Incheon Airport

SMART BUBBLE

FOR OUR POST-PANDEMIC FUTURE

Daecheol Kim

Fast Travel Team / Smart Airport Group

Incheon International Airport Corporation

Executive Summary

Background

- The aviation industry is experiencing a major crisis brought on by the unprecedented COVID-19 pandemic.
- Global flights began to resume slowly in a way called a Travel Bubble.

Unsustainability of Travel Bubbles

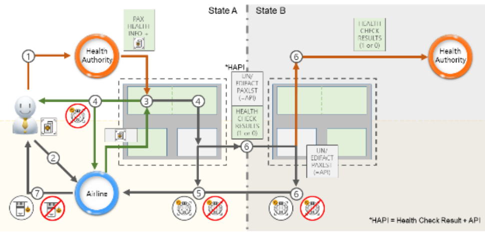
- Travel bubbles are based on bilateral agreements, and thus have inconsistencies with travel conditions among states.
- The current travel bubbles will not be compatible with the growth of the aviation industry in the future, as they merely target COVID-19 while sacrificing Passenger Facilitation.

Towards a Smart Bubble System

- A new concept of the Smart Bubble System is to reconcile the two conflicting purposes above: to control the pandemic and to facilitate passenger processes.
- The Smart Bubble System can be realized by integrating travel bubbles into the airport processes related to Passenger Facilitation: APIS and fast travel services.

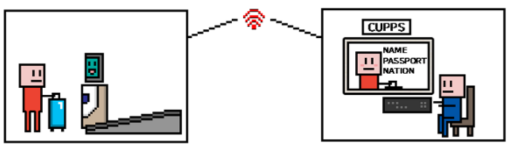
Composition of the Smart Bubble System (1): HAPIS

- HAPIS (Health information + APIS) prevents virus spreading between regions.
- HAPIS unifies health check processes, i.e. PCR test results, into airlines' check-in processes.
- When a passenger tries to check in, their health information is checked first before granting access to the airline's DCS.



Composition of the Smart Bubble System (2): CLASes

- CLASes (Contactless Airport Services) prevent virus spreading inside airports.
- CLASes include the current passenger facilitation agenda, including fast travel services, One-ID initiative, and Off-airport services
- There are five new CLASes suggested here regarding "contact-free" aside from "speed and convenience".



Check-in Counter

Central Check-in Counter

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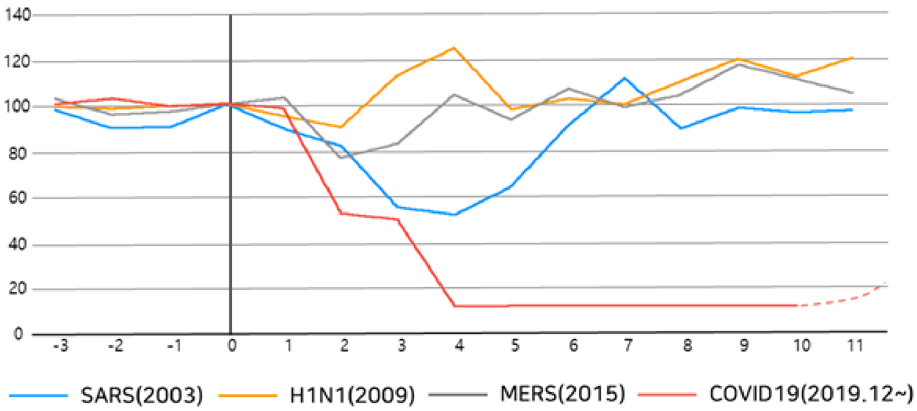
Introduction

Since the beginning of the 21st century, several infectious diseases have affected the global aviation industry. Below is a graph showing how much air travel demand in South Korea was affected by the previous four global pandemics since 2003. The remarkable thing is that COVID-19's red line has a clearly different shape from the others. Unlike its predecessors, COVID-19 called for comprehensive travel bans worldwide, and air travel demand plummeted by 95% compared to the demand before the outbreak.



