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DIGITAL OMOTENASHI PROJECT: A TOURISTS' APPLICATION DESIGN BY A DESIGN THINKING APPROACH

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Abstract

In Tourism, information technology has been a core in creating the features and functions of digital and social innovations. Thus, previous smart tourism studies mainly highlighted technology-driven approach (TDA). To achieve the goals of Smart tourism, however, we need more attention to the Sociotechnical Systems Perspective that embraces technical and social aspects, because currently established design systems and services of TDA are limited to prevent several social vulnerabilities. Therefore, we conducted the Digital Omotenashi project, which deals with foreign tourists' Japanese restaurant experiences with a design thinking approach. As a result, we synthesised EATJOY as a mobile application for satisfying users' sociotechnical requirements. Based on our key findings, the contributions of this study are condensed as follows: 1) designing tourists' information systems, consolidating various aspects in technical and social views; 2) rethinking the role of IT application as a communication tool between local staffs and foreign tourists; and 3) providing a positive direction of how users could create key contents in identifying novel and effective solutions in IS design by a design thinking approach.

Keywords: Smart Tourism, Design Thinking, User-centered Design, Prototyping, Omotenashi Culture.

1 INTRODUCTION

Recently, the community of smart tourism has argued that information technology (IT) could enrich the tourist' experiences with a variety of digital innovations (e.g. products, systems and services). (Buhalis & Amaranggana, 2013; Gretzel, Sigala, Xiang, & Koo, 2015), and they have highlighted the features and functions in identifying how IT could enhance users' experience and their information environments (McCabe, Sharples, & Foster, 2012; Minghetti & Buhalis, 2009; Panahi, Woods, & Thwaites, 2013). Also, smart tourism has become a core issue of information systems research in order to understand users' satisfactions, involvement, and their requirements in creating new IS artifacts.

Yet, these endeavours on smart tourism still have viable problems.

First, most previous smart tourism studies highlighted radical transformations by transplanting IT; therefore, it pays relatively little attention in achieving soft transformation that makes complementary effects between technology and social components. As a result, negative effects arose in tourism business such as system failures (Langefors, 1977; Bostrom & Heinen, 1977) and social disruptions (Benner, 2003; Werthner, et al., 2015). Also, these IS design artifacts have not embodied the aspects of tourists' latent behaviours adequately; thus, tourists encountered a variety challenges in low quality of experience (Google, 2014).

Second, previous research lacks of theories, frameworks, and models in delivering the body of knowledge and practice for IS practitioners. In the prior research, smart tourism community has iteratively highlighted importance of practical studies that contribute to the real industry (Ip, Law, & Lee, 2011; Law, Buhalis, & Cobanoglu, 2014). Thus, only a few studies developed conceptual and theoretical directions that connect between theories and actual practice (Werthner, et al., 2015).

Based on these two problems, in this paper, we take the sociotechnical systems perspective for enhancing various social components (e.g. people, culture and society) and ask a research question--*What aspects of sociotechnical systems perspective could identify the features and functions of tourism application systems?*

To address this research question, we invited the socio-technical systems theory (STS) as a theoretical foundation, because it argues the importance of optimisation of social and technical subsystems in IS design projects (e.g. design innovation versus design refinement). Using this theory, we clarified current problems and future directions of smart tourism community on the previous technology-driven approach in IS.

Based on this theoretical foundation, we conducted the Digital Omotenashi project in order to create an application of the sociotechnical systems. The objective of this project is to synthesize a tourist mobile application called *EATJOY* as a sociotechnical system in Japanese context. To do this, we followed a design thinking approach (Brown, 2008; Buchanan, 1992) to identify required features and functions by users in Japan. The design thinking approach consists in five iterative stages: 1) hypothesizing; 2) researching; 3) analyzing; 4) synthesizing; and 5) developing.

Our contributions can be summarized with the following three manners. First, we synthesized tourists' information systems, concerning various aspects of technical and social systems. Second, we highlighted the potential roles of IT as a communication application (communication-supportive, decision-supportive and culture-instructive). Third, we developed *EATJOY* as IS artifact, focusing on users' behaviors and their requirements using a design thinking approach in IS design process.

