enjoy〉
Around 20 years ago, my mother brought me to the planetarium every summer vacation. It was a kind of rich, short trip for me because I lived in Gifu. Even now, I like the planetarium a lot (age: 20s).
〈personal context: relax〉
It was a little episode some 10 years ago. I looked at the starlit sky of the planetarium and was greatly heartened as I stood at the brink of my second cancer operation (age: 60s).
〈sociocultural context: love〉
At a planetarium, I could not recline my seat because I weighed so little as a kid. I remember that my dad held my seat back with his elbow so I could watch the program (age: 30s).
〈physical context: visit〉
When I went to the science museum as a child, I participated in a science class, and then I had lunch and an ice-cream soda for dessert at the underground restaurant. After that, I stayed at the museum and watched a program at the planetarium (age: 50s).

It is difficult to classify each recollection into one context because the museum experience is a fusion of the three contexts; many recollections relate to two or more keywords. Thus, we create a "Memory Map" based on the contexts.

4. Developing the "Digital Time Capsule"

4.1 Purpose and features of the "Digital Time Capsule"

In this study, we developed a virtual museum of the memory base called the "Digital Time Capsule" that is an archive of visitor recollections of the Nagoya City Science Museum related to the Science and Technology Building and the Astronomy Building, which were demolished in September 2010, and rebuilt and reopened in March 2011.

In Japan, there are few instances in which past exhibitions have been digitized and archived. As an example, in the National Museum of Nature and Science, which was renovated in 2004, the former main building and Midori-Kan building have been reproduced in detail at a virtual museum, where it is possible to have an immersive experience of the past museum through movies or QuickTime VR (Apple).

However, in a virtual museum, there are only digitized exhibitions and their related data. If the museum is to pass history down to the generations, it is desirable to archive not only the exhibitions, but also the visitors' experiences there. Thus, the "Digital Time Capsule" consists of the following four parts:

1. CGI (Computer-generated imagery) of the

past museum (SketchUp, QuickTime VR).
2. Data of the exhibitions.
3. “Memory Map” of visitor memories.
4. History of the museum.

Numbers 1 and 2 above reproduce the past science museum faithfully in virtual space. The most important purpose is to archive precious data and property, such as that at the National Museum of Nature and Science, in virtual space forever. In addition, the system assumes a large role as a tool to recall memories.

Number 3 above, the “Memory Map”, collects and displays visitor recollections. By classifying various memories into the seven keywords, these museum experiences can be seen comprehensively. The “Memory Map” is a core content of this system. We describe the details of this content in the next chapter.

Number 4 above digitizes books about the museum’s history, which were published every ten years, including pamphlets on special exhibitions and photographs.

Incidentally, when treating various data, copyright is a serious issue. In this system, when collecting messages from visitors, the visitors agree to publication in the “Digital Time Capsule” beforehand. Additionally, for photographs or data, we archive and open only the data presently in the possession of the Nagoya City Science Museum.

4.2 CGI of the past museum

In this study, we digitize the interior of the Nagoya City Science Museum in exact detail so users can enjoy some “time travel” using 1) SketchUp (Google) and 2) QuickTime VR (Apple) technologies.

The digitized places include all floors no longer in existence, such as the Science and Technology Building (from the 1st to the 7th floor) and the Astronomy Building (from the 1st to the 3rd floor, including the planetarium).

1) Development with SketchUp

SketchUp is 3D-modeling software from Google that provides good imagery and enables exact modeling with numerical inputs. In this study, to reproduce the past Nagoya City Science Museum faithfully, we constructed 3D CGI by entering numbers from a blueprint (Figure 1).

In addition, the exhibitions were created using tools, such as a line and a rectangle, and photographs of every exhibition. It thus became possible to reproduce more realistic 3D images through mapping (Figure 2).

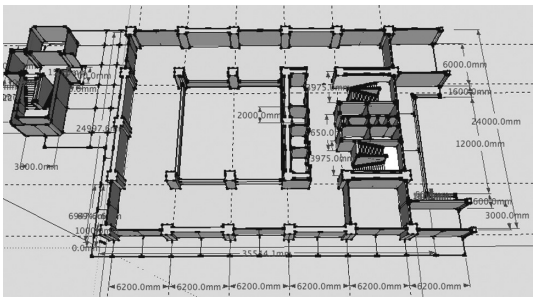

Figure 1 Exact modeling by numerical input

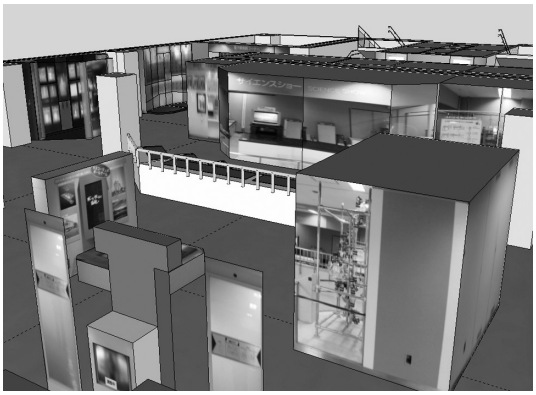

Figure 2 4th Floor Exhibitions

Figure 3 2nd floor (Astronomy Building)

2) Development with QuickTime VR

Because SketchUp creates a still picture or video clip ultimately, the user cannot freely see the inside of the virtual museum. Therefore, using QuickTime VR, it is possible to view 360 degrees using a mouse. Furthermore, it is possible to move from point to point and from room to room by setting up nodes (Figure 3).

The digitized work is important for expressing memories and is worthy as archive data of the past museum.

5. Development of the "Memory Map"

5.1 Collection of recollections

Recollections of the museum can be valuable. As noted in Chapter 2-1, in the Mitsuo Aida Museum or Museum Meijimura, the comments and photographs of visitors are archived and viewable on the Internet. However, they are simply listed in order on a time-axis. In this research, we classified recollections into seven keywords based on Falk's theory and devised the system so that the effects of "empathy" and "deep appreciation" might be acquired from others' recollections.

We primarily collected recollections from two classes of individuals: Astronomy club members and common visitors. Two types of collection methods, "message" and "video," were used. The sum total of the messages was 303. Table 1 presents the details.

The features of recollections are described below:

1) Astronomy club members

We collected messages from astronomy club members in November 2008 during a regular meeting. The questionnaire items were "Please describe your visit to the museum," "Please express your feelings about the museum," "Please tell us about your favorite place at the museum," etc. On the assumption that the astronomy club member likes the Nagoya City Science Museum, specific questions were given. Many empathetic recollections and profound messages were collected.

Table 1 Collection of recollections

subject	method	number of recollections	collection date
astronomy club member	message	119	Nov. 2008
visitor	message	144	Aug. 2010
visitor	video	30	Aug. 2010
staff, curator	video	10	Aug. 2010

Message (language)

Video (image)

Figure 4　Messages from visitors

2) Visitors

We collected messages from common visitors for two weeks in August 2010. Recollections were collected by two methods: message (language) and video (image) (Figure 4). For a message, the visitor answered the questionnaire on the spot. There were two questionnaire items: “Please describe your recollections of the museum” and “Please write a message to the museum.” On the video, the visitor freely spoke about favorite exhibitions or recollections of the museum over several minutes.

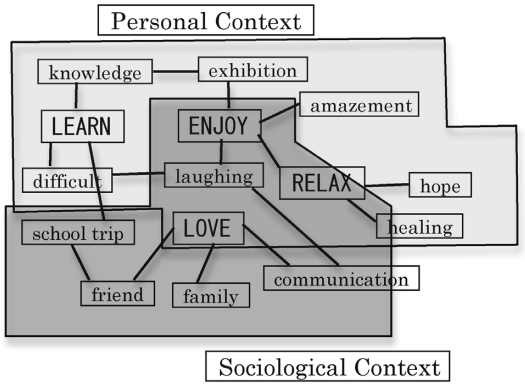

Figure 5　A draft of “Memory Map” excerpt

5.2 Classification of recollections

After investigation of the recollections, it became clear that most visitor recollections and experiences are not directly related to exhibitions, but are related to family or friends who visited together or on school trips. These recollections can be classified by the seven keywords presented earlier. A museum experience involves several contexts, as Falk points out. In the early stage of our research, we drew a picture of the relation between the recollection keywords (Figure 5). The picture indicates the complexity of museum experiences.

Nevertheless, the museum experiences were classified as well as possible, the results of which are shown in Figure 6. The recollec-

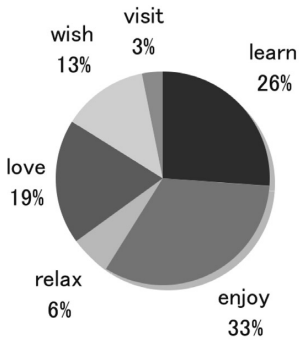

Figure 6　Results of museum experiences

tions can be broken down as follows: "learn" 26%, "enjoy" 33%, and "love" 19%.

5.3 Interface design

After the recollections are classified, content is displayed by FLASH animation software (Adobe).

The operation details are provided below (Figure 7):

1. On the top page, the seven keywords are listed along with illustrations.
2. When the illustration of a keyword is clicked, a screen appears with many icons representing the recollections.
3. When an icon is clicked, recollections are displayed.

Figure 7 "Memory Map"

As Figure 7 shows, the interface design is simply a 2D model, even though recollections consist of complex contexts. This is because this system must be designed as an exhibition. The following are part of the background of the interface design.

1. A visitor can view any screen or situation of the system.
2. With merely a glance, a visitor can determine the intention of the system.
3. When a visitor reads recollections, intelligible contents are displayed, with which the visitor can relate.

With the above background, the interface is very simple. However, as described in the following chapter, certain tasks remain. The museum of the past must continue to be comprehensively and effectively developed and displayed.

5.4 Management of recollections

Of necessity, the "Memory Map" does not show all visitor recollections, as very simple recollections such as "It was interesting" or "I would like to come again" are trivial. Thus, an administrator selects and prioritizes interesting recollections. When a recollection is marked, it is highlighted for attention.

To manage or classify recollections easily, a management system should be used. In this study, we use WordPress, one of the most popu-

Figure 8 View of WordPress

lar Content Management Systems (CMSs). Figure 8 shows a view of WordPress. The administrator can easily input recollections, keywords, images of an icon, or set a priority.

6. Evaluation of the "Digital Time Capsule"

Thirty people completed a questionnaire for the "Memory Map" that ranked interest, empathy, recall, archive, operability, etc. on a one-to-four scale: 4: emphatically yes, 3: yes, 2: no, and 1: emphatically no.

1) Interest

A high evaluation of 3.4 was obtained for the question "Is the "Memory Map" interesting?" Some people responded that it was interesting, brought back memories, etc.

2) Empathy, recall, archive

The questions on empathy, recall, and archive are listed below.

〈empathy〉
Did you empathize with the other visitors' recollections?
〈recall〉
Did you recall with the other visitors' recollections?
〈archive〉
Would you like to enter your own recollections or add a comment to the system?

The question on 〈empathy〉 received a score of 3.2, 〈recall〉 a score of 3.2, and 〈archive〉 a score of 3.3, all of which are high.

Moreover, our evaluation investigated the correlation between these three items. There is a clear correlation between empathy, recall, and archive. When a person empathizes strongly with the recollections, they tend to more easily recall their own experiences (r=0.656, p<0.01) and want to archive their own recollections (r=0.498, p<0.01).

However, there is no function in which visitors can enter new recollections freely in the "Digital Time Capsule" in real time because of the required management of the recollections. We now, therefore, propose an external means of recollection entry using Twitter, which is outside the system.

In recent years, many people have become familiar with social networking services (SNSs) such as Mixi or Facebook, so they are used to replying to the opinions of others freely. For example, in Facebook, if people agree positively with an opinion, they click the "like" icon. Therefore, in the next version of our system, we will introduce similar new features regarding empathy.

3) Operability

Operability received an evaluation score of only 2.8. Reasons given included difficulty knowing where to click.

Because the system is intended for the public as an exhibition, a range of users from children to the elderly must be accommodated and, thus, the system must be designed to be more intuitive and simpler to use.

7. Conclusion

In this study, the virtual museum "Digital Time Capsule" was developed based on visitor recollections. The "Digital Time Capsule" ar-

chives "time" literally. For the Nagoya City Science Museum, which spans a history of 40 years or more, the system must store everything. That is why we have begun to research the question, "What is a museum?" and to archive not only exhibitions and related data, but also visitor memories. In the "Digital Time Capsule," the former was archived with QuickTime VR and SketchUp, and the latter was archived by collecting museum experiences.

In our investigation, the "Memory Map" obtained a high evaluation, but more work is required. As empathy correlates with recall and archive, the system should better address this correlation.

Acknowledgements

We would like to thank all the people connected with the "Digital Time Capsule" project, especially the Nagoya City Science curators and staff.

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The Growth of Service Economy: The Impacts of Information Technology (IT) and Knowledge-Intensive Services (KIS) on Productivity in Japan's Service Sector

Keywords:
Knowledge-intensive services (KIS), information technology (IT), service economy, productivity

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Abstract

The service sector consists of 70-75% of the global economy in advanced countries. However, there are few empirical and statistical studies performed with regard to the service sector. As a result, productivity of service sectors has not been identified clearly in relation to the sectoral growth because the productivity of service sectors has not been improved for decades in Japan as well as major OECD countries. Based on major statistics and previous literatures, it is essential to realize the development of expertise knowledge, internally or externally, that aim to improve productivity in knowledge creation with the use of Information Technology (IT). In this regard, it is suggested that knowledge-intensive services (KIS) have a special role to play for facilitating knowledge creation in services. It is also pointed out that the role of smaller firms should be identified as they consist of a large part of the service sectors. In line with these trends, this research aims at identifying productivity for the selected service sectors with the appropriate use of KIS and IT. By incorporating business size dimension, empirical analyses successfully reveal that a balanced combination of IT and KIS inputs is related to revenue trends. In conclusion, it is important for future economic directions to take into account the balance of inputs into IT and services to support the growth of the entire economy and productivity growth through the development of smaller firms.

1. Introduction: Service Economy, Information Technology (IT), and Knowledge-intensive Services

Service[1] is a primary growth driver for the present world market as the tertiary sector of the economy. Starting from factor prices, intermediate inputs used in services, and idiosyncratic parameters of consumers (Fuchs 1965), the questions that are addressed recently are the role of supporting technologies and its relation to expertise knowledge used to create and deliver diversified services (Finnish Funding Agency for Technology and Innovation 2007, Miles 2005, 2008).

According to Eurostat, for instance, 43% of Science and Technology jobs in EU 27 countries are in the service sector (Eurostat 2007). Not only global services but also locally traded services are affected by systemic research and development (R&D) activities more than before (European Commission 2008, Wolfl 2005). To transform the service sector based on potential innovativeness of knowledge generated through service, it has been suggested that increasing connection and adoption of service-related technologies, such as IT services, should be pursued (Atkinson & Wial 2008, Council on Competitiveness 2004, Atkinson & Castro 2008, European Commission 2008). Furthermore, as we have witnessed in the financial crisis in 2008, the direction of future services has a huge impact on the course of the entire service sector to take for years ahead. To respond to these challenges, an essential question is how we deal scientifically with the creation of knowledge, its process to evolve into the innovation in services, and the contribution to the growth of productivity and total output in the economy.

In this regard, one area focused in recent years is consideration on knowledge-intensive services (KIS) in economic growth. In 2006, OECD has published a report on KIS (OECD 2006). According to the report, KIS are defined as 'the production or integration of service activities, undertaken by firms and public sectors in the context of manufacturing or services, in combination with manufactured outputs or as stand-alone service. KIS include information and communication services, R & D, management consulting, human resource management and recruiting, legal services (including intellectual property rights), accounting, financing, and marketing services.

It is observed that KIS play a role to strengthen knowledge production activities not only in services but also in manufacturing as they contribute to some types of technological and service innovation directly and form a link of technologies and knowledge beyond sectors (OECD 2006) by being consumed as intermediaries. Furthermore, KIS are considered as contributors for economic growth as one of the fastest growing sectors.

These observations have led this research to concern with the role of information and knowl-

[1] In this research, 'the service sector' refers to all non-manufacturing sectors as a tertiary sector of the economy in contrast to manufacturing sectors. Each sector in the service sector is mentioned as 'service sector(s).' Each service-related activity or service as a product is expressed as 'service(s).' A singular form of service may refer to a concept on service. If capitalized as 'Service', it refers to a specific sector defined by Tokyo Stock Exchange (please refer to the note section of Table 1).

edge as vital components for the analysis of productivity and output in service sectors.

2. Business Size and Productivity

Meanwhile, according to statistics in Japan (Figure 1), it is clarified that the Pareto distribution of revenue per employee and firm size shows different patterns in service sectors compared to manufacturing, leading to different structures for productivity and sectoral growth.

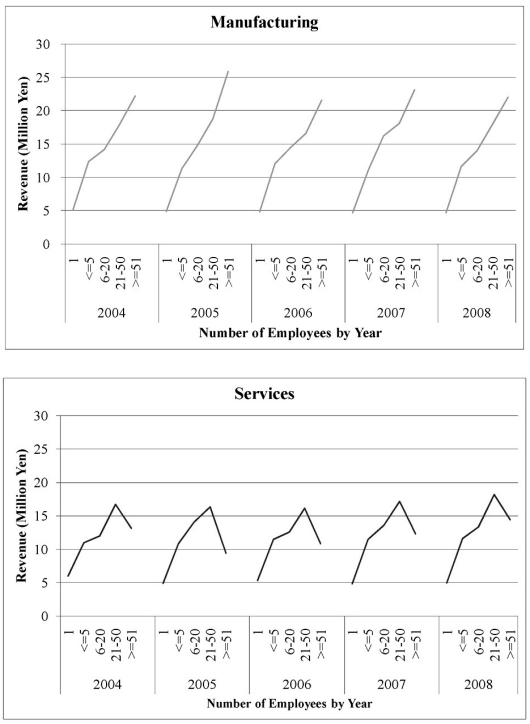

Figure 1 Revenue per employee in the manufacturing and service sector by firm size

Note: Y-axis refers to revenues in millions of Yen divided by the number of employees. X-axis shows data input for each year by firm size. Size classes are: 1, 2-5, 6-20, 21-50, and +51. Years covered are from 2004 to 2008. Industry classification is based on Japan Standard Industrial Classification. The top figure corresponds to Manufacturing (F). The figure at the bottom shows the aggregate of Information and telecommunication (H), Transportation (I), Wholesale and Retail (I), Real-estate (L), Restaurant and lodging (M), and Services (Q).

Source: Created by author based on Survey of SMEs Business Activity, The Small and Medium Enterprise Agency of Japan (2004-2008).

OECD (2008a, 2008b) also mentions that small to medium-sized enterprises (SMEs) are facing a structural change in the global economy, and the role of SMEs is becoming more important. From firm-level perspectives, firms are required to enhance the degree of expertise in the production and delivery of knowledge more to compete in the global market due to the increasing introduction and diffusion of IT. In recent years, in particular, even systemic R&D efforts in the field of services are intensified across small firms to generate new knowledge pertaining to service (European Commission 2008, Miles 2005, OECD 2006).

With these observations, this research articulates the needs for designing an analytical framework to measure the impact on economic growth and productivity focusing on business sizes. This research references to major panel data models, and modify to reflect the impact of knowledge creation activities such as R&D with the support of IT and KIS more precisely.

