

LUT UNIVERSITY

School of Engineering Science

Software Engineering

Master's Programme in Software Engineering and Digital Transformation

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**FEASIBILITY OF THE CHINESE HEALTH MONITORING PLATFORM IN  
FINNISH AND EUROPEAN CONTEXT**

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## **ABSTRACT**

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### **Feasibility of the Chinese health monitoring platform in Finnish and European context**

Master's Thesis

2020

55 pages, 18 figures

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Keywords: COVID-19, Health Code, Data Security, Alipay Platform

Infectious diseases have long threatened human life and health. COVID-19, which emerged in late 2019, has become one of the greatest threats facing humanity since the beginning of the 21<sup>st</sup> century. The Chinese government has launched an online epidemic prevention system in response to COVID-19 as a health monitoring platform in China to ensure the normal operation of society and the safety of people's lives. The online epidemic prevention system, called the Health Code, is based on the unique colours of the QR code to determine whether its owner is at potential risk of infection. The contribution of the health code to the epidemic prevention work is outstanding, so it would be an intelligent choice to introduce it in Finland and even the European Union. This research made a judgment on the feasibility of its promotion in Finland through the study of the health code itself, relevant laws and regulations, economic conditions, etc. Meanwhile, some suggestions for its improvement will also be given in this thesis.

## ACKNOWLEDGEMENTS

First of all, I would like to express my most sincere gratitude to Professor Kari Smolander and Professor Annika Wolff. Without the guidance of Professor Kari Smolander, the thesis might not have appeared at all. His suggestions on the research direction of this thesis and his guidance on the details in the later period make this thesis more complete.

Second, I want to express my heartfelt thanks to my parents. They not only gave me full support during my thesis writing period but also gave me unlimited encouragement throughout my whole master's career. Without their full support, I may not complete my studies successfully.

Finally, I would like to express my gratitude to my friends in China. They provided me with a lot of information during my thesis writing period, which enabled me to have a better understanding of the project I studied.

*Liu Muxing*

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Lappeenranta, Aug 2020

## TABLE OF CONTENTS

ABSTRACT.....	i
ACKNOWLEDGEMENTS.....	ii
LIST OF FIGURES .....	iv
LIST OF SYMBOLS AND ABBREVIATIONS .....	vi
1. INTRODUCTION .....	1
1.1. Background .....	1
1.2. Current Pandemic Situation.....	2
1.3. Research Questions .....	4
1.4. Structure of the Thesis.....	6
2. RESEARCH METHODOLOGY.....	8
3. ANALYSIS OF THE HEALTH MONITORING PLATFORM.....	9
3.1. City Health Code .....	9
3.1.1. WeChat Application .....	9
3.1.2. Alipay Application .....	12
3.1.3. Introduction to City Health Code.....	13
3.2. Instructions for City Health Code .....	16
4. ANALYSIS OF FEASIBILITY .....	27
4.1. Analysis of Necessity .....	27
4.2. Analysis of Legality .....	29
4.3. Analysis of Financial Return .....	33
5. PRACTICAL RECOMMENDATIONS .....	37
6. DISCUSSION .....	41
6.1. Current Research Results and Limitations .....	41
6.2. The Vision of a Community of Shared Future for Mankind .....	43
7. CONCLUSIONS.....	44
REFERENCES .....	46

## LIST OF FIGURES

<b>Figure 1.</b> Screenshot of "WeChat Pay" module. ....	10
<b>Figure 2.</b> Screenshot of "Health" module. ....	11
<b>Figure 3.</b> Applets of Alipay. ....	12
<b>Figure 4.</b> Different states of the city health code. ....	14
<b>Figure 5.</b> Alipay User Interface. ....	16
<b>Figure 6.</b> "All Apps" Interface. ....	17
<b>Figure 7.</b> "City Service" Interface. ....	17
<b>Figure 8.</b> Real-Time Data Displayed in the Interface. ....	18
<b>Figure 9.</b> EPIHC Icon. ....	18
<b>Figure 10.</b> Registration Page of EPIHC. ....	19
<b>Figure 11.</b> "To be Confirmed" Page. ....	20
<b>Figure 12.</b> The Interface of Personal Status Declaration. ....	21
<b>Figure 13.</b> Current EPIHC Style. "Modified" ....	22
<b>Figure 14.</b> Detailed Information of Users ....	22
<b>Figure 15.</b> "Clock In" Interface. ....	23
<b>Figure 16.</b> Travel Route Declaration Interface. ....	24
<b>Figure 17.</b> EPIHC Map. ....	25

**Figure 18.** Function List of EPIHC.....26

## **LIST OF SYMBOLS AND ABBREVIATIONS**

SARS-CoV	Severe Acute Respiratory Syndrome Coronavirus
MERS-CoV	Middle East Respiratory Syndrome Coronavirus
WHO	World Health Organization
EPIHC	Epidemic Prevention Information Health Code
NAT	Nucleic Acid Testing
CDPR	China Data Protection Regulations
GDPR	General Data Protection Regulations

# **1. INTRODUCTION**

## **1.1. Background**

Since December 2019, a number of unexplained pneumonia cases have been found in some hospitals in Wuhan, Hubei province, China. During that period, as the Spring Festival (Chinese New Year holiday) in China approached, a large number of workers returned home from the cities where they worked. This enormous population flowing caused unexplained pneumonia to spread rapidly. The pneumonia was later confirmed to be caused by a kind of novel coronavirus, but the source of this kind of coronavirus remains unknown. (Al Sulayyim et al., 2020.)

Soon, several research teams in China confirmed the novel coronavirus is homologous to SARS-CoV (Severe Acute Respiratory Syndrome Coronavirus) and MERS-CoV (Middle East Respiratory Syndrome Coronavirus). It is speculated that the original host of this novel coronavirus might be bats, and this novel coronavirus is the seventh known coronavirus to infect humans. (World Health Organization, 2020.)

On February 11<sup>st</sup> 2020, the director-general of the WHO (World Health Organization) Mr. Tedros Adhanom Ghebreyesus, at a press conference in Geneva, Switzerland, announced the designation of "COVID-19" for this pneumonia caused by the novel coronavirus (World Health Organization, 2020). Meanwhile, the novel coronavirus that causes COVID-19 has been named SARS-CoV-2. In the current phase of scientific research, there is no clear evidence to explain how humans become infected with SARS-CoV-2, but what is certain is that the SARS-CoV-2, like SARS-CoV and MERS-CoV, also came from the natural animal transmission. However, unlike the other two coronaviruses, SARS-CoV-2 is likely to be far more infectious than the other viruses, which is a huge threat to humans.

## **1.2. Current Pandemic Situation**

In mid-January 2020, the number of people infected with COVID-19 in Wuhan surged, and a small number of infected people have also been detected in other parts of China. In order to prevent the further spread of the epidemic, Wuhan decided to curb the population flow and officially declared the lockdown of the city on January 23<sup>rd</sup>. At the same time, 31 provinces in China announced to activate first-level public health emergency response. About a month later, most of China's provinces have switched from first-level response to second-level response, and by the end of February, the epidemic had been well controlled in China except for Wuhan and the number of COVID-19 cases had dropped sharply in the whole country.

In the meantime, however, despite China's repeated announcements to the world about the severity of the epidemic, the rest of the world has failed to grasp the magnitude of the problem. Around early March, South Korea, Italy, Iran and Japan all reported epidemics with varying degrees of intensity, and a number of COVID-19 cases were reported also in the European Union and the United States. Not only the spread of the SARS-CoV-2 is extremely rapid, but it is also far more infectious than other viruses. On March 11<sup>st</sup>, when the number of countries affected by the epidemic is growing rapidly, the WHO officially declared the COVID-19 epidemic a global pandemic. Soon the COVID-19 epidemic spread rapidly from Italy to the European Union. As of March 18<sup>th</sup>, the number of infected people and deaths in Europe has surpassed that of China, and a day later, Italy alone reported more deaths than China (The New York Times, 2020).

As of August 15<sup>th</sup>, 213 countries and territories had been confirmed infected with COVID-19, and 21,026,758 people had been reported as confirmed cases, the total number of deaths from COVID-19 reached 755,786. Of these confirmed cases, 3,733,965 cases have come from the European Union, the European Union has become one of the most affected regions by COVID-19 epidemic in the world. (World Health Organization, 2020.)

