

# Benefits of secure data linkage to the tourism industry:

## Holding a Privacy Tech study session

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### Abstract

*The tourism industry is an important policy pillar in Japan. Recently, data utilization has been promoted in the tourism industry, however, there are two issues: (1) there is a limit to the data that can be obtained by operators, and (2) data linkage across operators and government agencies is not feasible due to the privacy concerns of tourists included in the data. Therefore, in this study, the benefits that the utilization of data held by local businesses and administrations brings to the efficiency of tourism industry operations were confirmed, with the aim of setting up hypotheses for local businesses involved in the tourism industry to maintain and improve their operations with limited manpower and capital in regions that focus on the tourism industry. As a specific means of confirmation, a study session was held. The study session consisted of a classroom lecture and a workshop on the theme of Privacy Tech that enables secure data linkage and analysis. During the workshop, ideas for new data utilization by realizing secure data linkage using Privacy Tech were generated. Based on the ideas, the workshop discussed the benefits that future collaboration and analysis of data by various entities through Privacy Tech could bring to the efficiency of tourism industry operations.*

### Keywords

*Privacy Tech, tourism, data utilization, data linkage, study session*

### 1. Introduction

Tourism is an important part of Japan's policy, as evidenced by the Cabinet decision on March 31, 2023 on the "Basic Plan for the Promotion of a Tourism Nation" [Japan Tourism Agency, n.d.b]. In recent years, however, the number of employees involved in tourism in Japan has been declining due to the aging of the population and the impact of the COVID-19 pandemic. This is especially true for local businesses involved in tourism in rural areas. Therefore, it is necessary to streamline operations to maintain and improve activities necessary for the tourism industry with limited manpower and capital.

Data utilization is gaining attention as a means of improving business efficiency. This is because decisions can be made based on past numerical data. In addition, in order to improve the accuracy of analysis, it is said that the greater the amount of data used, the better. However, it is difficult for local businesses to collect data outside of places where they have contact with tourists. Specifically, in the case of a local business with a store, it is difficult to have contact with tourists outside of the store, the store's website, or social network services. Furthermore, it is difficult to rapidly increase the amount of data that can be collected because of the limited manpower and capital of local businesses.

From another point of view, tourist information is related to personal information and privacy. Therefore, even if multiple regional operators try to share data held by each other, it is difficult to do so from the viewpoint of the Personal Information

Protection Law and privacy protection.

The objective of this study is to help local operators maintain and improve the tourism industry with limited manpower and capital. To achieve business efficiency, it is necessary to support the use of data by local businesses by the promotion of data linkage. This study will focus on clarifying the benefits that would accrue if it became possible to utilize data held by local businesses and the government in conjunction with each other. In order to achieve this, a concrete method was devised, a study session was held with questionnaires, and the results discussed.

As a result of holding a study session and collecting questionnaires, positive evaluations were obtained for the mutual linkage of data among regional operators to recognize more detailed tourist dynamics.

### 2. Position of this study

#### 2.1 The rise of data utilization

In recent years, the use of data, especially personal information and privacy data, has been actively pursued. For example, efforts are being made to develop a system to improve the health of individuals based on privacy data collected using wearable biometric sensors [Sheikh et al., 2021]. However, as in the "Rikunabi case" in Japan, there are situations in which the use of personal data without permission may lead to infringement of the rights and interests of the individual concerned [Personal Information Protection Committee, n.d.].

#### 2.2 Data application in the tourism sector

An existing example of the use of data by regional operators in Japan is the activities of DMOs. For example, in Gero City,

Gifu Prefecture, the Gero City DMO, a tourism community development corporation, has been working to formulate appropriate accommodation plans by aggregating the number of tourists by place of residence, and to retain tourists at member stores in the community by using a tourist information application [Japan Tourism Agency, n.d.a].

One of the challenges in data utilization is the lack of data collection capacity among operators. According to a survey conducted by the Japan Association for Tourism Promotion in 2017, there is a lack of human resources for data collection in DMOs [Japan Tourism Promotion Association, n.d.]. In addition, local businesses and governments involved in tourism have only partial contact with tourists and are limited in their ability to collect data. Another possible method of data collection is to link data collected by businesses among other businesses, but this also poses a challenge. The hurdles and costs of collaboration and analysis are high from the viewpoint of protecting business secrets and the privacy of residents, etc., with data held by local businesses and the government.