3. Growth models

3.1 Choice of models

Focal points of analysis in this research are the impact of firm size on productivity and output in service sectors considering the role of knowledge creation activities in accordance with the impacts of knowledge-intensive services (KIS) to play on productivity growth in relation to IT services. In this research, IT are considered to be major contributors for creating new markets, improving productivity, and de-

livering services. The role of KIS is also taken into account as they are supposed to promote knowledge creation activities and innovation. To examine these questions, empirical analyses are performed by using Japanese firm-level data.

For the purpose of measuring the impact of investment into IT and the use of intermediate inputs into KIS, this research refers to models presented by Olley and Pakes (1996) (hereinafter referred to as 'OP') incorporating the findings of Levinsohn and Petrin (2003) ('LP').

As Castellani (2011) says, measurement errors occur in OLS as OLS allows for correlation between inputs and productivity. Fixed effects models and instrumental variables are used to deal with this issue. However, a downward bias tends to be found in fixed effects models caused by within-group variations. Simultaneity bias has not been fully overcome either by fixed effects models, instrumental variables, or Generalized Method of Moments (GMM). In response to the situation, OP and LP have challenged to yield satisfactory results in the estimation of productivity.

Firstly, OP propose to use investment as a proxy for unobserved productivity to account for the endogeneity of inputs. This specific implication can be aligned with the role of investment into research and IT for firms in service sectors. This model has been used in many empirics studying manufacturing sectors. It seems not difficult to ascertain the robustness of the model when it is applied to service sectors appropriately. At the same time, this model is not sufficient to be concerned with the impact of service intermediate inputs such as KIS.

As previously mentioned, the relationship among productivity, firm size and investment into R&D must be studied in relation to investment into IT that may facilitate innovation in services, which is defined in OECD (1996) as a concept broadened more than that for manufacturing.

Firm's capacity for innovation has not been addressed often in a way which is able to show firm's competence to use external sources for expertise for generating innovation, and to introduce IT for supporting the uses of external expertise. Several reports published by EU say that system competent providers may have an important function in lowering the threshold for small firms in particular, and the first experience of using external KIS[2] can have far-reaching effects on the firm's future service use (EU Scientific and Technical Research Committee 2008, European Commission 2008, 2009). In this regard, LP's model is useful for measuring the impact of intermediates on productivity shocks in line with the extended concept of innovation in services.

Based on the discussion in this section, micro panel models are constructed by focusing on the role of investment and intermediate inputs to control productivity. The following models and equations are defined by cross-referencing OP, LP, and, supplementarily Ackerberg, et al. (2007).

3.2 Production functions

First of all, the Cobb-Douglas production

[2] There is an empirical analysis investigating the impact of KIS using French micro-data. Please refer to Lelarge (2009).

function is defined for a firm *j*:

$$Y_j = A_j^{\beta_a} K_j^{\beta_k} L_j^{\beta_l} \quad (1)$$

where output, Y_j, is a function of capital, K_j, and labor, L_j, with unobserved efficiency level, A_j. By taking the natural logarithmic of the equation, the following equation is derived:

$$y_{jt} = \beta_0 + \beta_k k_{jt} + \beta_a a_{jt} + \beta_l \ell_{jt} + \omega_{jt} + \eta_{jt}. \quad (2)$$

β_0 is defined as the mean efficiency level across firms. ω_{jt} represents a transmitted component as a state variable, or productivity, and η_{jt} is an i.i.d. component. Ackerberg, Benkard, Berry & Pakes (2007) add *age* in the equation above.

The choice of labor for firm *j* is described:

$$L_j = \left[\frac{p_j}{w_j} \beta_l e^{\beta_0 + \omega_j} K_j^{\beta_k} \right]^{\frac{1}{1-\beta_l}} \quad (3)$$

Based on OP, productivity, ω_{jt}, takes the following form with investment, i_t :

$$\omega_t = \omega_t(i_t, k_t) \quad (4)$$

Rewriting Equation (2) obtains the following:

$$y_t = \beta_l l_t + \phi_t(i_t, k_t) + \eta_t, \quad (5)$$

where

$$\phi_t(i_t, k_t) = \beta_0 + \beta_k k_t + \omega_t(i_t, k_t). \quad (6)$$

The first-stage estimator that is linear in l_t and non-parametric in ϕ_t is used to obtain a consistent estimate of β_l. A fourth-order polynomial in i_t and k_t is used to approximate $\phi(\square)$, estimating (5) using OLS, with output regressed on labor and the polynomial terms.

The productivity follows an exogenous first-order Markov process:

$$F(\omega_{jt+1} \mid \{\omega_{j\tau}\}_{\tau=0}^{t}, l_{jt}) = F(\omega_{jt+1} \mid \omega_{jt}) \quad (7)$$

with I_{jt}, the firm's information set at time *t*.

OP assume that productivity in the next period is expected based on current productivity level. In the second stage, the productivity is estimated:

$$\omega_{it} = E[\omega_{it} \mid I_{it-1}] + \xi_{it} = E[\omega_{it} \mid \omega_{it-1}] + \xi_{it} \quad (8)$$

The level of probability that the expected productivity in the next period is achieved is homogenous across time. Also, a fixed effect assumption is attached to the evolution of productivity over time. ξ_{it} is treated as unexpected innovation between time *t* and *t-1*, which is uncorrelated to k_t for that k_t is determined at time *t-1*.

Then, the relationship of output, investment, and capital can be described:

$$E[y_t \mid i_t, k_t] = \beta_l E[l_t \mid i_t, k_t] + \phi_t(i_t, k_t) \quad (9)$$

The capital accumulation for firm *j* is defined:

$$\begin{aligned} k_{jt} = {} & (1-\delta_T) k_{Tjt-1} + (1-\delta_I) k_{Ijt-1} \\ & + (1-\delta_{rd}) rd_{jt-1} + i_{jt-1}. \end{aligned} \quad (10)$$

Equation (10) have tangibles (k_{Tj}), intangibles (k_{Tj}), and R&D (rd_{jt-1}) with individual depreciation rates, δ_T, δ_I, and δ_{rd}, respectively, so that capital accumulation patterns in service sectors will be observed by the type of capital.[3]

In the second stage of OP's model β_k, and β_a are estimated nonparametrically after estimating the values of β_l and ω_{jt-1}.

[3] Based on Corrado, Hulten, and Sichel (2009), a depreciation rate is set at 20% for δ_{rd}. As for δ_T and δ_I, Nikkei data for tangible and intangible capital are after depreciation, for which depreciation rates are not specified in this paper.

The firm's profit at time t is to derive:

$$\pi(k_{jt}, a_{jt}, \omega_{jt}, \Delta_t) - c(i_{jt}, \Delta_t) \tag{11}$$

in which Δ_t represents the economic environment surrounding the firm (i.e. input prices, industry characteristics, and market structure) and $c(\square)$ captures the cost of investment function. According to Ackerberg et al. (2007), the factors describing Δ_t can change over time but should be constant across firms at a time. Please note that ℓ_{jt} is not included in this function, for which labor is a static choice of input in OP.

The firm's maximization problem is written as a Bellman equation within OP's specification:

$$V(k_{jt}, a_{jt}, \omega_{jt}, \Delta_t) = \max \begin{Bmatrix} \phi(k_{jt}, a_{jt}, \omega_{jt}, \Delta_t), \max_{i_{jt} \geq 0} \{k_{jt}, a_{jt}, \omega_{jt}, \Delta_t\} \\ -c(i_{jt}, \Delta_t) + \beta \mathrm{E}[V(k_{jt+1}, a_{jt+1}, \omega_{jt+1}, \Delta_{t+1}) \\ | \, k_{jt}, a_{jt}, \omega_{jt}, \Delta_t, i_{jt}] \end{Bmatrix} \tag{12}$$

with the given profit condition in $(\pi \cdot c)$, at a single point in time, and the sell-off value, ϕ, of production equipment or service delivery equipment.

The exit decision of the firm is expressed as the rule:

$$\chi_{jt} = \begin{cases} 1 & (continue) \quad if \ \omega_{jt} \geq \bar{\omega}(k_{jt}, a_{jt}, \square_t) = \bar{\omega}(k_{jt}, a_{jt}) \\ 0 & (exit) \qquad otherwise, \end{cases} \tag{13}$$

The investment demand function is:

$$i_{jt} = i(k_{jt}, a_{jt}, \omega_{jt}, \Delta_t) = i(k_{jt}, a_{jt}, \omega_{jt}) \tag{14}$$

In OP, the decision on exit is not counted in the first-stage estimation because of the assumption that ω_{jt} is controlled, which implies that endogenous input choice and exit are controlled. In the second stage, the exit decision is incorporated in the estimation process. The variables that represent entry and exit choices in a designated industry are incorporated to give the analysis more information on market-specific conditions, for example, competition levels and efficiency of the market as a business environment. Also, standard error which is produced in OP model are to represent market spillover effects. These treatments allow the analysis to become more suitable for each sector.

Assuming that kit and ait are known to observer at time *t-1*, and that η_{it} is not correlated with exit at time *t*. When the firm exits with information set at time *t-1*, we have:

$$\begin{aligned} & E[y_{jt} - \beta_l l_{jt} \mid I_{jt-1}, \chi_{jt} = 1] \\ & = E[\beta_0 + \beta_k k_{jt} + \beta_a a_{jt} + \omega_{jt} + \eta_{jt} \mid I_{jt-1}, \chi_{jt} = 1] \\ & = \beta_0 + \beta_k k_{jt} + \beta_a a_{jt} + E[\omega_{jt} \mid I_{jt-1}, \chi_{jt} = 1] \end{aligned} \tag{15}$$

In LP's model, the equation (2) is revised as:

$$y_t = \beta_0 + \beta_l l_t + \beta_k k_t + \beta_m m_t + \omega_t + \eta_t. \tag{16}$$

Productivity ω_{jt} is also rewritten by replacing investment for intermediate inputs (m_t) to observe productivity:

$$\phi_t(m_t, k_t) = \beta_0 + \beta_k k_t + \beta_m m_t + \omega_t(m_t, k_t). \tag{17}$$

y_t, is predicted given (m_t, k_t) by using weighted least squares. OLS is used with a polynomial approximation in LP in the same way as OP. In the first stage, β_l is estimated, but not β_k and β_m.

The equation (17) has the next form in the second stage:

$$y_t^* = \beta_0 + \beta_k k_t + \beta_l m_t + E[\omega_t \mid \omega_{t-1}] + \eta_t^*. \tag{18}$$

Given two moment conditions for k and m, $E[(\xi_t + \eta_t)k_{t-1}] = E[\xi_t k_{t-1}] = 0$ and $E[(\xi_t + \eta_t)m_{t-1}] = E[\xi_t m_{t-1}] = 0$, the residuals are estimated:

$$\xi_t \hat{+} \eta_t(\beta^*) = y_t - \hat{\beta}_l l_t - \hat{\beta}_m m_t - \hat{\beta}_k k_t - E[\omega_t \hat{|} \omega_{t-1}], \quad (19)$$

As with β_k or β_m, the moment condition can be also written:

$$E[\xi_{it}(\beta_k, \beta_m) | \begin{matrix} k_{it} \\ m_{it-1} \end{matrix}] = 0 \quad (20)$$

for that ξ_{it} is not correlated with m_{it-1}. Given other moment conditions expressed in $E[(\xi_t + \eta_t)Z_t]$ where $Z_t = \{k_t, m_{t-1}, l_{t-1}, k_{t-1}, m_{t-2}\}$, the following GMM equation is solved by minimizing:

$$Q(\beta^*) = \min_{\beta^*} \sum_{h=1}^{\infty} (\sum_i \sum_{t=T_{i0}}^{T_{i1}} (\xi_{it} \hat{+} \eta_{it}(\beta^*)) Z_{ihi})^2, \quad (21)$$

where h is the instruments in Z_t, and T_{i0} and T_{i1} are the first period and last period that firm i is observed.

4. Data and Estimation Procedure

4.1 Data

This research uses a 19-year panel of Japan's listed firms from 1991 to 2008 obtained from Nikkei Needs (www.nikkei.co.jp/needs). It is comprised of annual financial statements (Balance Sheet, Profit and Loss, and Cash Flow statements) of firms that are traded at least for one period during the that period. Firm code and Industry code are assigned to each track of data. Nikkei database allows the use of the investment and intermediates proxy to observe productivity. To examine service sectors in comparison with manufacturing, three sectors are selected: Electronics (Tokyo Stock Exchange Industry Code: 3650), Information & Telecommunication (5250), and Service (9050). The original data files were checked to detect inconsistencies in individual tracks and missing tracks due to administrative factors or for any reason except for firm's choice of exit or failures. This cleaning procedure reduced the total number of observations in the database to be 8,195. Its decomposition is shown in Table 1.

Sector	NS C1	NS C2	NS C3	NSC4	NSC5	Total
Electronics	2	8	57	643	3,068	3,778
Info & Telecom	3	9	192	467	608	1,279
Service	0	14	281	1,059	1,784	3,138
Total	5	31	530	2,169	5,460	8,195

Table 1 Number of observations by NSC

Note: National Size Class (NSC1-5) corresponds to 1-9 employees (NSC1), 10-19 (NSC2), 20-99 (NSC3), 100-499 (NSC4), and 500+ (NSC5), respectively. 'Service' sector in this Table is not equivalent of general perception of what 'Service' industry is as the tertiary sector of the economy. The 'Service' sector in Table 1 covers a narrower range of sectors in accordance with Tokyo Stock Exchange Industry Code.[4]
Source: Nikkei Needs Databases (Balance Sheet, Profit and Loss, and Cash Flow) (1991-2008)

Please refer to Table 2 and Table 3 for the description of variables, and descriptive statistics, respectively. The measure of KIS (*KIS*) is a total of sales fees expensed for promotion and marketing of products for the purpose of improving the delivery of products, and spending for acquiring knowledge such as purchased patent and design. This selection of variables for the measurement of KIS is based on OECD (2006).

[4] Please refer to http://www.tse.or.jp/sicc/category/ct_chart.html to find which sector is classified in Electronics (Tokyo Stock Exchange Industry Code: 3650), Information & Telecommunication (5250), and Service (9050).

Name*(Variable)*, Unit	Description
Revenue *(y)*, Millions	Net income after tax. Income refers to operating income (sales from merchandise, products, amount of completed work, sales income in industries such as transportation, storage, broadcasting, electricity, gas, entertainment, and sales revenue in industries such as trust, securities, and futures) and nonoperating income less costs, sales expenditures, administration overhead, and nonoperating expenditures.
Fixed assets total *(K)*, Millions	Total of current assets, fixed assets, and consolidated adjustment account
Capital expenditures *(inv)*, Millions	Capital investment
Employee *(empe)*, Person	Consolidated number of employees including those working as full-time, dispatched to the firm, exclusive of trade union, leave of absence, board members with multiple appointments, temporary, and dispatched to the other firm who incur human resource costs
Age *(age)*, Year	Number of years in operation. Any gap of operation is also identified.
Exit *(exit)*, Dummy (0 or 1)	Firms not surviving for the consecutive 19 years from 1991 through 2009
Tangible fixed assets (K_T), Millions	Total of tangible fixed assets, land, and allowance for funds used during construction
Intangible fixed assets (K_I), Millions	Total of goodwill, patent, industrial new design, software, consolidated adjustment account, and other intangible fixed assets
R&D *(rd)*, Millions	Research and development (R&D) expenditures including depreciation
Export and sales *(d)*, Millions profits	Income from exports, amount of work completed in overseas, and operation of hotels and technical assistance and transfer
Software *(soft)*, Millions	Amount paid for programs, system specifications, and related documentation such as flowcharts to run on computers
Sales fees *(KIS)*, Millions	Total of sales fees, promotion fees, and provision for accrued fees dealer, wholesaler, sales agents and designated sales agents
Marketing *(KIS)*, Millions	Expenditures paid for advertisement, marketing, promotion and expansion
Patent and design *(KIS)*, Millions	Payment for the use of patent and design

Table 2 Description of Variables

Source: Nikkei Needs Databases (Balance Sheet, Profit and Loss, and Cash Flow) (1991-2008)

Variable	Electronics	Info & Telecom	Service
Y	3,778	1,279	3,137
	1867	3,704	1,008
	11,899	38,894	5,034
K	3,778	1,266	3,076
	124,104	55,281	21,042
	363,810	253,084	34,555
inv	2,268	1,125	1,957
	6,938	7,651	1,922
	25,732	4,441	4,013
empe	3,778	1,279	3,137
	5,245	3,332	1,543
	14,149	21,311	2,902
age	3,778	1,279	3,137
	13	5	9
	4.14	1.682	4.668
exit	3,778	1,279	3,137
	0.03	0.1	0.1
	0.159	0.296	0.297
K_T	3,998	1,301	3,267
	30,597.55	132,062.50	18,545.59
	92,566.16	1,016,194.00	47,739.02
K_I	3,991	1,299	3,266
	2,074.67	18,087.47	2,011.56
	14,687.68	118,552.30	13,674.08
rd	2,218	559	626
	4,556.07	2,857.23	740.3
	25,635.77	17,931.94	2,200.25
d	1,650	765	832
	62,904.78	30,982.49	28,702.45
	98,430.08	84,540.32	72,507.35
soft	1,377	890	1,468
	2,088.15	11,137.87	1,640.64
	12,623.39	79,582.38	16,591.41
Sales fees, *KIS*	3,998	1,301	3,268
	25,271.68	120,013.60	9,917.71
	93,098.60	810,563.80	21,965.86
Marketing, *KIS*	648	226	276
	4,342.43	2,402.26	1,782.58
	12,571.23	7,146.85	3,635.59
Patent and design, *KIS*	432	24	24
	1,255.66	1,145.29	136.13
	4,843.55	2,082.46	264.429

Table 3 Descriptive statistics of variables

Note: The number of observations is shown in the first row. Mean is presented in the middle row. Standard deviation is expressed in the lowest row.

Source: Nikkei Needs Databases (Balance Sheet, Profit and Loss, and Cash Flow) (1991-2008)

4.2 Estimation Procedures

Estimation procedures are described below. The procedures are programmed using STATA (www.stata.com) to run estimators.

1. Use Firm ID (*i*) and Year (*t*) as panel and time-series variable, respectively, to declare dataset as panel.
2. Classify firms by size according to National Size Class (NSC), grouping into Size 1 to Size 5.
3. Transform data into logarithmic forms for dependent and independent variables. In this step, *age* and *exit* are also calculated. When a firm has a non-operating period, it is identified as has_gaps flagged with "1", or else "0". A record is removed as an outlier if it exceeds a threshold, or standard deviation multiplied by three. Check autocorrelations and partial autocorrelations for each variable, performing Portmanteau (Q) statistics test for white noise and Dickey-Fuller test for a unit root. In this step, a correlogram is produced by generating point-wise confidence intervals. A partial correlogram is also created with confidence intervals based on a standard error of 1/sqrt(n).
4. Find the growth of size for each firm as a difference of the number of empe each year. This may result in a negative growth. Generate a logarithmic form of the growth, and squared. Then, calculate S.D. for the growth. Find the growth of *Y* in the same way. Repeat the same process for other variables: *rd, KIS* and *soft*.
5. Run a linear regression of *Y* on the independent variables with a robust bias correlation by using a squared root of the residual over 1 minus the diagonal element of the projection. This estimation is performed using OLS with heteroscedasticity-consistent covariance matrix (HCCM).
6. Run statistics tests with regard to the estimation: Durbin-Watson Test for first-order serial correlation; Breusch-Pagan Cook-Weisberg test for heteroskedasticity; Ramsey regression specification-error test for omitted variables using powers of the fitted values of the dependent variable.
7. All regression models are tested by variance inflation factor (VIF) and residual plots, which graphs a residual versus fitted values. Check VIF to see if it does not exceed 10. If the regression fails to meet any of the test results, the model is considered to be insufficiently valid, and removed from further consideration.
8. Repeat the same regression, however, in this case, with checking autocorrelation (AR(1)) by residuals with Cochrane-Orcutt transformation with no constant. This process is to test the assumption that the errors follow a first-order autoregressive process, in which the errors are assumed to be correlated with the residual serially. The regression uses estimated value of rho in *t-1* so that the estimates are robust to heteroskedasticity. Variables are omitted programmatically if collinearity is observed.
9. In each estimation, results are stored and the estimates are used to compute the function to obtain the projection of *Y*.
10. Fit a cross-sectional time-series regression model of revenue on the independent variables. The first model is for fixed-effects and the second model is for random-effects. Variables are omitted if collinearity is detected. Perform Breusch and Pagan Lagrangian multiplier test for random effects as well as Hausman test to determine which model fits better.
11. Run a Arellano-Bover/Blundell-Bond linear

dynamic panel-data estimation[5] using lags one and two of independent variables as instruments, in which the second order of the autocorrelation (AR(2)) test is calculated, and the conventionally derived variance estimator is used for GMM estimation.