The article reviews the smart tourism destination based on STS theory in Section II. In Section III, we demonstrate the design methodology. Then, in Section IV, we describe the research project, simulation and its result. Finally, in section IV, we summarize future research and place it within the context of related work.

2 LITERATURE REVIEW

In this study, we take the sociotechnical systems perspective, because we believe that this perspective can overcome the challenges on the technology driven approach. Therefore, we reviewed tourism & hospitality and IS research in order to understand the previous studies of how they developed the body of knowledge and practice on the two perspectives: 1) technology-driven and 2) sociotechnical approaches.

2.1 Current smart tourism in the technology-driven approach

For long decades, city, region and countries have importantly fostered tourism, because of its economic transfer effects in local (e.g. job creation, business profits) and surrounding economies (e.g. as the secondary economic effects, external economy) (Blanke & Chiesa, 2013). As one part of these efforts, scholars and practitioners have applied information technology (IT) to boost diverse developments of tourism enterprises and satisfactions of tourists (Buhalis & Law, 2008; Law, Buhalis, & Cobanoglu, 2014). The e-Tourism communities have provided considerable innovations and advantages by internet and mobile technologies. For example, the enterprises could obtain more competitiveness (e.g. efficiency, cost reduction), and the tourists could enjoyable travel experiences (Buhalis & Law, 2008; Law, Buhalis, & Cobanoglu, 2014).

E-Tourism conceptualized 'Smart Tourism' in order to apply 'Smartness' for dynamic usages in Smart city infrastructures (Buhalis & Amaranggana, 2013), and the goal is to achieve the maximized value among dynamically interconnected stakeholders. Yet, prior smart tourism studies have highlighted technical aspects as the core driver to change societies (Neuhofer, Buhalis, & Ladkin, 2015), and it has some limitations in diversity and complexity of social contexts. Therefore, we view that this technology-driven approach has encountered high possibility of system failures with lacks of vulnerability in the systems..

2.1.1 *Limited acceptance and benefits*

In the current society, organizations comprise various stakeholders, nature and existing work systems; therefore, most information systems require huge efforts in learning new systems in order to transform activities and interactions on the established social structures, workflows, and the inertia interrupts these activities (Polites & Karahanna, 2012).

Many previous studies have sought improved user acceptance and IS designs. These studies embraced the users' voices more in IS adoption between actual system usages, usefulness, and ease of use of users (Davis J. D., 1986; Davis F. D., 1989; Adams, Nelson, & Todd, 1992; Venkatesh, Morris, Davis, & Davis, 2003). In sociotechnical perspective, Churns (1987) argued the importance of social dynamics and Dillion & Morris (1996) also argued the technology-driven approach is challenging to deal with the entire social context (e.g. people, nature and relation). We also believe that tourism environments will be more complex settings with diverse stakeholders (Sheehan, Ritchie, & Hudson, 2007; Mistilis, Buhalis, & Gretzel, 2014) and different interests (Pike, 2005) as a social systems, in which technology will be one of the essential sub-systems.

2.1.2 *Social disruptions*

New information technology adoption triggers transformations of structural routines in organization (Tyre & Orlikowski, 1994; von Hippel, 1994; Edmondson, Bohmer, & Pisano, 2001); however, existing knowledge and practice do not provide sufficient actual directions in the complex societies.

Leidner & Kayworth (2006) pointed out culture as a significant factor that generates structural contradictions in organization, and the culture is the critical factor to determine the IS failures. Wlatham (2002) also argued technology adoption entails transformations of the culture. Benner (2003) found the ICT adoption in a country could influence on the established social systems and its stability

(e.g. economic equality, employee opportunities). Therefore, recently, with the issue of 'Digital disruption' (Werthner, et al., 2015) has more attention from the smart tourism community.

Harrison et al. (2007) found IS adoptions in healthcare industry by the technology-driven perspective made communication problems on the established social systems (e.g. the way of communication, power structure, workflow and perception on technology) and proposed the importance of users' activities and interactions as the critical factors in IS design.