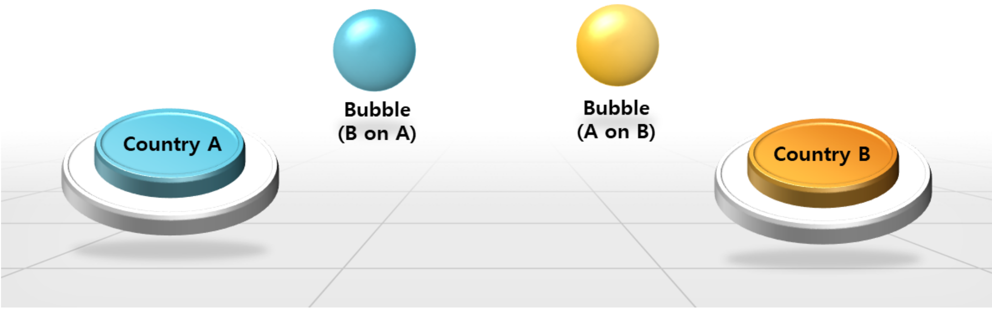
<Figure 1>

What we will encounter after COVID-19 will be different from what we have seen over the past two decades following those four previous diseases. It rather seems much more similar to what happened a century ago with the Spanish Flu. However, the lesson from the past century of border closures is now long-since obsolete as we prepare for a post-pandemic future. We have to devise a new airport paradigm, which should coordinate a harmony between the control of infectious diseases and the buoyant aviation industry.

1. Travel Bubbles - A Silver Lining

1.1. What is a Travel Bubble?

Although the world appears to be turning to exclusivism, many countries have begun to reopen their borders. The resumption is happening slowly, proceeding in a way called Travel Bubble. This is where two or more states, who are mutually recognized to be properly mitigating COVID-19, lift entry bans against each other under various conditions. Travel Bubbles are normally based on the reciprocity principle, but there can be unilateral cases as well.



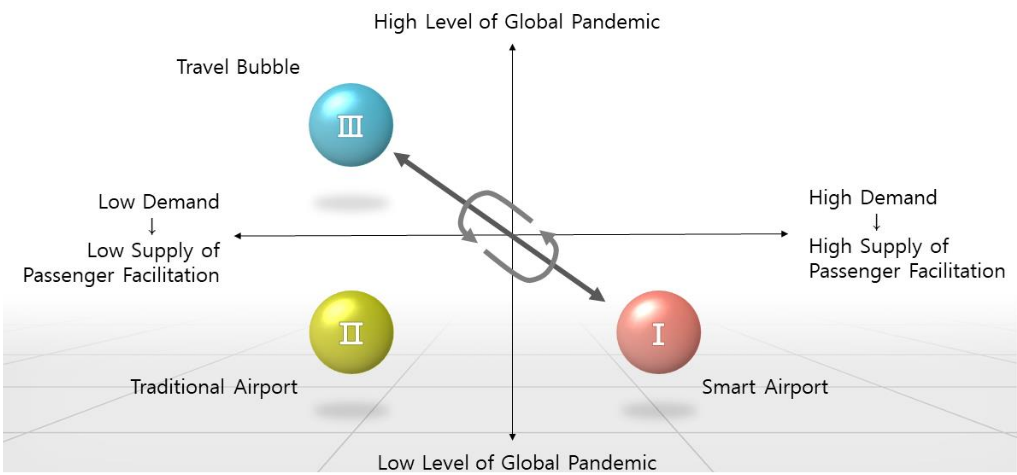
<Figure 2>

Figure 2 illustrates the basic structure of a travel bubble between State A and B. People from State A fly to State B on a travel bubble (blue one) called “B on A”. It is formed with several restrictions imposed by State B on passengers departing from State A.

Assume that the two states are South Korea and Japan. The travel bubble conditions between the two as of October 2020 are as below:

(1) The entry ban is lifted only for passengers with business purposes.
(2) Passengers are to submit a written pledge and schedule of activities.
(3) A certificate of PCR testing issued 72 hours before the departure date is required.
(4) Passengers must take a COVID-19 test at the departure airport upon entry.
(5) A certificate of PCR testing issued 72 hours before the arrival date is required.
(6) Passengers must take one more COVID-19 test at the destination airport upon arrival.

