THE USE OF QUALITATIVE APPROACH IN INFORMATION SYSTEM RESEARCH
Study of Digital Fencing

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ABSTRACT
During the pandemic, several governments choose to emphasize the strict approach to immigration on their border. This approach focuses on screening, tracing, and quarantine mechanisms. One of the countries that prioritize this method rather than relying on vaccination is Taiwan. This approach is also heavily affected by information technology advancement in government. This paper will discuss the implementation of digital fencing in Taiwan, using a qualitative method and personal narrative elaboration. The informants of this study are foreigners who entered and exited Taiwan during the COVID-19 pandemic and will provide a lot of resourceful data based on their experience. The

result indicates that the socio-technical approach helps Taiwan in implementing digital fencing to reduce the risk of COVID-19.

Keywords: *e-Government, COVID-19, digital fencing, socio-technical, Taiwan.*

A. INTRODUCTION

Since the initial COVID-19 cases appeared in November 2019, the pandemic has led to 125.160.255 cases and caused 2.748.737 deaths (World Health Organization 2021). To stop the transmission of the disease, countries, and governments have responded through various forms of Covid-19 policy, as we know in this current situation, governments play a vital role in adapting and managing the right policy to prevent the pandemic transmission (Dewi et al. 2020), that policy including blocking all trips to and from all areas defined as "red", 14-day home quarantine for those who live, work, or return from "red" areas, social distancing, travel restriction, lockdown, testing-tracking-tracing, and isolation through conventional ways and technological approach, etc. (Chung et al. 2020; Dewi et al. 2020)

The use of technology to manage the spread and transmission of the disease has recently been developed by many governments in this world. That technology is used to check symptoms, trace contacts, and alert persons who have been in proximity to an infected person, and also this technology can identify "hot spots" and track compliance with confinement measures and stay-at-home orders (Global Legal Research Directorate 2020).

There are two types of technology used in managing COVID-19 transmission. The first type is by using telecommunication provider-based measures; this type includes three kinds of action: (a) Mapping the amount of anonymized cell phone movement in a particular area (Germany, Austria, Italy), (b) Base station triangulation to approximate cell phone location (Taiwan), and (c) Access the A-GPS data generated by the phone (Israel). Then, the second type is a voluntary provision of data including The use of (a) an App recording device within a contact range via Bluetooth technique (Singapore, Austria), (b) an App recording daily symptoms (South Korea, Taiwan, Poland), and (c) QR code for entry or exit places (China) (Chung et al. 2020) (Global Legal Research Directorate 2020). Other studies sum up the use of digital technology in the COVID-19 pandemic into four functions as follows: (a) digital epidemiological surveillance; (b) rapid case identification; (c) interruption of community transmission, (d) public communication, and (e) clinical care (Budd et al. 2020). These studies indicate the importance of digital technology in the Covid-19 pandemic. But does the technology approach persevere enough? Or does it need to be followed by a non-technical approach? This study aims to observe the digital fence system technology in Taiwan during the early phase of the COVID-19 pandemic. Such observations will describe the effective use of technology in managing people's mobility.

Taiwan is one of the countries that implemented a technological approach to managing COVID-19 transmission, especially in tracking, tracing, and isolation (TTI) processes. Since the first case of COVID-19 in Taiwan on January 21, 2020,

the Taiwan government has developed many strategies to control the outbreak (Chen, S. 2021). When the outbreak occurred, at an early stage of controlling the virus transmission, the strategy in Taiwan had three pillars: real-time surveillance with rapid risk assessment, border control and quarantine, and laboratory capacity building. Before the outbreak occurred, the Taiwan Centres for Disease Control (Taiwan CDC) established comprehensive surveillance systems that included laboratory and social media surveillance (Jian et al. 2017). When the outbreak was detected by social media surveillance, then the surveillance team continued collecting outbreak news from social media, government reports, and official press releases to monitor the progress in China daily and periodically update rapid risk assessment to the provincial level for decision-making (H.-Y. Cheng, Li, and Yang 2020). Furthermore, in recent days the TTI process In Taiwan has continued by using the Digital Fence Intelligent Monitoring System, known as the "digital fence" which was developed in February 2020. The system monitors the location of those required to home quarantine via their cell phones or government-issued cell phones to prevent their movement and stop the spread of the infection (Global Legal Research Directorate 2020). The use of this system has proven successful in making Taiwan one of the countries that are quite successful in controlling the spread of the Covid-19 outbreak. Taiwan even managed to reach zero cases of COVID-19 transmission, while the cases still increase in many countries around the world.