### 2.3 Changes in privacy protection

As data utilization has been promoted, the concept of privacy has been proposed, especially in the utilization of personal information and privacy data.

In 1890, a paper titled “The Right to Privacy” emphasized the need to protect the right to privacy [Warren and Brandeis, 1890]. Here, the right to privacy was recognized as the right to be alone. As mass media develops, awareness of the protection of privacy has emerged.

In 1968, the right to information privacy was proposed, which defines the right to privacy as the right for individuals, groups, or organizations to decide for themselves when, how, and to what extent information about themselves is communicated to others [Fried, 1968].

Furthermore, in 2004, considering the development of information and communication technologies such as the Internet, discussions began to take place to structurally reconsider how privacy should be protected [Solove, 2004]. As described above, the way we understand the right to privacy is changing

year by year, as society and public opinion change due to the development of mass media and other technologies.

### 2.4 What is Privacy Tech?

Privacy Tech is discussed as a “technology to enhance privacy protection” in the documents of the Digital Agency [n.d.]. Therefore, in this study, the term “Privacy Tech” is used as “technology to enhance privacy protection.” For example, Privacy Tech is expected to be used in situations where companies want to securely distribute personal information and privacy-related data across companies and industries.

Typical technologies include “secure computation,” “federated learning,” “differential privacy,” and “blockchain,” which are being researched, developed, and put to practical use by academic institutions and private companies.

As an example, secure computation is discussed. Simply put, secure computation is a technique for performing calculations while encrypting data. One method of secure computation is to obtain the result of computation while keeping the target data encrypted, using the secure sharing method and Multi-Party Computation (MPC). Compared to other secure computation methods, this method is more useful in terms of data linkage, and in this study, a method was devised to achieve data linkage mainly using this method. This paper describes the secure sharing method and a series of secure computation processes using MPC.

First, if a situation is assumed in which it is necessary to perform a computation, but there is data to keep encrypted, to start the computation, the encrypted data is divided into meaningless data called shares. By collecting a certain number of shares, it is possible to decrypt the original data. Each of the divided shares is sent to a different server, and the servers communicate with each other to perform the calculation. As a result of the process, a new share is obtained. From this share, the data is decrypted. By executing this series of operations, the calculation results can be obtained with the data still encrypted (Figure 1).

The above is the process of one specific Privacy Tech technique, secure computation, which uses secure sharing and

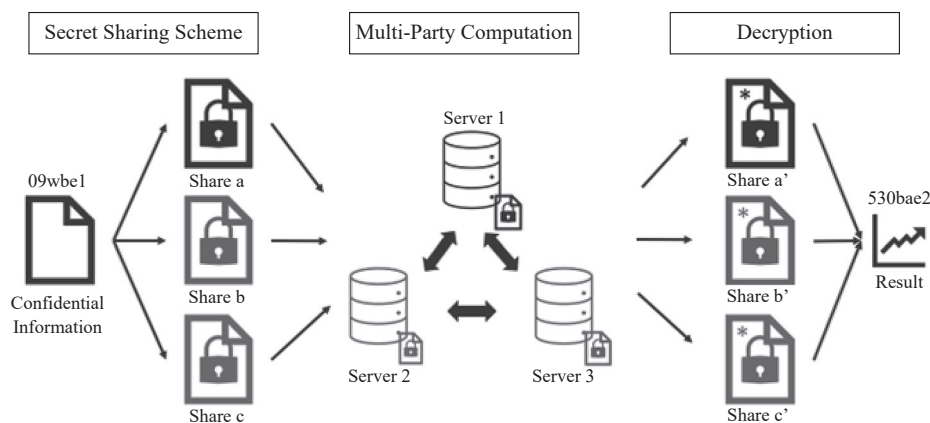


Figure 1: The process of secure computation

MPC.

**2.5 Specific examples using Privacy Tech**

One of the technologies that make up Privacy Tech, secure computation, has been used in a demonstration experiment in Estonia. In Estonia, the failure rate of university students is high, and an experiment was conducted to see if there was a relationship between this result and students’ employment of part-time jobs. The experiment examined: (1) tax payment data held by the Estonian National Tax Agency, and (2) education data and national ID held by the Estonian Ministry of Education, Culture, Sports, Science and Technology. After encrypting each of these data using secure computation, the relationship between students’ employment and failing grades were investigated. In this study, it was reported that there was no correlation between student employment and university failure [Bogdanov et al., 2016].