2.2 The sociotechnical approach as a potential way in smart tourism

IS design artifacts have considered positive directions in gaining competitiveness to enterprises (Hagmann & McCahon, 1993) and society (Kling, 2000); however, numerous failures were arisen due to its dynamic and complexity of its implementation process, for example, a breakdown of an acceptance, resistance and its resultant faded-benefits. Researchers with the sociotechnical approach argued this failure because of the erroneous views from IS designers (Langefors, 1977; Bostrom & Heinen, 1977). By the time, the majority of IS designers fairly considered the technology-driven perspective, and they had little attention to the social aspects of organization (Bostrom & Heinen, 1977).

From this literature review, we summarize that smart tourism also requires to explore social systems and this application with the view of sociotechnical approach, concerning the attributes of people, relationships and authority structures (Langefors, 1977; Lyytinen & Newman, 2008). By taking this view, IS designers could deeply consider the social aspects in order to understand the users' aspects and their information environments (Langefors, 1977) in creating more suitable tourism and hospitality system designs in IS.

3 METHODOLOGY

To embrace both technical and social systems, we used a design thinking approach (Brown, 2008; Buchanan, 1992; Cross, 2008) that develops interactive prototypes as a methodology for synthesising the new solution in sociotechnical condition. It is made up of five iterative stages (Hypothesis-Research-Anlysis-Synthesis-Development), and we followed the five stages in order to understand users and their information environments with the user-centered design techniques (Kumar & Whitney, 2003). The detailed design thinking approach stages would be described in the digital omotenashi project section 4.2.

4 DIGITAL OMOTENASHI PROJECT

4.1 Project background

Japanese government have paid great attentions in cultivating their tourism industry. Recently, as the country successfully invited 2020 Olympic game in Tokyo (Ota & Takeda, 2015), their tourism industry encounters pressuring situation that receives more needs and requests than ever about innovating their existing tourism systems in comprehensive way toward foreign tourists. During International Olympic Committee (IOC) meeting in 2014, they strongly highlighted on one traditional cultural advantage called 'Omotenashi'. In this culture, local people (from residence to service staffs) provides higher quality of service to the foreign tourists like as the hosts serves invited guest in their home. Thus, Japanese marketing researchers expect this culture to boost their quality of service (Al-sheikh, 2014; Joraku, 2013).

Due to lack of confidence and capability in foreign language, local Japanese people has fear to interact with foreign tourists. These individual and mass psychologies tend to inhibit basic service qualities, let alone Omotenashi effects. As results, foreign tourists currently suffer with various service difficulties (e.g. low service quality, service conflications, service denial) and resultant low level of travel satisfactions (Brasor, 2015). Therefore, the goal of Digital Omotenashi (DO) project is to propose innovative business system design by exploring the users, nature and its context.

4.2 Project stages by a design thinking approach

In this project, we conducted five cycles of design thinking approach for identifying suitable design of application. The objective of driving each cycle was to incrementally achieve deeper comprehensions in the relationships among people, nature, behavior, and technology in the context (Hypothesis, Research). And based on those comprehensions and insights, we could devise provisional functionalities that users may need (Analysis, Synthesis). Then, we could confirm those functions through results of each interim tests with our visual interactive prototype (Development, Test).

4.2.1 First stage: understanding users and their information environments

In the first stage, we followed three design actions: 1) hypothesis, 2) research and 3) analysis. In the hypothesis, we started with general design inquiries toward people, behavior, and structure as follows.

- Who are the main local stakeholders in service operations in Japan?
- How do the stakeholders responses to foreign tourists' service request?

With the hypothesis, one of authors and his project members visited 22 restaurants in Shibuya area in Tokyo, Japan, and observed situations and responses of local staffs and stores. The observation was relatively short (10 mins for each) and unstructured, because the goal of first cycle was to obtain broad understandings in targeting context. Based on first observation, we conducted a design analysis to share the captured findings and patterns in the context and could identify the next inquiries. Through this cycle, we defined three different stakeholders (foreign tourists, restaurant hosts, restaurant staffs) were interacting with their different interests. During this research and analysis, we confirmed one of our assumptions that there is a communication barrier between local Japanese staffs and foreign tourists, and the language barrier makes the staffs' expressions negative (e.g. Showing embarrassments, fears). On the other hand, Japanese metaphor of tourism and hospitality is a strict service standard that expresses full facial expressions and smiles, and these reactions by language barrier make more negative communications. Also, we observed only a few limited solutions (e.g. preparing English menu, using body languages) in order to overcome the communication barriers between Japanese staffs and foreign tourists.