12. Repeat a Cochrane-Orcutt AR(1) regression for firms engaging in trade. Repeat the same process for firms engaging in R&D.
13. Run a linear regression on the independent variables, incorporating NSC as categorical dummies
14. Proceed to OP estimation, using K_T and K_I as state variables in the production function, empe, employee squared *(empe^2), soft, rd,* and *KIS* as control variables, *exit* as the status of firm's entry and exit, and *inv* as a proxy variable controlling productivity. State variables and the proxy are used in its second-degree polynomial expansion. *age, has_gaps* and *d* are used only in the second equation. Bootstrap is set random-number seed to 1 performing 20 bootstrap replications with 95% confidence level. Store the projection of *Y* and estimate productivity. The interaction of soft and KIS *(soft*KIS)* is included to check combinatory impacts. The squares of rd, soft and *KIS (rd^2, soft^2 and KIS^2,* respectively) are also included in the second estimation.
15. Run LP estimation of Y based on (10) and (11) with 0.01 (1%) confidence level, on *K, empe, empe^2, age, has_gaps, soft,* and *rd* by using *KIS* as a proxy of productivity.[6] Capital is not divided into tangibles and intangibles as LP estimation takes only one type of capital. The squares of *soft, rd,* and *KIS* are used instead in the second estimation.
16. List all estimates to report R2, log likelihood, chi-square, Akaike Information Criterion (AIC), and Bayesian information criterion (BIC).

5. Results of Micro Panel Analysis

The estimation results in Table 4 are based on OP methodology, show, first of all, Electronics sector benefits most by tangible capital (K_T) in the estimation titled OP-1 in the table. *rd* and *d* are significant and positive. Since the coefficient on *KIS* is the second largest to that on K_T, it causes the coefficient on *rd* becomes smaller than that of conventional views expect. *rd^2* is then significant and positive in OP-2, with a smaller coefficient. On the other hand, *KIS^2* is insignificant in this estimation. Therefore, it is indicated that the amount of inputs into *KIS* is more important than the rate of *KIS* growth. It is interesting that *soft* is insignificant in both cases.

As for Service, only K_T is significant. The significance of K_T in the current term does not eliminate the importance of K_I for sectoral growth. This result may indicate that the current service sectors are weak in the capacity to utilize intangible capital and other inputs as much as it yields a satisfactory balance of tangibles and other inputs. Therefore, the interpre-

[5] Please refer to Blundell and Bond (1998) for further information.
[6] Trade (*d*) is excluded from the estimation using LP after various experiments because the inclusion of trade will fail Wald test.

	Electronics		Service		Information & Telecommunication	
	(1)	(2)	(1)	(2)	(1)	(2)
VARIABLES	OP-1	OP-2	OP-1	OP-2	OP-1	OP-2
			Summary			
Kt	1.168***	0.984***	1.934***	1.896***	-0.221	-0.165
	(0.274)	(0.297)	(0.694)	(0.702)	(0.279)	(0.334)
Ki	0.130	0.121	0.155	0.234	0.0153	-0.0786
	(0.158)	(0.167)	(0.415)	(0.461)	(0.296)	(0.241)
age	0.0717	0.0781	-0.234	-0.246	-0.0185	-0.000491
	(0.169)	(0.183)	(0.309)	(0.306)	(0.181)	(0.163)
has_gaps	-0.320	-0.367	0.579	0.510	0	0
	(0.319)	(0.321)	(0.639)	(0.610)	(0)	(0)
empe	0	0	0	0	0	0
	(0)	(0)	(0)	(0)	(0)	(0)
empe^2	-0.190*	-0.168	0.299	0.289	0.238*	0.248**
	(0.112)	(0.116)	(0.222)	(0.227)	(0.137)	(0.114)
rd	0.127*		-0.140		-0.148	
	(0.0739)		(0.149)		(0.105)	
soft	0.415		0.107		0.675	
	(0.484)		(1.211)		(0.716)	
KIS	0.529**		0.445		1.068	
	(0.246)		(0.803)		(0.655)	
soft*KIS	-0.0489	-0.00907	-0.0314	0.0137	-0.0643	-0.136*
	(0.0516)	(0.0424)	(0.136)	(0.142)	(0.0945)	(0.0729)
rd^2		0.0147**		-0.0124		-0.0227
		(0.00668)		(0.0168)		(0.0139)
soft^2		0.00516		-0.0306		0.122**
		(0.0355)		(0.112)		(0.0596)
KIS^2		0.0128		0.0124		0.101***
		(0.0175)		(0.0601)		(0.0387)
d	0.423*	0.402	0.146	0.117	-0.154	-0.213
	(0.253)	(0.258)	(0.233)	(0.196)	(0.149)	(0.146)
Constant	1.180	1.180	1.303	1.303	-2.189	-2.189
	(4.236)	(4.236)	(1.653)	(1.653)	(8.533)	(8.533)

Table 4 Productivity with Olley and Pakes

Note: Coefficients in the first row. Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. The column labeled 'OP-1' includes rd, soft, and KIS as independent variables. In the columns labeled 'OP-2', rd, soft, and KIS are replaced with rd^2, soft^2, and KIS ^2, respectively.

tation of the estimation should be accompanied with the results obtained with LP's model to see if productivity is responsive also to other factors.

As for Information & Telecommunication, as is the case, *empe^2* is positive and significant. In addition, *soft^2* and *KIS^2* are positive and significant although *soft*KIS* is significant and negative. Adding the coefficients on *soft^2* and *KIS^2* gives an impact close to *empe^2*. This indicates that the speed of growth in both soft and *KIS* is important, and that they may also cause a negative effect if the total amount spent for these two inputs is too much and crowd out spending for the other factors.

The next estimation is based on LP's model (Table 5). The result for Electronics is generally consistent with OP's result. The result shows difference from OP's especially for Service, in which KIS is significant with downward biases on capital, labor, and R&D and upward biases on *has_gaps*. The discrepancy may be caused by an insufficient investment made by firms in Service, which may make intermediates more responsive. These biases are also seen in Information & Telecommunication.

The discrepancy may be also because the estimation is performed using full samples, dealing with firm's behavior regardless of size. To check this question, an estimation is performed with OLS including firm size dummies defined according to NSC to test the existence of business size differences throughout time. Accord-

	Electronics		Service		Information & Telecommunication	
	(1)	(2)	(1)	(2)	(1)	(2)
VARIABLES	LV-1	LV-2	LV-1	LV-2	LV-1	LV-2
K	1**	1***	0.462		0.0126	
	(0.417)	(0.379)	(0.360)		(0.0530)	
age	0.101	0.0913	-0.234	-0.221	-0.174	-0.189
	(0.138)	(0.149)	(0.175)	(0.178)	(0.180)	(0.170)
has_gaps	-0.0998	-0.128	0.921***	0.890***	-0.779*	-0.799*
	(0.317)	(0.337)	(0.272)	(0.310)	(0.472)	(0.410)
empe	0	0	0	0	0	0
	(0)	(0)	(0)	(0)	(0)	(0)
empe^2	-0.0406	-0.0328	0.0296	0.0361	0.0704*	0.0734
	(0.0553)	(0.0457)	(0.0783)	(0.0772)	(0.0415)	(0.0450)
rd	0.103**		0.0123		0.0684	
	(0.0471)		(0.0868)		(0.0612)	
soft	-0.0651		-0.101*		0.625**	
	(0.0424)		(0.0589)		(0.310)	
KIS	0		1**		-0.332	
	(0.432)		(0.404)		(0.223)	
rd^2		0.0128**		0.00283		9.83e-05
		(0.00558)		(0.00702)		(0.00758)
soft^2		-0.00641		-0.00817		0.00572
		(0.00435)		(0.00607)		(0.00586)
KIS^2		0				0.140
		(0.0989)				(0.0851)
Exit	0.000368	-0.0292	-0.0124	-0.00943	0.469	1**
	(0.206)	(0.203)	(0.194)	(0.216)	(0.287)	(0.393)
Observations	652	652	196	196	180	180

Table 5 Productivity with Levinsohn and Petrin

Note: Coefficients in the first row. Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. The column labeled 'LV-1' include *K, age, has_gaps, empe, empe^2, rd, soft, KIS,* and exit as independent variables. In the columns labeled 'LV-2', *rd, soft,* and *KIS* are replaced with *rd^2, soft^2,* and *KIS^2,* respectively. The other blank cells are because the variable is removed due to collinearity.

ing to the result in Table 6, the coefficients on size dummies are negative in Service and Information & Telecommunication. This shows that the proportional size effect on output and/or productivity growth is not always true in non-manufacturing sectors. Combining this result with those of OP and LP, it shows importance to decompose firms by business size to capture growth trends of firms in the service sectors.

6. Summary

The relationship of input choices and productivity with firm size variations in services are examined using the firm-level data. In this research, specific functional forms and assumptions are introduced so that the analyses are aligned with service sectors. This research has focused on the role of knowledge creation activities, i.e. R&D, the use of IT, and the impacts of intermediates, such as KIS.

The empirical evidences suggest that the use of IT and KIS certainly affects output and productivity although the scale of impact varies across sectors and firm sizes. In some sectors, the combination of software and KIS works well for the output growth.

According to OECD (2005, 2009), the number of SMEs in Japan's service sectors is decreasing while SMEs are increasing in other major OECD countries. This is a unique characteristic pertaining to Japan. It is important to be reminded of this fact when we discuss service sectors from the viewpoint of firm sizes. The decreasing SMEs means that Japan is not being able to utilize the positive effect of the shifts of productivity distributions, where smaller firms can achieve higher productivity.

One of the contributions of this research is to have incorporated service R&D, software and KIS, as well as their combinatory impacts, into analysis. By doing so, the estimations successfully suggest a reason for the heterogeneity in productivity by firm size, and the factors for the current trend of output in service sectors.

VARIABLES	Electronics	Service	Information & Telecommunication
Kt	0.451***	0.214***	0.252***
	(0.0385)	(0.0165)	(0.0206)
Ki	0.0993***	0.144***	0.127***
	(0.0147)	(0.0152)	(0.0215)
age	-0.246***	-0.193***	-0.00209
	(0.0541)	(0.0391)	(0.0857)
empe			
empe^2	0.161***	0.236***	0.323***
	(0.0188)	(0.0185)	(0.0298)
_NSC 1			
_NSC 2	0		0.463
	(0)		(0.315)
_NSC 3	-0.134	-0.440	-1.059***
	(1.371)	(0.282)	(0.176)
_NSC 4	-1.062	-0.915***	-1.798***
	(1.330)	(0.284)	(0.222)
_NSC 5	-1.213	-1.329***	-2.293***
	(1.332)	(0.309)	(0.293)
Constant	1.673	0.571**	1.801***
	(1.350)	(0.279)	(0.129)
Observations	2765	2449	971
R-squared	0.461	0.357	0.611

Table 6 Growth by business size

Note: Coefficients in the first row. Robust standard errors in parentheses. *** $p<0.01$, ** $p<0.05$, * $p<0.1$. Observations are clustered by size denoted in NSC, and all equations include the grouping as dummy variables from NSC1 to NSC5. Missing results except for NSC dummies are because of omitted variables due to collinearity. As for NSC1 and NSC2 dummies, most sectors do not have sufficient numbers of observations in the datasets. Therefore, the lack of estimations are not due to collinearity issue but the lack of observation.

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Discovery and Analysis of Web Pages Censored by Google Search Engine in Japan

Keywords:
Search Engine, Censorship, World Wide Web

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Abstract

Google is a popular search engine but censors search engine results. This paper produces a system of discovering semi-automatically web pages that are removed from search results by Google censorship in Japan. This paper also analyzes removed web pages that are discovered by the system. The aim of this analysis is to find the tendency of the censorship. The method of discovering web pages that are removed from search results by Japanese Google censorship uses the difference between Google search engine results in America and in Japan. The experiment in this paper discovers 169 web pages that are removed by Japanese Google censorship in 2008 and 187 web pages in 2011.

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1. Introduction

The Internet has become indispensable in daily life. The Internet provides enormous information. Many people use search engines to efficiently obtain information from the Internet. Search engines are indispensable to information collection. Google is the most popular search engine. One of the reasons of this popularity is that the search results provide information that we want.

PageRank is one of the key technologies of Google search engine (Page 2001). PageRank is an algorithm that measures importance of web pages. The idea of PageRank is "A good web page is linked from many good web pages"; this idea assigns importance degree to each web page. The importance degree decides the order of listing search results; the more important a web page is, the nearer to the top of search result lists it appears.

Google (Google 2000) declares that Google's complex automated methods make human tampering with our search results extremely difficult; almost all people think that the search results of Google are determined based on objective measures. However, the search engine artificially manipulates several search results (Yoshimoto 2006) (Finkelstein 2003). For example, some corporations or parties in Japan complain to Google about search results containing web pages that have inconvenient information for the corporations or parties. Because of these complaints, Google censors search engine results so that some web pages that should be displayed in search results are not displayed. It removes from search results the web pages that are related with libel, crime, child pornography or accusation. It also removes the web pages where search engine optimization (SEO) (Google 2012) is applied too much. It is reasonable to remove these web pages, but there is no guarantee that the search engine always removes web pages that should be removed because of libel, crime, child pornography, accusation or search engine optimization. Moreover, it can artificially remove or modify search results for itself. Because only objective measures such as PageRank do not decide the search engine results, search engine users should know tendencies of the search engine results. For example, if Google removes from search results web pages of accusation against a certain corporation, Google users may lose a chance to obtain useful information about the corporation. Because we have to use search engines to obtain information from the Internet today, search engine censorship is an important problem. In Japan, "Information Grand Voyage Project", which is carried out by Ministry of Economy, Trade and Industry, deals with search engine censorship. Clayton et al. (Clayton 2006) researched Internet censorship, but we find few researches of search engine censorship. It is important to discover web pages that are removed from search results by search engine censorship because of the following reasons.

- The Internet is one of the major information media and has the same influence as regular mass media. Search engines have important roles in the Internet. Thus, tendencies of search engine results should be monitored.
- Search engines should not manipulate information on search results because this manipulation is the same as information manipula-

tion of mass media.

- Although everyone should have an ability to transmit information on the Internet, search engine censorship robs us of this ability.
- Censorship of the web pages that accuse bad or illegal things of corporations or parties prevents us from knowing the accusations.

This paper focuses on the web pages that are removed from search results by Google search engine censorship because it is the most popular search engine and because its censorship is known very well (Finkelstein 2003).

Google censorship can be divided into two types: a worldwide Google censorship and country-by-country Google censorship. The worldwide censorship is that censored web pages do not appear on any search result of the search engine all over the world; web pages on worldwide censorship do not appear on the search results of http://www.google.com, http://www.google.co.jp or so on. The country-by-country censorship is that censored web pages do not appear on search results of a certain country Google search engine but on those of other country Google search engines; the web pages that are removed from search results by Japanese Google censorship do not appear on search results of http://www.google.co.jp, but on search results of American Google site or so on.

Illegal web pages or web pages modified by SEO are removed from the search results of Google search engine sites all over the world. On the contrary, web pages of country-by-country Google censorship are not illegal or modified by SEO. The authors of this paper find web pages that are removed from search results by Japanese Google censorship and that are related with accusation against corporations. Thus, one of the reasons why web pages are removed by the country-by-country censorship is that the web pages are related with accusation against corporations or groups, which ask Google to remove the web pages from search results. It follows that discovering the web pages that are removed by the country-by-country censorship is discovering accusation web pages, which may have important information. This paper proposes the method of discovering web pages that are removed from search results by Japanese Google censorship. In the experiment in this paper, this method obtains 169 web pages in 2008 and 187 web pages in 2011, which are removed from search results by Japanese Google censorship. This paper also analyzes them and finds tendencies of censorship.

This paper focuses on search engine censorship, which is one of information manipulations. Several researches are related with censorship on the Internet. Kreimer discusses censorship of T.V., press, the Internet or so on from the viewpoint of law (Kreimer 2006). Kreimer tells that Internet service providers tend to censor web pages that may be illegal. Ding et al. propose a method of avoiding the Internet censorship (2011 Ding). Greengard reports that countries use Internet censorship to dominate the political dialogue and to create favorable conditions for government-controlled businesses (Greengard 2010). It is well known that China censors the Internet. Clayton surveys the Internet Firewall of China (Clayton 2006). Crandall et al. also research Internet censorship (Crandall 2007). Internet censorship has been

researched and many of the researches are related with Chinese Internet censorship, but there are few researches that are related with Internet search engine censorship. Many papers such as (Tashiro 2007) and (Yoshida 2007) have researched Internet search engines, but not focused on Internet search engine censorship.

2. Background

2.1 Google censorship

Google censorship is Google Corporation's removal or lack of inclusion of information from its services in order to comply with local laws or with the company's policies. Google censorship is divided into worldwide censorship and country-by-country censorship (Yoshimoto 2006).

(1) Worldwide Google censorship

The worldwide Google censorship is that some web pages are removed by censorship from search results of Google all over the world. All the search engines in the world censor illegal web pages and web pages modified by SEO. Because Google is an American corporation, all the search engines in the world remove, from search results, web pages that violate American laws and web pages that are removed by American Google censorship.

(2)Country-by-country Google censorship

Besides the worldwide censorship, Google censors web pages in each country. Country-by-country Google censorship is that some web pages are removed by censorship from search results of a country Google search engine but not from those of other country Google search engines. For example, Chinese Google search engine result for the keyword "Tiananmen Square Incident" (天安門事件) is different from American or Japanese Google search engine results for the same keyword. This difference originates from Chinese Google censorship of some web pages that are related with Tiananmen Square Incident. On the other hand, American and Japanese search engines do not remove these web pages from search results.

2.2 Classification of removed web pages

According to the president of Google Japan (Murakami 2006), Google Corporation removes the following web pages from search results.

- Web pages violating the guideline of Google Corporation
- Web pages modified by SEO
- Web pages related with child pornography, drug or libel
- Web pages that individuals or corporations complain that infringe their rights

However, all web pages that belong to the above categories are not always removed from search results. There are several reasons; one reason is a technical problem. It is difficult or heavy labor to choose automatically the web pages that belong to the above categories. Another reason is that it is sometimes difficult to determine whether web pages belong to the above categories; determining whether web pages belong to the above categories depends on people.