1.2. The Travel Bubble system is unsustainable.



<Figure 3>

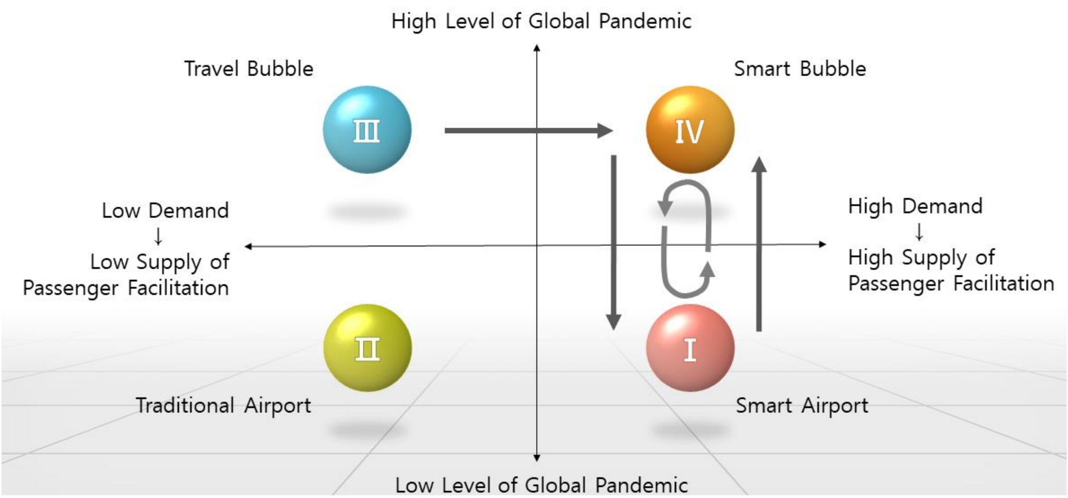
Figure 3 shows why the travel bubble structure is unsustainable. The quadrants are divided by the level of pandemic (vertical axis) and air travel demand (horizontal axis). The demand has a positive correlation with the level of passenger facilitation, which the aviation industry has worked hard to develop to deal with the continuously growing demand up until the outbreak of the pandemic. Such measures, with fast travel services including self-service and the recent One-ID initiative, usually induce more setup and operational costs than traditional ones. Thus, when air travel demand is low, the supply of passenger facilitation is low too.

Travel bubbles lie in the third sector, representing a high pandemic level and lowered air travel demand. Let's assume that we overcome the pandemic and return to normal. This would mean we can move to the first sector, which represents a high supply level of passenger facilitation to cover high air travel demand. Then, what if another unexpected global pandemic breaks out after that? Another version of 2020 will be repeated: Blocking borders, leaving the tourism industry declining, waiting on new vaccines, and reopening borders slowly via travel bubbles. Figure 03 shows this discouraging cycle, the unsustainability of today's travel bubbles.

2. Proposal: Smart Bubble System

2.1. Outline of the Smart Bubble System

The new system must secure the capability to cope with any unknown pandemic, while at the same time providing facilitated passenger processes at airports as usual. In the new structure, what we call the Smart Bubble System, passenger facilitation is no longer a compromised value, but an indispensable means to complete the new system.

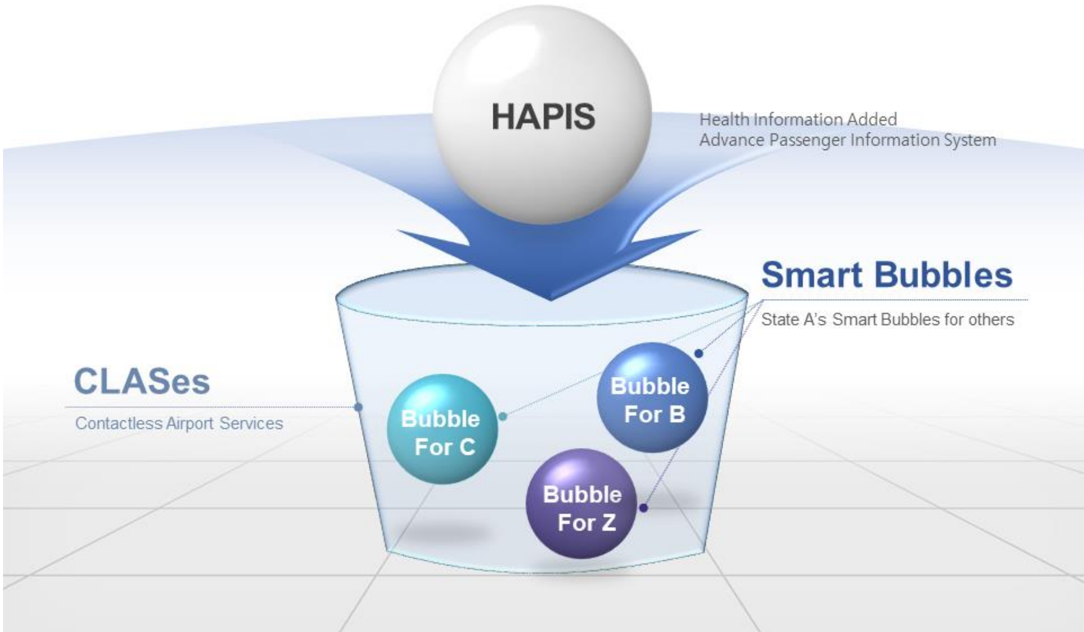


<Figure 4>

The fourth sector represents a situation where a high level of global pandemic and high travel demand can coexist. The contrast between the third and fourth sectors is how much damage the global pandemic causes to international travel demand. Figure 4 suggests that, with a more delicately designed travel bubble system, the aviation industry can remain uninfluenced by a global pandemic. It is achievable only when the new system is based on a passenger facilitation agenda such as APIS, fast travel services, and One-ID initiatives. These are what the aviation industry has discussed during the past few years in terms of efficiency and effectiveness in airport operations. The new smart bubble system places equal importance on both passenger facilitation and pandemic control, and brings flexibility to the aviation industry in response to global pandemics while keeping high travel demand unaffected.

