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The Evaluation of Hong Kong Residents' Acceptance Towards the New Digital Identity Platform "iAM Smart"

Master's thesis

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Hongkongi elanike valmisoleku hindamine uue digitaalse identiteedi platvormi iAM Smart rakendamise suhtes

Magistritöö

Juhendaja: Eric Blake Jackson
PhD Kandidaat

Tallinn 2023

Author’s declaration of originality

I hereby certify that I am the sole author of this thesis. All the used materials, references to the literature and the work of others have been referred to. This thesis has not been presented for examination anywhere else.

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Abstract

Digital identity is well-recognised as a paramount component in the digital government infrastructure due to its effectiveness in delivering and receiving government services through electronic means. The significance of it is evidenced by the increasing adoption of digital identification management system around the globe, including Hong Kong. In December 2020, the Hong Kong Government has released a brand new digital identity platform named iAM Smart. It is designed to act as a one-stop shop that offers Hong Kong residents a single digital identity and authentication method for both governmental and commercial transactions.

Given the freshness of iAM Smart, this study aims to provide a well-structured assessment on the overall acceptance level of the solution. Mixed-method approach was adopted by using both quantitative and qualitative methods, whereby the convergence of survey data and interview data has offered a better portrayal of this topic. In addition to the identification of relevant factors that influence the acceptance level, this study concluded the findings with the provision of potential recommendations.

Keywords: digital identity, digital government, identity management, digital transformation, UTAUT.

This thesis is written in English and is 67 pages long, including 7 chapters, 27 figures and 2 tables.

List of abbreviations and terms

TAM	Technology Acceptance Model
TRI	Technology Readiness Index
UTAUT	Unified Theory of Acceptance and Use of Technology
EU	European Union
OGCIO	Office of the Government Chief Information Officer
HKIC	Hong Kong Identity Card
FIDO UAF	FIDO Universal Authentication Framework
HKMA	Hong Kong Monetary Authority

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1 Introduction

As time goes by and the technology evolves, the world people live in right now should be radically different from a hundred years ago, and in the twenty-first century, the most influential change brought to the human race is arguably the popularization of internet. The internet not only brings people the convenient access to all sorts of information, but also allows them to create an identity in the cyber world, whereby they could carry out a variety of actions, from socializing on social media platform to executing a transaction that corresponds to the reality.

From the traditional perspective, a presumption of one's identity is made predominantly based on the physical presence. Without any physical interactions, the identity of oneself can hardly be substantiated and thus remains fictional. Nowadays, a different approach has been adopted at the crossroad between reality and cyber world, that also include legal context, of which two or more parties can legally reach an agreement through their digital identities instead of traditional face-to-face dealings or personal acquaintances [1] . The genuineness of one's identity may not always be accountable in real life scenario, the same also applies to digital identity, the consequences of being misused in fraudulent activities are likewise detrimental, regardless in the transactions with government or non-government services [2] .

As a result, a comprehensive legal framework with regard to the digital identity is imperative, especially in a digital government, enabling the transactions to be carried out in a secure manner [3] . Such notion is currently well-recognised around the globe, given the fact that the interaction basis of almost every services and sectors nowadays is highly reliant on the identification, and meanwhile, the internet of things gradually becomes the primary medium of transactions, which eventually raises the importance of a secure digital identification method [4] . For example the European project named ARIES, also known as ReliAble euRopean Identity EcoSystem, its main objective is to fill the gap between digital identity and physical identity through a holistic identity

management system that meets the characteristics of reliability and privacy-preservation [5] .

Following this trend, the Hong Kong Government further acknowledges the significance of having a digital identification management system in place, by way of launching a mobile application platform named iAM Smart at the end of 2020, in addition to the pre-existing digital government system that mainly relied on username and password authentication. Such initiative is surely something new to the Hong Kong residents, but it seems to be rather uncertain on whether or not it would bring a massive change to their daily lives.

Given the freshness of iAM Smart, there is a very limited number of researches that cover it, hence a well-structured assessment appears to be necessary on this topic. In order to carry out a holistic review, it is crucial to understand the wider concept of digital identity, what it represents in a functioning digital government, and which types of potential challenges it may face. In the third chapter, the research methodology of this paper is outlined, where further explanation is given on the chosen methodology, including the research design and data collection. In the fourth chapter, a detailed case overview on iAM Smart is described, that includes but not limit to the background of initiative, iAM Smart's functionalities, and the identified concerns. In the fifth chapter, the research findings of survey and interview are presented. In the sixth chapter, a discussion is carried out based on the overall research findings. The last chapter consists conclusion, limitations and future studies.

The first research question is "How to understand the level of iAM Smart platform acceptance by the Hong Kong residents?" It aims to find out a suitable approach that could offer a better interpretation of the acceptance level towards iAM Smart by also asking sub-questions like "What is the current awareness level of Hong Kong residents towards the iAM Smart platform?" and "What is the user experience of the platform?".

The second research question is "How to identify and define the relevant factors that influence the level of acceptance?" It aims to pinpoint the factors that are relevant and influential by further asking sub-questions like "What are the factors in the context of Hong Kong?" and "What recommendations can be given to encourage Hong Kong residents to utilise the iAM Smart platform more?"

2 Theoretical Background

2.1 Digital Government

Digital government, also known as e-government, refers to the utilization of information technologies by the government agencies, and these technologies are capable of changing relations between government branches, citizens and businesses [6] . It emphasizes that routine government information and services can be delivered by electronic channel, in particular internet technology, without the limitation of locations [7] . The European Commission also highlighted the importance of digital government, as it is deemed as the integral part of the public administrations modernisation, where the administrative burden on businesses and citizens could be reduced by high quality digital government services that are more efficient, convenient and transparent [8] . It is suggested that the level of success of a digital government should be measured by the public value it created from different dimensions, from the improved service itself to the overall social value [9] . The benefit of digital government is reaffirmed in a recent research, indicating that the innovations under digital government creates a supportive environment for businesses by the reduction of administrative and regulatory burdens [10] .

2.2 Identity Management

Identity management refers to the process of entities being recognised and represented as digital identities within the computer networks [11] , whereby the identity-related information could be used for secure access management by means of digital authentication and certification [12] . The execution of identity management comes in many different shapes and forms, depending on the context and demands, whereas it is inextricably linked to the management of privacy, security and trust [13] . Using e-commerce as an example, identity management system can assist to manage and minimize the amount of data that is transmitted from the user (i.e., online consumer) to the server end, meanwhile ensuring that the obligation to user would be reached once

the item is bought and paid for [14] . While the use cases of identity management system in private and government sectors share a few similarities, there are additional concerns that need to be taken into account on the government level, such as accountability and interoperability, given the fact that the government has to serve the entire population of a country instead of a particular group of individuals, where citizens don't really have a choice to opt out of the system [15] .

2.3 Digital Identity

Digital identity, also known as eID, refers to a set of attributes (i.e., data) belonged to a particular individual that is processed through electronic means in the cyber world [14] . Architecturally speaking, digital identity is comprised of two sets of information, i.e., transaction identity and database identity. Transaction identity is the more significant half, considering it is the indispensable part of information required for transactions, thereby the identity of an individual can be recognised before enabling a transaction. For database identity, it is much more dynamic, as it mainly shows the updated information pertaining to a particular individual [1] [16] . Furthermore, the digital identity schemes can be divided into two processes. First, it is the identity authentication, where credentials are used in order to establish a valid registration of an identity beyond reasonable doubt. Second, it is the identity verification, where the genuine identity has to be verified as the one applicant claimed to be, through the provision of credentials [1] [17] .

While everyone in cyber world possesses at least one digital identity, the appearance of it may vary according to the situational context, i.e., partial identity, which means the transactions only require a specific set of personal information from user that is commensurate with the service nature, and in some cases, the withhold of information offers the user a certain level of pseudonymity [14] [18] . The disparity here could be easily discerned between private and government services, as most of the private services, e.g., online marketplace and social media, rarely ask for sensitive data like national identity number, whereas the user has to provide such in order to access nearly all of the government services. It resonates with the aforementioned statement regarding why the government must take extra considerations throughout the implementation of identity management.

Digital identity is proved to be a paramount component in the digital government infrastructure due to its effectiveness in delivering and receiving government services through electronic means [19] . In order to further promote its effectiveness, it's observed that governments offer more than one digital identity options to citizens. Using Estonia as an example, online government services can be accessed by citizen's digital identity though national electronic identity card, Mobile ID (i.e., secure mobile SIM card), and Smart ID (i.e., mobile application). The huge success of the Estonian approach is evidenced by having 98% of the Estonian citizens using their digital identity [20] .

2.4 Digital Transformation

Digital transformation appears to be a generic term with numerous definitions based on different interpretations, meanwhile it is deemed interchangeable occasionally with digitization and digitalization. Previous research using semantic analysis concluded that digital transformation could be conceptually defined as "*a process that aims to improve an entity by triggering significant changes to its properties through combinations of information, computing, communication, and connectivity technologies*" [21] . Meanwhile, there's another research providing an empirically based definition derived from expert interviews, stating that digital transformation should be seen as a comprehensive organisational approach, where the process is heavily influenced by external factors (e.g., state-of-the-art technologies) and is a continuous progress that requires frequent adjustments, so as to improve the public administration [22] .

Digital transformation has been a hot topic all over the world for the last two decades. However, its genuine magnitude only got realised and actualized in the last few years, when the COVID-19 pandemic completely disrupted almost every way of life and necessitated the implementation of digital transformation for all sectors, that include governments [23] . In the case of Austria federal administration, research found out that the pandemic did not only facilitate the adoption of electronic means, but also changed the mindset of people toward digital means using new technologies. Moreover, it's noteworthy that organizations could enjoy a greater degree of benefit from digital transformation, if they are severely affected by the pandemic [24] .

2.5 Interoperability

As per EU directives, the definition of interoperability is given as "*the ability to exchange information and mutually to use the information which has been exchanged*" [25] . In the European Interoperability Framework, interoperability is seen as the capability of organizations to collaborate in achieving mutually beneficial goals, which entails sharing information and knowledge among organizations through the business processes, facilitated by the data exchange between their information technology systems [26] . Interoperability is highly relevant in the context of digital government, given the fact that there are many outdated legacy systems being unable to establish a connection with the internet, or different government departments have systems in place that lack the capacity for fully automatic data exchanges among these agencies [27] . Moreover, interoperability is also an important factor to the digital identity under digital government infrastructure. Using EU as an example, in the lack of an interoperable digital identity scheme, European citizens from one Member State are unable to utilise their digital identity to access the digital government services provided in another Member State [28] .

2.6 Technology Acceptance Model

According to the research, the TAM consists of two constructs playing fundamental determinants regarding information system usage, i.e., perceived usefulness, and perceived ease of use. The definition of perceived usefulness is "*the degree to which a person believes that using a particular system would enhance his or her job performance*". On the other hand, perceived ease of use is defined as "*the degree to which a person believes that using a particular system would be free of effort*" [29] . The model was subsequently advanced to the TAM2, by the incorporation of social influence processes (i.e., subjective norm, voluntariness and image), and cognitive instrumental processes (i.e., job relevance, output quality, result demonstrability and perceived ease of use), as the determinants of usage intentions and perceived usefulness [30] .

2.7 Technology Readiness Index

As per research, the readiness of technology is defined as "*people's propensity to embrace and use new technologies for accomplishing goals in home life and at work*". The TRI is comprised of mental motivators (i.e., optimism and innovativeness) and inhibitors (i.e., discomfort and insecurity). It could be used to evaluate the level of technology readiness of external users (i.e., customers) and internal users (i.e., employees) [31] . Over a decade later, the TRI 2.0 was introduced, an updated model offering a wider range of applicability with more concise outcome, of which the model was concluded to be a reliable and useful customer segmentation tool [32] .