Before the COVID-19 epidemic in China, American people were suffering from a severe influenza epidemic. As of April 4<sup>th</sup>, 2020, about 56 million people in the United States have been infected with the influenza, and about 62,000 have died (Centers for Disease Control and Prevention, 2020). Some of the so-called influenza-infected people were later highly suspected to be COVID-19 patients. As of August 15<sup>th</sup>, the number of confirmed COVID-19 cases in the United States had reached 5,203,206, and the number of deaths from the COVID-19 had reached 165,995 (World Health Organization, 2020). The data also showed that the number of confirmed COVID-19 cases in the United States is still growing rapidly, and the epidemic has become the most significant threat to social stability in the United States.

Northern Europe has always given the world an image of being environmentally friendly and hygienic. The possibility of an epidemic in Northern Europe is widely believed to be very low, but the data suggest otherwise. One of the most volatile factors in controlling an epidemic is the large population movements brought about by the internationalization and modernization of society. Unfortunately, the earlier stage of the epidemic outbreak in Italy coincided with a holiday season in Northern Europe, during this period, large numbers of people travelled from Northern Europe to Southern and Western Europe for their holidays. At the time, Europeans were optimistic about the COVID-19, thinking it was similar to mild cold and it may not be transmitted to European populations. The fact is, however, that the SARS-CoV-2 had already spread on a large scale at that time, many civilians had been infected with the SARS-CoV-2 and were in the incubation period without knowing it. And in the meantime, the governments neither responded actively to the epidemic nor tested for it. All these normal actions had resulted in an unrestricted transmission of the SARS-CoV-2 from infected people in incubation period to others, which is why the number of SARS-CoV-2 carriers is so large. Unfortunately, a large number of Northern European tourists also caught the virus during this period and brought it back to Northern Europe.

As of August 15<sup>th</sup>, there have been 7,700 confirmed cases and 333 deaths in Finland.

Meanwhile, the number of infected-people in Sweden has reached 84,294 and the number of deaths has reached 5,783. In Norway, there have been 9,850 confirmed cases and 261 deaths. (World Health Organization, 2020.)

In the history of human beings, whether it is SARS-CoV, MERS-CoV, SARS-CoV-2 or the so-called seasonal influenza in the United States, pandemic diseases have been one of the major risk factors for human health.

### **1.3. Research Questions**

Through the study of the epidemic data in China, it was found that it only took about two months for China to fully control the spread of the COVID-19 and restore the normal operation of the society from the early stage of the epidemic outbreak. However, in both the United States and Europe, COVID-19 is still unable to be effectively controlled and the number of infections continues to grow exponentially. To some extent, China has already ended the COVID-19 epidemic outbreak, where the mortality rate due to COVID-19 is only 0.16% outside Hubei province in China, and the national mortality rate is about 5% (World Health Organization, 2020).

According to statistics, the worldwide mortality rate caused by COVID-19 has reached 9.94%. In Europe, the mortality rate from COVID-19 in the UK and Italy have even reached about 14%. (World Health Organization, 2020.)

In the fight against the COVID-19, the Chinese government has taken tough measures to prevent the disease, and the success has been achieved at the expense of economic development and restrictions on gatherings. Therefore, at the early stage of the COVID-19 outbreak, the European scholars studied the mortality rate caused by this disease in China and concluded that it was not a very noteworthy disease. However, the fact proved that it was not that the epidemic was not serious, but that China's epidemic prevention model has achieved great success. Europe, on the other hand, did not make adequate preparations in the early stage when the epidemic could be completely

contained and did not immediately respond positively or absorb any beneficial experience from China during the COVID-19 epidemic outbreak. This leaves Europe with a missed opportunity to contain the epidemic.

In view of this, people should realize that when problems arise, they can be solved by borrowing the successful methods of others, but that meaningless questioning for political purposes cannot solve any problem. Human beings are now in an era of globalization. The destinies of all people are linked together to form a community of shared future for mankind. At any time in any state, human life and health should be the first.

In addition to the government's strong social epidemic prevention model, China's success in fighting the epidemic also includes online health monitoring. The health monitoring platform can tell the public where the epidemic area is and remind each person whether they should self-quarantine. It is a good and convenient platform to help people understand the epidemic situation so that people can stay away from and do not spread the virus, thus achieving the effect of epidemic prevention. There are many online health monitoring platforms in China, some of which are regional, but the one the government encourages people to use is a module called "city service" from Alipay. There are many powerful functions in the "city service" module, among which the main function linking the epidemic situation is called "city health code", also known as "green code". People can understand the situation of the epidemic through the green code, not only to check if they are potentially infected with COVID-19 but also to enable non-virus carriers to travel freely by displaying the green code.

Not only COVID-19 pandemic but also global infectious diseases have become one of the major threats to human health and social development. Could Finland or even the whole of Europe have a similar online health monitoring platform to protect people's health at a special time? In order to understand the feasibility of the Chinese health monitoring platform in Finnish and European context, the research questions of this thesis are as follows:

- Under the epidemic situation, what kind of epidemic prevention methods has China information system adopted?
- Whether China's online epidemic prevention model can be introduced to Finland and the European Union?

#### **1.4. Structure of the Thesis**

This thesis is based on the background of COVID-19 outbreak raging in all countries in the world. It elaborates the harm of epidemic diseases to society and economy as well as the threat to human health. Through the analysis of the epidemic situation in the world and China's response to the COVID-19 epidemic, this thesis explains why China is able to achieve success in the fight against the epidemic. Then, it introduces China's online epidemic prevention model. Next, through the analysis of various situations in Europe and mainly in Finland, it is discussed whether China's online epidemic prevention model can be extended to Finland and the whole European continent, so as to deal with various epidemic diseases that may appear in the future and make adequate preparations for various crises that may appear in the future.

Chapter two mainly describes the research methods used in this study. Due to the particularity of this epidemic and the short time for the emergence of China's online epidemic prevention model, this thesis mainly studied through literature. By referring to the constantly changing data related to the epidemic during the COVID-19 outbreak, as well as the actual reported epidemic situation and epidemic prevention models in various countries in the world, the effectiveness of different epidemic prevention models can be obtained through analysis.

In chapter 3, the software used in China's online health monitoring platform and the related modules and functions are introduced in detail. It includes the predecessor of the software, the early data collection, the technology used by the software, the way the software operates, and the impact of this epidemic prevention model on people's lives and the future. In addition, this chapter mainly introduces how this online health

monitoring platform is used and plays a role in epidemic prevention so that the first research question of this study can be answered.

Chapter four is mainly about the analysis of the second research question. It includes the analysis of social and legal provisions in Europe and then explains whether it is possible and necessary to introduce China's online health monitoring platform to Europe and mainly to Finland. This chapter also includes an analysis of the impact of the platform on the European economy and the technical requirements required by the platform itself.

In chapter 5, this thesis mainly proposes further suggestions based on the results of the study, such as what modifications should be made to the Chinese health monitoring platform when it is necessary to introduce it to Finland, or whether there is a better alternative, and how to optimize it according to the situation in Europe and Finland.

Chapter 6 briefly discusses the significance of the health monitoring platform for the future, and briefly describes the opportunities and challenges it brings to the society and citizens.

The last chapter will systematically summarize the research results of this study so that the subsequent scholars can better make other relevant and more in-depth studies.

## **2. RESEARCH METHODOLOGY**

This research mainly analyses whether the Chinese health monitoring platform is likely to be successfully promoted in Finland from the perspectives of European Union laws, economy and the impact of the COVID-19 on society. The COVID-19 epidemic, which began at the end of 2019, is an entirely new infectious disease. The disease has caused social paralysis in many countries for more than half a year and continues to do so. Therefore, it is imperative to study the prevention measures of COVID-19 in many aspects.

Because of the short emergence time of COVID-19, relevant research and protective measures for it are relatively imperfect, especially the research on the online epidemic prevention system is still at the initial stage. This research studies the Chinese health monitoring platform itself, including how it develops, what role it plays and how to use it. As for whether it can and should be promoted in Finland, this study mainly refers to the data provided by the WHO, the relevant laws of the European Union on data security, the information published by the Finnish government and all kinds of relevant news reports. This thesis will also make a simple comparison between the different data security policies of China and the European Union, to ensure the reliability of the research and the legitimacy of introducing Chinese health monitoring platform. Based on the above background, the research method of this thesis is completely based on literature research.