2.2. Composition of the Smart Bubble System

The Smart Bubble System consists of two pillars: HAPIS (Health Information + APIS) and CLASes (Contactless Airport Services). The role of HAPIS is to restrict infected passengers from crossing borders between states by absorbing the present travel bubble structure into APIS, which has been established and is used to interchange passenger information in advance for purposes of immigration and customs, etc. Figure 5 demonstrates the relation of HAPIS, CLASes, and the Smart bubble system.



<Figure 5>

With HAPIS, countless limitations and documentation requirements for entry permits from travel bubbles are integrated into APIS in the form of electronic data. This digitalization will facilitate the health check-related processes and enhance the predictability of both passengers and government agencies. Thus, HAPIS ensures that many more bubbles can be made much more easily (quantitative effects).

On the other hand, CLASes, which are related to current fast travel services such as self-service, prevent congestion inside airport terminals to ensure the reliability that airports are safe from infection. In other words, once a smart bubble is generated, CLASes help the bubble and the entire system to be reliable and sustainable until arrival in the destination country (qualitative effects).

3. Smart Bubble System (1): HAPIS (Health Information + APIS)

3.1. Introduction to HAPIS

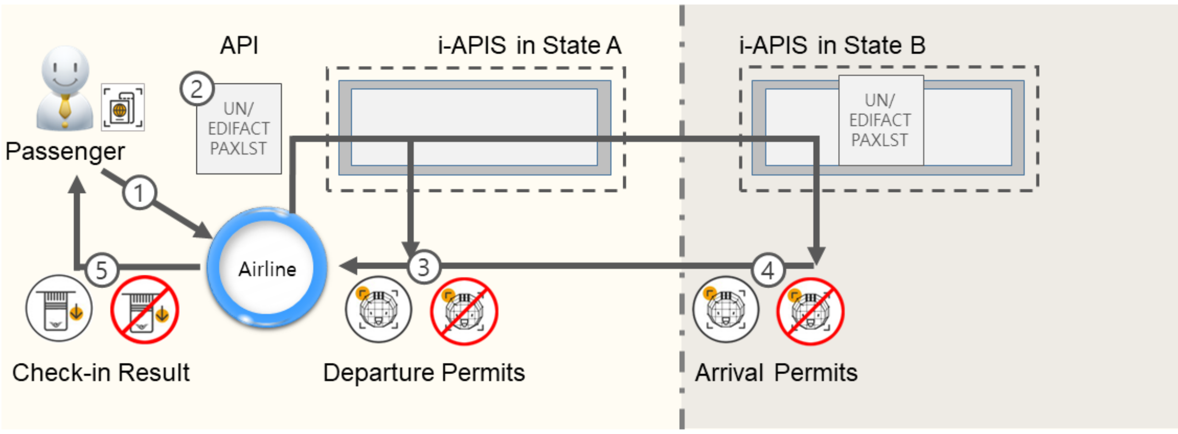
As mentioned above, HAPIS is not an entirely new concept. It is rather a modification of the existing Registered Traveler Scheme by integrating the health information of passengers into APIS. Health information such as a PCR test result could be interchanged here in an electronically written form. As with APIS, HAPIS is used to pre-screen passenger health information during the check-in process to restrict infected passengers from boarding.

It may seem simple and easy to add more electronic data into the current system, but we should consider the practicability from the aspects of cost as well as the protection of privacy. Moreover, we cannot impose heavy burdens on others, especially on the airlines who are suffering greatly to survive amidst the COVID-19 crisis.

Rule 1: Participation costs to stakeholders should be removed or minimized.

The first rule means that the new system must be driven by adjustment of the current system, not an overall replacement. Accordingly, the new system will be divided into two parts, which respectively deal with the current API and Health Information. Although the two parts are separately placed and work in the aspect of physical facilities, they are closely connected to each other in the aspect of passenger processing to form a virtually unified system. Let’s look into how passenger information flows in each system, then at how the entire HAPIS operates.