2.8 Unified Theory of Acceptance and Use of Technology

Refer to research, the UTAUT was formulated through the assessment of eight different relevant models including the TAM, in order to better explain the behavioural intention to use information technology and the usage behaviour ensued. The direct determinants of user acceptance and usage behaviour consist of four constructs, i.e., performance expectancy, effort expectancy, social influence and facilitating conditions. To moderate the impact of each relationships, a couple of key moderators are specified here, i.e., gender, age, experience and voluntariness of use [33] . The UTAUT was initially based on employee technology acceptance, the applicability of it was later extended to consumer use context in the subsequent paper, also known as UTAUT2, of which consumer related constructs, i.e., hedonic motivation, price value and habit, were added to the formula, whereas voluntariness of use was taken away from the list of moderators [34] .

TAM is designed to assess the usage of a particular system, while TRI focuses on individual's view about new technology in general. Thus, TRI appears to be less relevant, since this research doesn't only evaluate Hong Kong resident's general opinion to new technology, but also targeting one specific technology, i.e., iAM Smart.

Comparing TAM to UTAUT, TAM doesn't take account of many influential characteristics, such as experience and voluntariness of use, that might have affected individual's opinion on technology [35] . Therefore, as a unified theory, UTAUT appears to be a much more comprehensive and accurate model for this research.

Moreover, UTAUT is identified as the most relevant theory instead of UTAUT2, given the fact that iAM Smart is not a commercial product and any Hong Kong residents with HKIC are eligible to use it.

3 Research Methodology

The purpose of this study is to evaluate the level of acceptance of Hong Kong residents towards the new digital identity platform iAM Smart introduced by the Hong Kong Government. To achieve this goal, intrinsic case study appears to be the most relevant methodology. A mixed methods research approach would be adopted, combining both quantitative and qualitative methods, which entails methodological triangulation.

3.1 Research Design

3.1.1 Intrinsic Case Study

Case study method is defined as an empirical inquiry that examines a present-day phenomenon within its real-life setting, where it may not be easy to distinguish between the concerned phenomenon and its surrounding context, and thus various sources of evidence are required [36] . Furthermore, another research added that case study should be capable of identifying the complexity of cases from a wide variety of research fields, and meanwhile, the case study has to be carried out in its natural context via different methods [37] .

Intrinsic case study is a methodology that enables researchers to gain a more in-depth understanding about a particular case, where the intrinsic interest lies in the case only, instead of other situations or general problems [38] . In addition to the typical class of instances, intrinsic study is also applicable to the cases that are seen as special [39] .

Back to the case, iAM Smart is a newly introduced digital identity solution at the end of 2020, and there is no analogous technology in Hong Kong before, which makes this case one of a kind and deserves a detailed assessment by way of intrinsic case study.

3.1.2 Methodological Triangulation

Triangulation of methods, data sources and investigators is a strategy that could help with the case study research, as it offers the overview and investigation from multiple

perspectives toward the phenomena [40] . Additionally, the outcome of a qualitative study is likely to give more confidence to the researchers in terms of credibility, when different methods of data collection yield consistent result [41] .

For the methodological triangulation, there are two types, i.e., within-method and across-methods. The former refers to the combination of multiple data collection means within the same approach, either quantitative or qualitative, whereas the latter is a blend of both. As a result, the findings from one source can be cross-checked by another and make sure of the validity of the research [42] . Accordingly, it offers complementary findings via data convergence, meaning a more extensive, thorough, or even exhaustive portrayal of the topic being studied, hence a fuller picture could be drawn [43] .

3.1.3 Mixed Method Approach

Mixed method approach is defined as the research type that combines the elements of quantitative and qualitative methods for "*the broad purposes of breadth and depth of understanding and corroboration*" [44] . For this reason, the utilization of such approach could assist in addressing the research questions, therefore broaden and enhance the conclusions of a study [45] .

While mixed method approach seems to be overlapping with methodological triangulation. Previous researches suggested that mixed methods and triangulation are actually considered as complementary concepts that cover a wide range of research strategies [43] , whereas mixed method is identified as a unique form of methodological triangulation consisting both quantitative and qualitative methods [46] .

Back to the case, iAM Smart is a hot of the press technology in Hong Kong, yet there is a very limited number of studies that cover such topic so far. Hence, a mixed method approach comes handy here to obtain more insightful and accurate data input from different sources, so as to draw a conclusion on this topic in a more comprehensive manner.

3.2 Data Sources and Collection

Following the mixed method approach, the data collection process of this research comprises quantitative and qualitative methods. The chronological order of such a

process starts with a quantitative method and follows by a qualitative method. It is worth-mentioning that these two methods do not necessarily carry the same weight in a study, where one of them may be more decisive to address the research questions [46] .

Having said that, in this research, both quantitative and qualitative methods carry similar weight.

For the quantitative method, mixed methods survey is the chosen form of data collection, that consists of predominantly closed-ended questions and a single open-ended question. The questionnaire (Appendix 1) was distributed to the people living in Hong Kong by way of survey administration software Google Forms, and 150 responses were collected over the course of two weeks. The survey serves as a weathervane to gauge the general views of Hong Kong residents towards the iAM Smart, given the fact that previous findings of public opinion are lacking on this topic. It could help with answering research question 1 and its sub-questions by having a grasp of the current situation in Hong Kong, e.g., awareness level and user experience so far.

For the qualitative method, semi-structured interview (Appendix 2) is the chosen form of data collection, which contains mostly open-ended questions that are focused on the iAM Smart [47] . There were 4 interviews in total conducted through video communication software Zoom, of which all interviewees are confirmed to be Hong Kong residents who have registered to be iAM Smart users. During the interviews, the focus was put on the dialogue, where the answers from interviewees were followed up by deepening enquiries that would substantiate their narratives [48] . The interview helps answering research question 2 and its sub-questions by gaining a more complete understanding of the iAM Smart users' point of view, e.g., factors of acceptance and recommendations.

While the survey and interview are designed to answer certain research questions, they are complementary by nature, which means there are no strict rules with regard to the application of data in different research questions.

3.3 Data Analysis

3.3.1 Statistics Analysis

In order to analyse the quantitative data obtained from closed-ended survey questions, statistics analysis is needed. The relevant statistics type here is descriptive statistics, of which the main purpose is to generalize the outcome from a sample group to a population by converting dataset into manageable form described in mean, median and mode [49] . This approach offers valuable findings, considering it is completely impracticable to gather responses from every Hong Kong residents or iAM Smart users.

The analysis here mainly focuses on the ordinal data collected by the five-point Likert scale questions, one of the most often used psychometric scale in relation to latent traits [50] . The Likert scale questions in the questionnaire concentrate on three main aspects: levels of agreement, easiness and satisfaction. Since it is a five-point scale, the most negative sentiment (e.g., strongly disagree) is assigned with one point, while the most positive sentiment (e.g., strongly agree) is assigned with five point. The composite measure of responses is then presented by the mean scores of each questions based on the aforesaid five-point scale.

3.3.2 Content Analysis

The content analysis refers to a "*systematic, objective, quantitative analysis of message characteristics*" that summarizes the text instead of reporting the entire message set in detail, in addition, it is applicable to a wide range of inquiries with pertinent characteristics, i.e., quantitative and summarizing [51] .

There are numerous types of coding methods applicable to content analysis. In order to analyse the open-ended survey question (Appendix 1, question 16), the pattern code seems to be the most suitable method. Pattern coding is defined as "*explanatory or inferential codes, ones that identify an emergent theme, configuration, or explanation*" [52] . During the coding process, codes with alike nature would be grouped together to examine their similarities, and eventually, a pattern code is generated. The text examined most likely contains consequential phrases (e.g., if and because), for instance the pattern codes could be used to pinpoint the notion of malfunction theme at some organisations [53] . Back to question 16, it is asking respondents if they have any

recommendations that may improve iAM Smart in general. The question itself is not only discovering the potential solution, but also based on the replies, the analysis could possibly capture the spirit of shortcoming theme regarding the iAM Smart, so that the Hong Kong government could take into account and act upon.

3.3.3 Thematic Analysis

In order to analyse the qualitative data obtained from interviews, the audio recordings of the four interviews conducted in Cantonese (official spoken language of Hong Kong) were transcribed into Traditional Chinese characters (official written language of Hong Kong) by Sonix.ai, an artificial intelligence driven transcription software. The transcription written in Traditional Chinese was then reviewed by the author for multiple times with amendments made based on the audio recordings, so as to ensure that the transcription accurately documents the interview dialogues. Afterwards, the transcription written in Traditional Chinese was translated into English, so that it became understandable to all English speakers.

The thematic analysis is deemed to be the most suitable analysis method here. According to the research, thematic analysis refers to the process that identifies, analyses and reports patterns (i.e., themes) inside the data, whereby it is considered as the fundamental method to carry out qualitative analysis, due to its provision of core skills that are suitable for various forms of qualitative analysis [54] .

The thematic analysis process can be divided into six phases, from the familiarity of data as the first phase to the production of final report as the last phase [54] . The detailed structure of phases is provided in Table 1. It's noteworthy that, in some cases, qualitative data analysis software Nvivo was utilised at the first step to analyse a large set of data, since most of them were in different digital formats and lack an unified structure [55] . However, such software appears to be unnecessary in current research, given that the dataset here is much smaller and they are presented in a rather consistent manner under the semi-structured interview approach.

Table 1. Phases of Thematic Analysis (Source: Braun & Clarke, 2006, p. 35)

Phase	**Descriptions**
1.) Familiarizing yourself with your data	Transcribing data (if necessary), reading and rereading the data, noting down initial ideas.
2.) Generating initial codes	Coding interesting features of the data in a systematic fashion across the entire data set, collating data relevant to each code.
3.) Searching for themes	Collating codes into potential themes, gathering all data relevant to each potential theme.
4.) Reviewing themes	Checking in the themes work in relation to the coded extracts (Level 1) and the entire data set (Level 2), generating a thematic „map“ of the analysis.
5.) Defining and naming themes	Ongoing analysis to refine the specifics of each theme, and the overall story the analysis tells; generating clear definitions and names for each theme.
6.) Producing the report	The final opportunity for analysis. Selection of vivid, compelling extract examples, final analysis of selected extracts, relating back of the analysis to the research question and literature, producing a scholarly report of the analysis.

4 The Case

This chapter aims to provide an overview of the digital identity platform iAM Smart in Hong Kong by going through the historical background, current situation and identified issues. A better understanding of the context specifically to Hong Kong could ensure the following analysis section to be carried out in a more comprehensive manner.

4.1 Hong Kong Identity card

4.1.1 The Era of British Hong Kong

Hong Kong was a former colony of the British Empire since the nineteenth century by virtue of the Treaty of Nanking signed between the British Empire and the Qing dynasty , i.e., the last imperial dynasty of China [56] . Ever since, Hong Kong formed an individual jurisdiction separated from the Mainland China.

The current identity management system in Hong Kong could be traced back to the enactment of the Registration of Persons Ordinance in 1949, a legislation that intended to enhance the law and order at the time of turmoil, meanwhile help with the distribution of food and commodity supplies through the mandatory registration of identity card [58] . It resonated with the chaotic aftermath of World War II, when Hong Kong just returned to the British ruling from the Japanese.