2.3 Google censorship notice

When Google removes some web pages from search results, it shows censorship notice message on search results. Figure 1 is Google censorship notice message on search results of the

keyword “悪徳商法” (unethical business practice). This message tells that some web pages are removed from search results by Google censorship. However, this message does not tell what web pages are removed by Google censorship. This notice message tells that “ChillingEffect.org” site shows the reason of this censorship, but this site does not provide any information about the censorship of search results of the keyword “悪徳商法” (unethical business practice). This site sometimes gives information for removed web pages, but does not always information for removed web pages.

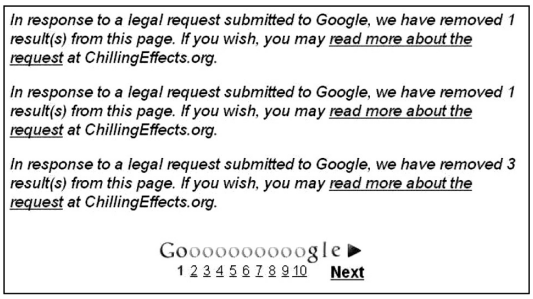

Figure 1 Google censorship notice

3. Method of discovering removed web pages

This paper focuses on Japanese Google censorship, but not on worldwide Google censorship. As described in the previous sections, web pages that are removed from search results by Japanese Google censorship appear on the search results of other country Google search engines. This fact enables discovery of web pages that are removed by Japanese Google censorship; comparison between search results of Japanese Google search engine and another country Google search engine can find web pages that are removed from search results by Japanese Google censorship. However, the web pages that do not appear on search results of Japanese Google but on those of American Google are not always the web pages that are removed by Japanese Google censorship. Thus, the method of this paper uses Google “info” option to determine whether the web pages are removed by Japanese Google censorship. The result of “info option” shows whether the web pages are removed by Google censorship.

3.1 Outline of discovery method

The outline of the discovery method is as follows.

- Obtaining search results by some keywords in American and Japanese Google search engines
- Determining whether some web pages exist on search results of American Google but not on those of Japanese Google
- Regarding such web pages as candidates of web pages that are removed by Japanese Google censorship if such web pages exist
- Using the search option “info” in Japanese Google search engine to determine whether the candidates of removed web pages are really removed by Japanese Google censorship

Using “info” option requires searching “info: web page URL” by Google. Figure 2 shows the search result of “info:web page URL”. This message tells that “web page URL” is removed from search results by censorship. If a web page is removed from search results by censorship, searching “info: the web page URL” obtains a message like Figure 2.

Web pages that appear on search results of American Google but not on that of Japanese Google become the candidates of web pages that are removed from search results by Japa-

nese Google censorship. However, these web pages are not always web pages that are removed by Japanese Google censorship because American and Japanese Google search engines do not always provide the same search results of the same keywords. If search results include similar web pages, they select and show only one web page among the similar web pages. The way of selecting one web page among similar web pages is different between American and Japanese Google search engines. Determining the web pages that are removed by censorship requires confirmation of the removed web pages by using the option "info".

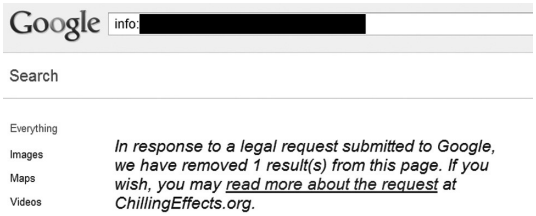

Figure 2 "info" option message

3.2 Method of discovering censored web pages

The method in section 3.1 discovers web pages that are removed by Japanese Google censorship. However, this method requires several keywords for the search engine. To save the labor of selecting and inputting keywords for the search engine, we produce a system for the discovery method. This system selects several keywords from a keyword list file, looks up the selected keywords in American and Japanese Google search engines, compares the search results of these search engines, checks whether some web pages appear on the search result of American Google but not on that of Japanese Google and confirms, by "info" option, that the candidates of removed web pages are really removed by Japanese Google censorship.

The system repeats this procedure to find web pages that are removed by Google censorship. However, this system requires many keywords. The system of this paper obtains keywords from removed web pages that are discovered by this system. Thus, all we have to do is to input several keywords to the system before the system starts. The system obtains keywords automatically every time it discovers web pages that are removed by Google censorship. To automatically obtain Japanese keywords from the web pages that are removed from search results by Google censorship, the system uses ChaSen, which is a morphological analysis tool for Japanese (NAIST 2003).

It is possible to produce an automatic program of the discovery method, but Google terms of service prohibit using automatically Google by software or so on. In the proposed system of discovering web pages that are removed by censorship, the search engine is used manually. This paper defines searcher as people that use the search engine in the discovery method. Figure 3 shows the system behavior. The system consists of web server, ChaSen and the produced program. The program selects keywords from the keyword list file and produces web pages to search web pages that are removed by censorship. The produced web pages contain CGI links, which the searcher manually clicks to use the search engine. The program sends the searcher e-mail that contains URL of the produced web pages.

We provide an initial keyword list file to the system, which repeats the procedure in Figure

3. New keywords are obtained from removed web pages that are discovered by the system. The system adds the new keywords to the keyword list file. However, this system obtains many keywords from the removed web pages. Some of them are usual words and not related with web pages that are removed by censorship. These words are useless and sometimes become obstacles to find removed web pages. Efficient discovery of removed web pages requires filtration of words. This paper uses the following conditions to obtain keywords from web pages that are removed by Google censorship.

- Obtained keywords should be nouns.
- Each obtained keyword appears on a censored web page less than or equal to ten times.

The reason for the first condition is as follows; in Japanese, it is difficult to obtain words from sentences because Japanese words are not separated by space in sentences and because Japanese has many verb forms and particles. ChaSen, which is used as a morphological analysis tool in this paper, does not always generate good morphological analysis results for web pages. In Japanese, to obtain nouns is easier than to obtain other parts of sentence. Thus, the discovery system uses nouns as keywords. The reason for the second condition is as follows; words that often appear on removed web pages are words that are often used in many web pages. Thus, these words do not characterize web pages that are removed by Google censorship.

4. Experiment

4.1 Environment

This experiment uses three PCs. Each PC has a keyword list file independently, but the same keyword list file at the beginning of the experiment. Each PC also has a different IP address and sends e-mail, which includes a web page URL to search removed web pages, to searchers two times per one hour because fre-

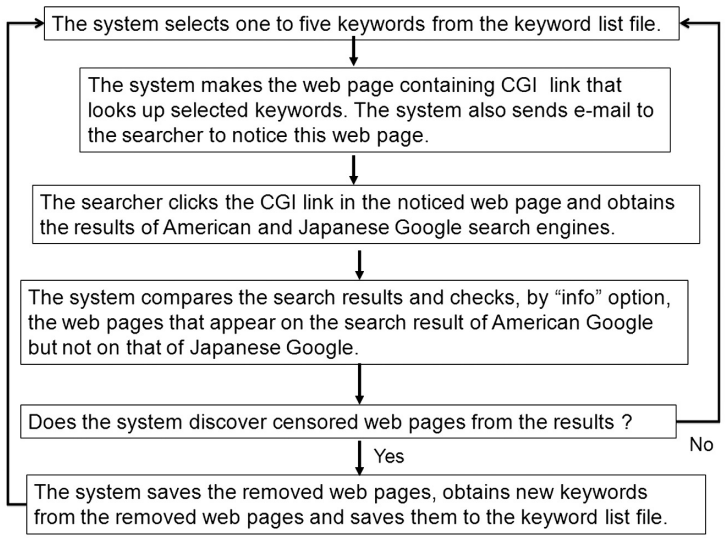

Figure 3 System behavior

Table 1 Numbers of web pages (2008)

BBS	85 pages
Wiki	19 pages
Blog	23 pages
Minor news sites	6 pages
Specific purposes	36 pages

Table 2 Numbers of web pages (2011)

BBS	93 pages
Wiki	20 pages
Blog	24 pages
Minor news sites	8 pages
Specific purposes	42 pages

quent accesses to the search engine in a short duration from one IP address are possibly DoS attack (Denial of Service attack). From each PC, the searchers receive e-mail and click CGI link in the web page in the e-mail.

4.2 Results

This paper performs this experiment two times; one is in 14 weeks from October 14th 2007 to January 19th 2008 and the other is in 14 weeks from July 10th 2011 to October 15th 2011. In both experiments, the total number of searching is 14,112. Both experiments use the same initial keyword list, which contains two words that are related with unethical business practice, six words that are related with religion and fifty words that are related with politician name. Before producing the method of discovering web pages that are removed from search results by censorship, the authors of this paper surveyed web pages that are removed by Japanese Google censorship. This survey found several web pages that are removed by Japanese Google censorship. These removed web pages are related with unethical business practice, religion and political things. Thus, words that are related with them are used as initial keywords in this experiment.

The experiment in 2008 obtains 169 web pages that are removed from search results by Japanese Google censorship and that in 2011 obtains 187 web pages. The removed web pages that are discovered in 2008 and in 2011 are not related with SEO or child pornography.

4.3 Tendencies of Google censorship

This paper classifies and analyzes the web pages that are discovered in the experiment. Examining the web pages that are discovered in the experiment suggests the following classification.

- Web based bulletin board system

  In Japan, “2-channel” is the most famous and the largest web based bulletin board system (BBS). The participants of BBSes can anonymously post documents to BBSes. Posted documents appear in chronological order or reference order. BBSes enable everyone to post any kinds of documents anonymously. Some of the documents posted to BBSes are related with accusation, corporation, unethical business practice, sexual crime, drug, copyright infringement, politician or religion. Some of web pages including these documents are removed from search results by Google censorship; especially, the result of the experiment shows that many of them are related with invasion of privacy or libel.
- Web pages to share information on specific things (Wiki)

  One of these web pages is Wikipedia (Wikipedia 2011), which is a free web-based encyclopedia. Everyone can post documents to

such web pages to increase information of the web pages.

Like BBS, everyone can anonymously post any documents to this kind of web pages. Some of documents have inappropriate information; especially, the result of this experiment shows that some of them are related with corporation and trial.

- Blog (Weblog)

  Blog web pages are like a diary web page that is written by individuals or groups. Some of Blog web pages are related with accusation, crime, religion, corporation and trial.

- Minor news sites

  Minor news sites are the sites of local newspapers in Japan or information magazines. These web pages are related with corporation, scandal, politician and crime.

- Web pages for specific purposes

  Each of these web pages has a specific purpose. For example, some of web pages are written for accusation against unethical business practice. Clearly, these web pages are related with unethical business practice, trial, religion, accusation or malpractice.

Table 1 shows the numbers of web pages in 2008 and Table 2 shows those in 2011. Table 3 shows the numbers of each kind of web pages for each kind of censorship causes and Table 4 shows those in 2011. Table 5 shows the numbers of each kind of web pages for the number of causes and Table 6 shows those in 2011.

Notice that the way of counting causes is different between Table 3 and Table 5. Similarly, it is different between Table 4 and Table 6. For example, in Table 3 and Table 4, a BBS web page that has accusation against corporation and invasion of privacy is deemed to have two kinds of censorship causes; “Accusation against corporation” is one kind of cause and “Invasion of privacy” is the other kind of cause. In Table 3 and Table 4, which are intended to show the numbers of kinds of censorship causes, even if a web page has two accusations against different corporations, it is deemed to have one kind of censorship cause.

On the other hand, Table 5 and Table 6 are intended to show the numbers of web pages according to the number of censorship causes. In Table 5 and Table 6, if a web page has two accusations against different corporations, the web page is deemed to have two causes. These two tables also show that the kind of web pages correlate with the numbers of censorship causes.

Table 3 and Table 4 show that some web pages have more than one kind of censorship cause. Thus, the total number of web pages in Table 3 is more than that in Table 1. In Table 3～6, the web pages with the mark “✱” represent that the cause of censorship of them cannot be found; this paper can also find no kind of causes that do not belong to the six categories from the result of the experiment.

4.4 System run time and the number of discovered web pages

Figure 3 and Figure 5 show the number of discoveries of removed web pages over system run time in 2008 and in 2011. Figure 4 and Figure 6 show the number of discoveries of removed web pages with allowing duplication over system run time in 2008 and in 2011. The two kinds of graphs show that the number of discoveries decreases with time progress.

Table 3 Number of each kind of web pages for each kind of causes (2008)

classifications / kinds of causes	BBS	Wiki	Blog	Minor news site	Web pages for specific purposes	Total
Accusation against corporation	52	22	16	7	40	137
Invasion of privacy	55	0	12	4	3	74
Libel	60	0	9	0	4	73
Crime	44	0	13	3	5	65
Religion	5	14	6	2	18	45
Trial	0	14	7	2	17	40
Nothing	2 ★	0	0	0	0	2

Table 4 Number of each kind of web pages for each kind of causes (2011)

classifications / kinds of causes	BBS	Wiki	Blog	Minor news site	Web pages for specific purposes	Total
Accusation against corporation	58	23	17	8	44	150
Invasion of privacy	59	0	12	6	4	81
Libel	64	0	9	0	5	78
Crime	46	0	13	3	6	68
Religion	6	14	6	2	19	47
Trial	0	14	7	2	20	43
Nothing	2 ★	0	0	0	0	2

Table 5 Number of each kind of web pages for the number of causes (2008)

classifications / causes	BBS	Wiki	Blog	Minor news site	Web pages for specific purpose
Over 4	41	0	11	4	4
2〜4	21	0	2	2	6
1	21	19	10	0	26
0	2 ★	0	0	0	0
Total	85	19	23	6	36

Table 6 Number of each kind of web pages for the number of causes (2011)

classifications / causes	BBS	Wiki	Blog	Minor news site	Web pages for specific purpose
Over 4	41	0	11	4	4
2〜4	24	0	2	2	8
1	26	20	11	2	30
0	2 ★	0	0	0	0
Total	93	20	24	8	42

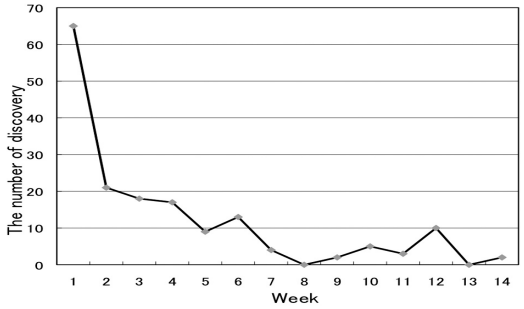

Figure 4 Number of discoveries (2008)

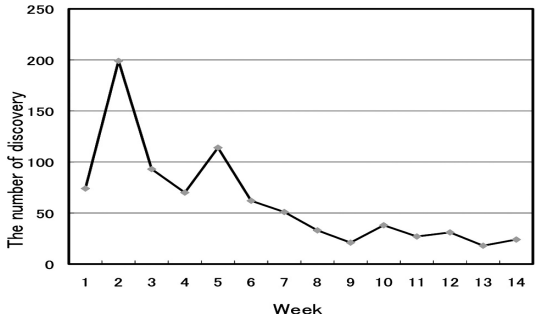

Figure 5 Number of discoveries allowing duplication (2008)

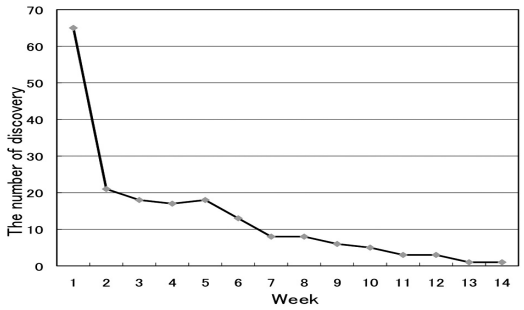

Figure 6 Number of discoveries (2011)

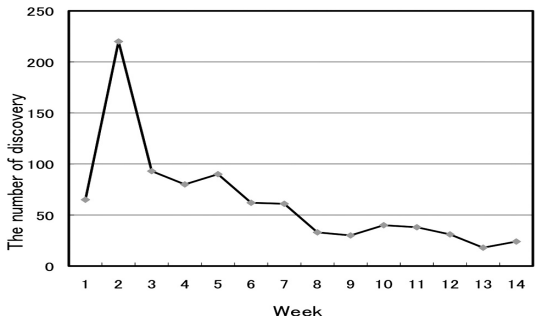

Figure 7 Number of discoveries allowing duplication (2011)

5. Discussion

5.1 Target of Google censorship

Table 1 and Table 2 show that about half of web pages that are removed by censorship are BBS web pages. Table 3 and Table 4 show that many removed BBS web pages are related with “accusation against corporation”, “invasion of privacy”, “libel” and “crime”. The reason of this tendency is that everyone can post many kinds of documents to BBSes anonymously.

Table 3 and Table 4 show that removed web pages such as wikipedia are related with “accusation against corporation”, “religion” and “trial”. These tables also show that many of blog web pages and minor news sites deal with corporations or crimes. The cause that these web pages are removed from search results is that they contain the names that are related with accusations or crimes.

Table 5 and Table 6 show tendencies of the number of censorship causes; BBS web pages, blog and minor news sites have many causes. On the other hand, wikipedia and web pages for specific purposes do not. In BBSes, many people post documents for one theme. For example, many people post to BBSes many documents about unethical business practice; a BBS web page contains many documents that describe many cases of unethical business practice. If the web page is removed by censorship, it is difficult to find the cause of the removal among many documents in the web page. However it is possible to recognize unethical business practice as causes of the removal.

Each web page of blog and minor news sites contains many documents of corporation scan-

dals or crimes. It is difficult to find the cause of the removal among many documents because of the same reason as BBS. On the other hand, it is easy to decide the cause of censorship for removed wikipedia web pages because each of them deals with one topic.

5.2 Web pages discovered newly by this experiment

The authors of this paper know several web pages that are removed by Japanese Google censorship before the experiment of this paper. These web pages are related with unethical business practice or accusation against corporation. The experiment in this paper newly discovers web pages that are removed from search results by censorship. Some of these pages are related with malpractice and some of them minor news sites.

5.3 Keyword relation

Keywords that are obtained by the system are related with initial keywords. This experiment obtains keywords such as “fraud”, “corporation”, “unethical”, “vice” and “religion”, which appear on many removed web pages that are discovered in this experiment. These words are directly related with the initial keywords.

On the other hand, this experiment discovers the removed web pages of malpractice, which are not directly related with the initial keywords. This result shows that the proposed system can discover removed web pages that are not directly related with initial keywords.

Figure 8 shows relations among keywords to discover two removed web pages; one is related with crimes and the other is related with malpractice. The initial keywords are not related with crime and malpractice. An arrow in Figure 8 represents dependency between two keywords. The arrow from “unethical business practice” (悪徳商法) to “organization” (組織) represents that discovering removed web pages by the keyword “unethical business practice” adds the keyword “organization” to the keyword list file. The keywords “unethical business practice” and a proper noun (a first name of a politician), which are on the top of Figure 8, are contained in the initial keyword file. Figure 8 hides the real names of three proper nouns. The two removed web pages in Figure 8 are not directly related with the keywords “Unethical business practice” and a proper noun in the initial keyword file. However two removed web pages are discovered from the initial keyword file.