### **3. ANALYSIS OF THE HEALTH MONITORING PLATFORM**

Shortly after the outbreak of COVID-19 in China, the government and people quickly realized the seriousness of the situation due to the previous experience of SARS. In the early stage of the outbreak, people could only choose passive defence against the coronavirus attack, but soon people found that passive defence could not get rid of the coronavirus quickly and completely, so many cities began to use their own unique methods of epidemic prevention. In the general epidemic prevention model of society, people do similar things, but at the same time, people began to explore the online epidemic prevention model. Many town governments have started to make online epidemic prevention platforms suitable for local people so that people can know the latest situation of the epidemic and the outbreak area through the information provided by the platform. Some businesses, such as supermarkets, also began creating simple platforms to register people coming in and out so that if someone is found to have COVID-19 symptoms, the supermarket can more easily and quickly notify people who have been in close contact with the person, and possibly report the situation to the relevant medical and anti-epidemic agencies. Increasingly, people are using the unified platform to monitor where COVID-19 is spreading and their own safety and health. The unified verification platform was originally called the "City Health Code".

#### **3.1. City Health Code**

There are two important applications embedded into city health code, which are also the most widely used applications in China, namely WeChat and Alipay. To some extent, it is precisely because of the universality of these two applications that the city health code can be widely accepted and rapidly promoted.

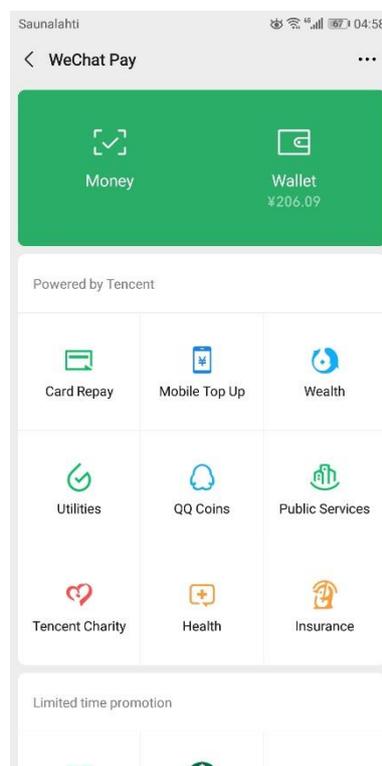
##### **3.1.1. WeChat Application**

WeChat is a free app for instant messaging for smart terminals launched by Tencent in early 2011 (Yang, 2020). WeChat supports cross-communication operators and

operating system platforms to quickly send free voice messages, videos, pictures and text over the network, while WeChat is embedded into numerous subroutines to help facilitate and change people's lifestyle and consumption habits. By the second quarter of 2016, WeChat has covered more than 94% of smartphones in China, with 806 million monthly active users and users in more than 200 countries and over 20 languages (WeChat Blog: Chatterbox, 2020).

WeChat not only provides basic instant messaging functions but also has many other practical functions, such as paying for living expenses, instant ordering for takeout, hotel reservation, and the transportation ticket purchase. WeChat has also established cooperative relations with several third-party software, thus bringing more convenient functions, such as taxi-hailing and shopping on e-commerce platforms.

For all the above reasons, WeChat has a very high market share in China, and almost everyone uses it. Because of the special nature of the application, it contains a lot of information. Shortly after the COVID-19 outbreak, WeChat added the “Health” module in “Powered by Tencent” module. Figure 1 below shows that "WeChat Pay" is



**Figure 1.** Screenshot of "WeChat Pay" module.

embedded into "Powered by Tencent" module.

The "Power by Tencent" module contains several common functions, including the "Health" module. During the COVID-19 epidemic period, after clicking the "Health" module, the latest reports and data analysis on the COVID-19 epidemic situation will appear on the program interface, including two different categories of "Mainland China" and "International". As shown in Figure 2, people can click on different keywords to find the relative latest information:



**Figure 2.** Screenshot of "Health" module.

People can view the most detailed epidemic information through the "Health" module. The default display information in the module will automatically prompt users to switch areas according to their location, to facilitate people to check the safety status of their area. People can find information about the COVID-19 epidemic situation in almost any region. The information includes fresh cases, total infections, cured cases, deaths and data analysis based on line-graphs.

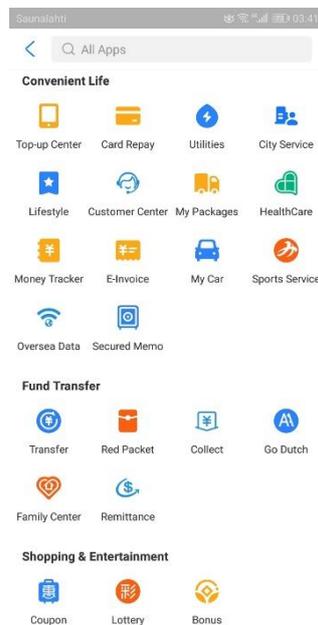
Before there was the city health code, the WeChat "Health" module was the most important module for people to understand the COVID-19 epidemic information and

safety in each region and surrounding areas.

### 3.1.2. Alipay Application

Taobao is the largest of China's e-commerce platforms, and its principal payment method is using Alipay as a payment intermediary. Alipay, the largest third-party payment platform in China, was founded in 2004 and has close cooperation with over 180 banks around the world. Alipay is owned by Alibaba Group, a reformer of e-commerce in China. As of June 2019, Alipay has been used in 38 countries and regions, with a user scale of 1.2 billion. (TheStreet, 2020.)

Like the WeChat platform, Alipay also has a huge market share in China. The most commonly used payment method in China is not traditional bank cards or cash, but electronic payment services provided by WeChat and Alipay platforms, both of which are used by almost everyone and all merchants (Shu, Shuk and Zhao, 2020). One reason Alipay is widely accepted by people is also because of its powerful functions. As can be seen from Figure 3 below, Alipay also has numerous applets to serve people's daily life.



**Figure 3.** Applets of Alipay.

More importantly, the original developer of the city health code also came from Alipay. Alipay is both the product manager and development team of the city health code. As

Alipay is headquartered in Hangzhou, China, Hangzhou was also the first place to use the city health code. In close cooperation with the government and related medical institutions, the city health code has been rapidly promoted throughout China.

### **3.1.3. Introduction to City Health Code**

The initial inspiration for the development of the city health code came from the people registration system within the community. In the initial stage, the development team visited and investigated lots of epidemic prevention station to understand user requirements. During the COVID-19 outbreak, the artificial people registration system brought people into contact with each other. Although it could accurately understand the spread situation of the epidemic, it could not prevent the spread of the epidemic effectively.

For the above reasons and the rapid spread of COVID-19, on February 9<sup>th</sup>, 2020, the government of Hangzhou, Zhejiang province, China announced the launch of new digital epidemic prevention measures. Two days later, the "Hangzhou Health Code" was officially launched and fully promoted in the city. Soon afterwards, Alipay announced that the health code from Hangzhou had reached over 200 cities across China, covering such important areas as bus stations, subways, communities, office buildings, shopping malls, supermarkets, airports and railway stations. Each city is also expanding the use of health code. On March 10<sup>th</sup>, the COVID-19 prevention and control command in Hubei province, China's worst-hit province, announced that it would distribute health code in Hubei province to allow people to travel in an orderly manner. Then, on March 16<sup>th</sup>, the Zhejiang provincial government announced that it would launch an international version of the health code aimed at overseas Chinese, overseas students and foreigners with Chinese visas. At this point, the city health code in mainland China is basically universal.

The initial purpose of the city health code is to prevent the spread of the epidemic, but with the gradual development of the health code, it has been able to include electronic

medical records and physical examination reports, thus explore and build personal health data. Meanwhile, the city health code can also evaluate the health of communities, enterprises and other regions through big data.

The classification of city health code is very simple, it is divided into green, yellow, red, and according to the actual situation of dynamic conversion. It shows the different states of the city health code in Figure 4 below:



**Figure 4.** Different states of the city health code.

The green code represents the user is healthy and can travel to any area with the health code. The yellow code indicates that the user has a low potential risk of infection and needs to be quarantined at home for seven days. If there is no abnormality for seven consecutive days, the yellow code will automatically turn to the green code. The red code shows that the user is at high risk of infection. After 14 days of home quarantine and no abnormality, the red code will be changed to the green code.

The dynamic conversion of city health code not only relieves the burden of COVID-19 prevention but also enables everyone to know at the first time whether they have had any potential contact with the suspected infected person. This enables people to be more aware of their own health and that of the surrounding areas, thus speeding up social recovery and making it safer for people to work.

The city health code is very scientific from a theoretical standpoint. It relies on the smartphone's built-in GPS system to record the owner's location and moving track. After the user completes the city health code register, the mobile GPS positioning system can automatically record the user's moving track, and within a certain period, if

a confirmed patient is found within the user's range of activity, the user's city health code will change colour depending on the specific circumstances to determine whether the user should be quarantined or for how long.