The role of identity card in Hong Kong became prominent during the 1970s and 1980s. At that time, Hong Kong was facing a massive wave of illegal immigration from Mainland China due to the Chinese Government's open-door policy, which severely threatened the socioeconomic order, especially when some of them failed to earn a normal living hence turning to criminal activities [59] . For this reason, the HKIC was deemed as the antidote to identify illegal immigrants, by legally requiring every residents in Hong Kong to present their valid HKIC on the demand of law enforcement agencies [60] . This statutory requirement is still in effect nowadays, under section 17C of the Immigration Ordinance, specifying that "*person who fails to produce proof of his*

identity for inspection as required by subsection (2) commits an offence and is liable on conviction to a fine". In the meantime, the stop and search power of a police officer is entrenched in the Police Force Ordinance under sections 54(1) and 54(2).

The Hong Kong Immigration Department first started to apply computer technology on the HKIC back in 1983, the computerised HKIC was then revised and introduced again four years later. The same card design had been using by the Hong Kong Government throughout the handover period until 2003 [63] .

4.1.2 The Era of Hong Kong Special Administrative Region

The handover of Hong Kong to China on 1st July 1997 under the governance principle of "one country, two systems" marked the end of the 156 years of British rule on the basis of the Sino-British Joint Declaration [64] . Having said that, the design of the HKIC didn't change alongside with the sovereignty, but instead, the same design remained in force until the issuance of new card design in 2003.

Starting from 2003, the Immigration Department started to issue the first generation of smart identity card featuring the new functionality to store the template of card holder's thumbprints with the microchip, that allows the card holder to go through the immigration clearance easily over the e-Channel, i.e., an automated clearance system [63] .

The second generation of smart identity card embedded with enhanced security features, also the latest design so far, was introduced by the Immigration Department in 2018 under the Next Generation Smart Identity Card System (a.k.a. SMARTICS-2), i.e., a strategy that aims to address "*the obsolescence of hardware and software of the existing SMARTICS and to cater for possible new business needs*" [65] .

4.2 Digital Identity Solutions before iAM Smart

Both generations of smart identity cards do not have a digital identity or digital signature function embedded automatically, so that the card holder cannot simply use the identity card to access any online government services, unlike the European examples, e.g., Estonia, Austria and Slovakia [66] , yet the Hong Kong Government has nonetheless offered alternative solutions.

4.2.1 e-Cert by Hongkong Post

The e-Cert was first introduced by the Hongkong Post back in 2000, the service was branded as the "*electronic-ID for online identity authentication*". Firstly, unlike other solutions, e-Cert is actually a paid service charging annual subscription fee. It serves to assure that the data pertinent to an electronic transaction is transmitted in a confidential and non-repudiated manner, where the digital signature is confirmed belonging to the purported identity in accordance with the Electronic Transactions Ordinance. In order to sign digitally, the e-Cert has to be loaded onto the user's smart identity card or installed in the computer as a software [67] [69] .

4.2.2 MyGovHK

The MyGovHK was introduced by the Hong Kong Government as a personalized platform of service delivery back in 2010 [70] . It primarily offers the user a "*one-stop access to multiple government online services in a simple and secure manner*" [71] . Before that, different online government services rely on their own login systems separately, which means that the user has to memorise multiple credentials, i.e., combinations of username and password, at the same time. With MyGovHK, the user only needs one set of credential in order to access a long list of online services.

4.3 iAM Smart

4.3.1 Background

The official plan to introduce a free-of-charge digital identity for online transaction authentication was first released in the Hong Kong Smart City Blueprint back in 2017, a policy that aims to develop Hong Kong into a "*world class smart city*" by embracing innovation and technology [72] . It's noted that the government officials in Hong Kong have taken reference to the Estonian example when they were designing the digital identity scheme, for instance, the digital identity is linked to the user's biometric features as a secure key to unlock personal data [73] .

Following the smart city initiatives, the digital identity platform iAM Smart was eventually launched by the OGCIO in December 2020. It is designed to act as a one-stop shop that offers Hong Kong residents a single digital identity and authentication

method for both governmental and commercial transactions [74] . The iAM Smart mobile application can be downloaded from different app marketplace, e.g., Apple App Store and Google Play.

Even though iAM Smart is a digital identity issued by the Hong Kong Government, it doesn't share the same legal status as the physical HKIC, and it cannot be stored in the HKIC like the e-Cert previously mentioned [75] . In other words, when the police officer exercises the power of stop and search, a HKIC should still be presented based on the legal requirement, rather than the iAM Smart mobile application.

4.3.2 Registration

Any holder of a HKIC who is aged 11 or above can register a free account on the iAM Smart platform [75] .

The registration of iAM Smart user account can be carried out in multiple ways. For applicant between the age of 11 and 17, the approval from parent or guardian is needed regardless which chosen method. The registration details below only focus on users aged 18 or above [76] .

For the first method, the applicant could complete the entire registration process remotely through personal smart phone with biometric authentication function, that includes using the smart phone to take pictures of applicant's HKIC (Figure 1) and also selfies (Figure 2) [76] . Notably, each smart phone can only be assigned with one iAM Smart user account [75] .

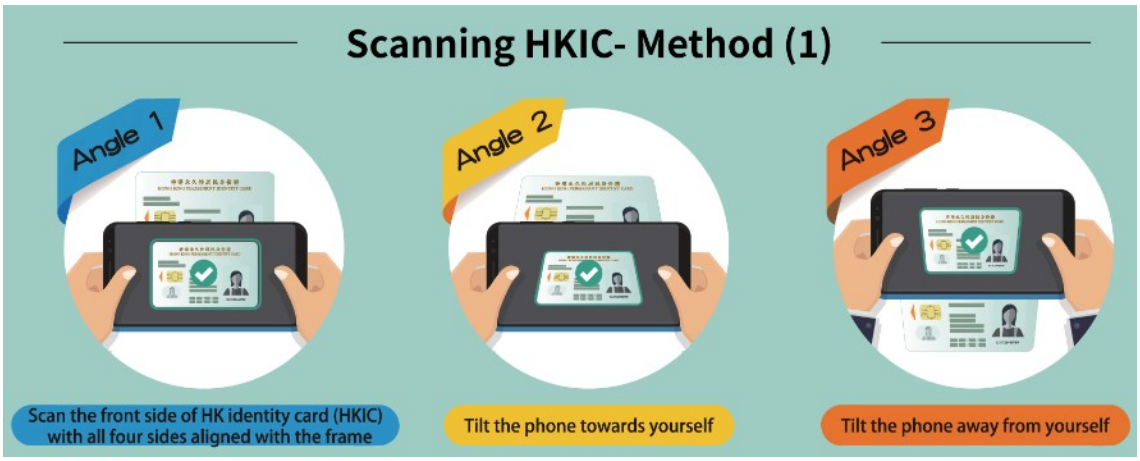

Figure 1. Scanning Method of HKIC (Source: iAM Smart - Registration Methods, 2020)

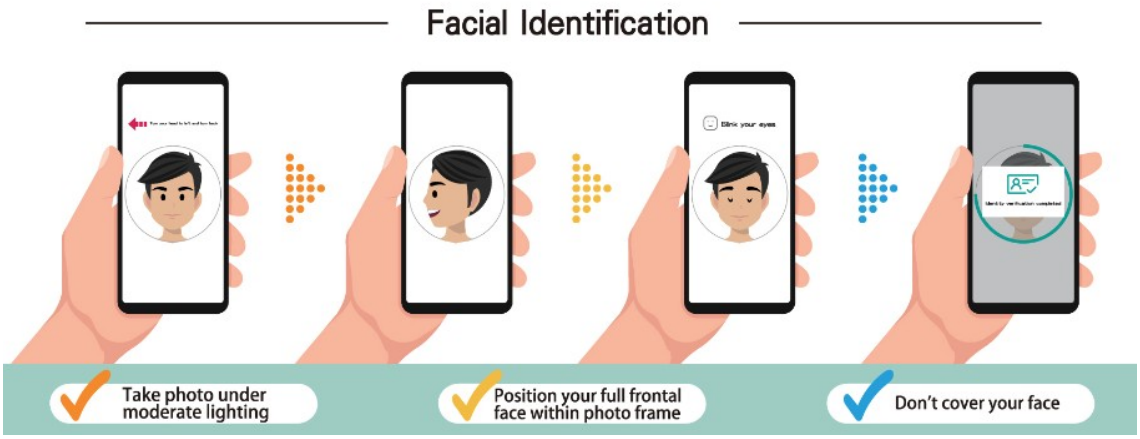

Figure 2. Facial Identification (Source: iAM Smart - Registration Methods, 2020)

For the second method, the applicant could complete the registration at the self-registration kiosk in person. The process starts with linking the registration at the kiosk machine to the applicant's iAM Smart mobile application on personal smart phone via QR code, and then the machine would verify the applicant's identity using the HKIC inserted and facial identification (Figure 3) [76] .

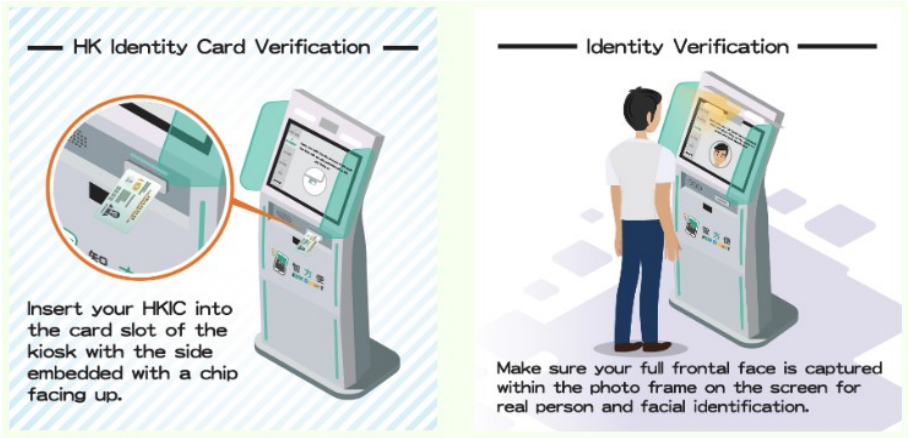

Figure 3. HKIC & Identity Verification (Source: iAM Smart - Registration Methods, 2020)

For the third method, the applicant could complete the registration at the registration service counter in person. The user likewise has to install the iAM Smart mobile application in advance. The staff at service counter would then go through the entire registration process, e.g., verification of applicant's identity and confirmation of the account setting [76] .

4.3.3 Privacy and Security

4.3.3.1 Tokenised Identity

The tokenised identity is a "*unique online service-specific identifier*" representing iAM Smart account's identification to an online service. Each online service has a unique value of tokenised identity assigned to the user of iAM Smart, in a way that one user could have multiple tokenised identity at the same time, depending on how many online services the user accesses. It safeguards iAM Smart user's privacy, considering the digital footprint of user can hardly be traced or correlated by comparing the tokenised identity [77] .

4.3.3.2 Data Storage

The iAM Smart system will only store the user's basic personal information provided upon account registration, that is the "*major card face data*" on HKIC, i.e., HKIC no., Chinese name, English name, date of birth and gender. These data are for the purpose of user management, of which the user is required to re-register if there's any change of "*major card face data*" [77] . On the contrary, the biometric data, photo of HKIC and selfie will not be stored in the system [78] .

For data security sake, OGCIO makes it clear that the core data and user's personal data within the iAM Smart system would be encrypted in accordance with the Advanced Encryption Standard and stored in the government data centre [78] .

4.3.4 Functions

4.3.4.1 Authentication

The identity authentication function of iAM Smart is supported by the FIDO Universal Authentication Framework, a solution that enables the smart phone of a iAM Smart user to bound the biometric authentication of registered device with the iAM Smart account, where the user is required to log in the iAM Smart mobile app, so as to authorise any further access to online services [77] . The authentication process is very simple. Once the user select to perform login via iAM Smart, the webpage will be directed to a QR code for the user to scan and approve the request within the iAM Smart mobile app, where neither personal information nor credentials are required at all (Figure 4) [79] .