**2.6 Significance of using Privacy Tech in this study**

Privacy Tech will make it possible for multiple organizations, including local businesses and government agencies, to use the data they hold to collaborate and analyse each other’s data, while protecting their trade secrets and privacy. In addition, there are technological approaches to a technology that constitutes Privacy Tech and jurisprudential approaches to the right to privacy. On the other hand, however, there are still many uncertainties about the merits in the real world and many views on real use cases.

**2.7 Purpose of research**

The purpose of this study is to set up hypotheses for local operators to maintain and improve the tourism industry with limited manpower and capital. Therefore, in this study, efforts were made to confirm the merits of linking and analysing data held by local businesses and governments, with the aim of maintaining and improving the tourism industry. Specifically, a study session on Privacy Tech, a technology that enables secure data linkage and analysis, was held. In addition, a workshop was held within the study session, where employees of local businesses and government officials were asked to think about what kind of initiatives would be possible if data could

be securely linked. Finally, based on the results obtained in the study session and the workshop, the use of Privacy Tech to collect, collaborate, and analyse data jointly by various entities to benefit the efficiency of the tourism industry for local operators, was discussed and a hypothesis for maintaining and improving the tourism industry with limited personnel and capital for local operators was formulated.

The details of this study are shown below (Figure 2).

**3. Practical content**

**3.1 Overview of the study session**

This project was carried out through an industry-government-academia collaboration between Nagoya University’s Yasuda, Endo, and Urata laboratories, Takayama City, Gifu Prefecture, and Acompany Co., Ltd.

As a practical implementation of this study, a “Digital Study Session with Students from Nagoya University on Privacy Tech (hereinafter referred to as the “Digital Study Session”)” was held on January 20, 2023, at 19:00 in the main conference room of the Murahan Takayama City Youth Activity Office in Takayama City, Gifu Prefecture. A total of 15 people participated in the Digital Study Session, including business operators in Takayama City and employees of the Takayama City Office (Figure 3).



Figure 3: Digital Study Session (photographed during the study session)

**3.2 Background of the initiative**

Prior to this project, the following comments was received

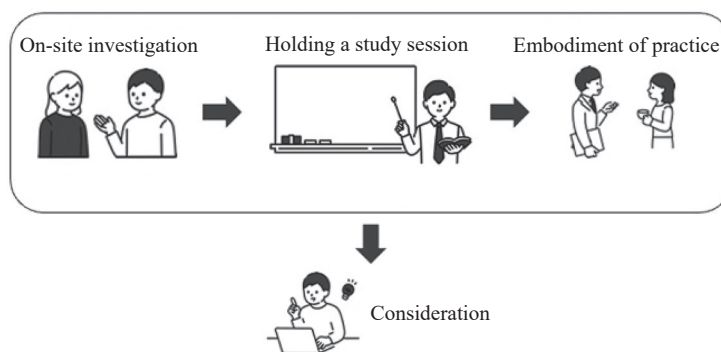


Figure 2: Initiative details

from local businesses in Takayama City, “We would like to link and analyse data among businesses in the Takayama area to improve management efficiency and create new services. However, we do not want to disclose personal information or information related to management to outside parties.” In other words, it was confirmed that there is a need to link data among local businesses, but not to disclose highly important data such as personal information and information related to management.

In order to satisfy this need, that is, to realize data linkage among regional operators, the use of Privacy Tech is considered to be useful. However, Privacy Tech is a new concept, and as described in a document published by the Digital Agency, the judgment of safety standards in Japan has not yet been established [Digital Agency, n.d.], awareness is low, and the understanding of local businesses, government, and residents has not been obtained. Under such circumstances, it was assumed that it would be difficult to practice collaboration and analysis using this technology for data related to trade secrets and privacy.

Therefore, in this study, a study session was held to help local businesses and government officials understand the outline of Privacy Tech and the concept of data protection, and to confirm the benefits of using this technology to link and analyse data held by each of them.

### 3.3 Contents of the Digital Study Session

The study session consisted of two major parts. In the first half, in addition to the basic concepts of personal information protection and privacy, a classroom lecture on the benefits and precedents of Privacy Tech was provided. In this section, in addition to the author’s explanation, Mr. Sato of Acompany Co., Ltd., which operates a Privacy Tech business, cooperated and introduced precedent cases.