This article will make use of border security mindset through system information concept, with the projection that the observation and analysis can scrutinize the phenomenon and elaborate the digital fencing mechanism. Currently, there are limited articles that discuss the existence of digital fencing in immigration control especially the one that happened during the pandemic, this article has the chance to fill the gap by providing empirical data through observation and analysis from Taiwan during the pandemic. Therefore, this study will assess how qualitative approach can be use in a information system research regarding the use of digital fencing in Taiwan. With the findings and the result provided, this study also will further discuss Taiwan's success in controlling the spread of COVID-19 through the use of the "digital fence" system.

B. LITERATURE REVIEW

System Information

There are various forms of information systems. An information system can be a combination of hardware, software, communication networks, data resources, policies, procedures, and even people to retrieve, change, store, and disseminate information within an organization (O'Brien and Marakas n.d.). According to John F. Nash (1995: 8), an information system is a combination of people, technological facilities or tools, media, procedures, and controls that aim to organize a communication network, certain and routine transaction processes, to assist management and internal and external users, also to provide a basis for making appropriate decisions.

An information system is a system within an organization that is related to daily transaction management needs that support the managerial operational

functions of an organization with strategic activities of an organization that can be presented to external parties using the necessary reports (Sutrabri 2012)

Digital Fencing COVID-19

As an effort to overcome the spread of the COVID-19 virus, the state is trying to issue effective policies to reduce the number of COVID-19 virus patients. The government is required to ensure that the public complies with quarantine requirements and other policies. The existence of "digital fencing" is one form of the government's efforts to overcome the COVID-19 problem in line with the previous sentence. As a form of case-control, tourists entering the country's territory will be quarantined temporarily at home or in quarantine facilities. This digital fencing is a system designed using cell phone signals with the aim of monitoring if people who are in quarantine violate existing protocols (H. Y. Cheng and Liu 2022; Lin et al. 2020; Summers et al. 2020). Apart from that, this system also aims to isolate disease carriers without symptoms (Sayampanathan et al. 2021), and isolate disease carriers with symptoms from people who are not infected with Covid-19. This system is an effective method for fighting the Covid-19 virus (Takefuji 2021).

Monitoring the location of people who are in quarantine is needed by the government as an effort to control the COVID-19 virus. Digital fencing was created as a digital monitoring system that has been integrated with data from various sources including immigration data, health insurance, and cell phone services. This digital fencing system is integrated into the "Quarantine System for Entry" application (Yeh and Cheng 2020) this application has one function a user location tracker. If there are people during the quarantine period who cross the predetermined quarantine area boundaries, this application will automatically send a signal to the local authorities and police. The success of this innovation in Taiwan is due, among other things, to bold political decisions in controlling border areas, identifying cases, collecting and distributing resources (Takefuji 2021b; Wang, Ng, and Brook 2020).

The government created "digital fencing" to ensure that people or tourists who are in the COVID-19 quarantine period do not leave their quarantine area during the 14-day isolation period. By using Global Positioning System (GPS) technology, authorities can monitor the movements and movements of patients (Wong n.d.).

C. METHOD

This research used a qualitative research design and a narrative research tradition. A narrative study is a study of “the ways humans experience the world” (Clandinin and Connelly 2001). Narrative research comprises many procedures; including gathering data through the collection of individuals' stories, reporting their experiences, and chronologically ordering the meaning of those experiences (Creswell 2014). This approach is rarely used in information system research, as more IS research relies on the natural science perspective (Siponen and Klaavuniemi 2021) so this also is the contribution of this study in the information system fields.