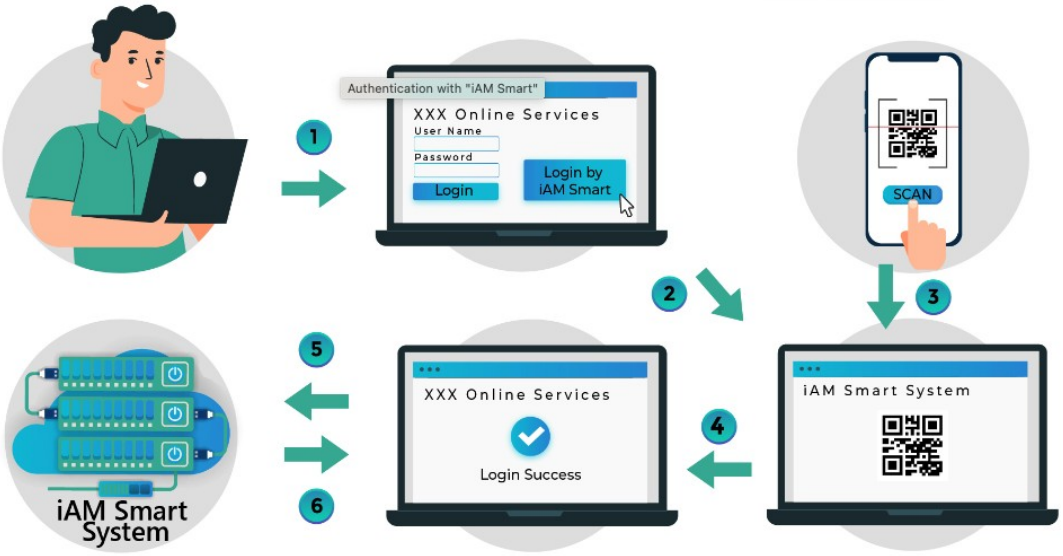

Figure 4. Authentication with iAM Smart (Source: iAM Smart - Technical Details for "iAM Smart", 2020)

The authentication function here is rather flexible, the iAM Smart mobile application can be used to authorise the access request of online services via different channels and devices (Figure 5).

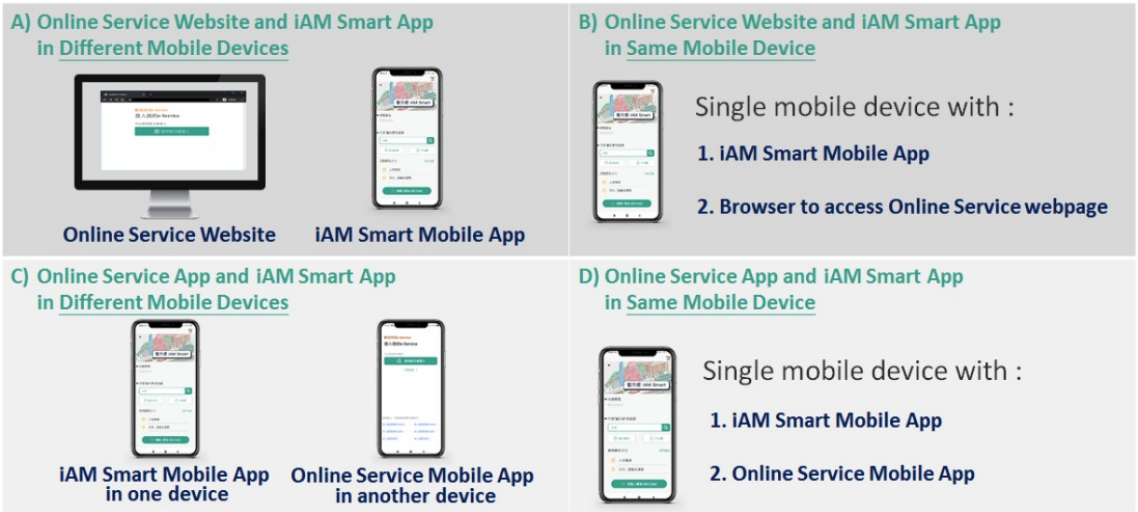

Figure 5. Authentication Scenarios (Source: iAM Smart Application Programming Interfaces - Use Cases, 2021)

In addition to that, the iAM Smart also provides re-authentication function. After the user is granted access of a particular online service, if the user want to complete a transaction (e.g., confirming application submission), the online service would then send the user a request of re-authentication to finalise the action [77] .

4.3.4.2 Personalised Notification

The iAM Smart offers the user a timely notification of the newly released information or messages from the chosen online government services based on one's preference and needs [80] .

4.3.4.3 "e-ME" Form Filing

This e-ME Form Filing function offers the iAM Smart user a separate account profile to store the personal information that may be used in the future form submission. The e-ME profile is empty by default, but the user could opt to fill in the personal information (e.g., mobile number and marital status) in advance on a voluntary basis. Additionally, the e-ME profile can also store address data issued by recognised provider, in which the data can be later treated as an address proof [77] .

In the form filling section of online service, when the user chooses to fill in the form by iAM Smart, the tokenised account identifier and filling request will be transmitted to the iAM Smart system, which prompts user for authorisation in the iAM Smart mobile application. The user can accordingly select the required information from the e-ME profile to complete the form filling action (Figure 6) [79] .

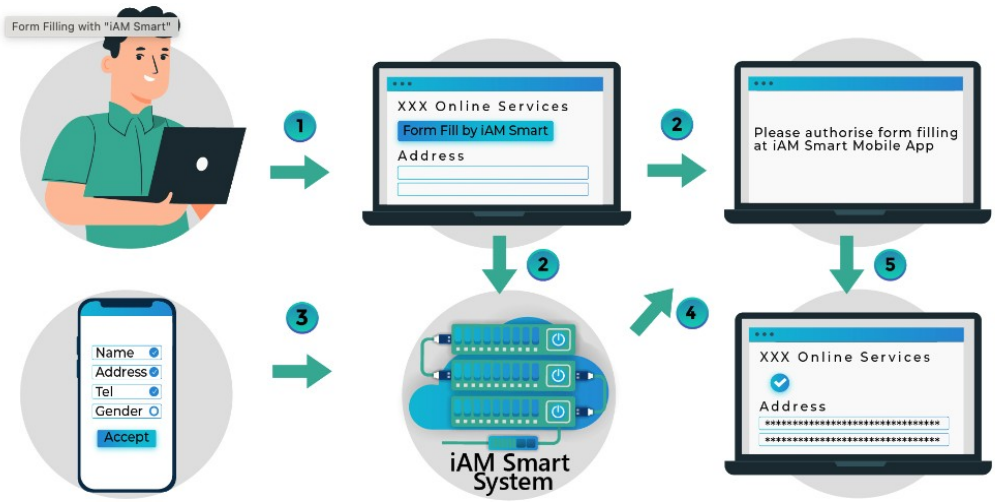

Figure 6. Form filling with iAM Smart (Source: iAM Smart - Technical Details for "iAM Smart", 2020)

4.3.4.4 Digital Signing

Digital signing is an add-on function that is only applicable for iAM Smart user who has upgraded to the iAM Smart + account, and it is legally based on the Electronic

Transaction Ordinance. In order to complete the upgrade, the applicant has to visit either self-registration kiosk or registration service counter in person [75] .

In order to sign digitally, a document hash (i.e., hash code pertaining to the document ready to be signed [77]) generated by the online service and the user's tokenised identity will be sent together to the iAM Smart system. There will be a four-digit identification code shown on the online service webpage, meanwhile, the iAM Smart mobile app will invite the user to authorise the signature. After verifying the document details and identification code, the user can authorise the action and sign digitally (Figure 7) [79] .

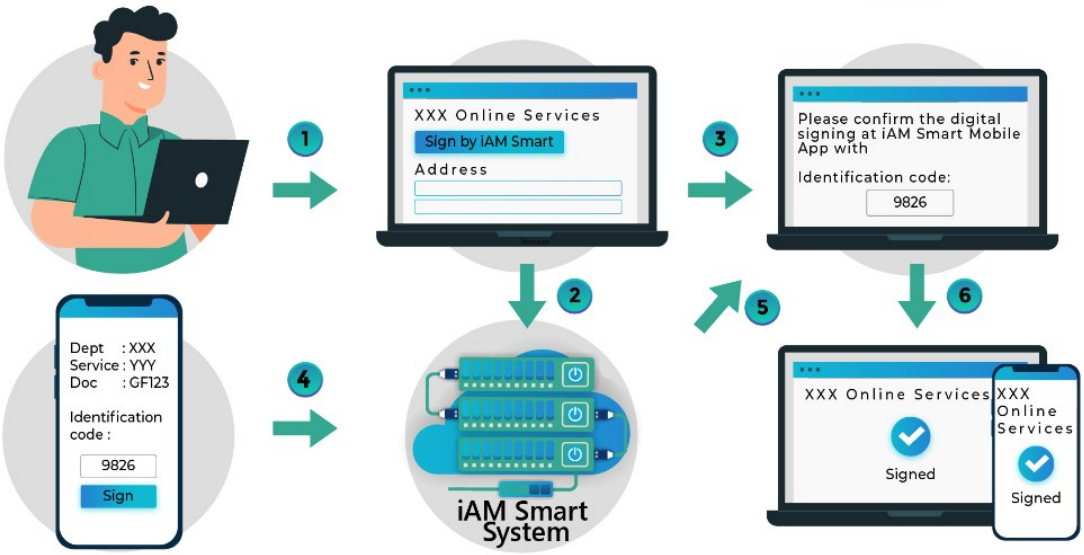

Figure 7. Digital Signing with iAM Smart (Source: iAM Smart - Technical Details for "iAM Smart", 2020)

4.3.5 Concerns

4.3.5.1 Service Coverage

According to the service catalogue last updated in April 2023, the iAM Smart currently supports 258 online services provided by 48 government departments, and there are 5 online services (e.g., eTAX) that are fully integrated with the functions of iAM Smart, i.e., authentication, "e-ME" form filling, personalised notifications and digital signing [81] .

Contrary to the broad coverage of government services, there are not too many options for the non-government services provided by the private sectors.

Being dubbed as one of the Asian tigers, Hong Kong has long been recognised as an important and influential international financial centre. The competitive edge of Hong Kong is evidenced by being ranked the freest economy around the globe for 25 consecutive years until 2019 [82] . According to the latest Global Financial Centres Index issued in March 2023, Hong Kong still manages to remain the level of competitiveness by ranking fourth place in the world right after New York, London and Singapore [83] . The prominent banking system has contributed a lot to Hong Kong's exceptionally strong international presence, considering there are 163 licensed banks plus 30 other restricted licensed banks and deposit-taking companies participating in the Hong Kong financial market, that include 78 out of the top 100 largest banks in the world [84] .

As the iAM Smart was introduced, the Hong Kong Government has been encouraging the financial institutions to adopt the digital identity solution. In the Hong Kong Smart City Blueprint 2.0, it is stressed that the iAM Smart has to be enhanced for the wider use in remote on-boarding and digital payments in the financial industry [85] . The Hong Kong Monetary Authority considers iAM Smart as the foundation of the fintech ecosystem development alongside with the smart city strategy, and has been partnering with the OGCIO to facilitate the integration of iAM Smart into the financial services, i.e., Pilot Sandbox Programme for iAM Smart [86] . The HKMA has also reaffirmed the possibility for the financial institutions to carry out remote customer on-boarding via iAM Smart in accordance with the relevant AML/CFT guidelines [87] .