Figure 1. *Design Analysis from the field observation*

4.2.2 *Second stage: identifying latent problems and hidden needs from users*

In the second stage, we revisited our design inquiries again in order to identify a set of latent problems and hidden needs from users. With this objective, we asked the following qualified design inquiries:

- What kinds of problems can be identified as the communication barriers between stakeholders?
- What are the current solutions against the potential problems?

With design inquiries, one of author and his project team members visited two international franchise cafés (IFC) and two local ramen restaurants (LRR) to conduct the secondary observation. We assumed that IFCs are highly internationalized business with a well-prepared service for foreign tourists and LRRs would have relatively low capability of international hospitality in their business. We expected that these longer observations (60 mins for each, semi-structured) would give fruitful understandings and critical clues to conceptualize design opportunities. During the design analysis on the secondary observation, we found that the perceived communication barrier even more negatively affects the service operations in the forms of service delay and interruption, because the local staffs call for the other staffs' help in the context. On this problem, we observed the foreign tourists got the pressure, and they decided the easiest choice in a short moment to avoid the uncomfortable situation. Surprisingly, the two fields (IFCs and LRRs) had different resultant operational solutions. In IFCs, the staffs had capability of communications in general. They effectively communicated with the tourists by combining their well-trained body languages (holding and pointing the visual objects and images) and somewhat foreign language skills. On the other hand, the staffs of LRRs were encountering less frequency of interacting with foreign customers, because vending machines (VM) of the stores were effectively mediating with their communications. To complete the orders, customers were required to choose the menu and finish their payment in advance through machine. The customers only delivered their orders without any spoken words by passing the paper ticket to the staff. Based on our design research and analysis, we conceptualized a tourist restaurant communication artifact called EATJOY.

4.2.3 *Third stage: developing multiple prototypes and feedback from users*

With the first prototype, one author and his design team developed multiple prototypes in order to qualified the features and functions in order to clarify a suitable design solution into the social contexts. To develop the EATJOY system, the following design inquiries were highlighted.

- How have you dealt with communication issue?
- What were your inconvenient issues? in travelling (for tourists) / in service receptions (for staffs)
- Do you think this design will help your situation? (Open question)

To do this, we had semi-structured qualitative interviews combining with indirect usability test with potential users (three local staffs and five foreign tourists) in Roppongi area in Tokyo, Japan. From the usability testing, we tentatively confirmed the positive impact and benefits of the basic concept of EATJOY. Local staffs moderately accepted our assumptions in communication barriers in their work, and showed positive responses in using our mobile applications. Foreign tourists, on the other hand, proposed the other suggestions and ideas to improve our application more actively. One interesting

opinion was the adherence to finding machine-equipped restaurants, because using such shops gives them not only comfortable emotions but also unique experiences. And they pointed out several difficulties in making choice of restaurant among excessive information from web, and in finding actual locations of those shops because of all the public and store signs written in Japanese and Chinese characters. Additionally, they desired applications to contain some fun aspects, such as mission-giving to make tourists explore new sites and stores. Through discussion in analysis part, we made consensus in taking vending machine (VM) concept with more amusing functions, and we synthesized this into our advanced function plan of the application. The great change was to entirely altering the concept of application from simple English-menu archiving application to mobile VM application. And at this point, our plan was to replace entire interaction process between local staffs and foreigners by application-mediated interactions to solve identified problems. Therefore, in design development, we developed second interactive prototype, that transfers the contents of order to the POS system of the store, when the tourist decide and click the menu that they want to order in the application.