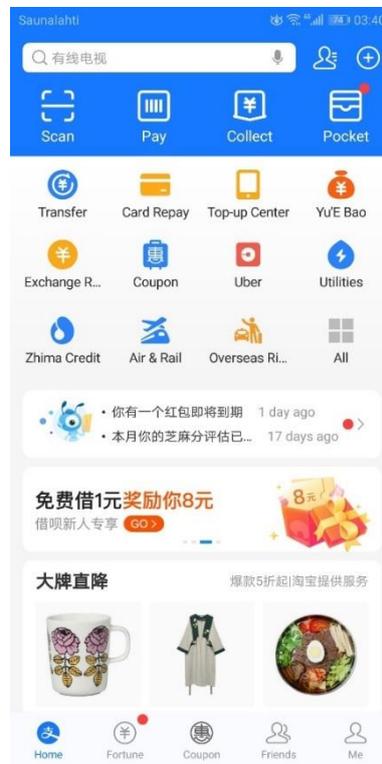
Such a monitoring mechanism ensures the accuracy and timeliness of the obtained data. Although this monitoring mechanism collects an enormous amount of data, most of it is useless. Moreover, if the collected data is directly used with no analysis by some deep algorithm, sensitive information such as users' personal health information and users' daily activity track will be likely to be leaked. The behaviour of this monitoring mechanism is more like a kind of surveillance, which will inadvertently invade the privacy and data security of users. Obviously, using Bluetooth technology and storing data on the user's mobile device is the best solution based on privacy and data security. The technical mechanism of using Bluetooth is to confirm whether the user has had close contact with the confirmed patient through the range of Bluetooth detection, so as to give relevant health advice. Here, the use of Bluetooth technology makes it unnecessary for the health monitoring platform to collect specific activity track information of users. Although the use of Bluetooth protects users from surveillance and significantly reduces the intrusion on user data security, these so-called surveillance and data intrusions are targeted at governments. From an individual point of view, the use of Bluetooth technology may increase the risk of data leakage. Moreover, the biggest problem with implementing Bluetooth technology is that in the early days of the Chinese government's decision to establish a health monitoring platform, relevant technology companies banned any application from using Bluetooth without a time limit for protecting users' privacy. For these reasons, the Chinese government had to abandon the use of Bluetooth technology. In the later stage of the COVID-19 epidemic, when some countries established their own epidemic prevention application based on the model of Chinese health monitoring platform, although relevant technology companies relaxed their control over Bluetooth technology, the effect of using Bluetooth technology as monitoring means is unsatisfactory, so the Chinese health monitoring platform continues to use GPS positioning system to monitor people's

health conditions.

### 3.2. Instructions for City Health Code

China is a vast country with many provinces, and each province has a unique epidemic situation. Therefore, different provinces have different epidemic prevention norms, which results in the non-recognition of the city health code among different provinces. However, after a period of development, the General Office of the State Council and the National Health Commission of China promoted the mutual recognition mechanism of the city health code among provinces and upgraded the “City Health Code” to the “EPIHC (Epidemic Prevention Information Health Code)”. It relates the EPIHC to 31 provinces in China, realising the information sharing of health code and the mutual recognition mechanism among most provinces in China.

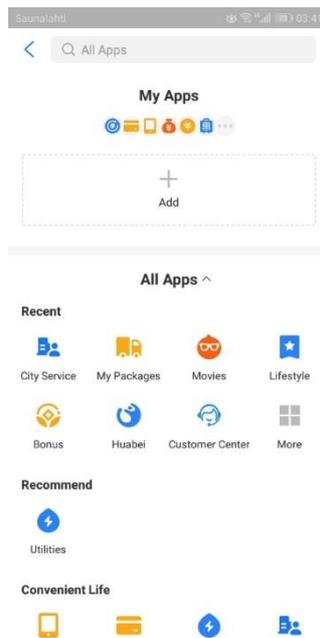
People can get EPIHC through the Alipay or WeChat application. Take Alipay, for example, after opening Alipay, it shows the user interface of Alipay in Figure 5 below:



**Figure 5.** Alipay User Interface.

If the user taps "Me" on the phone, another user interface will appear with personal

information. In the Personal Information module, the user's default location information, contact information, name, and identification number can be found. If the user needs to find EPIHC, the user needs to go back to the home screen and tap the “All” icon. In "All Apps", it contains all applets cooperating with Alipay. The display of the interface will be different depending on the user's location, and users can also choose which applets to show or hide. Before obtaining the EPIHC, the user needs to enter the “City Service” interface, as shown in Figure 6 below:



**Figure 6.** “All Apps” Interface.

After entering the interface of “City Service”, users will see many applets, including Epidemic Service, Mobile Phone Recharge, Medical Insurance, Environmental Protection and Public Welfare, etc. However, as some of these services need to locate the user's location, and most of the services belong to China-specific services, so there is no English version of this interface. The user only needs to tap the first icon in Figure 7 below to enter the “Epidemic Service” interface.



**Figure 7.** "City Service" Interface.

When the user enters the “Epidemic Service” interface, the interface will first display two sets of data, namely the real-time data of the epidemic situation in whole China and the real-time data of the epidemic situation in the user’s default province. The National Health Commission of China provided both sets of data. As shown in Figure 8 below, the two sets of data are the data of the whole China and the data of the individual province, respectively. From left to right are the number of confirmed cases in China, the number of suspected cases in China, the number of deaths in China, the number of cured cases in China, the number of confirmed cases in the province, the number of deaths in the province and the number of cured cases in the province. The data in the figure below is valid until May 23<sup>rd</sup>, 2020. Different from Alipay platform, WeChat platform displays detailed data of the global epidemic situation according to the data provided by WHO in the real-time data module and provides users with the function of inquiring about the epidemic situation of designated cities in all countries.



**Figure 8.** Real-Time Data Displayed in the Interface.

There are two columns of icons below the real-time data, EPIHC icon at the bottom left.

As shown in Figure 9 below:



**Figure 9.** EPIHC Icon.

After the user taps the EPIHC icon, it will show the registration page on the screen. Because EPIHC is associated with Alipay's personal user information, the user's personal information will be automatically filled into the registration page. As Alipay involves banking, social insurance, wages and other information, its registration system is real-name. In this step, EPIHC captures three major pieces of information about the user, namely the certificate used for registration, the certificate number and the mobile phone number. As shown in Figure 10 below:

The screenshot shows a mobile application interface for user registration. At the top, there is a status bar with the text 'Saunalahti' and a time of 03:43. Below the status bar is a navigation bar with a back arrow, the text '用户注册', a star icon labeled '收藏', and two other icons. The main content area contains the following information:

\*\*星, 凌晨好  
请核实以下信息是否准确无误。

证件类型	居民身份证
证件号码	*****0338
手机号码	187****2961

Below the form is a radio button followed by the text '同意《用户注册协议》《隐私政策》'. At the bottom is a large blue button labeled '提交'.

**Figure 10.** Registration Page of EPIHC.

Figure 10 shows the need to check the consent user registration agreement and privacy policy before submitting personal information. The user registration agreement is a series of provisions that restricts users from abusing illegal means to interfere with the operation of the software. The ultimate purpose of the privacy policy is to inform the user so that the user can understand how the product collects and uses personal information. The privacy policy is also the primary channel to provide users with the right to informed consent. Laws around the world generally require that users should be clearly informed of how sensitive or non-sensitive personal information is collected

and how it is used and that users are provided with the right to withdraw their consent. These two protocols guarantee users' basic right to data security. However, for the urgency of the COVID-19 epidemic outbreak, the relevant development agencies failed to complete the legitimacy of the health monitoring platform, and these two protocols were not added to the registration page before the "City Health Code" was transformed into EPIHC, which makes the "City Health Code" faced serious legal problems. In addition, the original purpose of the city health code is to manage the movement of people within small communities, and the information of people within a community is registered in paper documents already. Therefore, this traditional way of information registration makes the original developers of the city health code ignore people's data security needs.

After completing the step of user registration, the system will enter the "To be Confirmed" interface. Because of the special characteristics of China, residents in Hong Kong, Macao and Taiwan have different ways of obtaining EPIHC from residents in mainland China. Hong Kong, Macao and Taiwan residents need to enter another interface to complete the previous registration step. The Chinese character at the bottom of Figure 11 means "Get EPIHC Immediately".