Despite being part of the pillar industries in Hong Kong economy [88] and being highly encouraged by the government, the banking industry seems to have no interest in the collaboration with iAM Smart system, as service catalogue reveals that there are only two banks (out of 13 non-government service providers) supporting limited functions of iAM Smart at this moment [81] . Using the leading domestic bank in Hong Kong – Hang Seng Bank as an example, the bank has only integrated the authentication function of iAM Smart, of which the usage is strictly limited to the brick-and-mortar branches, for the customers to verify their identity without the provision of physical HKIC [89] . The low participation rate of the iAM Smart integration process appears to be unreasonably disproportionate with the extensive scale of the banking industry in Hong Kong, which is very likely to hinder the continuous development of iAM Smart.

4.3.5.2 Coverage Rate of Population

Apart from being one of the top economies, Hong Kong is also considered a place that firmly embraces the use of new digital technology. In the IMD World Digital Competitiveness Ranking 2022, Hong Kong ranked ninth in the world and third in the Asia Pacific [90] . Meanwhile, in the IMD Smart City Index Report 2023, Hong Kong ranked nineteenth in the world and sixth in the Asia Pacific [91] .

In spite of the impressive international ranking, the latest government data reveals that, as of June 2022, there are only 1.3 million of Hong Kong residents who have registered the iAM Smart user account, that equals to 19% of the total population. In the meantime, Hong Kong's long-term rival – Singapore kicked off the smart city blue print merely three years before Hong Kong in 2014, and yet the coverage rate of digital identity in Singapore has also reached 97% [92] .

4.3.5.3 Public Opinion

Up until this point, the general feedback of iAM Smart from the public appears to be far from satisfactory. According to the Apple App Store, the iAM Smart mobile application has a disappointing ratings of 1.8 stars out of the scale of 5 stars. There are 2,342 ratings in total given by the users, and notably, a large majority of users gave the iAM Smart mobile application the lowest possible rating of 1 star (Figure 8).

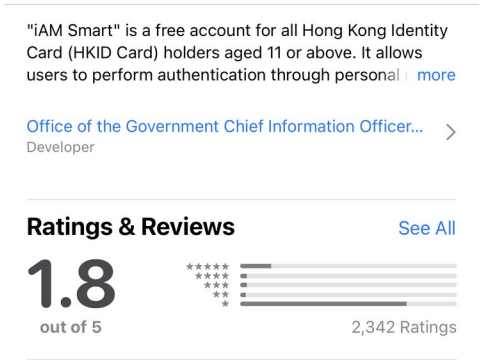

Figure 8. iAM Smart Mobile App Ratings (Source: Apple App Store)

Upon cursory examination of the reviews, it's observed that most of the negative ratings are attributed to technical issues, of which the users can hardly utilise the mobile application on a convenient basis. Such as the identity verification issues like unsuccessful HKIC scanning and facial identification (Figure 9), and mobile application errors (Figure 10).

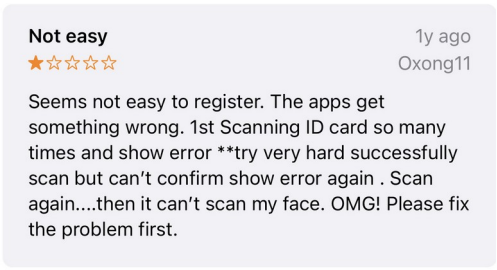

Figure 9. iAM Smart Mobile App Review 1 (Source: Apple App Store)

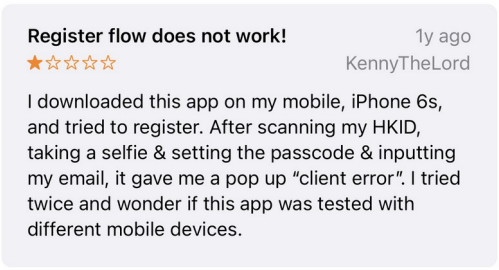

Figure 10. iAM Smart Mobile App Review 2 (Source: Apple App Store)

On the other hand, there was a territory-wide survey conducted by the researchers last year, that partly involved the topic of iAM Smart. According to the research findings, it's noted that the public opinion towards iAM Smart was divided into three groups. First group belonged to the majority who didn't have strong opinions. Second group belonged to those refusing to use iAM Smart at all. Third group belonged to those who highly value the level of convenience over privacy concerns [93] .

5 Result

This chapter serves to sum up the overall research findings obtained from two main streams, i.e., survey and interview.

5.1 Survey

The primary objective of this survey is to answer the first research question "How to understand the level of iAM Smart platform acceptance by the Hong Kong residents?" and the sub-questions in relation to the current awareness level and the user experience of iAM Smart.

The questionnaire (Appendix 1) was distributed to the people living in Hong Kong by way of survey administration software Google Forms, and a total of 150 responses were collected over the course of two weeks. It's confirmed that all of the respondents are Hong Kong residents (Figure 11), the group of people who are eligible to use the iAM Smart system.

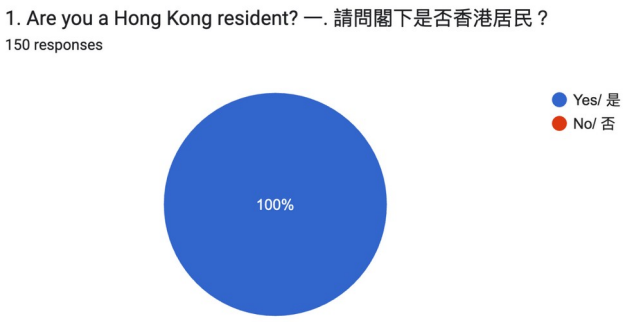

Figure 11. Survey Responses to Question 1

While there is a considerable proportion of respondents who hadn't heard of iAM Smart, over two-thirds of them were aware of it (Figure 12), mainly through government channels such as department branches and press release (Figure 13).

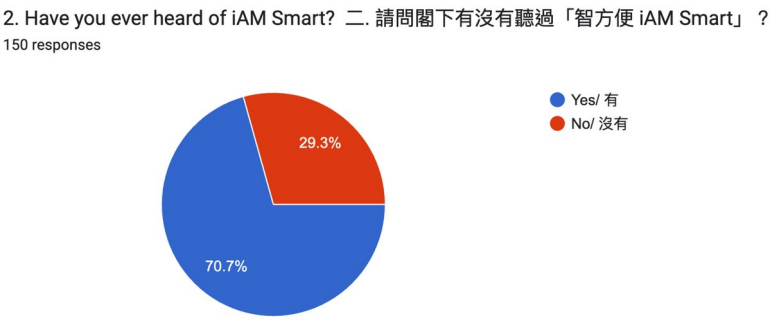

Figure 12. Survey Responses to Question 2

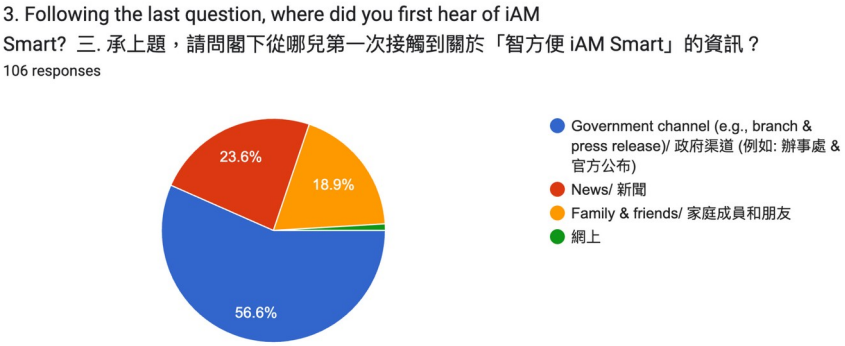

Figure 13. Survey Responses to Question 3

Among 106 respondents who knew about iAM Smart, nearly half of them had registered for iAM Smart user accounts (Figure 14). If we look at the sample size of 150 respondents, it shows that approximately one-third of them are iAM Smart registered users, which is higher than the 19% coverage rate provided by the government [92] . While it's true that these two sets of data were collected in different time periods, the result difference could be attributable to the limited survey sample size and the demography of respondents.

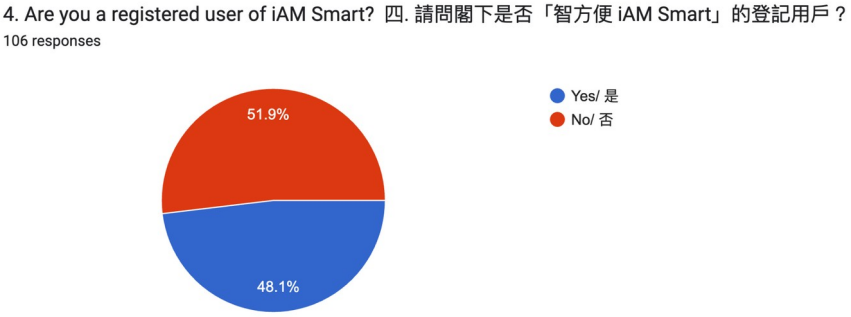

Figure 14. Survey Responses to Question 4

Of 51 respondents who are iAM Smart users, half of them started to use iAM Smart out of convenience (Figure 15). It resonated with the findings in question 6, where the general opinion leaned towards positive with mean score of 3.6667 and more than half of the iAM Smart user respondents, either agreed or strongly agreed that iAM Smart helps them to access online government services effectively. (Figure 16).

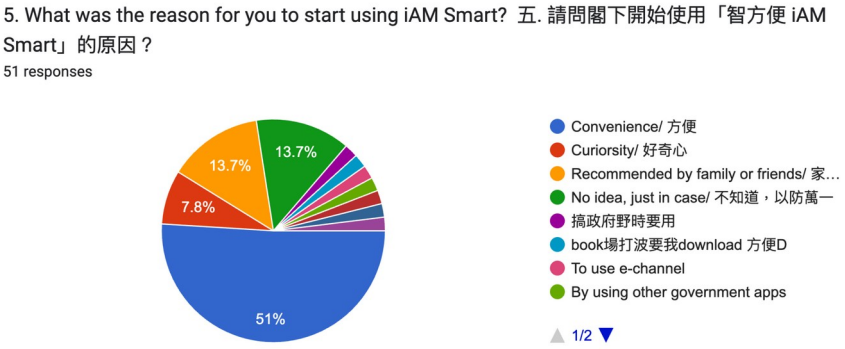

Figure 15. Survey Responses to Question 5

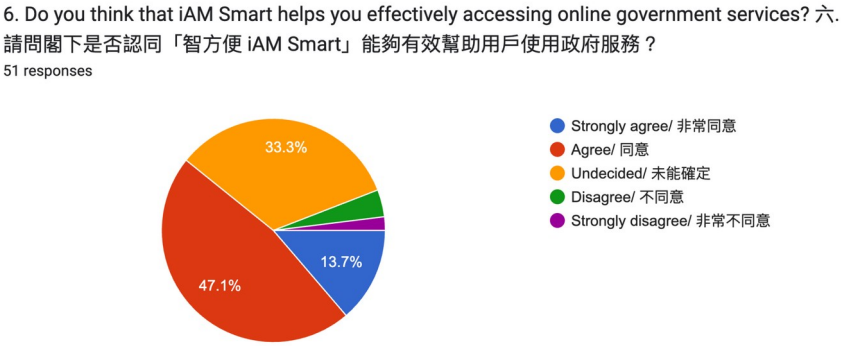

Figure 16. Survey Responses to Question 6

Refer to survey question 7, it's been crystal clear that none of the iAM Smart user respondents access the government services through iAM Smart on a daily basis, whereas most of them use it merely few times a year or even less (Figure 17). This finding is supplemented by question 8, where eTAX and transport licensing were the top two online services being accessed though iAM Smart (Figure 18), as people only have to deal with the taxation and transport license once a year or even longer period of time.