4.2.4 Following iterative stages: clarifying a design solution

In the fourth and fifth stages, we conducted recursive cycles with the design thinking approach in order to clarify our insights from field studies and reconfigured the features and functions of EATJOY as follows:

- Tuned the previous concept of full technology-mediated interaction
 - Through the research, we found that interaction with local people enriches tourism experience and resultant satisfactions toward the tourists to some extent. Also, combining body language with the application usage was effective enough and more simple to the tourists, and technically more feasible in development (e.g. creating transmission bridge to POS system)
- Improved information-search functions
 - The tourists expressed difficulties in matching information to their reality. For example, to search accessible and renowned local restaurants near their planned travel route was not easy, and hard for them to find and access those restaurants due to public and store signs written in Japanese and Chinese characters
- Added decision-supportive functions
 - Several tourists mentioned difficulties in making decision in a large group and many choices they have. And their stopgap behaviour was to make a rule (e.g. following the leaders' choice) or playing pitching pennies game.
- Added cultural-instructive functions
 - Most of the tourists desired to receive explanations of cultures and food in their traveling site. However, there were only few subjects who can offer such explanations.

4.3 EATJOY mobile application

EATJOY is an interactive mobile application and platform to foreign tourists and local staffs in Japan, and it supports four main activities of foreign tourists: 1) Searching, 2) Decision-making, 3) Communicating and 4) Understanding. Figure 2 shows the concrete features and functions of EATJOY.

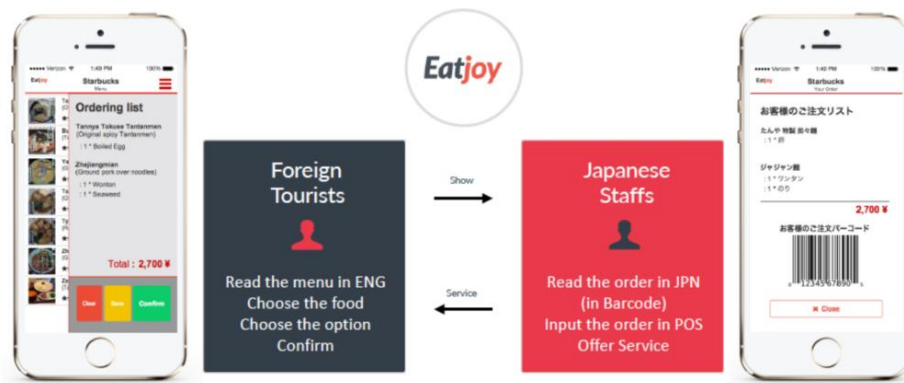


Figure 2. Features and Functions of EATJOY

- In searching, the application provides several useful channels and information to help discover and reach the renowned local restaurants. For instance, tourists can search restaurants in unknown places through choosing category of food, keywords and locations searching. And they can reach to the site by using recognitions of image (store signs) and QR codes attached at the store front.
- For decision-making, the application offers tailored suggestions to the tourists in a form of amusing game. In the function, the tourists can receive five series of restaurant suggestions (created based on the current location and preference of tourists) with penny pitching game, so they may joyfully reduce their efforts in searching and making decisions in choice.
- In communicating, our applications provides interactive visual menu in foreign language. The menu has similar visual appearance and work process with analogue VMs. So the tourists can order the food and drinks easily like they are already doing with the analogue VMs. Then they can hand over their device that progressed to the order contents screen, written in local language, to the local staff. Through this actions and supports, the tourists can deliver their order and express their preference with body language. And the local staffs can easily understand what tourists want and avoid misunderstanding through checking the translated order contents in the screen
- After a few seconds of ordering process, the application automatically displays the story-telling screens to the tourists. The screen contains cultural explanations (e.g. etiquette, originations) and interesting stories related to food and region.

The meaning of EATJOY is the fine-tuner that adjusts complex relations of sociotechnical systems (people, behaviour, structure and technology) in optimal blend in Japanese cultural context. By using EATJOY, tourists and local staffs can fully utilise their cultural advantage (e.g. Omotenashi culture) and experiences by IT-enabled interactions during their hospitalities.