姓名	**星
身份证号	*****0338

立即领取

**Figure 11.** "To be Confirmed" Page.

In the current EPIHC, Alipay works with several government agencies, including the Ministry of Transport, Customs and Immigration Administration. China Electronics Technology Group provided relevant technical support, the public can only inquire about their own health information, and others' health information is confidential. After passing the real-name authentication, users can check their epidemic prevention and health-related information, such as whether they are COVID-19 patients or suspected

patients, whether they have had close contact with COVID-19 patients, whether they have entered or left China in the past 14 days, or whether they have returned home from areas with high epidemic incidence. EPIHC can also be provided to the national government service platform to scan the QR code for health inspection after authorisation by the user. EPIHC's policy on user data security is based primarily on the *Information Security Technology - Personal Information Security Specifications* and is in compliance with other relevant Chinese laws such as the *Prevention and Treatment of Infectious Diseases Law*, the *Emergency Response Law*.

After confirming the acquisition of EPIHC, the system will jump to the page that declares personal status, which includes the user location information automatically located by the system. And there are two questions about users' condition: "Have you been in contact with a confirmed or suspected COVID-19 patient in the last 14 days?" and "Do you have any of the following symptoms? Multiple choices:" The answers options for these two questions are "Yes, No, Not Sure" and "No Symptoms, Cold, Difficulty Breathing, Vomiting and diarrhoea, Other Symptoms." Its interface is shown in Figure 12 below:

\*当前所在城市 河北省/保定市/莲池区 >

近期情况

\*近14天内您是否接触新冠肺炎确诊患者或疑似患者?

是  否  不确定

\*您是否有以下症状，如有请选择（可多选）

没有出现症状

感冒样症状：乏力、咳嗽、发烧、肌肉痛、头痛

喘憋、呼吸急促

恶心、呕吐、腹泻

**Figure 12.** The Interface of Personal Status Declaration.

Once all personal information has been confirmed and the personal current health status

has been filled out, the user will be provided with the latest EPIHC, as shown in Figure 13 below:



**Figure 13.** Current EPIHC Style. “Modified”

As it involves some sensitive personal information, the QR code in Figure 13 is blurred. As can be seen from Figure 13, the latest EPIHC abandoned the method the original “City Health Code” used colours to distinguish the health status of users. The latest EPIHC uses more detailed information. The Chinese character at the bottom of Figure 13 means "Details of my epidemic prevention health information". When the user taps on this option, the system will display the interface of the user’s detailed information. As shown in Figure 14 below:



**Figure 14.** Detailed Information of Users

In the interface of the user’s detailed information, the system mainly takes the data provided by relevant institutions as the judgment conditions, so as to give various judgment results. Its judgments include:

- “Is the user a confirmed patient?”
- “Is the user a suspected patient?”
- “Had the user been tested for Nucleic Acid Testing (NAT)?”
- “Had the user been tested for antibodies?”
- “Had the user had close contact with a confirmed or suspected patient?”
- “Is the user a person who entered the country from abroad within the last 14 days?”
- "If the user is a person who has entered the country within the last 14 days, are there any confirmed or suspected patients on the flight?"

If EPIHC users need to prove their health status continually, then they will need to “clock in” to get daily health records. The system will automatically record the time of “clock in” and the health status declared by the user, so as to give the judgment result of whether the user is healthy. This step is entirely up to the user to decide whether to use. Since EPIHC was used in China during the period of universal home quarantine, most people will not use this function. When the user does not need this function, the system will only temporarily stop recording the user’s health status and will do nothing else to the user. Because no institution will monitor the user through the user’s EPIHC. EPIHC is not mandatory and is usually only required for access to large public spaces or for cross-city travel. In the “clock in” interface, it requires users to provide their body temperature data for the day and information about whether they have any symptoms. Users can also check the risk level of their area and whether there are high-risk areas nearby. As shown in Figure 15 below:

健康打卡时间	2020-05-23 03:46:17
当前所在城市	河北省保定市莲池区
所在城市疫情风险等级	低风险
 查看附近疫情场所	去查看 >
近14天是否接触过新冠肺炎确诊患者或者疑似患者?	否
当前健康状况	没有出现症状
当前体温	36.5°C

**Figure 15.** "Clock In" Interface.

Users can choose to declare whether they have travelled within the country within 14 days to determine whether they are at potential risk of infection or whether they pose a threat to the health of others. Since China's transport authorities use the real-name ticket system, users can also check their travel routes through other agencies if they have forgotten their specific trips. If the user chooses to declare his/her trip, the information must be true and valid. The system will verify whether the information filled in by the user is true and valid according to the identity information provided by the user. This operation will be invalid if the travel information filled in by the user does not match the system's query results. Because of the special nature of COVID-19, the negative consequences of misinformation or concealment will be irreversible. As shown in the bottom of Figure 16 below, after the user has consented and authorised the system to query the information of where the user has visited in the past 14 days during the epidemic period, the user can complete the whole declaration process by tapping the Chinese character “申报” at the bottom of the interface. “申报” means “Declare”.

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到访地区 [请选择停留过的地区 >](#)

联系方式 187\*\*\*\*2961

验证码  [获取验证码](#)

1、本服务支持用户申报和查询本人过去14天内曾到访的国内城市（停留4小时以上）和境外国家（地区）。  
2、如果您忘记过去14天内行程信息，可以访问疫情防控行程卡服务进行查询：[通信大数据行程卡](#)。如结果出现严重偏差，请及时联系运营商客服。  
3、本行程申报与查询结果，通过“通信大数据行程卡”进行核验。如所填行程中未包括“行程卡”返回的到访地，则核验不通过，需重新查询后申报，避免行程漏报。  
4、如果您过去14天内未出行，请填写住址所在的国内城市或境外国家（地区）。

同意并授权运营商查询本人在疫情期间过去14天内曾到访地信息

[申报](#)

**Figure 16.** Travel Route Declaration Interface.

When a user queries a high-risk area nearby, the system will display it to the user in the form of a map. The red areas on the map are areas where patients with COVID-19 had

been present. The map does not show any personal information about COVID-19 patients. Users can only see which areas are COVID-19 prone and which are relatively safe, so they can choose the corresponding travel plan based on this map. As shown in Figure 17 below, because EPIHC can only be used in China at present, so it cannot obtain effective query information for the time being.



**Figure 17.** EPIHC Map.

Users can also query to find out the security level of their city. If users need to travel across cities, they can also check the epidemic situation in other cities in advance to decide whether to travel. EPIHC also provides mutual authentication for users. Users can gain the health status of each other by scanning the QR code of each other. It will include no sensitive personal information in the health status information received.

Phone numbers for COVID-19 assistance are also included in the EPIHC. Users can directly access the phone numbers of almost any region. In addition, EPIHC has many other services besides its own simple QR code. For example, if a user has some psychological problems after a long period of home quarantine, the user can log on to EPIHC to find an online psychological assistance service. During the epidemic, the use of face masks was huge. Although European society did not recognise the effectiveness of face masks, the use of face masks did help China better prevent the spread of the epidemic. In the interface of EPIHC, users can also query the storage and purchase location of face masks to solve the mask shortage problem. The many functions of EPIHC enable Chinese residents to have a comprehensive and rapid understanding of the current epidemic situation. It not only improves the security of people's lives but

also makes many government information more transparent and the economy recovers more quickly. The following Figure 18 is the partial function list of EPIHC:



**Figure 18.** Function List of EPIHC.

This list includes information of enterprises returning to work, investigation of epidemic prevention methods, rumour refuting of epidemic situation, transportation recovery, NAT testing and query, etc. Since COVID-19 will not entirely disappear in the short term, these functions are still being improved and added.

#### **4. ANALYSIS OF FEASIBILITY**

At the beginning and middle period of COVID-19 epidemic outbreak in 2020, lots of countries have adopted lockouts and school suspensions for the severity of the epidemic, to reduce the contact between people and the movement of people. The EPIHC introduced by the Chinese government is of a huge scale, high frequency of use and strict implementation. At present, no country adopts the same online epidemic prevention model as China. EPIHC contains not only personal health information but also data from street hygiene, medical institutions, businesses, health departments, transportation systems, and exit and entry management systems. EPIHC provides policymakers with the most intuitive information about the epidemic through real-time monitoring of population health and movement. It also provides a wealth of information to support the formulation of epidemic prevention and work resumption policies. From the perspective of big data and artificial intelligence, EPIHC is not only the fusion of technology and government policy but also its timeliness and scale are unprecedented. From the point of view of people's life safety, the promotion of EPIHC has more advantages than disadvantages.