5.4 Discovery effectiveness

Figure 3〜6 show that the number of removed web pages that are discovered by the system decreases with time. The experiment in 2008 discovered 169 removed web pages and 855 removed web pages with allowing duplication. The experiment in 2011 discovered 187 removed web pages and 885 removed web pages with allowing duplication. Both in 2008 and in 2011, the number of discovered web pages is about 20% of the total number of web pages discovered with duplication. Some of the keywords that are used in the system are “ice cream”, “chair”, “etc” and “October”. These keywords appear on many web pages on the Internet and are useless for discovery of censored web pages. Examining removed web pages that are discovered in the experiment clarifies that the removed web pages contain proper

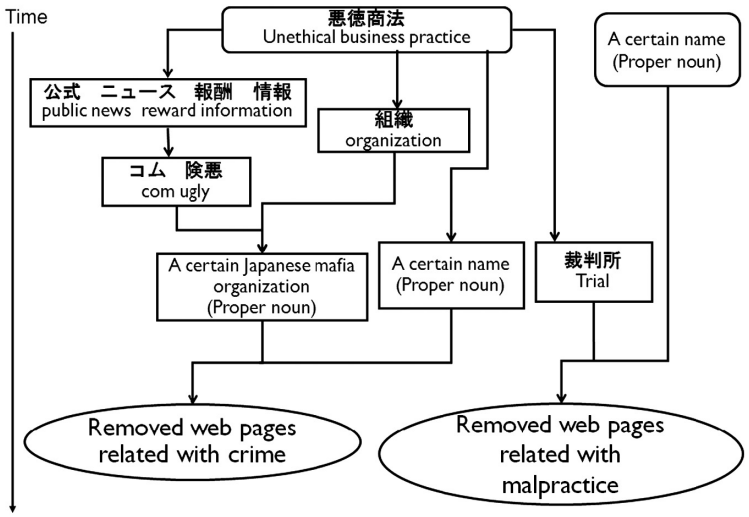

Figure 8 Relation among keywords

nouns such as names of persons, groups or corporations. Thus, proper nouns are better than normal nouns to discover removed web pages.

5.5 Comparison of experiment results

This paper obtains 169 removed web pages in 2008 and 187 removed web pages in 2011. This subsection compares the results in 2008 and in 2011. The removed web pages that are discovered in 2011 include those in 2008. It follows that the removed web pages that were discovered by this method in 2008 have been still removed from search results by Google censorship. Moreover, the experiment in 2011 finds more removed web pages than that in 2008.

5.6 "info" option of Google search engine

The discovery method of this paper uses "info" option of the search engine to check whether web pages are removed from search results by censorship, but there is no guarantee that the search engine always provides "info" option. The discovery method of this paper would prefer the law or rule that search engines should provide the function of "info" option, but it is important to check, without "info" option of the search engine, whether web pages are removed from search results by the censorship. Without "info" option, it is possible to check whether a web page is removed from search results by the censorship; one of the ways of checking is picking up keywords from the web page so that the search result of the keywords includes all web pages that are related with the keywords, and checking whether the web page is in the search result. Thus, "info" option is not indispensible for the discovery method of this paper.

6. Conclusion

This paper produced the method of discovering web pages that are removed from search results by Japanese Google censorship. This method discovered 169 removed web pages in 2008 and 187 removed web pages in 2011. Ana-

lyzing them found a tendency of censorship.

One of future works is to develop the method of discovering web pages that are removed from search results by Google worldwide censorship.

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Social Construction of U.S. Propaganda Organization: Discourse Analysis of the United States Information Agency (USIA)

Keywords
social constructionism, discourse analysis, organization studies, propaganda, United States Information Agency (USIA)

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Abstract:

The purpose of this research is to examine by discourse analysis the social construction of the United States Information Agency (USIA), a first independent propaganda organization in peace time. The findings show that the USIA was organized as a result of social effects of the knowledge on American propaganda and propaganda organization accumulated by the U.S. political and governmental leaders since World War II rather than by a single reason of rationality, cost-efficiency, or legal institutions. Through this study, it can be understood how a propaganda organization in the U.S. government is dynamically constituted through the texts embedded in certain historical and social contexts.

1. Introduction

This paper examines by drawing on discourse analysis how the organizing of the United States Information Agency (USIA) was socially realized. The USIA should be interesting for information and organization scholars in that it was established in August 1953 as a first and last independent propaganda (foreign information) organization in peace time.

However, the USIA is still under-studied by those other than historians while even studying a security and propaganda organization such as the USIA is not well-developed (Grey, 2009; Osgood, 2006: 389). This paper tries to fill this research gap and to contribute to socio-informatics from the organization and discourse perspective.

2. Organization and Discourse Analysis

Discourse analysis is different in perspective and approach from other forms of qualitative analysis. It deals with the relationship between texts and contexts in human reality. It varies by research objectives but is premised on that human reality is socially constructed and social relations are embedded in certain texts and contexts. Organization, private or public, is human reality so discourse analysis is well suited for organization studies (Phillips and Hardy, 2002: 6-8, 14, 19, 41).

The author surveyed the contextualized texts of U.S. political and governmental leaders during the period from World War II until after the establishment of the USIA. The findings and discussion go as follows.

3. American Propaganda, Propaganda Organization, and the USIA

3.1 World War II

The organizational origin of the USIA dates back to propaganda policies of the Franklin Roosevelt administration. Before the war, the State Department was conducting as part of "diplomacy" educational and cultural activities by using own emissaries. In 1938, Secretary of State Cordell Hull paid increasing attention to the value of civilian exchanges in Latin America and directed his subordinates to organize a cultural relations section within the State. It was this time when the post "cultural attaché" was created.

Russo-German Non-aggression Pact on August 23, 1939 pressed Roosevelt to impose a state of emergency nationwide. In August 1940, the president established the Office of the Coordinator of Inter-American Affairs within the White House and designated Nelson Rockefeller as its chief. Rockefeller collaborated with the State and concentrated on the binational cultural/commercial advertisements to counter Nazi propaganda in Latin America.

In 1941, when Roosevelt commented on the Life magazine the coming "American Century," the Coordinator of Information (COI) was established at the top level. Although first and last COI William Bill Donovan initially expected to be given a comprehensive authority both to "collect and analyze all information and data, which may bear upon national security" and to perform "supplementary activities" including propaganda, he encountered fierce opponents from other government bodies. War Secretary Henry Stimson, the Army G-2 (intelligence),

Hull, and Rockefeller all delivered their concerns to the president about the bureaucratic infringement by the Donovan's office on information. Also, the "domestic" propaganda function was denied by Roosevelt himself as he differentiated propaganda tasks given to Donovan from motivating U.S. citizens. With that limited capacity, Donovan managed to give birth to its own subordinate propaganda organization, the Foreign Information Service (FIS) whose director was Robert Sherwood, a playwright and speechwriter for Roosevelt (Cull, 2008: 11-14; Dizard, 2004: 11).

There were philosophical differences between Donovan and Sherwood, however. For Donovan who was interested in secret military activities and impressed by German propaganda, the FIS was supposed to be a weapon of war using "a judicious mixture of rumor and deception…to foster disunity and confusion in support of military operations." On the contrary, Sherwood followed the British practice of "Strategy of Truth" and insisted on civilian control separate from military operations. The FIS opened regional stations overseas called United States Information Service (USIS). The FIS also started in January 1942, a first American radio program and on February 24 opened its own radio station, the Voices of America (later Voice of America, VOA). From the beginning, the VOA continued trying to stand politically neutral in its broadcasting (Winkler, 1979: 27-8).

As the war grew heated and the discrepancies on American propaganda between Donovan and Sherwood increased, Roosevelt issued on June 13 the executive order providing that the COI was divided into two: the Office of Strategic Services (OSS) and the Office of War Information (OWI). The OSS was headed by Donovan. As a military and intelligence organization, the OSS was decided to conduct secret "black" propaganda operations or "moral operations" including distributing false and/or unattributed materials, or controlling front organizations. The OWI was led by Elmer Davis, a journalist, author, and radio commentator. The OWI absorbed the FIS/USIS and the VOA, and its employees consisted of many kinds of non-military U.S. citizens and foreigners. The OWI was never entitled to access to the president unlike the Rockefeller's office. Its responsibility was to "formulate and carry out, through the use of press, radio, motion picture, and other facilities, information programs designed to facilitate the development of an informed and intelligent understanding, at home and abroad, of the status and progress of the war effort and the war policies, activities, and aims of the Government." Davis further defined the OWI as "an information agency, setting forth the proposals of authoritative persons or agencies" (Cull, 2008: 14-5, 18; Winkler, 1979: 25, 31, 34, 42).

3.2 Early Postwar Years

On August 31, 1945, President Truman abolished by his executive order the OWI. However, this order also stated:

> the nature of present-day foreign relations makes it essential for the United States to maintain information activities abroad as an integral part of the conduct of our foreign affairs (Henderson, 1969: 35)

Under this understanding, the president ordered in late 1945 Secretary of State to create

propaganda programs "to be conducted on a continuing basis." As such, the State took over the functions of the OWI/VOA/USIS and the Rockefeller's office. In a press release that year, the president explained that the United States would not "outstrip the extensive and growing information programs of other nations" but "endeavor to see to it that other peoples receive a full and fair picture of American life and of the aims and policies of the United States Government." Publisher William Benton, who took office in September as Assistant Secretary of State for Public Affairs, echoed the president's views on American propaganda. In a congressional statement on January 3, 1946, Benton urged the Congress to clearly discern between American "information" and Russian "propaganda" (Henderson, 35, 37).

On March 12, 1947, Truman began the so-called "containment" anti-Soviet foreign policy. This idea derived from Minister George Kennan's argument that the Soviet Union was internationally expansionist so the U.S. must tackle it by economic, military, diplomatic or "psychological" measures. The National Security Act of July 26 1947 established the Central Intelligence Agency (CIA) as a successor of the OSS and the National Security Council (NSC) for the coordination of national security policy-making at the highest level. In December, the NSC decision (NSC4-A) specified the CIA as a body of implementing the whole "covert" action programs including black propaganda. NSC 10/2 in 1948 further asked the CIA for the creation of the Office of Policy Coordination (OPC) for covert action which was ordered to ask for policy guidance, in peace time from the State, and at war from the Department of Defense (DoD). The DoD initially hesitated to get involved in both overt and covert propaganda in peace time. Except for Generals like Dwight Eisenhower or Robert McClure, the U.S. military was inclined to think that it should discriminate "psychological warfare" which is conducted only at war from "selling democracy" which was thought to fall within the State (Paddock, 2002: 47-8, 129-30).

In the summer of 1947, a congressional group co-chaired by Alexander H. Smith and Karl E. Mundt visited the USIS European posts and pointed out that communists were "conducting aggressive psychological warfare against us." "In order to prevent this, to safeguard our national security, to promote world peace and implement our own foreign policy, …a strong and effective information and educational exchange program is essential." Thus, on January 27, 1948, the Smith-Mundt Act was signed into law after more than a hundred times modifications. Under this act, the State again organizationally drew the line between media and cultural/educational propaganda. The main objectives of this act were to ban domestic propaganda and "to promote a better understanding of the United States in other countries, and to increase mutual understanding" across the world (Henderson, 1969: 41-2).

After late 1949, the Soviets started the "hate America" propaganda campaigns. NSC 68, which Paul Nitze in the State's Policy Planning Staff drafted on April 14, 1950, accordingly argued for the "methods short of war" to "reduce the power and influence of the USSR." At this critical junction, Edward Barrett came to the State as the Assistant Secretary. The OWI veteran and journalist, Barrett advised Truman to

practice "Campaign of Truth" to reveal the Soviets' "deceit, distortion, and lies" (Belmonte, 2008: 40).

Behind a veil of secrecy, the CIA set up in 1949 the National Committee for Free Europe (NCFE) as a private organization. Under the NCFE, the Radio Free Europe (RFE) began next year in Munich the first broadcasting toward Czech Republic. Following suit with the RFE, the Radio Free Asia in 1951 for communist China and the Radio Liberation (later Radio Liberty) in 1953 for the USSR initiated their stand-alone campaigns. The CIA radio stations and the VOA overlapped in radio broadcasting but different through American propagandist lens. The RFE/RL was mostly staffed by émigrés from the listening countries and broadcasted their comments on internal matters to the limited number of countries in Eastern Europe. On the other hand, the VOA did not use the voices of other countries but those of America in the name of the U.S. government (Belmonte, 2008: 42; Dizard, 2004: 142).

The outbreak of the Korean War in 1950 awakened the U.S. military to create on January 15, 1951 the Office of the Chief of Psychological Warfare (OCPW) with Robert McClure as its head. The DoD and the OCPW then began inventing a strategy for psychological warfare. Since then, the OPCW had been at odds with the CIA over covert propaganda. McClure even raised a question in 1953 of whether the CIA would become the "fourth service" (Paddock, 2002: 88-89, 103, 131, 135).

In April, 1951, the Truman administration created the Psychological Strategy Board (PSB) to "coordinate" propaganda policies. However, the views on the role of the PSB were divided among its members. The CIA and the PSB staff described the body as the "command post" which would coordinate all of major policies contemplated by the government. The State, who feared to lose its leadership in foreign policy, tried to limit the PSB's role to only providing a forum for the exchange of ideas and information on individual psychological programs (Osgood, 2006: 43-5).

3.3 Establishment of the USIA

On January 20, 1953, Dwight Eisenhower was elected to the presidency. Eisenhower was the first president contender who dealt in public with American propaganda. On February 2, the president said in his State of the Union message that he would "make more effective all activities of the government-related international information" (Henderson, 1969: 48).

At the request of the president, two presidential committees were built for reviewing the Truman's "Campaign of Truth." As early as January 19, the President's Advisory Committee on Government Organization was established for this purpose, headed by Nelson Rockefeller. Five days later on January 24, the President's Committee on International Information Activities headed by William Jackson also got started by analyzing the entire range of U.S. Cold War policies covert as well as overt.

This is when there were some congressmen launching their harsh attacks against U.S. propaganda and alleged communists inside the government. The House Committee on Un-American Activities and the Permanent Subcommittee on Investigations of the Government Operations Committee of the U.S. Senate chaired by Senator Joseph McCarthy called for

the abolishment of the State's propaganda division and the VOA replete with alleged "commies." Their arguments were based mostly on speculations or political motives.

After the death of Stalin on March 5, the USSR began moderating its propaganda overseas from "hate America" to "peace offensive." On April 7, the Rockefeller Committee recommended the establishment of "a new foreign information agency" under the NSC. Partly responding to this, Eisenhower submitted on June 1, 1953 to the Congress the Reorganization Plan No.8. The subsequent official reports continued to express different views on American propaganda and propaganda organization. The report issued by the Hickenlooper committee of the Congress suggested either giving greater autonomy to the State's propaganda organization or creating an independent agency while keeping the function of exchange-of-persons under the State in order to prevent it from being political and too closely associated with propagandists. The Jackson Committee's report on June 30 did not directly tackle the new information organization issue. Instead, it stressed the importance of overall propaganda coordination and recommended the establishment of an Operations Coordinating Board (OCB) under the NSC.

The influential but not decisive individuals in the government were Eisenhower, Rockefeller, C. D. Jackson, or State Secretary John Foster Dulles. Eisenhower claimed to distinguish between overt and covert propaganda. C. D. Jackson, a WWII veteran, was a member of the Jackson Committee and the first "psychological warfare" adviser to the president from February 1953 to March 1954. Dulles personally thought that the State should concentrate solely on traditional "diplomacy" and foreign "policy" so he wanted to abandon its propaganda or liberation "operations." He even tried to disband the VOA, against which C. D. Jackson soon warned. He also ordered his subordinates "to find a basis of cooperation with McCarthy" to avoid being criticized by the Congress (Henderson, 1969: 48-52; Osgood, 2006: 77-85; Belmonte, 2008: 52; Dizard, 2004: 67).

Based on the Reorganization Plan, the USIA was legally established on August 1, 1953, absorbing the propaganda functions of the State, Mutual Security Agency (MSA), Technical Cooperation Administration (TCA), and occupied areas other than cultural and educational exchanges. On October 28, in a press release Eisenhower stated:

> The purpose of the United States Information Agency shall be to submit evidence to peoples of other nations by means of communications techniques that the objectives and policies of the United States are in harmony with and will advance their legitimate aspirations for freedom, progress and peace (Henderson, 1969: 65).

Former VOA consultant Theodore Streibert became the first Director of the USIA. He confirmed the president's commitment by promising that the USIA keeps "avoiding a propagandistic tone." The USIA distributed fact-based information on American life and policy through radio, publications or exhibits to the foreign public except for high-level governmental officials. Simultaneously, the USIA (not the VOA) often engaged in "unattributed" (gray) propa-

ganda activities. The USIA used abroad the name "USIS" to avoid the misunderstanding that the USIA was a U.S. "(intelligence) agency" (Cull, 2008: 102; Osgood, 2006: 89-90).

That said, the USIA could not become a leader or coordinator of U.S. propaganda among the government. The USIA made overt and gray foreign propaganda materials together with other federal organizations under the State's guidance. The USIA also had to keep the virtually master-servant relations with the State, the CIA and the DoD since unlike them, the USIA had no authorities to make policy and USIA officials had no chance for high-level promotion at least until 1964. Plus, the Director of the USIA firstly had the access to the OCB but not to the NSC. The USIA was even challenged from inside. The VOA often insisted on its journalistic independence from the State and the USIA (Dizard, 2004: 68-9; Cull, 2008: 178, 261).

4. Discussion

The findings show that the USIA was organized as a result of social effects of the knowledge on American propaganda and propaganda organization accumulated by the U.S. political and governmental leaders since World War II rather than by a single reason of rationality, cost-efficiency, or legal institutions. The discourse on U.S. propaganda and propaganda organization revolved around political, bureaucratic, or professional negotiations.

As illustrated above, WWII brought about the texts and contexts where both cultural/educational and overt/covert propaganda should be organized separately while professionals in military-civilian, intelligence, or diplomacy continued to compete for propaganda. Following this tradition, the USIA was discursively positioned as an overt and gray foreign information organization to counter enemy propaganda and to explain American life and policy on a factual basis. At the same time, the USIA was depicted in a negative way by American political and government leaders as a non-military, non-intelligence, non-diplomatic, non-cultural/educational, and non-domestic operational organization with little bureaucratic privilege.

Although there were some powerful American leaders in the organizing of the USIA, their texts could not be completely immune to the American historical and social contexts. Educational and cultural exchanges continued to be recognized as separate parts of American propaganda. After the ambitious efforts by the COI, few U.S. leaders dared to advocate for a single centralized propaganda organization. Consequently, the USIA was independent but just one of the propaganda organizations in the government with no authority over central coordination and covert/domestic propaganda affairs.

5. Conclusion

This paper examined the social construction of the USIA. Through the analysis of the related discourse, it is concluded that the organizing of the USIA was achieved as a result of social effects of the knowledge on American propaganda and propaganda organization accumulated by the U.S. leaders in the political and governmental arena since World War II. The under-

standing of the organizational fluctuation of the USIA since the 1960s requires more research and discussion.

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Social Recruiting of University Students in Japan

Keywords:
Social Media, Facebook, Digital Natives, Social Recruiting, So-Katsu, Communication

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Abstract

Social Recruiting called So-Katsu in Japan attracts much attention in 2011. Many job searching university students use social media such as Facebook or Twitter to collect information and to communicate with each other or employees. Especially Facebook is expected to be a main communication platform between university students and employees.

This study illustrates the outline of So-Katsu and examines "activation level" of Facebook recruiting pages. The result from a survey of Facebook recruiting pages (N=403) suggests that there is no definite correlation between the number of "activation level" and that of "like" or "people talking about".