4.4 EATJOY demonstration

EATJOY demo was developed as a communication application between foreign tourists and local staffs. The following persona, Felix Schulze, and his journey demonstrate what the key features and functions of EATJOY are and how EATJOY does work in the actual communication contexts between a tourist (Schulze) and local staffs (Kurino).

4.4.1 Journey of Felix Schulze

Felix is 20 years old male, travelling from Germany. He is a college student on an Asian backpacking trip. He has limited time in Japan and plans to visit many of the typical tourist destinations of Japan and one of his purposes of this trip is to eat Japanese traditional foods. So, he wants to go the authentic Japanese restaurants rather than the international cuisines in Japan. He uses a Lonely

Planet book and TripAdvisor to find restaurants; however he is often disappointed that there are too many tourists and some reviews have not matched, concerning his personal preferences.

Actually, he can't read and speak Japanese. Therefore, when examining them menu in restaurants, it is challenging for him to understand what kind of foods are served without English names or photos. Many of the times, he feels that he is missing out on the Japanese experience when he doesn't understand the menu and tends to choose the most basic version of dishes. Sometimes, he hesitates to enter Japanese restaurants when there's no English menus or available information.

After hearing the functions and features of EATJOY, Felix installed mobile application EATJOY in his smartphone. And he decides to make a trip alone. However, he was forgetting about his situation that he's not capable to understand Japanese, and there is no specific person who can help him communicating in Japanese next to him. He becomes embarrassed, because most of the public and store signs are written in Japanese and Chinese characters. Thus, he cannot know; which food do the restaurants provide; how to find the good one. At the moment, he recalls EATJOY, and starts searching restaurant by location. Then, in his screen, plenty of local restaurants are listing up, so he filters them by the evaluation score in order to check the good one easily. After a few minutes considering, he decides which restaurant to visit, based on menu, price and reviews. When arriving at the store front, he takes photo of store sign to get the VM screen. Then, he chooses the menu, and gives his device to local staff without delays. The local staff initially seemed nervous, but she smiles when receiving his phone. And through her body language (pointing out the screen, shaping her hand to 'X'), she informs that the menu that Felix ordered is not possible to provide due to running out of ingredients. Felix easily understands what she explains, and change the menu right away with the device, and confirms the order with the staff. A few second after the order completion, he automatically receives story screen that contains the cultural story related to Ramen. According to the story, to make eating sound in ramen store is polite manner, because that indicates satisfied taste of food and service. Felix follows the instruction, and the staff responds to his manner by her smiling.

4.4.2 Journey of Shiori Kurino (Japanese Staff)

Shiori is 23 year old female, working in Tatsu-ya ramen restaurant in Tokyo. She has been working there full-time for roughly a year. Due to the location of the store, it's quite rare to receive foreigners entering her restaurant, and when they do so, she becomes really nervous and embarrassed over her low English skills. Once she tried to prepare the English menu for the foreign tourists, but the store received more complains about clerical errors and limited number of choices about new and seasonal menus due to difficulties in updating the menu constantly. She knows several neighboring restaurants sometimes glaze to the foreign customers that the store is full, in order to avoid speaking English in their service. Whereas, the manager of her store desires more customers and don't care whether they are Japanese or not. But like Shiori, most of the staffs can't speak English and need to learn.

As usual, Shiori works in the restaurant, and the store is almost full with long queue due to peak time. She mainly takes the order and supports serving of food to the customers at counter. During her work, she suddenly detects one foreign customer waiting in the queue, and she becomes so nervous, because she's not confident to receive the order of foreigners due to her low English skill. For a moment, she glances backward to the kitchen to find anyone who can help her, but all of the staffs seem busy. If she asks help, they may have to stop their work to help her, and it will harm the effective operation of kitchen. In the end, the foreign customer approaches to the counter and suddenly hand over his mobile device to her. She looks at the device, and realizes that the screen of the device contains his order in her local language. But since there was no more ingredient for that food, it was needed for her to inform that his order is not possible now. Thanks to the initiation of the body-language-communication by the foreign customer, she easily explains the situation through her body language (pointing out the screen, shaping her hand to 'X') as well. He easily understands, and ask changes the menu by pointing the image of the screen again. She feels novel, because it was seasonal menu that the old English-written menu for the foreigners does not contain it. After confirmation of the order, she

brightly returns thanks to him, and serves the food. And she looks his eating, and cannot help smiling because he expresses his satisfaction of food through his eating sound, like other local customers do.