After a question-and-answer session regarding the content of the first half, in the second half participants were asked to think about what kind of initiatives can be taken using Privacy Tech from the perspective of analysing the dynamics of tourists in the Takayama region. In the study session, worksheets were distributed and participants were asked to fill in the data they would use and their purpose. After coming up with ideas individually, several participants were asked to present their ideas. The author and Mr. Sato of Acompany Co., Ltd. commented on the presentations from the viewpoint of Privacy Tech use, and discussion on ideas was deepened. After the study session, the worksheets were collected, and each student checked the ideas. In addition, after the study session ended, a questionnaire was conducted regarding the content of the study session and the use of data using Privacy Tech.

### 3.4 Results

The participants were asked to rate the content of the first half of the study session lecture on a 5-point scale. To the question, “Did you think the content of the study session was useful

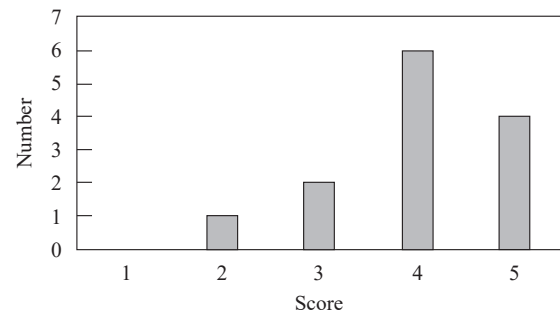


Figure 4: Survey results for study session

for your work?” participants were asked to answer 5 if they “agree” or 1 if they “do not agree.” As a result, the average score for this item was 4 (Figure 4). In addition, a question asking what they would like to work on or do with Privacy Tech following the classroom lecture elicited the following comments.

- Analyzing register data
- Combining lodging data with food and beverage data for use in restaurant management
- Trends in foreign tourists
- Combining ETC data and lodging data to set targets, scope of collaboration, and analysis resources
- The “tolerance” of residents and users will be determined by how well privacy tech is implemented

The following results were obtained when asked if they could think of situations in which they would use Privacy Tech through the workshop in the second half of the study session (Figure 5).

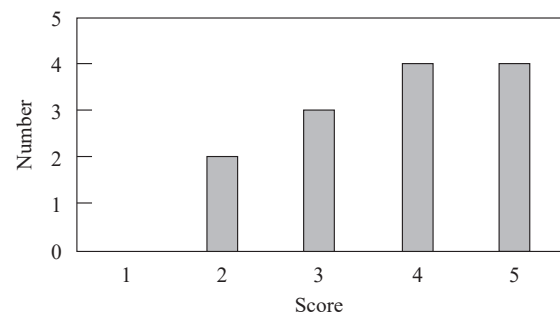


Figure 5: Results of the self-assessment questionnaire on the ability to think about situations in which Privacy Tech is used

When asked whether they were able to visualize the use of Privacy Tech through the workshop in the latter half of the study session, about 70 % of the survey respondents gave a positive evaluation of 4 or higher on a 5-point scale (Figure 6).

In addition, at the workshop held in the second half of the study session, various ideas were generated for analysing the dynamics of tourists in the Takayama region, based on the assumption that data held by local businesses and governments could be freely linked and analysed. For example, to address

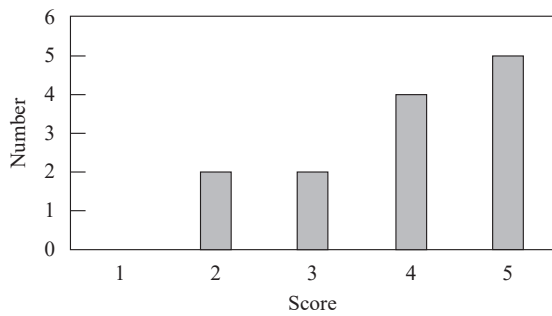


Figure 6: Results of self-assessment questionnaire on the image of Privacy Tech use

the issue of the so-called “dinner refugees,” tourists who are unable to eat dinner because restaurants in the city centre close early, information has been developed on reservation data of guests and the flow of people in the city. The idea was that by visualizing and analysing data and posting data on SNS, it would be possible to adjust business hours and develop menus to match demand.

Finally, when asked if they would be interested in participating in similar workshops in the future, the results are shown in Figure 7.

Overall, it was confirmed that efforts to revitalize the analysis of tourist dynamics will emerge by realizing efforts to link and analyse data held by local businesses and governments using Privacy Tech.