3.2. Information Flows in APIS

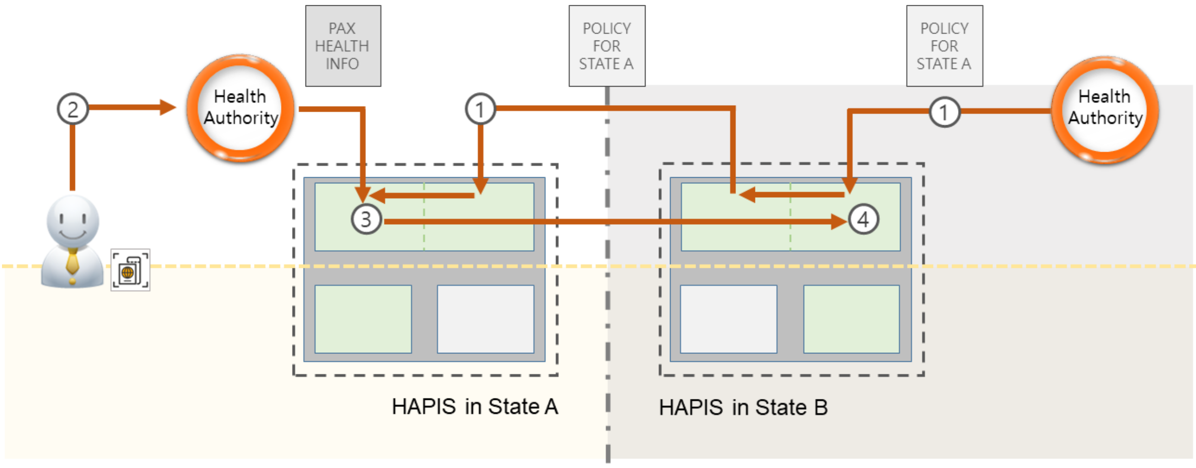


<Figure 6>

In the present APIS, when a passenger tries to check in (1), their personal information is written in the UN/EDIFACT PAXLST format and sent to the i-APIS servers (2). The advance passenger information is examined by the origin state for immigration purposes, and the result affects the determination of whether to grant the check-in request (3). The same process is repeated in the arrival state's i-APIS for the same purposes (4). After the API is checked completely by both states, a boarding pass, as proof of check-in, is then issued to the passenger (5).

Let's see how and where the health information of the passenger should be placed and connected to APIS.

3.3. Basic Flows of Health Information in HAPIS



<Figure 7>

The green servers in Figure 7 are additionally introduced into APIS to deal with passenger health information. Their functions include the interchange of passenger health data, each state's public health policies, and the results of passenger health checks. The basic flows of such health information between State A and B are given below:

(1) State B sends its public health policies on passengers departing from State A. The policies contain the travel bubble conditions, including characteristics of passengers, airlines, and flights, as well as State A's ability to mitigate the spread of COVID-19.
(2) A passenger provides their health information to State A's health authority.
(3) State A's health authority enters the passenger's health information into the green servers, and HAPIS performs a calculation to make a pre-check-in decision.
(4) State A sends the health check results only, with no detailed personal information, to State B's HAPIS.

Rule 2: Sensitive private information is not exchanged between states.

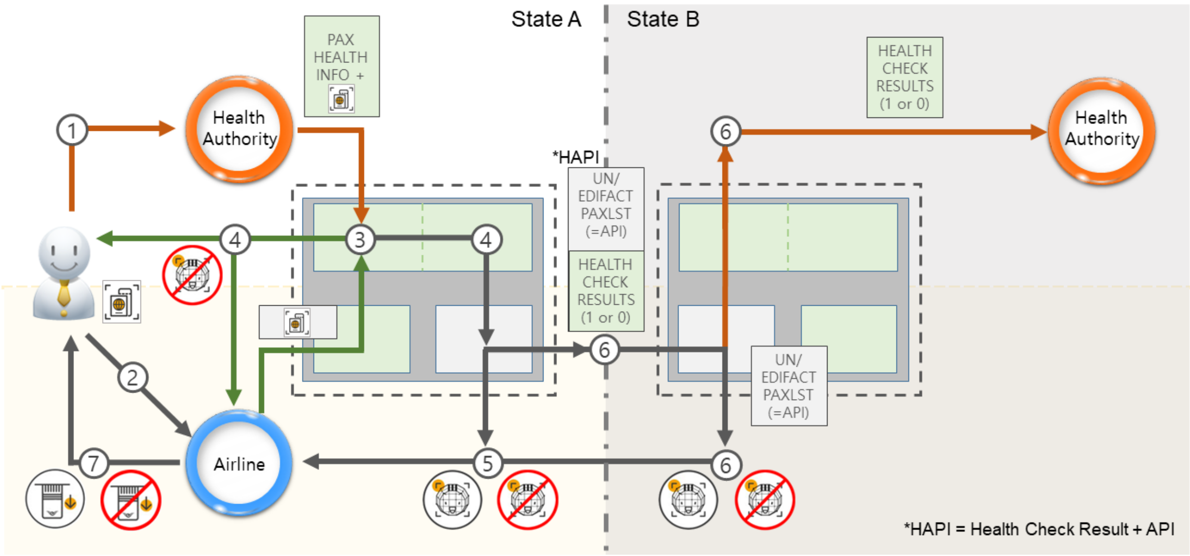
The second rule requires that health information include the simplest possible information and be interchanged in a simple format only. This is due to considerations for privacy regulations and cost-effectiveness. In addition, it covers the single window rule, which is one of the API principles established by ICAO, WCO, and IATA.