##### **4.1. Analysis of Necessity**

The outbreak of COVID-19 in Finland should prompt people to think deeply about how to do an excellent job in a public health emergency. A review of the worldwide spread of various viruses over the past century, and the response and results of countries in this COVID-19 epidemic, should conclude that people are the prime body of public health epidemic prevention. Only by raising people's awareness and ability of public health epidemic prevention, can construct the epidemic prevention front, prevent and reduce the spread of the epidemic, and properly handle it after the beginning of an epidemic outbreak.

As of 15<sup>th</sup> August 2020, the total number of COVID-19 patients in Finland has reached

7,700, while the total number of COVID-19 related deaths has reached 333, according to the Finnish Institute for Health and Welfare. Although the overall number is not as high as in the rest of the European Union, the significant increase in COVID-19 incidence in Finland compared to previous figures may mean a new outbreak is on the way. (Finnish Institute for Health and Welfare, 2020.) By this time, the outbreak had been persisting in Finland for over five months. And although China has a more dense population and the more serious epidemic situation initially, it took about two months for China to control the spread of the epidemic, in about three months, the number of COVID-19 patients in China has been greatly reduced, and the number of new cases relative to China's population is almost negligible.

It can be seen that China's epidemic prevention and control methods are worthy of reference by Finland. EPIHC plays a very important role in China's epidemic prevention and control system. First of all, EPIHC unifies the collection and query channels of epidemic information. Before EPIHC was launched, the channel for people to report health information was mainly through medical institutions, which could not avoid person-to-person contact, which also increased the risk of people being infected. Traditional medical institutions are a waste of time for individuals to register health information, while for social institutions, the processing of information slows down their work efficiency. The emergence of EPIHC enables people's health information to be processed through a unified channel, which improves the operation speed of the entire society. Second, the use of EPIHC increases the safety of public places and transportation systems. In public places or transportation systems, relevant staff only need to scan EPIHC to confirm the safety of the public, so that people can be more assured to open the public places for normal life and entertainment. Third, EPIHC keeps epidemic information up to date by using dynamic data, so it can not only collect people's health information but also provide people with information. This makes the epidemic information more transparent. People can easily check the safety level of their own areas, and they can quickly know which places are at high risk of the epidemic, to avoid going to those places to reduce their risk of being infected.

Covid-19 is an emergency, unlike the known scenarios and identified problems that people face in normal times. Emergency management cannot afford to take too long to prepare. When the original mechanism cannot solve the existing problems, for example, when the traditional government system cannot quickly respond to the front-line problems, the delayed collection and processing of all kinds of information will cause immeasurable losses. The way of manual input of information is extremely inefficient, while the way like EPIHC has the characteristics of fast response speed, low investment, fast replication and flexible adjustment. Furthermore, the emergency management approach needs to draw lessons from military thinking. For local disasters within a limited time, active decision-making can effectively solve the problem.

The essence of EPIHC is not a regulatory platform, but a service platform. The introduction of EPIHC will not only reduce the current health threats that people face but may also become the basis for smart cities. Therefore, it is necessary to promote the health monitoring platform in Finland and the European Union.

#### **4.2. Analysis of Legality**

As is known to all, Finland attaches great importance to the security and privacy of personal data. Any enterprise, individual and government should follow relevant laws on data security. As a government-level system, Chinese health monitoring platform, if introduced to Finland, should also comply with the relevant laws of Finland and the European Union.

As a government-level application in China, EPIHC undoubtedly should in compliance with relevant regulations and laws in China. EPIHC needs following the *Information Security Technology - Personal Information Security Specifications*, also known as the China Data Protection Regulations (CDPR). The European Union's rules for protecting personal information security and privacy are called General Data Protection Regulations (GDPR).

The GDPR came into effect in the European Union on May 25<sup>th</sup>, 2018, while China's corresponding CDPR came into effect earlier on May 1<sup>st</sup>, 2018. However, this does not mean that the CDPR precedes that of the EU. In fact, the GDPR's predecessor was the European Union's Computer Data Protection Act of 1995. The European Parliament has approved the GDPR on April 14<sup>th</sup>, 2016. (GDPR.EU, 2020.) It is widely believed that China is the most direct recipient of the GDPR of the European Union, and introducing CDPR is largely influenced by GDPR. GDPR is considered being the most stringent personal data protection regulation in the history of the world, which will revolutionise the personal data protection of European Union citizens.

Although CDPR is a legal provision formulated according to the framework of GDPR, the Chinese government has also made corresponding modifications according to its own national conditions, which means that although CDPR and GDPR share a great degree of similarity, they cannot be applied to each other in the two regions. First, by comparing CDPR and GDPR, it can be found that CDPR has a more detailed description of personal data. However, this does not mean that CDPR is more stringent than GDPR. On the contrary, CDPR controls the details so that some data can bypass these details. As is known to all, China's e-commerce is absolutely leading in the world, and the excessively strict data protection mechanism will make big data analysis and electronic economy face significant challenges. Second, although CDPR has detailed provisions on personal data protection, the Chinese government has added more rules on national security, which sometimes may invalidate some provisions on personal data protection. There are also data protection clauses for national and regional security in GDPR, but GDPR pays more attention to the importance of personal data.

Some other scholars believe that CDPR is actually more stringent than GDPR. Although there are many differences between CDPR and GDPR, it is a compatible mode of data protection mechanism between the two regions. (Sacks, 2020.) Although there are differences and similarities between the two provisions, this does not prove whether EPIHC can satisfy both CDPR and GDPR. As for whether Chinese health

monitoring platform can be introduced into Finland, it needs to study whether EPIHC can fully meet the requirements of GDPR.

Although the protection of personal data on Chinese health monitoring platform is gradually improving, it is not perfect. When the government initially promoted EPIHC, because of the limited time and the neglect of the complete and coherent legal system of personal information protection, EPIHC had poor operability and was too aggressive in emergency treatment. Some medical units and their staff have poor legal awareness of personal information protection and management and pay little attention to it, which leads to the disclosure of some personal information and whereabouts. The above incidents have led to some people being harassed by harassing text messages, abusive phone calls, discrimination and even personal attacks.

Considering the severity and harmfulness of COVID-19, the Chinese government think it as a major public health emergency in particular, and because this event with regional characteristics, so in the first stage, the promotion EPIHC for epidemic information collection and processing, use only regarding the *Emergency Response Law of China* and the law on the prevention and treatment of infectious diseases and other related laws and regulations. In such a state of emergency, the Chinese government cares more about the prevention and control of the epidemic and has no intention to steal user information. However, such a radical measure also brings a great threat to personal data security.

Meanwhile, this monitoring platform is not fully under CDPR or GDPR of the European Union. The most immediate health code flaw in data security is the lack of the right to informed consent. At the beginning of the launch of the health code, most of the multiple health codes in different provinces of WeChat platform or Alipay platform lacked user agreement or privacy policy, or even many of the health code had neither. China's CDPR stipulates that network operators should publicly collect and show the purpose, manner and scope of personal data when collecting and using such data. In the second chapter of GDPR of the European Union, there are the same

provisions about the right of consent (General Data Protection Regulation (GDPR), 2020). In Internet information service, user agreement and privacy policy are legal and the most commonly used ways to obtain users' informed consent. Given that the use of health code in China is semi-mandatory or even mandatory, the lack of both protocols is actually an infringement of citizens' privacy rights.

Using health code is undoubtedly an effective means of epidemic prevention worthy of promotion. However, the government and relevant departments have not put forward countermeasures to deal with the information collected during the epidemic after the epidemic. The data protection work of the health code is obviously not comprehensive. To a large extent, it only pays attention to the collection and use of information but ignores the erasability of data. For data that has been collected, if the data has not been deleted after the purpose of the data collection has been achieved, it is likely that the data will be used for other activities unrelated to the original purpose of the data collection. Even the collected data is at risk of being stolen, which is not only a violation of the security of user data but also an illegal act. This behaviour has seriously violated the relevant regulations in the CDPR. Since the formulation of CDPR is largely based on the GDPR of the European Union, this behaviour is also against the relevant provisions of GDPR. There are clear provisions in article 17 of chapter 3 of GDPR (General Data Protection Regulation (GDPR), 2020):

*“The data subject shall have the right to obtain from the controller the erasure of personal data concerning him or her without undue delay and the controller shall have the obligation to erase personal data without undue delay where one of the following grounds applies:*

- a. the personal data are no longer necessary in relation to the purposes for which they were collected or otherwise processed;*
- b. ...*
- c. ...*
- d. the personal data have been unlawfully processed;*

e. ... ”

Through the item-by-item analysis of GDPR, it can be found that the direct introduction of EPIHC mainly violates the right of informed consent and the right to erasure (‘right to be forgotten’). Obviously, if the Chinese health monitoring platform is directly introduced into Finland, it is against the rights of the data subject stipulated in the GDPR of the European Union. However, as a public health emergency of international concern, COVID-19 is extremely harmful to human beings and has profound negative social and economic effects. For this kind of emergency, there should be more comprehensive laws and regulations to follow. As described in article 9 of chapter 2 of GDPR, it is necessary to collect and process personal data for the sake of public health and public interest, and to protect the vital interests of the data subject or other relevant personnel, the data must also be processed (General Data Protection Regulation (GDPR), 2020). Although there is a description in GDPR of how to process personal data in a state of emergency, this does not mean that any agency can violate the right of informed consent and the right to erasure, as they can coexist and are of the same priority, and there is no conflict between them.