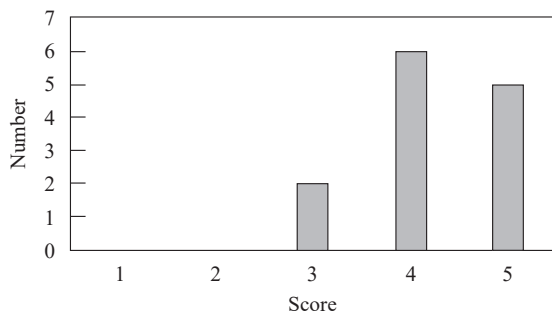


Figure 7: Willingness to participate in the next or subsequent digital study sessions

#### 4. Consideration

Based on the results of the study session, a detailed dynamic analysis of tourists was conducted from the data held by local businesses, which has not been solved by existing efforts, by collaboration and analysing data held by local businesses and the government. It was confirmed that benefits emerge, such as creating new possibilities and implementing effective campaigns.

On the other hand, at present, no safety standards have been established or legal arrangements for Privacy Tech, and there are concerns about collaborating and analysing data related to trade secrets and privacy across local businesses and governments. Rules have not been established. As a result, it was

difficult to proceed with concrete demonstrations because the incident risks that would result from proceeding with these efforts could not be accurately predicted.

In the future, as safety standards are established and legal arrangements are made, it will become legal and socially possible to use Privacy Tech to collaborate and analyse data related to business secrets and privacy across local businesses and governments. If it becomes accepted as a standard, it will promote the use of data to conduct detailed dynamic analysis of tourists. For example, consider the case where Privacy Tech is used to measure the effectiveness of a campaign funded by the government in collaboration with local businesses. By conducting an integrated analysis of data held by local businesses and the government, it will be possible to visualize the characteristics of buyers for each sales method related to the campaign, as well as the industries and stores where usage has particularly increased as a result of this initiative. It is believed that these analyses will enable appropriate feedback to be made, such as making more effective changes to campaign sales methods, targeted regional businesses, and their categorization.

After the study session, the following individual opinion was received from local business operators who participated in the digital study session. “Couldn’t it be possible to coexist with businesses in the Takayama area by selling trends analysed from purchasing data on tourists held by local businesses to businesses outside the area who need this information?” Because the proportion of people engaged in the tourism industry is high, their income is lower than that of neighbouring municipalities, which can sometimes be perceived negatively. By conducting a detailed analysis and clarifying the average income and industry profits for each industry, it may be possible to increase the number of people entering or moving in from nearby or outside the industry. Also, it may be possible to collaborate and analyse information related to management, set appropriate customer attraction targets and allocate costs when holding joint campaigns, etc. By demonstrating the possibility of using Privacy Tech to utilize data held by local businesses and governments that have not been analysed, local businesses are also encouraged to consider new ways to utilize data. Furthermore, in the use of data related to individual tourists as described above, it is possible to change the purpose and use of data by applying certain processing to personal information in Japan. This will also lead to making use of the characteristics of the protection law.

The following two hypotheses can be raised for promoting data linkage using Privacy Tech based on what has been described so far. First, it is essential for governments and ministries to establish rules for Privacy Tech. By providing legal use cases to service providers, it will be possible to promote data linkage using Privacy Tech. Secondly, it is necessary to increase the level of understanding and recognition of Privacy Tech in society. This is to increase the level of understanding and tolerance on the part of service users whose data will be linked, as was indicated in the opinions of the participants in

the post-workshop questionnaire.

## 5. Conclusion

From the perspective of conducting detailed dynamic analysis of tourists, this study aimed to confirm the merits of collaboration and analysing data held by local business operators and governments, so that it is possible to securely link and analyse data. A study session on Privacy Tech was held. Through the study session, it was confirmed that using Privacy Tech to link and analyse data held by local businesses and governments is useful for conducting detailed dynamic analysis of tourists. Additionally, the study group and Privacy Tech were highly evaluated, and participants made several concrete proposals for initiatives.

Although safety standards for Privacy Tech in Japan have not yet been established, if they are clearly established and it becomes possible to utilize data across local businesses and governments, it will be useful for conducting detailed dynamic analysis of tourists. It is considered that initiatives could emerge.

As for prospects, it is necessary to wait for the establishment of Privacy Tech safety standards and the results of legal arrangements regarding the specific implementation of the contents in this discussion. On the other hand, efforts to mutually collaborate and analyze important data held by local companies can be promoted within the scope of current safety standards and legal arrangements. In addition, these efforts will likely lead to the creation of rules for the use of Privacy Tech and the formation of social recognition.

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