In this study, personal narratives were used to chronicle the implementation of digital fencing systems to control the pandemic based on the experiences of the person who has experienced how the system is implemented. The informant of this study is a foreigner who has been visiting Taiwan during the outbreak. The selection of foreigners' points of view aims to provide more comprehensive stories about how digital fencing has been implemented in Taiwan. So far, many publications about digital fencing have sprung up only from Taiwanese governments and local Taiwanese.

Since the narrative inquiry is one of the qualitative methods with a high level of subjectivity, it is important to point out the potential limitations of this study. First, the personal narratives may reflect biases associated with the informant's personal, professional, and academic background. Second, the interpretations of the personal narratives may reflect the collective biases of both researchers because of their personal beliefs, professional views, and political stances (Dishman and Schroeder 2020).

On the other hand, the first-hand experience of the foreigner who visited Taiwan during the COVID-19 pandemic will be fruitful for this study as a whole sequence of events that occurred when passing the digital fence can be explained. Therefore, we can understand that personal narratives are still relevant to be used in this research. The use of the narrative approach in this study is also unique as it can contribute to the application of qualitative methods in information systems studies.

D. EXPLANATION

Before being hit by the pandemic, Taiwan had the knowledge and the experience in combating SARS in 2003, causing the anticipation since the first time the virus was detected in Wuhan, quite high. The result of learning from experience is shown in the statistics, as Taiwan is crowned as one of the most efficient countries in combating COVID-19, along with New Zealand (Patel and Sridhar 2020; Summers et al. 2020).

The main effort that also became the key to success in limiting the cases and the casualties from the pandemic is by doing lockdown. However, in Taiwan, the mechanism to fight the pandemic came out as the strict regulations of immigration in the form of electronic/digital fencing. This choice of policy is heavily implemented for the incoming individual from outside Taiwan who wants to enter the country.

Several steps happen in electronic fencing in Taiwan. This process is based on the researchers' observations when entering Taiwan Taoyuan Airport the first time on 24 September 2020 and the second time on 9 May 2022. For the first time, the electronic fence quarantine was used to control visitors entering Taiwan from overseas. The process observations are then coded into two categories: S and T. S indicate a social approach that is conducted through social interaction. T indicates a technological approach that is conducted through technology interaction. The summary and analysis of every step are presented in Table 1:

TABLE I. SOCIAL AND TECHNOLOGICAL CATEGORY OF TAIWAN'S ELECTRONIC FENCE QUARANTINE MECHANISM

No	*Process*	*Social*	*Technological*
1	Inbound visitors report quarantine systems for entry to Taiwan (available at https://hdhq.mohw.gov.tw/). In this process, travelers/visitors must already report their quarantine accommodation (most likely a designated hotel, for foreigners) to the system.	No	Yes
2	After landing, each visitor will be questioned about their Taiwan cell phone number.	Yes	No
3	If they do not have a Taiwan cell phone number, they should buy the number after exiting the airplane.	Yes	No
4	The new number will be registered to the quarantine system available at https://hdhq.mohw.gov.tw/.	No	Yes
5	Visitors can leave the airport by using designated transportation (in this case taxis or buses that have been subsidized by the government).	Yes	No
6	Once arrive at the destination (quarantine place, mostly designated hotels), foreigners should do a 14-day quarantine with a tracking system attached to their cellular phone.	Yes	Yes
7	Even though electronic fences have been used by registered cell phone numbers, a police officer from the local precinct checked the foreigners' premises to ensure that there were no violations from the foreigners regarding quarantine requirements.	Yes	No
8	Foreigners in quarantine should fill in the daily paperwork regarding their health condition, including whether having fever, diarrhea, coughing, and other COVID-19-related symptoms. It should be sent to the police officers as mentioned in process no 7 by using LINE Messenger and/or SMS.	Yes	Yes
9	The Centers for Disease Control (CDC) of Taiwan sent an automatic SMS to foreigners at 09.00 am every day during 14 days of quarantine. The SMS will be resent every 15 minutes if it is not replied to by the person in quarantine. An automatic phone call will be activated if in an hour the person in quarantine does not respond to the SMS.	Yes	Yes

No	*Process*	*Social*	*Technological*
10	After finishing the 14 days of quarantine, foreigners will be allowed to leave the room. Another 7 days of control from another cell phone number still controlled the quarantined individual by asking similar questions.	No	Yes
11	After 21 days the electronic fence quarantine has ended.	N/A	Yes

Source: Author's observation

From the 11 steps above, we can catch a glimpse of how detailed and strict the tracing and control are towards any individual who enters Taiwan during a pandemic. This particular electronic/digital fencing mechanism indicates the combination of social and technological approaches to preventing the COVID-19 pandemic from overseas. It can be seen that 6 processes can be regarded as social interaction and 7 steps can be regarded as technological interaction processes. Both processes i.e., numbers 6 and 8 are unique where these processes share both social and technological processes at the same time.