Rule 3: Reciprocal trust is fundamental to HAPIS.

With the second rule, the interchanged data can only hold the results of the health check calculations, and therefore could be comprised of binary data: for example, 1 for infected and 0 for uninfected. This means that the arrival state's health authority cannot receive the detailed identity of infected passengers on a flight until the result data is matched with API. Thus, the mutual trust between the two states is of great importance in assuring that the counterpart is doing well enough as promised in an agreement between the two.

3.4. Integrated Data Flows in a Bilateral HAPIS

From the three rules above, a bilateral HAPIS is derived, which protects passenger privacy just as before the COVID-19 pandemic and has no side-effects compared to the current APIS. Figure 8 below shows how the bilateral HAPIS works regarding integrated information flows between the two states.



<Figure 8>

HAPIS consists of two parts, the green servers (health information) and the white servers (API). They are bound with each other to form a single HAPIS (the grey server behind). The green and white servers are physically separate but functionally correlated so as to work as a virtually unified system with a passenger's identity number as a common factor. The integrated data flows in a bilateral HAPIS are given below:

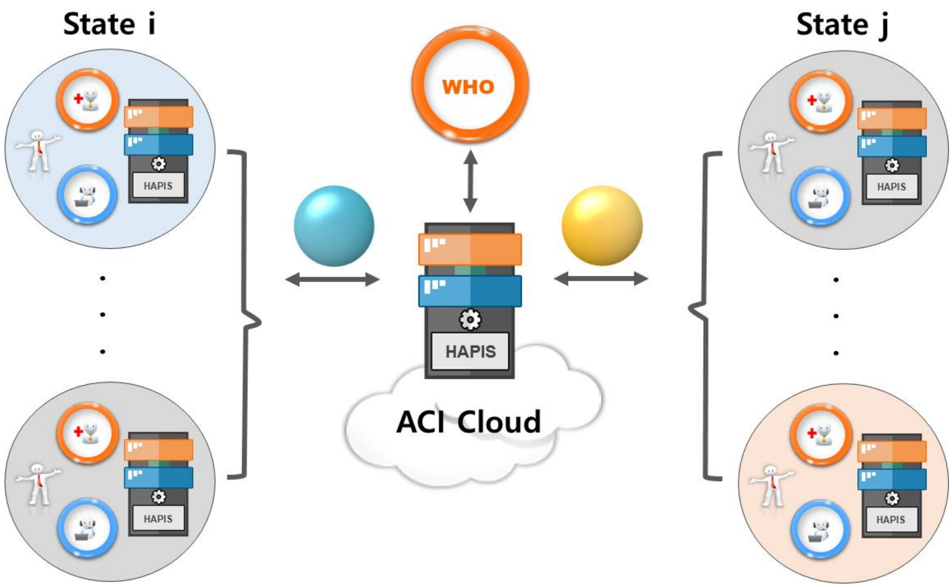
(1) A passenger provides their health information and identity number to State A's health authority, and the data is stored in the green servers (health information part).
(2) The passenger attempts check-in and provides their identity number to the airline.
(3) The airline's or airport's check-in system sends the passenger's information to the green servers to check their health condition.
(4) The first check-in decision is made according to the health condition. If the person fails to meet State B's public health policy, HAPIS denies check-in; if accepted, the person's API is transferred to the white servers for the second check-in decision.
(5) The passenger's API is checked by the departure state's immigration agency, and the second check-in decision is made.
(6) The passenger's API turns into HAPI, which is sent to State B. The immigration agency makes the final check-in decision and transfers the results to the airline as well as the health authority.
(7) The passenger receives their boarding pass.