Through the demonstration, we found that EATJOY allows effective interaction between foreign tourists and local staffs in the hospitality context through combining technology and stopgap behaviours of users adequately (e.g. image-utilised menu, body language and VM metaphor). In detail, through offering digitized VM and its menu contents described in foreign language and images, our application allowed tourists to decide their menu easily and reasonably in advance so that they do not have to be embarrassed in their ordering in the store. Also, our application allowed local staffs to understand foreign customers' demand easily by providing translated contents of the order in local language, and this alleviated psychological tension of the local staffs, which has been main barrier of generating Omotenashi cultural effects. Concurrently, the application naturally induced usage of body language with the mobile application in the communication process of the tourists and the staffs, and it was supported by provision of visual images in the application.

5 CONCLUSION

Previous Smart Tourism studies still remains in technology-driven approaches, because tradition of e-Tourism studies have dealt with technology as the key factor of innovation, and it has developed considerable improvements and innovations. Yet, embracing user and other social aspects adequately in the Information Systems Design (ISD) has been a central issue in IS literatures, because user was the key subject that generates the value of the systems. Furthermore, the meanings of the user became more expanded, because this approach accompanies more benefits and synergy effects from complementary interconnections and resultant interactions of diverse stakeholders and social contexts. Therefore, in this study, we highlighted sociotechnical studies and sociotechnical studies that have provided relatively solid explanations against limitations of TDAs. Based on this, we summarized our research propositions and focused on the importance of deeper considerations in social aspects in order to embrace users' aspect and their information environment in creating more suitable tourism and hospitality systems

In our study, we synthesized a tourist mobile application called EATJOY as a sociotechnical system in Japanese cultural context. Throughout a design thinking approach, our mobile application considered variety of relations and identified useful design of smart tourism systems, concerning Omotenashi culture in Japan. As a design outcome, the EATJOY supports various behaviours and psychologies between tourists (searching, decision-making, communicating and understanding) and local staffs.

This study contributes to the smart tourism in information systems as follows:

First, we synthesized tourists' information systems, concerning various aspects of technical and social systems. With a design thinking approach, we elicited deeper comprehensions and optimal blend of various social subsystems (diverse stakeholders, cultures) and technology. Based on this, our application design provides trigger effects toward problems and restrained cultural systems embedded in established structure of Japan through establishing dynamic interconnection and resultant interaction of social aspects and mobile application (technology). We believe this could be a destination of future Smart Tourism. Technology is not an element to be unconditionally transplanted, but to be tailored in the social context in order to make problem-solving as well as incremental enhancement of the existing social system.

Second, we highlighted the potential roles of IT as a communication application. In the prior research, the functions of IS in tourism have been mainly concentrated on information searching and process optimizations. Throughout this study, we suggest that IS can take diverse roles: 1) communication-supportive; 2) decision-supportive; and 3) culture-instructive in tourism and hospitality.

Third, we provided a direction of how users could generate core contents in identifying effective solutions in IS design by a design thinking approach. During the process, users usually have their own

stopgap behaviours (e.g. body language, vending machine approach, and penny pitching games) in order to counteract against the problems. We elucidated these behaviours as insights to create design clues on the view of a socio-technical systems.

Like other studies, this study also has some limitations. We synthesized IS artifact based on the findings of sociotechnical conditions. Although we made investigations in relations and the impact of our mobile application by design cycles and usability test, it lacks of empirical data in confirming design of our application. Therefore, future studies might conduct empirical studies that collect the data in relations of components, and test them in more long term with more samples.

Also, this paper proposes considerable achievements in the aspects of sociotechnical systems. However, the study still lacks in providing theoretical explorations about how a design thinking approach could satisfy the condition of sociotechnical systems. The future study might conduct more detailed research in studying more solid theoretical explanations about design thinking approach within sociotechnical theory.

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