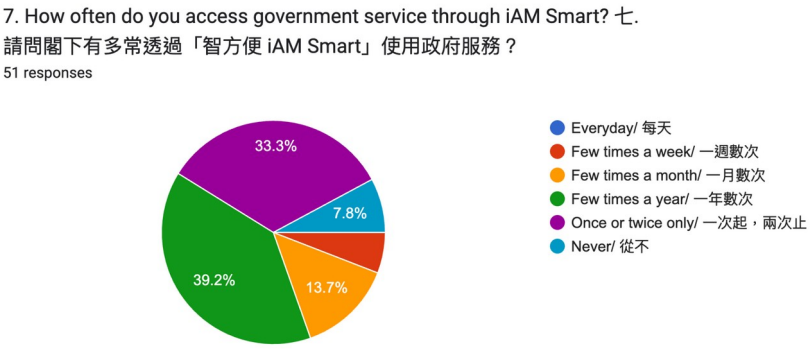

Figure 17. Survey Responses to Question 7

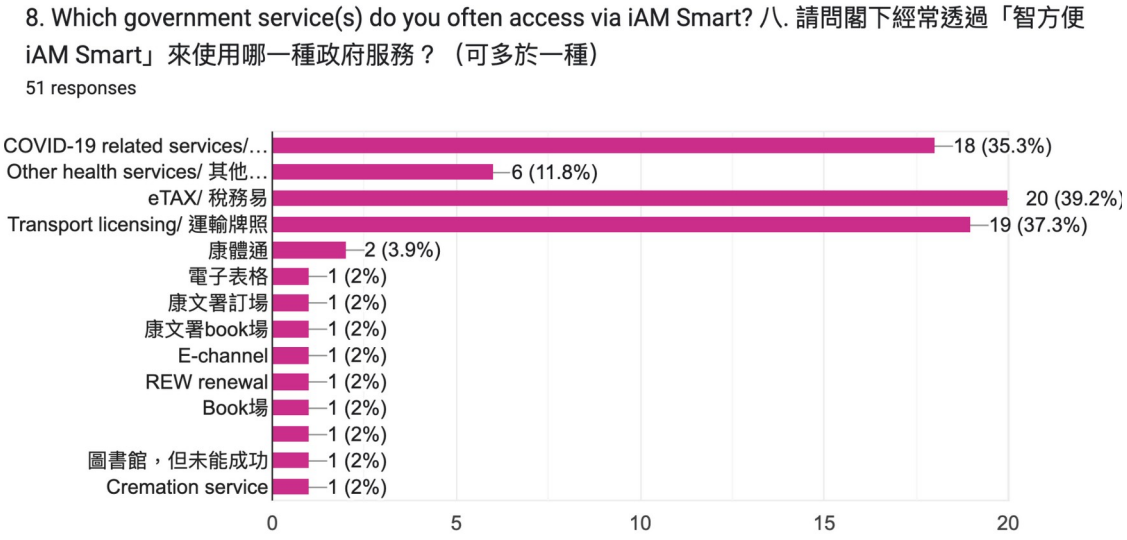

Figure 18. Survey Responses to Question 8

Resonating with survey questions 5 and 6, the general opinion regarding the ease of use is also tilting towards the positive side with mean score of 3.4706, therein half of the respondent found that it is either easy or very easy to use iAM Smart (Figure 19).

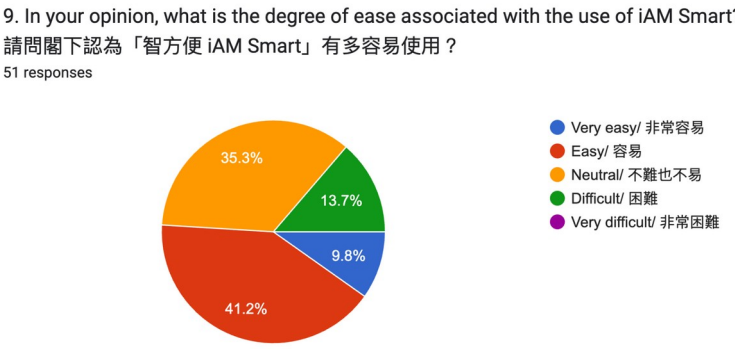

Figure 19. Survey Responses to Question 9

The result for survey question 10 is rather divided, of which the mean score is 3.0588. There's no majority of opinion here, since the positive, neutral and negative views share similar number of responses (Figure 20).

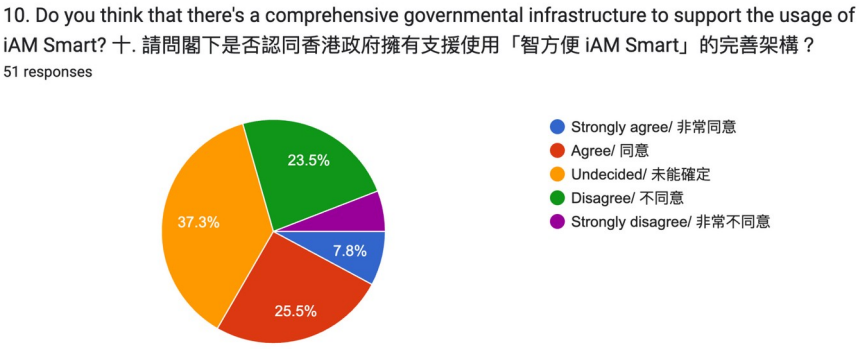

Figure 20. Survey Responses to Question 10

Among 51 iAM Smart user respondents, only 5 of them (excluded one respondent who later claimed never used any non-government services with iAM Smart in question 12) had used iAM Smart to access non-government services (Figure 21). Such number appears to be aligned with the scarce amount of non-government services available for iAM Smart [81] . There's no particularly popular non-government services, as most respondents used different kind of services (Figure 22). Also, the usage frequency varies, some said few times a month while some said once or twice only (Figure 23).

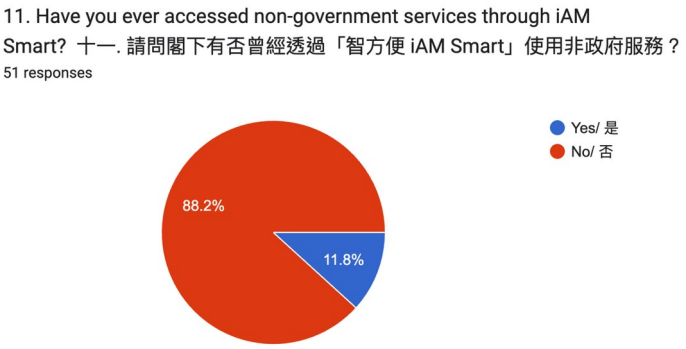

Figure 21. Survey Responses to Question 11

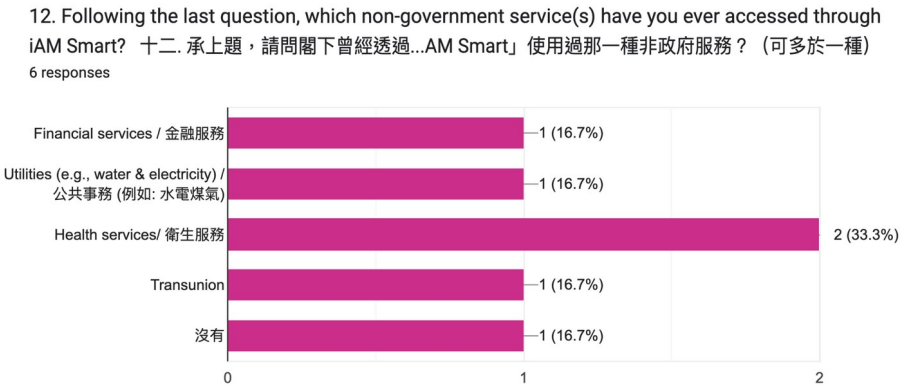

Figure 22. Survey Responses to Question 12

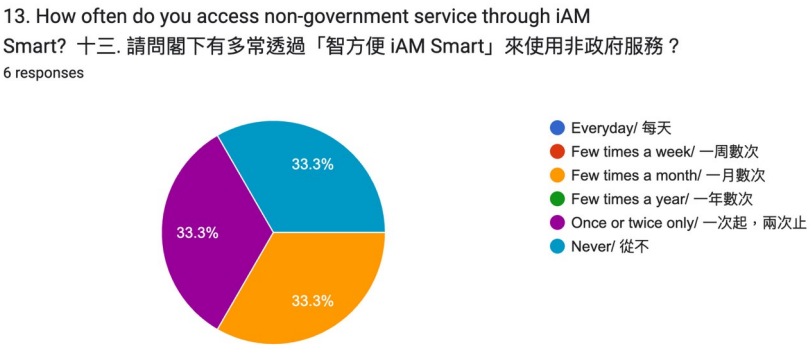

Figure 23. Survey Responses to Question 13

While the public opinions regarding convenience and ease of use tend to be positive, the overall level of satisfaction seems to be more of neutral sentiment, with a mean score of 3.1765 and 52.9% of neutral responses (Figure 24).

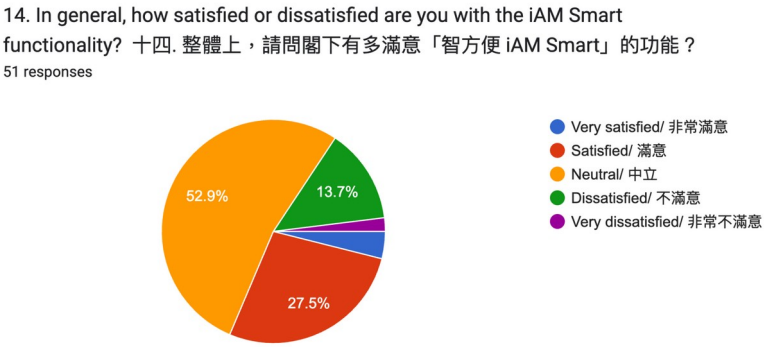

Figure 24. Survey Responses to Question 14

Majority of the respondents either agreed or strongly agreed that the Hong Kong Government should promote more about the usage of iAM Smart (Figure 25), and similar opinion can be found in the following open-ended question 16, where respondents were asked to give recommendations to improve iAM Smart in general. Content analysis was applied on this question in order to sum up the open-ended responses into multiple themes. Filtering out responses with no substance, a total of 19 recommendation themes can be identified in 41 valid responses. The first ranking theme is "more promotion/ education" with 12 responses, following by "better user interface" with 7 responses.

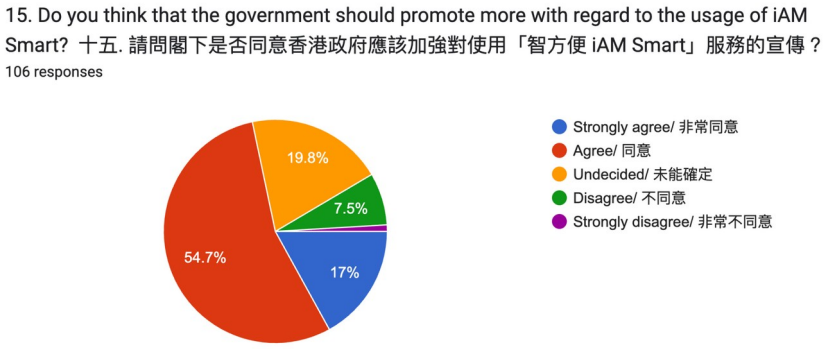

Figure 25. Survey Responses to Question 15

Table 2. Survey Responses to Question 16

Recommendation themes	No. of responses
Adopting newer technology	1
Better user interface	7
Custom list of often-used functions/ services	1
Easier account registration	2
Further explanation on data security and transparency concerns	1
Improved level of cyber security	1
Improved speed of the server	1
Less back and forth authentications	1
More convenient usage	1
Adding online chat function	1
Available to more government services	2
Available to more non-government services	2
More promotion/ education	12
More registration machines	1
More user friendly	3
Open source data	1
Simplified process of government service access	1
Trust building with residents	1
Wider use of digital signature	1
Not applicable	65
Grand Total	**106**

The last question asked about respondents' perceptions of the usefulness of iAM Smart. In similar fashion, more than half of them found iAM Smart convenient, and the overall perception is more of positive than negative sentiment (Figure 26).