The poor correlation between "activation level" and "like" reveals that whether the Facebook recruiting page is active or not, is not influenced by whether the page is popular or not. From this viewpoint, Facebook recruiting pages may be a chance for low profile companies to increase their awareness, and recruit good students. However, at the same time, "Scale free" model in Facebook recruiting pages suggests the trend that new vertices (students) attach preferentially to sites (Facebook recruiting pages) which are already well connected ("liked" or "people taking about").

1. Introduction

Japanese university students usually start their job search in their third year, and get a job offer before graduation. According to an international survey on beginning time for job search conducted by the Japan Institute for Labour Policy and Training, 88.0% of Japanese students answered they started job search "before their graduation". The percentages of Japanese university students responded "the time of their graduation" and "after their graduation" were 1.8% and 1.0%. For German university students, percentages of "before their graduation", "the time of their graduation" and "after their graduation" were 46.7%, 33.0% and 18.1%. The averages of European countries were 39.1%, 28.6% and 24.7% respectively. (Yoshimoto et al., 2001) These results of the survey show the Japanese recruiting system which companies employ new graduates all at once is unique.

Under these circumstances, Japanese universities have provided various supports for student's job search since they entered university. As a result, job search occupies an important place in campus life of university students. In 2011, Keidanren (Japan Federation of Economic Organizations) urged companies to postpone the time for recruiting activities of October and start them from December. In response, many companies reinforce recruitment activities using social media such as Twitter or Facebook. Especially Facebook is expected to be a main communication platform between university students and employees.

Recruiting or job search through active social media communication between companies and students is called "So-Katsu" (Social Job Search) in Japan. So-Katsu is the results from unity between an intension of companies want to approach to good students and that of students want to contact with desired companies.

While So-Katsu has attracted much attention, few studies have examined this issue at the moment because it is latest and fluid. Matsushita (2011) addressed informatization of recruiting and job search and a possibility of relationship between information education and career education in universities. However, So-Katsu itself was rarely mentioned in his paper.

This paper, therefore, reveals the overview of So-Katsu in Japan, and "activation level" of Facebook pages for recruiting of each company. To what extent do Japanese use social media? Why does So-Katsu become a buzz word in Japan? How much do university students visit or talk about Facebook recruiting pages of each company? These questions are addressed in this paper. This article contributes not to wining strategy for job hunting or recruiting but to understanding the structure of communication on Facebook as a tool of So-Katsu.

2. Social Media

Social Media such as Twitter, mixi, Facebook, allow individuals to communicate with others, and visualize their communication.

Twitter, micro-blog service, was lunched in 2006, released Japanese version in 2008, also mobile phone version in 2009. Twitter enables people "tweet" a 140-character message (including photos or web links). People can also "follow" anyone they want and see their tweets on timeline. Mixi started their service in 2004,

and is now the most popular SNS (Social Network Site) in Japan with 20 millions users. There are two interesting aspects of registration on mixi. One is that users can register with nickname. The other is that mixi requires their mobile phone numbers.

When we look at the world, Facebook started in 2004 and is the most popular SNS with 800 million users in 2011. Facebook also started Japanese version in 2008. As compared to mixi, users are encouraged to register themself with real name to sign up and most users show "real profile" in their page.

According to MMD (Mobile Marketing Data) labo (2011), percentages of "give out real name and position (company, school etc)" were 60.8% of Facebook users, and 9.7% of mixi users. Compared with this result, 5.0% of Facebook users, and 61.7% of mixi users "register as nickname which my friends can recognize".

In September 2011, 49.5% of Facebook users, 52.4% of Twitter users and 30.5% of mixi users "register and use regularly". [See Figure 1] The percentages of users "always login" Facebook and mixi were 16.2% and 3.5%. Those of users "login several times a day" were 34.7% and 16.8%. These percentages show facebook users login and check more frequently than mixi users.

Social media use through smart phones is one feature of the Japanese. 29.6% of males and 25.3% of females in their 20s have smart phones. They use SNS such as mixi (84.1%), GREE (25.7%), Facebook (25.7%). Twitter from smart phones was 31.4% (Internet-Hakusyo, 2011).

Digital Natives are surrounded by digital toys or tools such as computers, videogames, digital

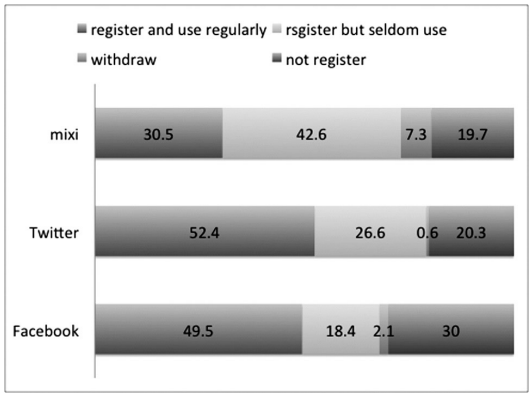

Figure 1 Register and Activity in Social Media
Source: Mobile Marketing Data Labo (2011) User Insight Investigation on Big 3 Social Media

music players, mobile phones. M. Prensky (2001) called them "native speakers" of the digital language of computers, video games and the Internet. Hashimoto (2010) suggested that "86 generation (born in around 1986)" write with mobile phones and read with PC, while "76 generation" write with PC and read with mobile phones in Japan. In addition, "96 generation" write and read with mobile phones mainly. Hashimoto named "96 generation" "Neo Digital Natives".

As above, communication in social media especially Facebook is becoming active. And mobile or smart phones are main tool for "Neo Digital Natives" to communicate with each other through social media in Japan.

3. "So-Katsu" (Social Job Search) in Japan

3.1 Informatization of Recruiting/Job Search

To get a job offer in Japan requires some steps. Firstly, university students have to search, choose and entry companies they want to work for by attending seminars or meetings held by companies. Secondly they have to

send their entry sheet or undergo various written tests and interviews to receive a job offer.

According to Ministry of Health, Labour and Welfare (2012), an employment rate of university students in 2008 was 87.7% and dropped to 80% in 2010, 77.4% in 2011. [See Figure 2] "Ice Age" for employment forced university students to entry too many companies, attend too many seminars or meetings, and write too many entry sheets.

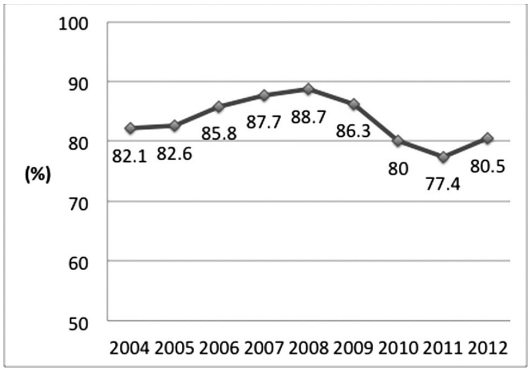

Figure 2 Employment Rate of University Students in Feb.

Source: Ministry of Health, Labour and Welfare (2012) Survey on Potential Recruits Among Graduating Students at Universities, Junior Colleges, Technical Colleges, and Vocational Schools

According to research by LEGGENDA Co. (2010), job searching students "entry" 56.9 and "will entry" 54.6 companies in Nov. 2010. That is, we can say a general job searching student entry about 100 companies.

On the other hand, this took companies much cost for recruiting students. Informatization of recruiting such as web entry, seminar or meeting through video sharing site, or web-based test proceeded for cost cut. However, informatization of recruiting brought the ironic result that job searching students could entry more companies than ever. It occured often that seminar or meeting became full of booking in a minute. Smart phones contributed to this situation. According to research by LEGGENDA Co. (2011), 35.5% of job searching students had smart phones and 18.6% of job searching students did not have it answered "they plan to buy smart phones". They think the advantages of smart phones in job search were "booking seminar or meeting" (76.7%), "map" (74.7%), "checking web-mail" (61.8%), "collecting information from web site of companies or job information site" (56.3%).

As above, "Ice Age" for employment from 2009 in Japan caused a flood of entries from job search students and informatization of recruiting of companies. The prevalence of smart phones fostered this situation.

3.2 What is "So-Katsu"?

So-Katsu is a buzz word for job search or recruiting with social media in Japan. In United States, Jacobs (2009) defined "Social Recruiting is delivering sound hiring decisions by actively using web-based technologies to build a shared understanding between employers / recruiters and passive and active job seekers." Unlike social recruiting in United States where a career change is active, So-Katsu consists mainly of job searching students.

According to research by "Syusyoku journal" (2011), job searching students use video sharing site such as YouTube or Nico Nico Douga (59.9%), Twitter (48.5%) and Facebook (18.1%). For example, video sharing site such as Nico Nico Douga or Ustream has no limits on the number of people attending and time to watch. Job searching students interested in the semi-

nar or meeting can watch the video of the seminar or meeting whenever or wherever they want. “Shukatsu Live Channel” operated by Softbank Human Capital is authorized by Ustream and delivers videos of seminars or meetings of companies. Twitter is a useful medium to collect or access information not only about seminars or meetings but also about companies themself, interviews, or recruiting by following personnel or professionals.

In addition to Twitter, Facebook attracts increasing attention in 2011. As I mentioned before, Facebook is marked by communication with real name and visualization of their activity or communication by pushing “like” button or leaving their comments on their friend’s activities. That is to say, type of Facebook communication is a stock of information, in comparison with Twitter as a medium of information flow.

There are merits for both companies and students. Especially low profile companies such as B to B (Business to Business) or venture, find it difficult to attract entries from students because job searching students have a tendency to entry only popular B to C (Business to Consumer) companies. Low profile companies hope that they can hire with good students and raise recognition of them by using Facebook. On the other hand, job searching students hope that they can get instantaneous or detailed information of a company, communicate with employee of a company directly, or show their personality on their pages by using Facebook.

In summary, So-Katsu is one phase of informatization of recruiting. Video sharing site or Twitter is certainly social media. However their communication is “one way communication” like mass media such as TV, radio, or newspapers. On the other hand, Facebook brings mutual communication to recruiting or job search and visualize them.

4. Research Method

This study examines an outline of activity of Facebook for recruiting. Data used for this study were collected by “Sokatsu.com 2013” website in 2011. As at November 22, the number of companies using Facebook for recruiting was 425. In this study, the number of “like” and “people taking about” of each recruiting Facebook page was examined and “activation level” of the page was calculated by dividing “people talking about” by “like” of 403 recruiting Facebook pages (22 broken link was eliminated from 425 pages) on 22 November. “People talking about” is the number of people who take following actions to pages in recent 7 days.

- Liked the page
- Liked, commented on, or shared the page post
- Answered a Question the page has asked
- Responded to the event in the page
- Mentioned the page
- Tagged the page in a photo
- Checked in or recommended the place

5. Results

The average numbers of “like” was 246.6, and that of “people talking about” was 47.0. On the other hand, standard division of them was 539.6 and 120.2 respectively. Therefore the number of “like” and “people talking about” of recruiting Facebook page was not normally dis-

tributed. As Figure 3 and Figure 4 indicate, the distribution of "like" and "people talking about" was power law (R^2=0.85, 0.91).

In the distribution of "like", top 20% pages attracted "like" from users account for 76.4% of the total. Similarly, top 20% of them accounted for 81.5% of the total in the distribution of "people talking about".

The average and standard division of "activation level" was 0.27 and 0.3. As Figure 5 shows, "activation level" was also not normally distributed but power law. Top 20% pages of "activation level" occupied 56.6% of the total. There was no definite correlation between the number of "activation level" and that of "Like" or "people talking about".

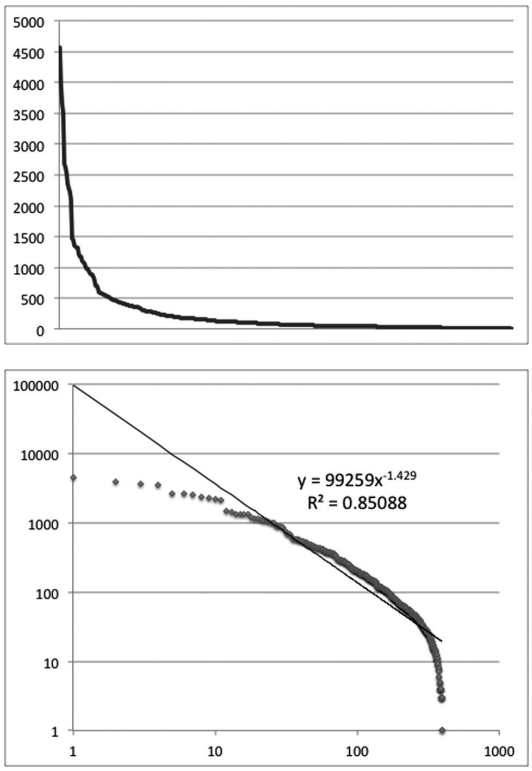

Figure 3 Distribution and log-log graph of "like"

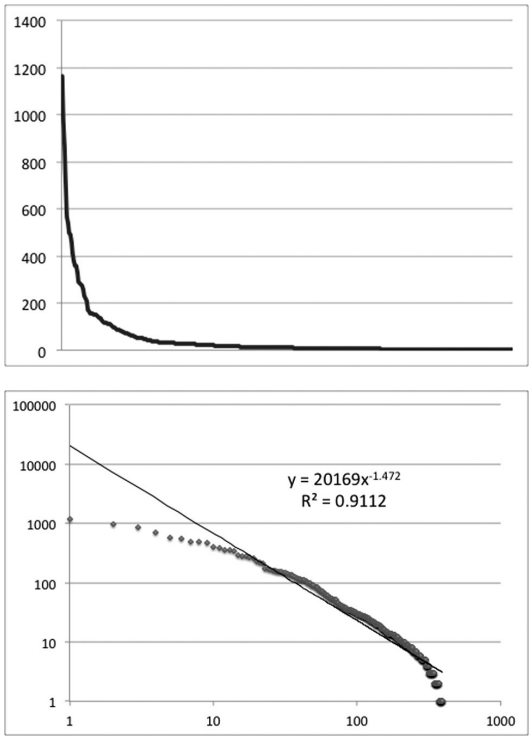

Figure 4 Distribution and log-log graph of "people talking about"

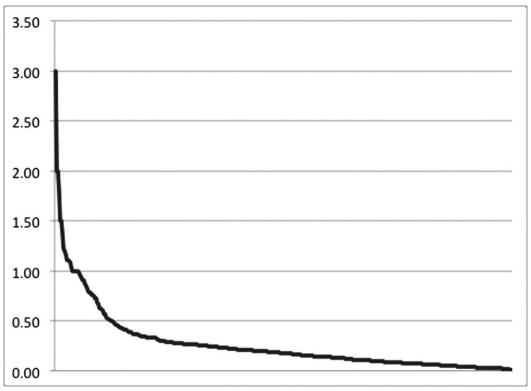

Figure 5 Distribution of "Activation level"

6. Conclusion and Discussion

The goals of this article were twofold. The first was to illustrate the outline of So-Katsu and the spread of social media for job search in Japan. The second was to investigate the activa-

tion of Facebook pages for recruiting.

In summary, we found the power law distribution of "like", "people talking about" and "activation level". Barabási & Albert (1999) revealed "Scale free" network with features as a consequence of two generic mechanisms: (i) networks expand continuously by the addition of new vertices, and (ii) new vertices attach preferentially to sites that are already well connected. "Scale free" model in networks was true of Facebook recruiting pages. The poor correlation between "activation level" and "like" reveals that whether the Facebook recruiting page is active: people talking about or not is not influenced by whether the page is popular or not. From this viewpoint, Facebook recruiting pages may be a chance for low profile companies to increase their awareness, and recruit good students. However, at the same time, "Scale free" model in Facebook recruiting pages suggests the trend that new vertices (students) attach preferentially to sites (Facebook recruiting pages) which are already well connected ("liked" or "people taking about").

There are several limitations to this study. The number of "like" and "people talking about" of sample Facebook pages was not necessarily coincident, because the number of "people talking about" showed latest 7 days activity, while that of "like" was in all. There was a possibility that the number of "people talking about" two weeks age was quite different from the data in this article. Another limitation of this study is that actual status of Facebook recruiting pages is not sure. It is not sure that what kind of activities has done in Facebook recruiting pages to attract job searching students, or what kind of activities attracts them in fact. Despite these data limitations and its preliminary character, this study will advance research on social recruiting in Japan.

The growing So-Katsu in Japan will have more impact on communication and identity formed through job searching. Whether communication featured in each social media service is private or public, will be a significant factor for So-Katsu or Social Recruiting.

For example, we can say that communication or network in LinkedIn is public. LinkedIn is a professional network site launched in 2003 (Japanese version in 2011), and with over 120 million people around the world. LinkedIn helps people make network with professionals and exchange information or opportunities for career. In LinkedIn, users register in real name, and show their professional skills or experiments like their curriculum vitae. Meanwhile communication in mixi is private, because people can register nickname and use mainly from mobile, as I said earlier. As Table. 1 shows, communication in Twitter or Facebook is intermediate between LinkedIn and mixi. Some people may express their opinion on political topics. The others may upload pictures of their friend or family. Or we can see opinions on political topics and pictures of his family at once on your Twitter timeline or Facebook News Feed.

Table 1 Profile and Communication in Social Media

	mixi	Twitter	Facebook	LinkedIn
profile	nickname >real name	nickname >real name	real name	real name
communication	private	private >public	public >private	public

I recommend that future research on social recruiting in Japan focus on how job searching students and recruiting companies communicate or act on their Facebook pages, and what is difference between “get” job and “change” job.

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“Fukushima-method” for Local Dissemination of Information to Recover Living Conditions after Nuclear Accident

Keywords:
Nuclear accident, Fukushima, radiation protection, social information, living conditions, Chernobyl, ETHOS project, self-governance

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Abstract

This paper describes a socio-informatics process in learning the effect of radiation on living conditions after the nuclear accident in Fukushima, which Japanese society has experienced since the 3.11 earthquake and tsunami in 2011. First some experiences of lectures on radiation performed by an expert are analyzed from a social point of view. In particular an example in Iwaki City of Fukushima Prefecture, which was a designed dialogue process for learning radiation, is analyzed in detail to illustrate a local dissemination of information to recover the living conditions of the inhabitants after the nuclear accident. A similarity is then noticed with the lessons of Chernobyl, in particular with the “ETHOS” project in Belarus, which was reflected into the recommendations by ICRP, the International Commission on Radiological Protection, from 2007 through 2009 in their publications. Suggestions are also noted that the lessons are extendable to a learning of self-governance of democracy in the information society of Japan.

1. Introduction

This paper deals with a socio-informatics process of recognition by Japanese on the autonomy and self-governance of information on radiological protection in Fukushima. It is concerned with the March 11 (3.11) earthquake and tsunami in 2011 and the subsequent Fukushima Daiichi Nuclear Power Plant (F1-NPP) accident.

The gigantic scale M9.0 earthquake which hit east Japan on 3.11 may have reminded Japanese of the self-recognition of endurance and endeavor under the difficult times. It goes as well as a mutual recognition of friendship with world people, who sent us such warm-hearted encouragements. However, confusions have unfortunately followed afterwards in radiological information of the accident.

For example, German Meteorological Agency has shown on daily webpage a simulation on "relative distribution of emitted radioactive particles" with a note in a small font, "a fictive emission". It was fictive. But few would read this. In fact Japanese as well as neighboring countries referred heavily on this. It is partly since Meteorological Society of Japan notified on March 18 that the members are asked not to disclose the calculations of radioactivity with respect to the single voice of the Government.