Rule 4: The roles of airports in building HAPIS are more important than those of other stakeholders.

The newly suggested data flows above in comparison to those of the current APIS occur at the first, third, and fourth flow. This means that the establishment of this "virtually" unified HAPIS can be achieved with cost-effectiveness. However, realizing this cost-effectiveness requires the key player: the airport operator. This is because airport operators have easier access to the airline's departure control systems than the health authority, and some airports even have their own check-in systems (CUPPS). For instance, it is conceivable that an airport operator installs a few modules in the present CUPPS devices, such as OCR, to connect the white and green servers. Such relatively simpler modifications are feasible only when there is a participant who is familiar with passenger processes in airports. In conclusion, it implies that the establishment of HAPIS could be facilitated with airports' participation.

3.5. Multilateral HAPIS

A Multilateral HAPIS needs another important player, a central governance, to act as a hub point which connects all the smart bubbles in the world. The necessity of such a third party is due to the efficiency in the establishment and operation of a global HAPIS. For instance, to build a multilateral HAPIS structure among the 193 UN member states by only two-party agreements, there must be 18,500 bilateral arrangements. However, a hub player can proceed with this by means of 193 agreements between itself and the 193 states.



<Figure 9>

Rule 5: In a multilateral view, a hub HAPIS is necessary for the consistency and predictability of the global smart bubble system.

Figure 9 shows a multilateral HAPIS structure. Each state's public health-related immigration regulations and health check results flow into other states through ACI's hub HAPIS. The hub is not only a transmitter of this information, but also an international coordinator, because it can help with development of new global standards to which member states can agree and adhere. In this case, the WHO may participate as an adviser of new standards such as when and what level of smart bubbles would be applied to a state based on the assessment of the WHO on the state's ability to mitigate a pandemic.

4. Smart Bubble System (2): CLASes (Contactless Airport Services)

With HAPIS working effectively, international spread of COVID-19 will be strongly suppressed with minimal damage to passenger facilitation. In some cases, however, airlines should allow infected passengers to board for certain special reasons, for example humanitarian consideration. We thus need another set of measures to prevent the virus from spreading during passenger processes. Those countermeasures are basically the well-known digitalized services such as self-kiosks. Although they have been used mainly to facilitate check-in processes, their attributes as contactless services have begun to attract more attention amidst the pandemic.

However, there are some service gaps that existing fast travel services cannot fill. For example, passengers still have to visit airline counters to check their baggage even after they have completed online check-in, and many airlines operate only traditional check-in counters due to cost efficiency. The proposal here, Contactless Airport Services, is meant to supplement those gaps and complete the smart bubble system. CLASes focus on relatively new services, and well-known passenger facilitation agendas like fast travel services and One-ID initiative are not dealt with here. The table below shows the five new CLASes.

Contactless Airport Services	Related airport service area
(i) Home Baggage Drop (ii) Baggage Bus Station	· Off-Terminal Airport
(iii) Hybrid Check-in Counter (iv) Information Desk on Cloud	· Manned Airport Terminal Services
(v) Advance Duty Free Delivery	· Duty Free Shopping
(vi) Declaration in the Air	· Declarations to Government Agencies

<Table 1>

4.1 Home Baggage Drop (HBD)

4.1.1. Needs

If a passenger has completed online check-in at home and has no baggage to check, they do not need to stop by any check-in point at the airport. They can simply walk through the airport to the boarding gate. However, if the passenger has baggage to check, they must visit a baggage drop point, i.e. a check-in counter or an automated device. HBD is meant to fill up this service gap to complete off-terminal airport services.

4.1.2. Processes

① ② ③

<Figure 10>

(1) Service registration by a passenger
(2) Baggage pre-acceptance by a delivery driver
(3) Baggage acceptance and induction by airline staff or automated devices

4.1.3. Expected effects

HBD will complete the current online check-in service, which lacks the baggage checking process. Passengers do not need to be concerned with long lines at check-in counters. Passengers can also make pre-travel decisions, such as means of transportation or duty free shopping plans, which will increase non-aviation profits for airports. HBD can also relieve congestion at airport terminals and the workloads of staff. A new business model outside the airport, a baggage delivery service, is another aspect of the positive external effects.

4.1.4. Issues

An unfamiliar process of “baggage pre-acceptance” should be defined regarding baggage tags. The usual tags are difficult to obtain from home, and it is not feasible for the delivery driver to carry printers and labels by hand. Home printed bag tagging is currently available, but it is at risk of interruption on the way to bag drop points. While electronic or RFID bag tags may eliminate the necessity of this pre-acceptance process, they are not yet widely used.