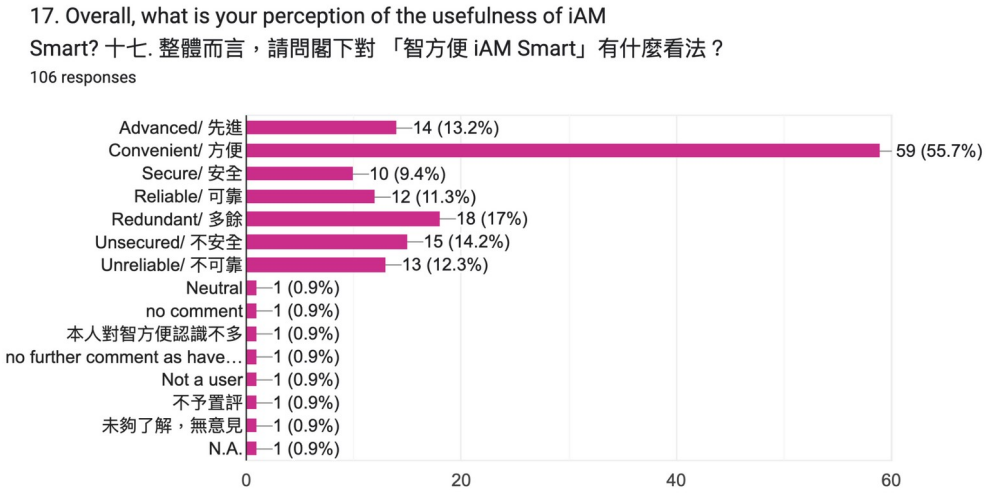

Figure 26. Survey Responses to Question 17

5.2 Interview

The primary objective of this interview is to answer the second research question "How to identify and define the relevant factors that influence the level of acceptance?" and the sub-questions specifying the Hong Kong context on this topic and potential recommendations.

The interview (Appendix 2) is comprised of 10 questions. There were total 4 interviews conducted through video communication software Zoom. All four interviewees were confirmed to be Hong Kong residents who had accessed government services via their iAM Smart user accounts, so that the interviews could obtain a more in-depth understanding about the underlying factors that might influence users' view on iAM Smart.

Applying the thematic analysis approach, six themes can be identified from the interview transcript (Section 3.3.3).

5.2.1 Perceived Inconvenience

The Hong Kong residents are more likely to use iAM Smart, if the digital identity solution is seen as an antidote to any perceived inconvenience while using the government services.

Most of the inconvenience in the last few years were caused by Covid-19, of which the Hong Kong Government had announced a list of pandemic restrictions, including the suspension of government services and temporary close of government offices [94] . For example, interviewee 1 mentioned how useful iAM Smart was to solve her problem regarding driving license renewal during the Covid-19 peak season, given that the Transport Department was short-handed. She also highlighted that "*Before, we need to queue at the office of the Transport Department in order to apply for the driving licence renewal.*" Through iAM Smart, she can now complete the entire process within a few clicks on the government website.

Furthermore, interviewee 2 revealed that "*During the pandemic, the Hong Kong government required everyone to use a digital contract tracing app named LeaveHomeSafe, wherein people are mandatory to open LeaveHomeSafe and scan the QR code at the entrance before entering any indoor venues e.g., restaurants.*" In order to avoid being tracked by the government, iAM Smart became a convenient alternative to interviewee 2, as it possesses vaccination certificate retrieval function that can likewise fulfil the regulation. It is noteworthy that interviewee 2 deleted the iAM Smart mobile application immediately, once the perceived inconvenience disappeared, due to the fact that the pandemic restrictions are now lifted and vaccination records are no longer required to enter any indoor venues.

On the other hand, iAM Smart can help with the complicated logon process of online government services that are considered inconvenient. For example, interviewee 3 emphasized that "*Using iAM Smart, I could reach the facility booking webpage in one go via Face ID without the need to fill in personal information, so it saves a lot of time and helps me easier to complete the booking.*" Similar opinion from interviewee 4 as well, as he said "*Now I don't have to remember my TIN (taxpayer identification number) and password to log in (eTAX).*"

5.2.2 Coverage

According to the interviews, the service coverage of iAM Smart could be decisive. The current issue of traffic violation penalty notice procedure was raised by interviewee 1, where she pointed out that "*If iAM Smart is in place here, there's no need to send the notice back and forth between drivers and police.*" Such penalty notice is something needed to be dealt with by countless drivers on daily basis, it is conceivable that the integration of iAM Smart into traffic violation procedure could have created the necessity for the drivers to use the digital identity solution on a more frequent basis.

Besides, interviewee 2 suggested the usage of iAM Smart in big events like elections, so that "*people could save time from queuing to vote at the polling stations.*" Interviewee 3 shared a similar thought, but in another huge event like the Consumption Voucher Scheme, i.e., a one-off monetary allowance given by the Hong Kong Government to the Hong Kong residents [95] .

5.2.3 Privacy

Privacy preservation is well-recognised as a crucial element in the design of digital identity scheme [5] . It is worth-mentioning that all interviewees felt comfortable with the idea of their personal information provided upon registration being stored in the iAM Smart system, as interviewee 1 highlighted "*the government already has all of our personal information already, and the usage of information is within government departments*". It further leads to another point, the policy and terms in place regarding data usage, where all the user data must be kept within the government by virtue of the regulation.

On the flip side, the no-go zone for data handling was pinpointed by interviewee 2, as he said "*There would only be a problem if the government is trying to track the whereabouts or IP addresses of iAM Smart users.*"

5.2.4 Security

Alongside with privacy, the management of security is the another key element of identity management [13] . With biometric authentication, the level of security in iAM Smart system can be enhanced. The significance of biometric authentication is widely

acknowledged by all interviewees, and interviewee 4 even stated that "*I am not comfortable using a password to log in.*"

5.2.5 Recommendations

Three out of four interviewees indicated that, the main reason for them to start using iAM Smart was because of the word-of-mouth recommendations from other people. They all started with the perceived inconvenience in government services, and then iAM Smart was recommended as a solution against the problems. Given the troubles that bothered, the interviewees were more than willing to try out the new technology. The recommendations could be from different people, e.g., friends, netizens and family members. In the case of interviewee 2, he didn't even know what was iAM Smart before his friend told him so.

5.2.6 Promotion & Education

Among all interviewees, they likewise raised a similar theme, which is the need for the Hong Kong Government to bring out more promotion and education. It could be achieved on multiple fronts, e.g., promotion at government facilities, education from government staffs, more self-registration kiosks and offering incentives. Government staff is arguably the most critical front, considering the fact that they are the representatives of the government who directly interact with the Hong Kong residents on a daily basis, their involvement could significantly raise the public awareness of the new digital identity solution. Unfortunately, the current input from the government staffs is apparently missing, as interviewee 2 gave an example in the vaccination centre where "*Most staff there wouldn't help you with the iAM Smart, but tell you to read the instructions yourself.* "

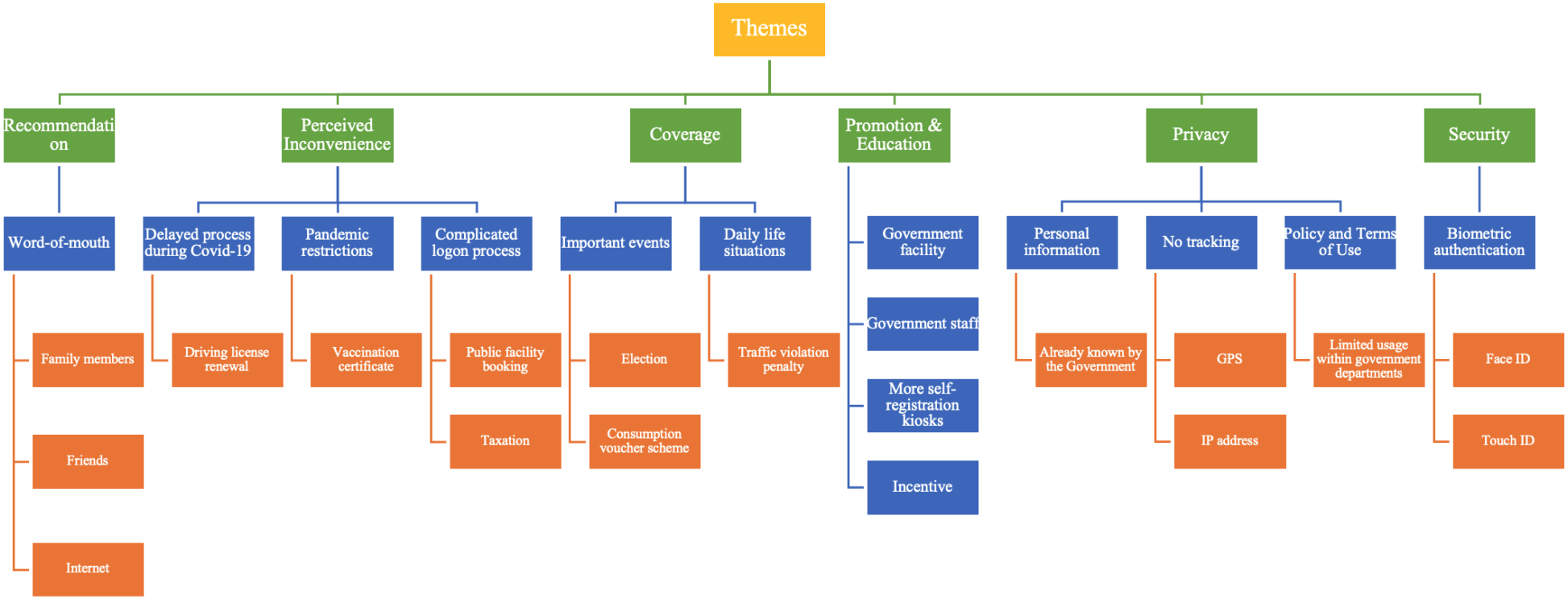

Figure 27. Thematic Analysis of Interview Transcript

6 Discussion

This chapter serves to discuss the research result by taking account into the existing literatures and the research data obtained through survey and interview.

6.1 How to understand the level of iAM Smart platform acceptance by the Hong Kong residents?

Being the research starting point, this research question laid down the foundation by identifying the most suitable approach to understand the acceptance level of iAM Smart. This framework was started with the application of UTAUT, where the direct determinants that affect user acceptance and usage behaviour include performance expectancy, effort expectancy, social influence and facilitating conditions [33] . Based on these four constructs, the corresponding questions were added into the questionnaire. For example, survey question 9 was directly referring to the effort expectancy (i.e., "*the degree of ease associated with the use of the system*" [33]).

6.1.1 What is the current awareness level of Hong Kong residents towards the iAM Smart platform?

According to the survey result, 29.3% of respondents had never heard of iAM Smart (Figure 12). While it is commonplace for newly released technology not being known by the public, iAM Smart has been launched for over two years already, but a considerable group of people still don't know anything about it. Hence, there is a room of improvement regarding the level of awareness apparently.