The second example is about ICRP, the International Commission on Radiological Protection. On March 21, 2011, ICRP has issued a special recommendation directed only to Japan (Cousins 2011) about how to cope with the difficult situation after the F1-NPP accident. This kind of document is rarely issued. It refers actually to ICRP recent publications No.'s 103, 109 and particularly 111. They are issued after the Chernobyl experience of 1986 through 1991, the regime change of former Soviet Union. In fact the related laws in Japan are based on the previous version of ICRP Publ.60 issued in 1990. It was after this Publ.60 that the Chernobyl situation was gradually revealed into international society. Mass media in Japan has only once reported on March 26 about this ICRP recommendation of March 21. The exception was another webpage on April 5 translated into Japanese by Science Council of Japan with a proper reference to the ICRP publications. But probably very few people might have noticed this page. With this circumstance it was difficult for people as well as for bureaucrats in Japan to understand the importance of ICRP Publ. 103 through 111.

In fact on April 19, 2011, Japanese Ministry of Education, Culture, Sports, Science and Technology decided, based on the data at 1,600 schools in Fukushima Prefecture, that 20mSv/year was the limit for new school year. But bureaucrats didn't spend enough time to explain the "situation-based approach", e.g. "existing exposure situation", a new terminology introduced in ICRP Publ.103 through 111. It is clearly new for Japanese, which would demand careful risk communications. The result was such that parents got flatly anxious, since the emergency evacuation limit was also 20mSv/year, the same value. Apparently no special care was taken of their children. This sort of confusion has become seemingly fatal on the credibility and reliance to the Government.

The third example to illustrate the difficulty is the so-called "SPEEDI" problem. SPEEDI is a simulation-software in Japan to forecast the geographic and time-dependent flow of ambient

radioactive materials when ejected from an NPP accident. The result of the simulation was however not delivered properly to the inhabitants in the affected area. They were thus forced to evacuate without knowing the directions of winds. The reason why Japanese Government was unable to disclose readily the SPEEDI data was explained later that it was to avoid "panic", according to the statement on May 2 by Mr. Hosono, the Special Advisor to the Prime Minister (a newspaper article of Asahi Shinbun, May 4, in Japanese). In reality the calculation was a result of a fictive emission of 1Bq/hour as the then best assumption. But it produced various confusing situations. At the end, the data were not utilized until demanded in a press conference (Investigation Committee 2011, Independent Committee 2012). It was disclosed on March 23, after the exposure time.

Based on these, it became clear that people in Japan were forced skeptical to the authorities or bureaucrats. The ultimate help is neither available nor expected from their Government. They are forced to rethink how to look after themselves, and where to look for the information. This aspect in Japan must have been blurred without the F1-NPP accident.

The purpose of the present paper is therefore to trace the social flow of information, suggesting people to improve the autonomy and self-governance in particular in and around Fukushima. The task is achieved in this paper by looking into a series of case studies on the learning process of radiation.

In Sect.2 an account is given to the social background for lectures on radiation. In Sect. 3 a summary is described on some lectures given by the author (Y.Mizuno) from April till September 2011. In Sect.4 one of them is scrutinized as a designed learning. In Sect.5 we discuss the one in Sect.4 with ETHOS project in Belarus after Chernobyl, another design to recover the living conditions after the accident.

2. Social Background for Lectures on Radiation

At first, it is worth noting that in Japan the learning on nuclear radiation at schools has been excluded from the compulsory junior high school for more than 30 years. Actually the unit had been in the course until 1980, but later disappeared. It must also be mentioned that 2011 was the first "trial" year (as a front-loaded content from the new course) on its revival for pupil to learn radiation at the 3rd grade of junior high school. At senior high school the percentage of pupil who learn physics including radiation is only 12%. These suggest that very few Japanese had a prerequisite knowledge on radiation nor of introductory physics course like the structure of atoms etc. beforehand.

This situation therefore urged university professors to lecture on radiation for ordinary people, who would require the basic knowledge for daily news, such as μSv/h of dose rate. The first actions took place were probably on "twitter" by physicists at universities, such like the author (Mizuno) or Prof. R. Hayano at the University of Tokyo. In fact the number of Hayano's followers climbed up to 150,000 in 7 days after 3.11. They may have acquired an ample knowledge on radiation in the meantime.

On the other hand, misleading videos were put up on YouTube, saying erroneously that man-made radiation were accumulated in bod-

ies whereas natural ones not (truth is dependent on each sort of elements). Other videos said wrongly that even a minuscule level of exposure was fatal when man-made (truth is dependent on the dose in unit of Sv). These must have created a misunderstanding on radiation in the society. These also exaggerated the distrust to Government or close experts on NPP. The impression seemed prevalent since the Government didn't give the answer people wanted, e.g. the worst scenario. But this sort of distrust made the matters worse, since it was based on the unfounded knowledge.

There are people with solely classical media, like TV or newspapers. They were kept frightened daily by each piece of news on F1-NPP accident or radioactivity. No one was able to help them, since it was an actuality.

Inside Fukushima the story was different. It was because from the beginning an authority was employed from Nagasaki University as an advisor by the prefectural government. It created however another upset among some people due to a lack of basic knowledge on low dose exposure. Our experience of Hiroshima and Nagasaki was not too helpful here, because in Japan it is the worship and not the source of scientific knowledge on radiation.

It was thus found necessary that precise knowledge be propagated concerning the science of radiation. One of the first public lectures in Tokyo was organized by a university physicist on April 2. The author (Y.Mizuno) was asked late March to hold another lecture in Kyoto.

Since then until the end of September 2011, seven lectures were given by him. Let us now examine the responses to these lectures, because the responses actually evoked the experts to find where to stand and what to aim at in the society with a future of Fukushima.

3. Case Studies on Lectures of Radiation

3.1 Radiation Lecture on April 10 in Kyoto

The first lecture was on April 10 organized by a young physicist at Kyoto University, calling for parents with child rearing. The topic was about knowledge required for basic feature of radiation. Questions raised in the lecture were reasonable, such like cumulative effects of contaminated food with different isotopes. It was a righteous question, since the emergency measures were taken for foodstuff on March 29 by the central Government without reference to accumulation. Likewise an apt question was raised by a mother with small children, asking whether she could bathe them in sea a few months ahead for summer. The author couldn't answer the question either, since he was an expert on nuclear physics. The expert knowledge was necessary but not sufficient.

3.2 Lecture on May 1 in Fukushima City

The second lecture was on May 1 in Fukushima City, where a group of experts organized a series of consultation facilities and lectures, city by city, in the devastated areas. The experts of lawyers, real estate appraisers, etc. first got together in 1996 after the Kobe Earthquake to perform a one-stop service of consultation. The author and a medical doctor joined them in 2011 as experts for radiation.

In a shelter the author met a fisherman being forced evacuate from the sea coast of Namie Town, located at around 5km of F1-NPP. The

fisherman just wanted to continue the fishing on his boat, because he loved his work. He said he would wait for 2, 3 or even 5 years to resume his work, but without the instruction or perspective he was embarrassed. All the refugees knew the dose rate around the shelter was much higher than before the evacuation. The official instructions were without estimate at first. He just wanted to get an estimate for his life. The author couldn't answer, but explained the process, taking an example from the case of school restart on April 20. Namely, at first the dose rate must be measured, then a scrutiny and judgment must follow etc. etc. The fisherman understood the scene and said he was lucky by asking. But the learning was for the author because he found his ignorance.

3.3 Lecture on May 3 in Iwaki City

The expert team moved to Iwaki City, south of Fukushima. At the end of the lecture on radiation one lady stood up and asked, "Please tell me whether we are safe or dangerous, please through you own mouth." The author murmured to be precise with conditions as radiology, when the lawyer blocked him and passed on to the medical doctor, who said strongly that she was safe. This example demonstrates what people requires is not the precision of data but the tacit implication of the situation. The cases also show a limit for experts, because the expert knowledge is analytical but what people requires is synthetic depending on the actual living conditions. It is not foreseen without dialog with respect to each life of people and the dignity in their profession.

3.4 Lecture on September 17 in Kyoto

On September 17 a get-together meeting was held in Kyoto for refugees from Fukushima. The author gave a lecture with an emphasis on individual monitoring of radiation exposure. But he noticed awkward when a question was raised from a young mother, "Are we guinea pigs? Do you escape from Fukushima?" He answered "No" adding the reasons why. It was too late when he realized it was the worst answer. Actually she grieved, "Do you say our escape from Fukushima was in vain?"

By then two opposite views on radiation safety prevailed in Japan. Scientists affirmed low dose effects as a "black box" because the risk was too low to detect. For example with 1 mSv/year, an excessive risk of cancer etc. was estimated between 0 and about 10^{-5} (based on Linear-No-Threshold hypothesis as maximum). This is not even sensible, together with tens of other risks. But she couldn't believe the official safety any longer, irrespective of the scientific data. Chief Cabinet Secretary Mr. Edano (2011) has explained, "Present dose of radiation is not readily influential", repeating seven times in total on TV continually. Later on November 8 2011 he made an explanation that it was not necessary on health. Thereupon, agitations towards radiation panic got inevitable in Japan. This situation made the risk communication at least more difficult.

As the result two types of inhabitants emerged, one without care to radiation, the other with a full swing of anxiety. Probably the distrust of people against bureaucrats and experts was maximized. Experts couldn't predict any explosion of F1-NPP. They were even far from being respectful to people's lives.

After the lecture, he visited the tables of the refugees one by one to supplement the lecture. They remedied the situation and reached at a mutual understanding when he tried to listen to them. The point was not the respective data, but a respect to individual's life as the whole.

3.5 Lessons from the Lectures

The above descriptions in the case studies may sound pessimistic. Of course the basic knowledge on radiation is required at any rate. The lectures were useful in this sense. But it is likewise essential to notice that expert information is only a piece of a whole, and the whole is invisible or difficult to reconstruct.

Meanwhile the authors have been using "twitter", by which the abovementioned difficulties were shared partly. The authors noticed, through twitter conversation and a meeting in Fukushima in August, that the needs were certainly present for learning radiation by inhabitants. But it must be done without resorting to top-down manner by one-sided expert. It is simply because any expert is a layperson in the other areas.

Based on these observations, the authors have organized a learning process for the inhabitants. The detail is as follows.

4. Iwaki Case Analysis: "Fukushima-method"

In a rural part of Iwaki City, at first a lecture was held on July 29 by an expert of fishery and agriculture etc. with a detail on transfer factors of radioactivity to crops. It was found difficult for the inhabitants. The author (R. Ando) thus organized a second learning with a dialog.

It was designed as a dialog meeting, and not a one-sided lecture. The objective was set up to ease the anxiety of the inhabitants. It must be therefore a dialog to resolve the problems. Secondly it must be held inside the community, since an invisible gap among the community seemed present and the gap was a source of the anxiety. The community must be reinforced to be robust in this sense.

At first, a questionnaire was collected to probe the concerns of the participants, and to control the flow of the meeting. Namely it starts from a clear entry, through a designed series of steppingstones for understanding of radiation, up to the exit where the outcome is expected for each inhabitant. The method was communicated beforehand so that the lecturer (Mizuno) shall captured the methodological objectives. He was at first a bit shocked, since he was asked not to play the important role. But immediately he got it and collaborated with the organizer. The progression of the meeting was subdivided into steps, so that a scientific account was given at first and then the corresponding questions be raised accordingly.

The dialog meeting was held on September 24, 2011 with a total of 24 participants in Tabito Town, Iwaki City, Fukushima Prefecture. The city is huge with the north border at 26km from F1-NPP, but the south end touching another prefecture. Thus the inhabitants were affected heavily by confusing bureaucratic measures, and even by rumors.

The meeting has started by self-introduction to share the difference of each standpoint and understanding on the situation. The questions were raised spontaneously in a friendly atmosphere. The answers were performed with a respect to each inhabitant, since he started to

know the people in the area. In fact before the meeting, we held a sort of field physics experiment on radiation shielding against the gamma rays. This collaboration made him feel a sort of quasi-member of the community. It was natural that he apologized them as a scientist after such annoying accident for them.

During the dialog meeting, the organizer tried to intervene the "teacher" and "students" to help them communicate the relevant information. The meeting went smooth as a whole with the dialog. However, the problem is that the answers were understood but not agreeable to the inhabitants. The more they learn, the more distance they feel from science, because the issue to tackle is more comprehensive as health or the life itself.

Let us contemplate an example. One of the audiences asked, "I found an excessive Cesium, in the beef of my cattle farm, by a small amount over the regulation. Is the measurement so reliable?" The answer was on the origin of scientific errors, one by statistics and the other of systematic one. He added that at any rate some regulation should be set at some value. It was understood but not agreed by the farmer.

Later the final answer was found by the farmer himself through a daily chat on various matters, like radioactive materials, radiation, national or local government affairs after the accident, issue of mass media, a transformation of human relations around him, influence of these on his living conditions, and anxieties for future. These are all out of the scope of science. Nevertheless by talking with the organizer, he finally found by himself a viable solution such that by taking the biological half-life of Cesium into account, namely with a period of cooling and a method of feeding while in the cattle house, he found how to manage the problem.

This case clearly tells a live example of the difference between the analytic way of understanding and a synthetic route to solution. The outcome of a dialog meeting must be a shared realistic approach among stakeholders, with an expert advice if necessary. This is nothing but a socio-informatics aspect of the process to find a solution, which lies behind the problem and often too complex to be noticed.

This finding of a sort of context-dependent approach, which we call "Fukushima-method" here, further suggests that 1) the most essential aspect of the problem is nothing but isolation or segregation of people in community who would share the living conditions. This must be considered, 2) a vicious circle may persist that an apparent difficulty of the contamination on land may render helpless feeling on one side, and another difficulty of irritation or incompetence that might multiply the anxieties. All these would produce the difficulties that we may witness in Fukushima.

Via a formulation of tacit aspects of the "Fukushima-method", it is therefore suggested that 1) as a first step the stakeholders should share the problems among themselves, and their solitude shall be degraded, 2) hold a dialogue meeting to clarify the explicit problems now identified, and pursue to find the solution in the end by themselves. Probably only through the process of autonomy and self-governance as such, the relations among the community members would be refurbished towards a reliability. The dignity in humanity would be hereupon recovered in them, so that they shall cope with such a difficult era. The

anxiety would be thus expected reduced through the process herewith suggested.

The objectives of dialog meetings must then be conscious not to clear the anxiety directly, but to proceed the way indirectly to solve the various related issues in a sense to further continue to cope with their realistic problems.

With these processes, the expert knowledge may not be the leading actor anymore, but it is a tool to be functional. Of course the present situation has been initiated by radioactive material and radiation. Of no doubt a proper knowing of scientific knowledge is prerequisite and useful. But it is not the goal of the learning. The scientific knowledge is a chart and compass in a sense when tackling the reality. The judgment on where to go on in life is conducted solely by the people in the community.

In this context the role of scientists is not a teacher, but an advisor or a neighbor who would concern the community. In ideal the science itself is value-neutral, but in reality it may not be, depending on the community involved. As a "reliable" scientist in community, the most effective theme would be to behave as a stakeholder or a neighbor. As a result the knowledge would be understood consequently.

5. Discussions

We realized later that "Fukushima-method" was similar to "ETHOS" project (ICRP 2009). "ETHOS" was organized in Belarus for a few years since 1996, after ten years of Chernobyl. It was proposed by European Commission as a pilot project for a rehabilitation of living conditions of the inhabitants after the accident.

The point was to involve directly the local population in the management of radiological situation with the perspective to improve their quality of life on a longer term. The method was to address jointly the technical and societal dimension with local and national stakeholders in a decentralized approach. To realize this, steps were to listen and learn from the villagers about concerns and priorities with a support of local professionals and authorities. This is nothing but what we struggle in Fukushima.

The present coincidence reminds us of the cultural aspect of natural disasters as being a learning process in the affected society. The radiological situation is almost unprecedented, and the characteristics of Fukushima accident are different from that of Chernobyl. But the essence in human and societal dimension would be the same. This time we learn what the democracy is all over again in its essence within the current information society in Japan.

The problems discussed here would originate all from the humane reactions in such that one cannot determine where to go, what to do as his profession, how to cope with his professional problem that he had been the master heretofore. We cannot live daily life due to the invisible radiation. It clearly invades the basic human rights and fundamentals of self-determination. It is for this reason that the problems discussed here are strongly related to the autonomy and self-governance in the democratic society.

Self-determination of patient in the informed consent with medical doctor is an ethical issue in medical sociology. We notify here that the situation is in parallel with the affected people and the scientist, described in this paper. Thus the discussions here could also be extend-

ed and compared to the sociological studies treated e.g. in Freidson (1970) in the forthcoming papers.

Acknowledgements:

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Analysis of Organization of New Zealand Television Industry Enabling Acceleration of Complete Transition to Digital Broadcasting and Improvement of Proportion of Domestic Program Production

Keywords:
Digital broadcasting, vertical separation, Domestic program production, Maori TV, Freeview

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Abstract

Broadcasting in New Zealand has been in the form of vertical separation ever since industry restructuring that occurred in 2003. Although implementation of digital broadcasting has lagged behind in New Zealand as compared with other advanced nations due to a financial crisis at the national level, as a result of severing the broadcasting division from TVNZ and assigning it to the control of Cordia, which is involved in the construction, operation and maintenance of digital broadcast networks, broadcasting operations have been deployed in the form of private broadcasting of TV3, TV4 and Maori TV. In addition, as a result of granting all licenses to Freeview, a neutral broadcaster not engaged in programming, it has become easier to implement services by new entrants. A new entry into the industry in the form of Maori TV was implemented, resulting in expanded transmission of programs broadcast in the Maori language. As a result of TVNZ being able to specialize in the area of program production, the proportion of domestically produced programs has demonstrated an increasing trend in recent years.

Furthermore, this study is based on findings obtained from visits to New Zealand by the author from September 12 to 19, 2010 and from September 1 to 14, 2011, a field survey of MTS, and interviews with broadcasting personnel affiliated with TVNZ and Media Works.

Introduction

The "program production" and "transmission" sectors of the broadcasting industry are in a relationship of the upstream and downstream sectors of a vertical economy corporation in the same manner as the electricity industry composed of "power generation" and "distribution" sectors, and differ from the nature of an "economy of scope" that explains a horizontal relationship. In the past, amidst the numerous broadcast stations in which the two businesses of "program production" and "transmission" were in the form of a vertical economy, New Zealand is an example of having successfully deployed a new framework in which these two businesses are separated vertically and established in the form of independent businesses.

Production and Transmission channels are vertically separated, making it easy for new content providers such as Maori TV in New Zealand, independent content aggregators, and new Internet video services to gain a foothold. The reason for a broadcasting station specializing in program production like the Maori Television Service (MTS) to having been able to newly enter the industry and begin broadcasting in Maori over a wide service area accompanying the commencement of digital broadcasting was because a specialized firm like Cordia was able to function in their place in implementing digitalization of Transmission functions requiring extensive expertise and funding.

Literature Review

Examples of previous research providing an analysis of "vertical economies" include that by Kaserman and Mayo (1991), Gilsdorf (1994), Vernon and Graham (1971), Christensen and Greene (1976), Kitamura and Nemoto (1999) and Hayashi, Goo and Chamberlain (1997). Kaserman and Mayo (1991) proposed that "vertical economies" are generally measured by expanding the cost concept of multiple commodities. Cost functions of multiple stages of the electrical power industry are estimated to measure the size of the vertical economy directly. Gilsdorf (1994) demonstrated cost complementarity of each of the sectors of power generation, transmission and distribution by estimating the production cost functions of multiple commodities. Kitamura and Nemoto (1999) measured the "vertical economies" in both the power generation sector and transmission sector of the electricity industry. Hayashi, Goo and Chamberlain (1997) confirmed whether or not vertical economies exist by demonstrating the "separability" of cost functions for two sectors.