From a legal point of view, Chinese health monitoring platform does not fully meet the European Union’s requirements for data security. However, there is no evidence to prove the abuse or even infringement of personal data by EPIHC. EPIHC is undoubtedly an effective tool to prevent the spread of the epidemic, it only needs to make some uncomplicated adjustments to the agreements and functions of EPIHC to make it meet the requirements of the European Union so that it can be promoted in Finland.

### **4.3. Analysis of Financial Return**

In the lengthy history of human, infectious diseases and other public health emergencies have been the important threat of human life and health, threatening the survival and development of human. In recent years, Ebola virus, avian flu, SARS and other major

public health emergencies broke out frequently, which aggravated the negative impact on society. Many scholars believe that this situation will have a negative impact on economic growth and a more serious impact on countries with the tertiary industry as the principal source of income (Chow and Chow, 2020).

Because of COVID-19, Tourism in Finland came to a standstill in the first half of the year, and many small and medium-sized tourism companies expressed they would face bankruptcy if the epidemic outbreak continues. But it is not just Finland's tourism industry that has stalled. Transportation, catering industry, traditional retail, and studio entertainment have all been decimated by the quarantine.

Epidemics will first affect individuals, then affect related industries through individuals, and finally hit the country's macro-economy. As the COVID-19 continues to intensify, European countries are taking increasingly stringent control measures. The impact of the epidemic on the European economy is clear. European stock markets fell sharply, as governments and companies reacted aggressively to the downturn, but the economic slowdown was already underway. European countries have given different positive responses to this situation. For example, the British government has provided 330 billion pounds in loans to British businesses and waived a 12-month sales tax in the worst-affected sectors of retail, catering and entertainment; individuals who are in trouble because of the COVID-19 can also delay repayments.

Finland is not the worst-hit country, but to deal with the potential threat, it has launched a 5 billion euro response strategy to mitigate the impact on its economy. The Finnish government also supports social and health spending. ETLA estimates that the outbreak could knock as much as 5% off Finland's economy. In the worst case, Finland's economy will shrink by 10% in the second quarter. (ETLA, 2020.)

It can be seen from the data that COVID-19 has a tremendous impact on national finance, and the existing and potential impacts are underestimated. EPIHC, as an epidemic prevention tool during the COVID-19 outbreak, has low research and

development costs. If the Finnish government needs to introduce the Chinese health monitoring platform, it need not introduce all its functions. It only needs to promote and use the most basic dynamic health code, which can solve many social problems. The social and economic problems that the health monitoring platform can solve are also the fundamental problems affecting the economic development of Finland in the past half a year.

The first is that people's daily activities have come to a standstill, and the government's supply capacity has been severely damaged. Because of the high infectivity, long incubation period and difficulty in controlling COVID-19, Finland and other countries in Europe have had to resort to lockdown to limit the movement of people. This has inevitably led to the degradation of people's consumption levels, and it also reduces business revenue and profits. The second is the waste of resources caused by the reduction of people's consumption demand. Because of the shutdown of various industries, many products that need to be processed in the short term have to face the situation of being idle and eliminated. This situation will also have a negative impact on international trade, the most significant impact is the slowing down of logistics. This is due not only to the dangers of COVID-19 but also to the reduced requirements for supplies. Third, because of the recession in all walks of life, the employment pressure is bound to increase, and some small enterprises have to take measures such as cutting wages or laying off workers to save their own enterprises. In the absence of effective life and health protection mechanisms, companies cannot guarantee their employees' living expenses, and many people have no source of income during the COVID-19 epidemic outbreak. This not only increases the living pressure of the people but also makes the people doubt the governing ability of the government. Finally, because of the above reasons, the national fiscal revenue will also be greatly reduced. During the COVID-19 epidemic outbreak period, government spending on medical supplies and epidemic prevention and control supplies has continued to grow. To sum up, all the existing problems are based on the restrictions on the movement of people during the COVID-19 outbreak. However, EPIHC can realise the free movement of people under

the condition of ensuring the health and safety of people, and the current problems will be solved.

Therefore, from a financial point of view, the benefits of the health monitoring platform far outweigh its expenses. The technical problems that health monitoring platforms face are almost negligible. Hence the economic benefits of the use of the health monitoring platform are so great that it is entirely feasible and necessary to promote it in Finland and throughout Europe.

## 5. PRACTICAL RECOMMENDATIONS

The Finnish government attaches great importance to the COVID-19 outbreak and has made a lot of countermeasures against it. It includes amendments to the *Communicable Diseases Act*. The Finnish President approved the *Communicable Diseases Act* on July 9<sup>th</sup>, 2020, and it will take effect on August 31<sup>st</sup>, 2020. It was this amendment that allowed the Finnish government to build an online epidemic prevention system based on a mobile application. According to the Finnish government, the application will manage and control the spread of COVID-19. One of its most important functions is to tell whether a user had close contact with an infected person. The National Cyber Security Centre and the National Supervisory Authority for Welfare and Health (Valvira) will jointly evaluate and monitor the data security of the application's information system. (Valtioneuvosto, 2020.)

While it is not yet clear whether the upcoming Finnish application is a reference to the Chinese health monitoring platform, the application's functions are consistent with the primary functions of the Chinese health monitoring platform. Unlike the Chinese health monitoring platform, the upcoming application in Finland will not collect users' personal information, and the use of the application is entirely voluntary. The government will not force people to use the application. Although the use of EPIHC is not mandatory in China, in many public places, if there is no EPIHC, access is likely not possible. Therefore, Chinese health monitoring platform is a semi-mandatory application. More importantly, the upcoming application in Finland will not collect and use the user's location information. Instead, it will rely on Bluetooth to detect whether the user had in close contact with an infected person. This is a very significant technological improvement, which fundamentally solves the problem of user data security.

Although it is uncertain whether the Finnish government has followed the Chinese model of online epidemic prevention, the promotion of the application proves that it is

entirely feasible to introduce the Chinese health monitoring platform into Finland or Europe after solving the legal problems of the Chinese health monitoring platform. EPIHC and all the other products of the Chinese health monitoring platform, their success in China largely depends on the Chinese people's recognition of the efficiency of the Internet and their determination to protect against the COVID-19. But although Finland is about to launch its own health monitoring platform, its effectiveness is unknown. Western countries and China have great different cognitions between individual and collective. Chinese people are more willing to sacrifice their own interests in the face of major difficulties to achieve collective preservation, while people in western countries advocate individual freedom and regard personal interests as inviolable. So even though the upcoming application is a promising way to prevent the epidemic, the acceptance of it by the Finnish public is unpredictable.

Therefore, whether such applications should be made mandatory in certain places with high population mobility and density will be a huge problem and challenge for the Finnish government. Health monitoring platforms seem to put people in a dilemma where they need to make a hard choice between health and privacy. Obviously, most people would choose health without thinking, because physical health is one of the most basic human needs. However, this does not mean that these people are willing to give up their privacy rights. People are still unwilling to give up their rights, but they have to accept the disclosure of their information under the circumstances of no choice. In fact, however, people should not be forced to face such a choice, because the right to health and the right to privacy should not be opposite, and people should enjoy both rights. Fortunately, the gradual improvement of various laws is making things better, and people's rights are being more carefully protected.

Looking back at the development of Chinese health platform, it only took nearly two months from the beginning of the outbreak to the launch of the EPIHC. This speed of development is a feat of the Internet industry. However, EPIHC also has many defects because of its rapid development process. Fortunately, the government has made it a

more mature health monitoring platform through continuous improvement in the later period. COVID-19 is the first public health emergency of international concern since human entered the era of efficient Internet. To some extent, information technology has played a more profound role in the prevention and control of COVID-19 than the traditional medical industry. Chinese health monitoring platform has provided a valuable reference for many countries affected by the COVID-19, including Finland. As the first health monitoring application to be launched in Finland, it has a longer development time, a better legal system and safer data security. Thus, it will inevitably become a template and reference for future similar applications.