There are 70.7% of respondents knew about iAM Smart (Figure 12), but only half of them (i.e., 51 respondents) decided to become a registered user (Figure 14), which indicated that the level of awareness might or might not drive up the acceptance rate of iAM Smart, it's more of a fifty-fifty chance.

On the other hand, when it comes to the assessment of acceptance level, the study outcome may not be accurate enough if certain group of individuals do not use the targeted technology simply due to the lack of knowledge, which renders the UTAUT determinants irrelevant. Yet, it is arguable that the impact of such scenario could possibly be adjusted by key moderator – voluntariness of use, since it is not mandatory for the Hong Kong residents to register an iAM Smart user account.

6.1.2 What is the user experience of the platform?

The user experience of iAM Smart may vary, depending on the personal preference of each individual and what kind of services and functions do they use. Therefore, it is necessary to assess the general opinion of user experience with questions from multiple perspectives in order to get a holistic view.

In survey questions 6 (Figure 16) and 9 (Figure 19), rather positive responses were received, of which the iAM Smart user respondents generally thought that iAM Smart helps them to effectively access the online government services, and the digital identity solution is quite easy to use. On top of that, survey question 17 reveals that majority of respondents have rather positive sentiment towards iAM Smart, by describing it as a convenient (59 responses), advanced (14 responses), reliable (12 responses) and secure (10 responses) solution (Figure 26). Analogous responses could be discerned in the interviews as well, where all the interviewees agreed that iAM Smart is a convenient solution.

In contrast, the general feedback received from the Apple App Store was tragically negative (section 4.3.5.3), which was radically different from the aforesaid survey result. The polarised opinions regarding iAM Smart may be attributed to the fact that a great deal of the negative feedbacks on App Store were related to technical issues happened during the registration process, and most of those feedbacks were given at least a year ago or even more, wherein the mobile application was still at its early stage that required more bug fixing actions. In order words, a tremendous amount of feedback givers seemed to have a really bad first impression of the iAM Smart, as they struggled to create an account. As a result, this group of individuals could not truly experience the

functionalities of iAM Smart, as oppose to the group of respondents in this survey who were benefited from iAM Smart.

6.2 How to identify and define the relevant factors that influence the level of acceptance?

Throughout the interviews, it was noticeable that the interviewees mostly likely didn't start to use the iAM Smart mobile application out of the blue without specific reasons, but instead, all of them were driven to adopt iAM Smart at the first place by certain things. Based on the thematic analysis, the most significant factor is identified as perceived inconvenience, wherein an individual was bothered by a specific scenario, and the solution in question later came as a quick fix. In the meantime, the social influence construct mentioned in the UTAUT also played an important role here, since the individual was made well aware of the solution by the word-of-mouth recommendations given by others. Afterwards, the privacy and security factors came into play, as the individual needed to ensure that, the technology solution is secure and reliable enough to carry out the task without being potentially victimized in any data breaches, before finally accepting the solution.

6.2.1 What are the factors in the context of Hong Kong?

While the factor of perceived inconvenience could probably be applicable in other countries, the examples gathered during the interviews were specifically referring to the unique context of Hong Kong. The main reason behind is that, some of the scenarios were subjected to the pandemic restriction policies of the Hong Kong Government in the past few years, and unlike the rest of the world, these restrictions were notoriously draconian [96] . Thus, the level of inconvenience perceived by the Hong Kong residents is unlikely to have the direct applicability in other regions. In particular the western countries with higher degree of freedom and autonomy, their citizens appear to be less tolerant in terms of regulations and restrictions, hence much easier to find situations inconvenient.

On the other hand, the service coverage is another distinct factor in the context of Hong Kong. Among all the government services, survey result shows that the most popular

service is eTAX (Figure 18), which is conceivable given the fact that a huge group of Hong Kong residents are obligated to submit annual tax return. If people do not want to fill in the old-fashioned paper form, eTAX is the expeditious alternative that serves exactly the same function. Additionally, eTAX is one of the very few government services that supports all four functions of iAM Smart (i.e., authentication, form filling, personalised notifications and digital signing) [81] . It demonstrates that the coverage of government services that are most often used by the Hong Kong residents could possibly help with the level of acceptance.

6.2.2 What recommendations can be given to encourage Hong Kong residents to utilise the iAM Smart platform more?

The interview result on this question is validated by the survey, considering both data collection methods yield a consistent outcome, of which promotion and education are considered the most effective ways to encourage people using the iAM Smart platform. The validity of this recommendation is also supported by the outcome that 29.3% of the respondents had never heard of this digital identity solution before the survey (Figure 12).

Apart from the promotion and education, the survey result also shows that quite a few respondents thought the iAM Smart mobile application needs a better user interface. While the appearance of user interface could be a subjective matter, research indicated that the design of access portals is in fact a crucial factor of success for e-government [7] . Therefore, it is worthwhile to figure out the potential shortcomings of the existing iAM Smart user interface.

Another recommendation is about the expansion of service coverage of iAM Smart. The interview result has provided a few suggestions from the government service perspective, whereby the Hong Kong residents could have easier access to important events like the election and Consumption Voucher Scheme, and a user-friendly channel to respond the traffic violation notice. Meanwhile, the survey result proved the insufficiency of non-government service coverage. Given the lack of options (section 4.3.5.1), it perfectly explained why most of the iAM Smart user respondents refrained from using iAM Smart to access any non-government services (Figure 21). The research

outcome here resonates with a government report published last year, therein "*active private sector initiatives*" was highlighted as a success factor for the smart city development [92] .

7 Conclusion

Following the Smart City Blueprint, iAM Smart definitely has the potential to become the core element that enables the full digital connection between Hong Kong residents and the government. The crux of the matter here is how to popularize the digital identity technology by identifying the factors that influence the level of acceptance. In this study, two main research questions were asked to first understand the current situation regarding iAM Smart, and second to identify any potential factors. For the first question, the research took an unexpected turn after the data collection stage, since the initial secondary research (i.e., App Store ratings & review) showed that iAM Smart was in a completely unfavourable position given the overwhelming negative reviews, but the first-hand data later gathered from the survey and interview suggested otherwise. The conflicting results here offer this research a chance to further investigate the root causes and accordingly draw up a more comprehensive conclusion. For the second question, the research findings indicated that the level of acceptance needs to be addressed with multidisciplinary factors, from the inconvenience of government services perceived by the residents to the lack of non-government service coverage. For this reason, it is unequivocal that multifaceted recommendations are needed to pinpoint the factors in different nature, considering one-size-fits-all approach doesn't exist. To conclude, this research not only presents a fuller picture of the iAM Smart acceptance level, but also provides the Hong Kong Government a list of potential recommendations that may improve the digital identity platform.

7.1 Limitation & Future Work

This research didn't separate iAM Smart+ from iAM Smart even though their functions are different due to the fact that the latter doesn't possess digital signing capability. But instead, these two versions were seen as the same application throughout the research process, for instance in the questionnaire, no questions related to iAM Smart+ were ever asked, and the total number of iAM Smart+ users among respondents was remained

unknown. It is because of the limitation that this research focuses only on the digital identity platform, any further investigation of the iAM Smart+ or digital signature might have deviated the research away from the main topic. As such, iAM Smart+ could be the topic of future researches, that allows the digital signing function to be examined thoroughly, and perhaps also evaluate the acceptance level of digital signature in Hong Kong.

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Appendix 1 – Questionnaire

1. Are you a Hong Kong resident? / 請問閣下是否香港居民？
2. Have you ever heard of iAM Smart? / 請問閣下有沒有聽過「智方便 iAM Smart」？
3. Following the last question, where did you first hear of iAM Smart? / 承上題，請問閣下從哪兒第一次接觸到關於「智方便 iAM Smart」的資訊？
4. Are you a registered user of iAM Smart? / 請問閣下是否「智方便 iAM Smart」的登記用戶？
5. What was the reason for you to start using iAM Smart? / 請問閣下開始使用「智方便 iAM Smart」的原因？
6. Do you think that iAM Smart helps you effectively accessing online government services? / 請問閣下是否認同「智方便 iAM Smart」能夠有效幫助用戶使用政府服務？
7. How often do you access government service through iAM Smart? / 請問閣下有多常透過「智方便 iAM Smart」使用政府服務？
8. Which government service(s) do you often access via iAM Smart? / 請問閣下經常透過「智方便 iAM Smart」來使用哪一種政府服務？
9. In your opinion, what is the degree of ease associated with the use of iAM Smart? / 請問閣下認為「智方便 iAM Smart」有多容易使用？
10. Do you think that there's a comprehensive governmental infrastructure to support the usage of iAM Smart? / 請問閣下是否認同香港政府擁有支援使用「智方便 iAM Smart」的完善架構？

11. Have you ever accessed non-government services through iAM Smart? / 請問閣下有否曾經透過「智方便 iAM Smart」使用非政府服務？

12. Following the last question, which non-government service(s) have you ever accessed through iAM Smart? / 承上題，請問閣下曾經透過「智方便 iAM Smart」使用過那一種非政府服務？

13. How often do you access non-government service through iAM Smart? / 請問閣下有多常透過「智方便 iAM Smart」來使用非政府服務？

14. In general, how satisfied or dissatisfied are you with the iAM Smart functionality? / 整體上，請問閣下有多滿意「智方便 iAM Smart」的功能？

15. Do you think that the government should promote more with regard to the usage of iAM Smart? / 請問閣下是否同意香港政府應該加強對使用「智方便 iAM Smart」服務的宣傳？

16. Could you provide any potential recommendation(s) that may improve iAM Smart in general? / 請問閣下有沒有任何對改善「智方便 iAM Smart」的建議？

17. Overall, what is your perception of the usefulness of iAM Smart? / 整體而言，請問閣下對 「智方便 iAM Smart」有什麼看法？

Appendix 2 – Interview Questions

1. Are you a Hong Kong resident? / 請問閣下是否香港居民？
2. Have you ever heard of iAM Smart? / 請問閣下有沒有聽過「智方便 iAM Smart」？
3. Are you a registered user of iAM Smart? / 請問閣下是否「智方便 iAM Smart」的登記用戶？
4. Could you describe your experiences with using iAM Smart? / 請問閣下可不可以描述一下使用「智方便 iAM Smart」的相關體驗？
5. In your opinion, what are the advantages and disadvantages of using iAM Smart compared to traditional forms of identity verification? / 相對於傳統的身份認證程序，請問閣下認為使用「智方便 iAM Smart」有任何優點和缺點？"
6. What are your reservation(s) when using iAM Smart? / 請問閣下對使用「智方便 iAM Smart」有唔有任何保留/存疑？
7. How comfortable are you with the idea of personal information provided upon registration (i.e., HKID no., English name, Chinese name, gender and DoB) being uploaded and stored onto the iAM Smart system? / 請問閣下對於把用戶登記時提供的個人資料（例如：身份證號碼、中英文姓名、性別和生日日期）上載及儲存至「智方便 iAM Smart」系統平台是否感到放心？
8. How comfortable are you with the idea of using smart phone's biometric functions (e.g., facial and fingerprint) for identity authentication and iAM Smart user login? / 請問閣下對於使用智能手機的生物認證功能（例如：指紋和面部辨識）作為「智方便 iAM Smart」的身份驗證和登入方式是否感到放心？

9. Apart from the existing service coverage, could you describe a scenario where you think using iAM Smart would be particularly useful? / 除了現有的服務範圍之外，請問閣下能否描述一個您認為使用「智方便 iAM Smart」會特別有用的情況？

10. Could you think of any recommendation(s) that may improve Hong Kong residents' level of acceptance towards iAM Smart? / 請問閣下有什麼建議可以提高香港居民對「智方便 iAM Smart」的接受程度？

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