Examples of prior research in the field of broadcasting include that by Ueda and Mitomo that consisted of assigning the program production sector and transmission sector of the broadcasting industry to the upstream sector and downstream sector of a vertical economy corporation, and demonstrating the separability of cost functions with respect to the two sectors using a translog cost function of multiple commodities (although the basic concept was proposed by Christensen, Jorgensen and Lau (1973)) followed by measurement of whether or not "vertical economies" exist. Furthermore, although other research includes that conducted by Ueda and Mitomo (2004) and Igasa and Nakayama (2011) that focus on an analysis of "economy of scope" of the television business

and radio business, this research provides an explanation of a horizontal relationship, and this differs from "vertical economies" in a vertical relationship.

Acceleration of Complete Transition to Digital Broadcasting

The government of New Zealand announced in September 2010 that it would move up the time of termination of analog broadcasting from the originally specified time of 2016 to November 2013. The fact that complete transition to digital broadcasting is expected to be able to be realized in the short period of only 5 years is due to the contribution made by the organization of the broadcasting industry in this country.

In August 2009, the New Zealand government established an administrative organization known as "Freeview" for promoting complete digitalization of television broadcasting in a joint effort with the broadcasting industry, and although it had adopted a policy calling for the timing of complete transition to digital broadcasting to be proposed as a result of conducting a comprehensive examination in consideration of such factors as the state of proliferation of digital broadcasting, the state of installation of digital equipment, and the progress being made in other countries, based on a survey result indicating that the proliferation rate of digital televisions had reached 70% of all households in September 2009, it decided to move up the termination of analog broadcasting to November 2013. In contrast it having taken Japan 8 years from the initiation of digital broadcasting (2003) to the termination of analog broadcasting (2011), following the initiation of digital broadcasting in April 2008, the fact that complete transition to digital broadcasting is expected to be able to be realized in the short period of only 5 years is due to the contribution made by the organization of the broadcasting industry in this country.

The organization of New Zealand's broadcasting industry was longitudinally divided into two sectors consisting of a program production sector (Television New Zealand (TVNZ)) and a transmission sector (Transmission Holdings Ltd.) in July 2003 following enactment of the "TVNZ Act" in February of that year. Although preparations for digitalization were delayed in comparison with other advanced countries due to a national financial crisis, digitalization was attempted to be implemented by separating the transmission sector from TVNZ and allowing it to be left to the management of Cordia. Cordia is involved in the implementation, operation and maintenance of a digital broadcasting network, and is responsible for all Transmission functions of New Zealand television broadcasts, including "TV3" and "TV4" under the ownership of the private broadcasting entity "Media Works" and programs broadcast on "MTS" in the Maori language, in addition to programming of "TV One" and "TV2" broadcast by the public broadcasting entity TVNZ. In addition, it has been able to efficiently promote digitalization by granting licenses to the independent broadcasting entity "Freeview" that is not involved in programming. After having been granted license, "Freeview" began terrestrial digital broadcasting in April 2008.

(※) Freeview was established in 2007 by New Zealand's free-to-air broadcasters, including

TVNZ, Mediaworks TV (owner of TV3 and C4), Maori Television, and Radio New Zealand, to offer a free digital television service. To watch programs broadcast on Freeview, viewers must have a television with an inbuilt digital receiver; or a digital set-top box.

Improvement of Proportion of Domestic Program Production

The reason for a broadcasting station specializing in program production like the Maori Television Service (MTS) to having been able to newly enter the industry and begin broadcasting in Maori over a wide service area accompanying the commencement of digital broadcasting was because a specialized firm like Cordia was able to function in their place in implementing digitalization of Transmission functions requiring extensive expertise and funding. Different from "telecommunication", "broadcasting" requires that interruption of service be absolutely avoided, and the adoption of an industry structure that enables a specialized firm in the form of Cordia to handle all "Transmission" functions requiring advanced operation and maintenance technologies made it possible to easily overcome obstacles to newly entering the industry.

In addition, since New Zealand is an English-speaking country, imported programs from the U. S., U. K. and Australia accounted for nearly 70% of programming, while the proportion of domestic programming to all programming was low at only 30%, thus resulting in foreign-dependent programming that is uncommon among advanced countries. Despite the "TVNZ Act" stipulating an increase in the proportion of domestically produced programs and a reduction of the dependency on overseas programs along with giving consideration to minority societies by increasing Maori language broadcasts and broadcasts introducing unique cultures, even the public broadcasting entity TVNZ continued to depend on foreign countries for 70% of its programming. However, as a result of TVNZ being able to specialize in the area of program production, it was able to realize 100% domestically produced programming through its new channel known as "TVNZ Heartland" began in June 2010. In addition, the proportion of domestically produced programs has demonstrated an increasing trend in recent years, including the Maori language broadcaster MTS producing roughly 90% of its programs domestically.

Table 1 Year of the commencement of digital broadcasting service

Year	Country
1998	UK, USA
1999	Sweden
2000	Spain
2001	Australia, Finland, Korea
2002	Germany
2003	Netherlands, Italy, Belgie, Switzerland, Canada, India, Japan
2004	Taiwan, Mexico
2005	France, Czecho
2006	Austria, Greece, Lithuania, Estonia, Saudi-arabia
2007	China, Slovenia, Norway, Morocco, Brazil
2008	New Zealand (April), Hungary (December)
2009	Poland (January), Portugal (April), Ireland (September)
2010	Russia

Source : NHK Databook (2011) "Broadcasting stations in the world" pp.288-289

There are many benefits from switching from analogue to digital transmission for television. These include the lower cost and greater service available from digital services, and the opportunity to reallocate approximately 100MHz of ultra high frequency (UHF) spectrum to other economic activity, such as mobile broadband services. Government support for digital switchover began in 2007, with support of the Freeview digital platform.

In the field of broadcasting, in contrast to broadcasting stations in New Zealand which are separated vertically, those in Japan are integrated vertically.

Broadcasting in New Zealand has been in the form of vertical separation ever since industry restructuring that occurred in 2003. Although implementation of digital broadcasting has lagged behind in New Zealand as compared with other advanced nations due to a financial crisis at the national level, as a result of severing the broadcasting division from TVNZ and assigning it to the control of Cordia, which is involved in the construction, operation and maintenance of digital broadcast networks, broadcasting operations have been deployed in the form of private broadcasting of TV3, TV4 and Maori TV.

In addition, as a result of granting all licenses to Freeview, a neutral broadcaster not engaged in programming, it has become easier to implement services by new entrants in the field such as banks and web operators, thereby making it possible to further promote digitization. In actuality, the industry restructuring implemented by the New Zealand government was correct. A new entry into the industry in the form of Maori TV was implemented, resulting in ex-

Table 2 Simultaneous Period of Anarogue and Digital TV Broadcasting

Country	Commencement of digital service	Termination of analogue service	Simultaneous period
UK	1998.11.15	2012	14 years
Australia	2001.1.1	2013.12.31	12 years
USA	1998.10.29	2009.2.17	11 years
Mexico	2004.7.5	2015.12	11 years
Korea	2001	2012.12.31	11 years
Algeria	2009.7	2020	11 years
Spain	2000	2010.4.3	10 years
Panama	2009.12	2019	10 years
Brazil	2007.12.3	2016.6.29	9 years
Japan	2003.12.1	2011.7.24	8 years
Sweden	1999.4.1	2007.10.15	8 years
China	2007	2015	8 years
Canada	2003.3	2011.8	8 years
Morocco	2007.3	2015	8 years
Singapore	2008.2	2015	8 years
Romania	2005.12.1	2012.12.31	7 years
Germany	2002.11	2008	6 years
Italy	2004.1.1	2010.1.1	6 years
Czecho	2004	2010.10.10	6 years
Finland	2001.8.27	2007.9.1	6 years
France	2005.3.31	2011.11.30	6 years
Switzerland	2003/6	2008.2	5 years
South Africa	2006.3	2011.11.1	5 years
Hong Kong	2007.12.31	2012	5 years
New Zealand	2008.4	2013.11	5 years
Taiwan	2006.7	2010	4 years
Netherlands	2003	2006.12.11	3 years
Hungary	2008.12.1	2011.12.31	3 years
Poland	2009.1.1	2012.12.12	3 years
Portugal	2009.4	2012.4	3 years
Norway	2007.9.31	2009.12	2 years

Source : NHK Databook (2011) “Broadcasting stations in the world” pp.288-289

panded transmission of programs broadcast in the Maori language. Differing from "communications", in the case of "broadcasting", where interruption of radio waves must be avoided at all costs, and since advanced operation and maintenance technologies are required for this purpose, this has resulted in the formation of a barrier that hinders entrance of new businesses.

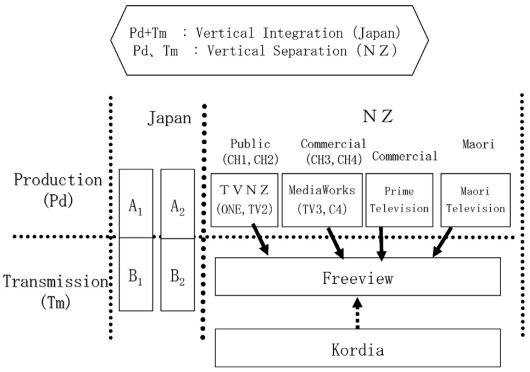

Figure 1 Vertical Integration and Vertical Separation

Table 3 Hours of Local Content on Network Television

Year	TV One	TV2	TV3	Prime	Maori TV	C4	Total
2000	3,544	1,158	1,484				6,186
2001	3,587	1,298	1,305				6,190
2002	4,003	1,758	1,439				7,200
2003	3,586	1,742	1,347				6,675
2004	3.401	1,603	1,420				6,424
2005	3,551	1,523	1,381	571			7,025
2006	3,492	1,270	1,300	863	2,323	1,008	10,256
2007	3,762	1,168	1,585	760	2,477	1,031	10,783
2008	3.954	1,110	1,976	817	2,608	1,136	11,601
2009	3,812	1,129	2,114	846	2,544	975	11,420

Source : TV On Air's website (www.nzonair.govt.nz)

NZ On Air measures New Zealand programmes screened on television. Its anuual "Local Content Report" has been tracking the hours of New Zealand made programming broadcast free-to air since 1990. TV One and Maori Television recorded the most local content in 2009; Prime and C4 the least. Three channels increased their local-content hours slightly TV2, TV3 and Prime; the others showed a slight decrease. In 2009, 11,420 hours of New Zealand-made television programmes screened on the country's six free-to-air channels. This figure was down 1.6 percent from 2008 - the first decrease since 2004. Total local content on the six free-to air channels was 33.7 percent.

TV One screened most local content at 3,812 hours. Maori Television was second, with 2, 544 hours. Maori Television screened the most local content in prime time (6pm-10pm).

The reason why New Zealand was able to complete digital broadcasting in the short period of time of only five years was mainly due to contracting implementation to Cordia, a specialized firm having its own transmission functions. In addition, New Zealand was able to deploy the production of original programming as a result of concentrating funding and personnel on production. Moreover, the use of "network sharing" served to reduce both costs and time.

Changes in the Industrial Structure of Japan

The conversion of terrestrial broadcasting to digital broadcasting was completed in the end of March 2012 with the termination of analog broadcasting in the three prefectures in the Tohoku region where conversion had lagged behind other regions due to the Great East Japan Earthquake.

As a result, Japan has deployed one of the most advanced broadband networks in the world throughout the entire country. In addition, legislation was enacted in 2011 to facilitate flexible utilization of this network. In response to these new developments, efforts are being made towards the realization of an industrial structure capable of adapting to these changes in a short period of time as in New Zealand while also promoting the entrance of new firms into the industry.

Following revision of the Broadcast Act for the first time in nearly 60 years for the purpose of convergence of broadcasting and communications, separation of the fields of hardware and software (vertical separation) has come to be observed at terrestrial transmission stations as well in which separate firms are responsible for production and transmission operations. Under the provisions of the Broadcast Act enacted on June 30, 2011, the Ibaraki Broadcast System, which is the only privately-owned radio station in Ibaraki prefecture, implemented vertical separation of its production and transmission functions. The Ibaraki Broadcast System transferred its transmission operations, including its broadcasting license and facilities, to IBS, while the Ibaraki Broadcast System was transformed to a software company that focused on operations such as programming and advertising operations.

Although the Ibaraki Broadcast System had been engaged in the production of programs that introduced local history and culture on the basis of its public nature of contributing to the local community, since this type of programming generated little advertising, profitability was extremely poor. Following the implementation of vertical separation, the production sector of the Ibaraki Broadcast System was relieved of the restriction of its public nature as a result of transferred its broadcast license, thereby enabling it to create programming directly linked to promoting the sales of new products and characters of various corporations.

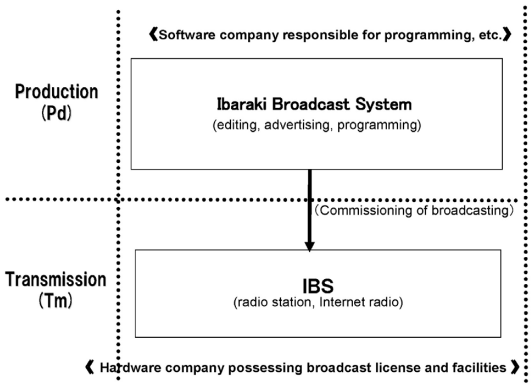

Figure 2 Vertical Separation of the Ibaraki Broadcast System

The Asahi Broadcasting Corporation, located in Osaka, also commissioned its programming function to a subsidiary known as ABC Media Communications (ABC). In contrast to Tochigi TV, a television station located in Tochigi prefecture, having consolidated a radio station operated by the Tochigi Broadcasting Corporation in April 2012, Chubu Nippon Broadcasting Corporation (CBC), located in Nagoya, had already transferred control of its radio operations to CBC Radio in September 2011 while retaining only its television operations. It is therefore predicted that various forms of broadcast station reorganization will continue to take place in Japan in the future based on the securing of adequate profitability.

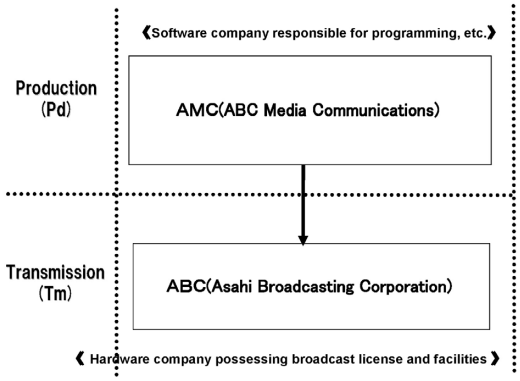

Figure 3 Vertical Separation of ABC

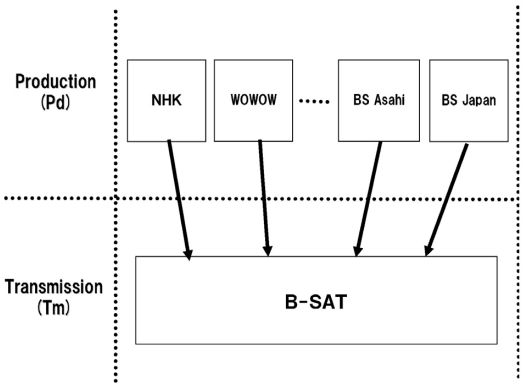

Figure 4 BS Broadcasting in Japan

Although seven new channels were added to the existing broadcast satellite (BS) digital broadcasts in March 2012, this can be said to be possible for the very reason that the industrial structure of BS broadcasting had been vertically separated resulting in a system that only required new entrants into the industry to only be responsible for production functions. It is unlikely that the entry of new firms into the industry would have been possible in the case of a conventional industrial structure that also incorporates transmission functions requiring extensive equipment investment and expertise. As a result, BS broadcasting has been able to realize a multi-channel service system deploying a total of 31 channels consisting of 18 pay channels and 13 free channels.

On the other hand, communication satellite (CS) broadcasts (SkyPerfec! e2) is scheduled add an additional 14 channels to its existing 42 channels in the near future. This realization of multi-channel broadcasting through the addition of new entrants to the industry is also due in large part to the same vertically separated industrial structure employed for BS broadcasting. In addition, CS broadcasting differs from BS broadcasting is that platform firms have also been added that are responsible for billing, ad-

Table 4 New BS Channels Added in March 2012

Channel Name	Description
Disney Channel	Disney cartoons
Imagica BS	Western and Asian movies and dramas
J-Sports 3	Baseball, rugby and other sports programming
J-Sports 4	
BS Fishing Vision	Fishing information and travel programs
BS Japanese Movie Channel	Period dramas and Japanese movies
Dlife	Western dramas and variety programs

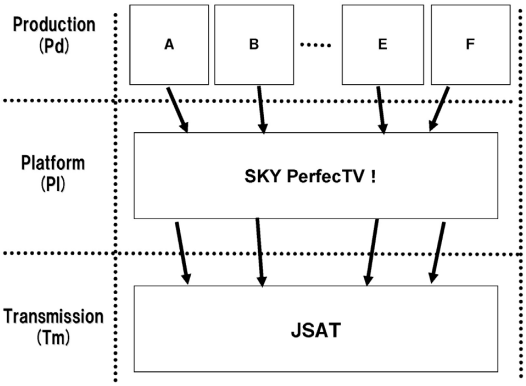

Figure 5 CS Broadcasting in Japan

vertising and the like.

Starting in April 2012, broadcasts for reception by SmartPhones (V-High Multimedia Broadcasting), known as "NOTTV", began that use frequency bands previously utilized by ground-based television broadcasting. Although this service is expected to be provided nationwide by 2014 and scheduled to be utilized by 6 million viewers by 2015, a huge equipment investment of about 50 billion yen will be required to provide 126 base stations for the purpose of realizing nationwide coverage, and since this will be difficult to implement by individual production firms, a dedicated firm for providing transmission functions in the form of "Japan Mobilecasting Inc." will be responsible for transmitting all channels.

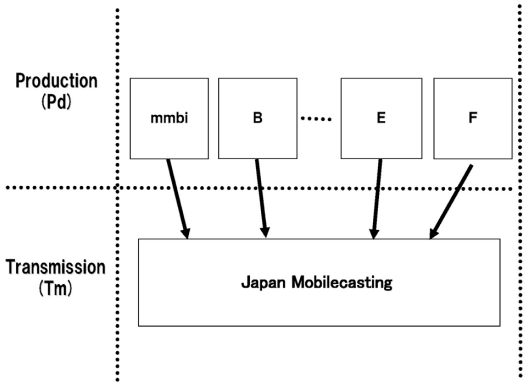

Figure 6 SmartPhone Broadcasting
(V-High Multimedia Broadcasting)

Conclusions

This study aimed to analyze the structure of TV broadcasting industry in Japan and in New Zealand. The fact that complete transition to digital broadcasting is expected to be able to be realized in the short period of only 5 years is due to the contribution made by the organization of the broadcasting industry in this country. Production and Transmission channels are vertically separated, making it easy for new content providers such as Maori TV in New Zealand, independent content aggregators, and new Internet video services to gain a foothold. The reason for a broadcasting station specializing in program production like the Maori Television Service (MTS) to having been able to newly enter the industry and begin broadcasting in Maori over a wide service area accompanying the commencement of digital broadcasting was because a specialized firm like Cordia was able to function in their place in implementing digitalization of Transmission functions requiring extensive expertise and funding.

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