The upcoming epidemic prevention application to be promoted by the Finnish government may be an opportunity and a substantial beginning for Finnish society to enter the digital society officially. The application itself may not require sophisticated technology, but it can be useful for epidemic prevention through simple data docking. This data utilisation also conforms to the global trend, namely the fusion of people and information. The underlying foundation of this technology is the ubiquity of smartphones, which greatly shorten the time and space distance between people and information, and forms a dynamic data chain between people. Clearly, this is a bold attempt to create a digital society in Finland. Perhaps Finland could avoid many of the potential problems by following China's experience in creating the health monitoring platform. For example:

- The government should complete the relevant technical and legal standards of similar platforms, and conduct unified and standardised data collection, use and sharing; strengthen data security management and prevent data leakage; timely publication of relevant legal regulations.
- After passing the special period, relevant data should be deleted reasonably; if there are valid reasons for the continued use of relevant data, the purpose of the use of the data should be clarified and the citizen's authorisation should be obtained.
- The popularity of smartphones does not mean that everyone is using smartphones.

Some marginalised people and some elderly people will encounter many problems because of their ignorance of government policies. The government should develop alternative solutions to deal with this situation.

- The problem with big data is often not the algorithm, but data reliability. The initial data declaration stage of the health monitoring platform must be completed by the users themselves, which leads to the failure of the health monitoring platform to guarantee that the health information recorded by the platform is accurate. The government should strengthen cooperation with all sectors of society to ensure the accuracy of the data obtained, such as medical institutions and transportation institutions.
- The government should change the traditional management thinking, invest more in the development of science and technology on the premise of not infringing individual rights and interests, and get ready to enter the digital society.

## **6. DISCUSSION**

### **6.1. Current Research Results and Limitations**

The overall study of the Chinese health monitoring platform shows it is feasible and necessary to introduce it to Finland. Through the study of Chinese health monitoring platform, it can be found that after a long period of development and improvement, the platform itself has become very practical, and the prevention and treatment effect of infectious diseases is even comparable to that of the traditional medical industry. The protection of individual health by the Chinese health monitoring platform is also obvious. By monitoring the distance between people, it can determine whether users are at risk of infection so that users can make their own decisions, such as whether to self-quarantine or seek medical help.

Although Chinese health monitoring platform ignored many legal issues in the early stage of development because of the urgency of time and the severity of the epidemic, in the later stage after the “health code” gradually developed into EPIHC, user agreement and privacy policy were added, so that EPIHC fully complied with CDPR. However, so far, no provision on right to erasure (‘right to be forgotten’) has been found in the legal statement of Chinese health monitoring platform, which clearly violates the GDPR of the European Union. However, this problem is not insoluble, just need to make adjustments to the platform according to the relevant provisions in GDPR. Therefore, although in some legal details, the Chinese health monitoring platform cannot fully comply with the European Union law, there are no extremely significant legal loopholes. By modifying the details, the promotion of the Chinese health monitoring platform in Finland and Europe is also completely feasible.

From an economic perspective, countries around the world are in various degrees of economic shutdown because of the epidemic. Europe's catering, entertainment and tourism industries are facing unprecedented challenges. All industries are suffering

because of the preventive measures against COVID-19. Introducing Chinese health monitoring platform fundamentally solves the problem that the industries cannot operate. The efficient identification of high-risk groups makes public places safer, people can be more assured to carry out various recreational activities, and the health safety of all industries has been effectively guaranteed.

However, because of the short time of COVID-19 and the incomplete research literature, the thesis did not make a more complete analysis of the transmission mode of COVID-19 and the technology of Chinese health monitoring platform. According to the existing references, the transmission modes of the epidemic are mainly droplets and contact transmission, while the monitoring mode of the Chinese health monitoring platform is based on location information to draw conclusions. Therefore, the Chinese health monitoring platform is correct and effective in preventing COVID-19. The Finnish government's upcoming COVID-19 prevention and control application uses Bluetooth technology. Bluetooth not only protects users' privacy better than location information, but it is also more accurate. Therefore, the technical analysis of Chinese health monitoring platform is obviously redundant.

During the COVID-19 outbreak, the health monitoring platform will undoubtedly play a prominent role in preventing the epidemic. However, as an accompanying product of the epidemic, how to develop it after the epidemic is over remains a problem. It will be an excellent decision to normalise the use of the health monitoring platform and make it an electronic medical record for physical examination or health management system. However, such a decision is also faced with many problems, such as information leakage and abuse. During the COVID-19 outbreak, the personal information transferred by citizens has boundaries and time limits. The collected personal information should be sealed or destroyed after the outbreak is over. Whether the health monitoring platform should be retained after the COVID-19 epidemic is not only a question facing the Chinese government but also will be a question facing the Finnish government in the future. Therefore, the prospective development direction of the

health monitoring platform may become the main research direction for it in the future.

## **6.2. The Vision of a Community of Shared Future for Mankind**

In the context of globalisation, crises in any country can quickly spread to the entire world and endanger the entire international community through the transmission of globalisation mechanism. Faced with these crises, international cooperation is particularly important. If countries can seek common ground while reserving differences and cooperate with each other, instead of transferring crises to another group and rejecting external information, there will be a more optimised solution to the crises in front of the cooperation of all mankind (Li and Chen, 2019).

Since the beginning of the 21<sup>st</sup> century, the COVID-19 has been the first major public health emergency with the fastest spread, the widest range of infection and the most difficult to control. The outbreak of the COVID-19 broke the normal order of society, but people quickly built a community to fight against the epidemic. In the prior days of the outbreak, the Chinese government also adhered to the concept of community and took transparent measures to work closely with the WHO to try its best to prevent the spread of the epidemic around the world. However, in such an emergency, it seems inconceivable that some countries would attribute the outbreak to ideological differences between countries. Because of this, many countries have lost the best stage of epidemic prevention and control. Therefore, the Finnish government should learn from the experience and seek coping strategies with a positive attitude instead of taking a wait-and-see attitude. The world today faces many challenges, such as food shortage, climate change, population explosion, environmental pollution and so on. However, the destiny of mankind should not be a victim of competition among countries. Instead, any country should promote the common development of other countries and seek positive cooperation while seeking its own development. In this way, a community of shared future for mankind has been formed.

## 7. CONCLUSIONS

This thesis mainly focuses on two research questions:

- Under the epidemic situation, what kind of epidemic prevention methods has China information system adopted?
- Whether China's online epidemic prevention model can be introduced to Finland and the European Union?

COVID-19 has been raging around the world since its emergence. It not only seriously endangers human life and health but also seriously affects social operation and economic development. Currently, the number of COVID-19 infections in Finland and across the European Union is gradually decreasing, but it is uncertain whether the next COVID-19 outbreak will occur. Therefore, the prevention and treatment measures against COVID-19 and other potentially infectious diseases need to be improved continuously. Effective and comprehensive protective measures can not only protect people's health but also enable social and economic development to be normalised.

The protection of traditional medical institutions is important, but in the era of network and big data, online epidemic prevention system can also play a significant role. China developed several online epidemic prevention systems in the prior days of the outbreak, to enable people to know whether they are at risk of infection through efficient online mechanisms. Among the many online epidemic prevention systems, "health code" has become the one that stands out. It is mainly operated through Alipay and WeChat platform, with efficient identification method and simple use method. However, there were many problems in the early promotion of "health code", such as personal data security, information error, system failure. However, after a period of development, "health code" strengthened into EPIHC, which officially became the Chinese health monitoring platform for COVID-19. EPIHC is already a very mature health monitoring platform. Because of the different legal provisions between China and the European Union, the laws EPIHC complies with are not fully compatible with the GDPR of the

European Union. However, there is no serious and unchangeable legal gap.

The Finnish government has plans to launch its own health monitoring platform and roll it out nationwide in the autumn of 2020. Despite the application's late launch, the decision has revolutionary implications. It is a precedent not only for the health prevention system in Finland but also for the health prevention system in the European region. The decision is also likely to be largely copied by other European countries. While it is not clear whether the Finnish government has learned from the experience of the Chinese health monitoring platform, it does prove the feasibility of introducing the Chinese health monitoring platform to Finland and even to the whole of Europe.

However, the research does not make much discussion on how “health code” develops into EPIHC. The reason is that no matter how it develops, the ultimate research object will be the full version of EPIHC, which will not have too much impact on the feasibility of the health monitoring platform. But this has high implications for the possible future introduction of other platforms or applications because the application development and improvement process would be an excellent example.

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