Just like what happened in other countries, along with the decline of COVID-19 cases, these steps also adjusted to become not as tight as before, but still carried on with high precaution. During the researcher's second visit to Taiwan on 9 May 2022, the duration of the quarantine period was reduced to 7 days, followed by 7 days of self-health management period (when the people that have finished 7 days of quarantine still cannot take public transport, cannot visit public places, and have to limit outdoor activities). All the steps are done just like at the beginning of the pandemic but with the adjustment of the duration of the quarantine. In addition, starting from 15 June 2022, the quarantine duration is 3 days, followed by 4 days of self-health management. The screening test in the Taiwan Taoyuan Airport also changed from a Swab PCR test to a Saliva-Based Antigen Test which the result is still easily accessible via the internet, sent by the government to the traveler's email. This shows that the adjustment of the digital fencing mechanism that is carried out with the collaboration between social and technological aspects is flexible enough in the implementation.

All of the efforts made by Taiwan government is also supported by the facts that during Covid 19, there was considered no limitation whatsoever to share and publish the data to public domain (Erdi Yanuar and Syafriyana Hijri n.d.). In this case, it affects how transparency is being exercised by the Taiwan government, developing more trust towards them by the public. Moreover, this is also affecting the acceleration of the management of the pandemic, as the increase of trust can have implication towards the ability of the government to surmount the impact of the pandemic, according to the research conducted by Hidayat et al with the title "The Importance Of Public Trust In Government Policies In Efforts To Accelerate The Management Of The Covid 19 Plague" (Hidayat et al. n.d.).

The combination of social and technological processes has shown that Taiwan has successfully applied a suitable policy to prevent the outbreak of COVID-19 inside the country by combining social and technological approaches

for overseas visitors. From the social perspective, it can be seen that the policy is chosen so that the population in Taiwan will not undergo a state of panic or even be affected by xenophobic symptoms because of the pandemic. The use of technology also eases the implementation of digital fencing, as by doing a very tight screening process embedded into electronic/digital fencing, the people who are already inside Taiwan can rest assured since the foreigners and also Taiwanese who just came from outside of the country have been quarantined and monitored thoroughly in relation with COVID-19 possible cases.

From this study, it can be seen that the application of border control by maximizing the use of information systems has been optimized by the government of Taiwan. Also, the study of digital fencing on surmounting the impact of the pandemic in this article should provide a certain degree of novelty on the scope of information systems, border control, and public policy studies.

E. CONCLUSION

This study describes the process of the digital fence in Taiwan during the COVID-19 pandemic. Based on firsthand observation, the process of entering Taiwan during the digital fence quarantine was depicted. The field note is then grouped into two categories: social and technological. The result indicated that both perspectives appeared equally in the eleven processes with each having six processes two of which were shared between the two categories. This result might indicate that both social and technological approaches were important in the success of the digital fence concept during the COVID-19 pandemic. The human-computer interaction that not only relies on the technology side proves to be successful in Taiwan. Moreover, the combination of socio-technical aspects of the Digital Fencing mechanism does not hinder the adjustment of the quarantine policies, related to the decline of COVID-19 cases which has an impact on the ease of quarantine procedure for individuals who travel to Taiwan.

This study also contributes to the advancement of the qualitative approach in information system research by using the narrative approach with reliance on observation as the data collection method. For further studies, this research suggests surveys to get more consistent results from various foreigners who enter Taiwan. The trends of using socio-technical approaches in the information system discipline have decreased lately (Sarker et al. 2019). This study demonstrates that socio-technical has a positive impact on electronic government usage during the COVID-19 pandemic.

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