Development of a portable device with which a delivery driver can access an airline's DCS is required for security reasons. Whether the passenger has actually completed the baggage registration process must be checked before the driver loads the baggage on a truck. Thus, delivery drivers need to be certified by authorities to access the DCS and handle baggage.

There are also other security issues of concern. During delivery, baggage may be left behind for a long time before induction onto baggage conveyor belts. Terrorism could interfere with the processes, so a highly strict security plan for the delivery phase is required. One example of such a plan is to install security cameras both inside and outside a delivery truck.

4.2. Baggage Bus Station (BBS)

4.2.1. Needs

There are various access points to an airport, including train stations, bus stops, taxi stands, and parking lots. The problem is that many passengers, who carry their baggage to check in, are subject to convergence on a few acceptance points at the airport, causing them to try to rush through. As a result, baggage check-in points often tend to turn into congested bottlenecks.

4.2.2. Processes

<Figure 11>

BBS shares the basic concept of “delivery” with Home Baggage Drop. The difference is the baggage collection points. Passengers can drop their baggage at numerous acceptance points near the airport, called Baggage Bus Stations, which are scattered along various routes to the airport. Each BBS has kiosks equipped with a bag tag printer and security storage to protect dropped baggage safe. Baggage handling belts are not equipped. The stations are monitored in real time to verify security and how many baggage items are in the storage. Delivery staff of a certified ground operator collect the baggage on a regular time basis, like bus runs, to induction points. BBS will reduce congestions at terminals, providing passengers with various check-in options and helping with their time management.

4.2.3. Issues

Because BBS are located near airport terminals, airport operators can maintain security during the process more easily than for HBD. Exclusive devices such as kiosks connected to DCS and security storage need to be developed, implying a relatively high initial cost.

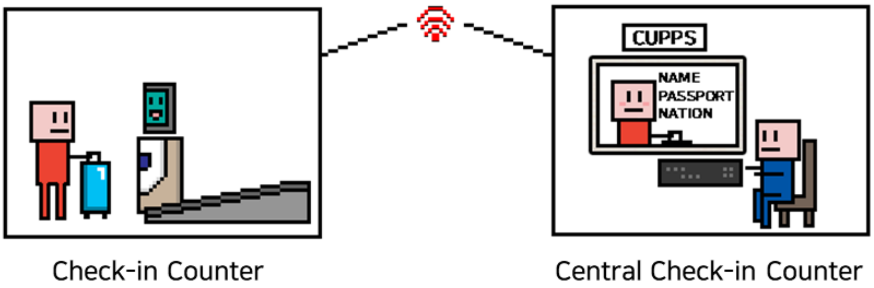
4.3. Hybrid Check-in Counter (HCC)

4.3.1. Needs

Since the outbreak of COVID-19, many experts have placed emphasis on self-service as a measure against the spread of disease inside airports. However, there are some airlines who hesitate to provide self-service because they incur setup costs. Especially when airlines have fewer flights from/to the airport, they have a tendency to use a basic check-in method only, i.e. manned check-in counters. Photo 1 shows the result of this. A certain airline, which operates just one flight a day at ICN, suffers heavy congestion around the check-in counters, even when there are hundreds of unoccupied counters and kiosks in the airport.

<Photo 1>

4.3.2. Processes



<Figure 12>

HCC consists of traditional counters and a remotely located central check-in counter. HCC separates airline staff from the conventional check-in counters, but the staff are still connected to passengers through a visual-communication system. Because a passenger and staff are physically apart from each other, the entire passenger process should be provided half as self-service and half as manned services. That is why this service uses the word “hybrid”. Below are the detailed check-in flows.

At a check-in counter	At a central check-in counter
·A passenger visits a check-in counter	·A camera device equipped to the CUPPS platform senses the passenger, and staff begins guidance.
⇩	
·The passenger conducts visual identification by facing the camera.	·Staff completes identity verification and issues a boarding pass.
⇩	
·The passenger takes the boarding pass and places baggage on the belt.	· Staff checks the weight and size via web cams and issues bag tags.
⇩	
·The passenger takes the bag tags and attaches them to the baggage.	· Staff finishes checking the baggage, and orders induction onto the main belt.
⇩	
·The passenger takes a receipt.	· Staff completes the process.

<Table 2>

4.3.3. Expected effects

HCC stands on the basis of CUPPS, so even small airlines can participate with low setup costs. HCC also has merits in joint operations among airlines. In theory, one central check-in counter can be connected to all terminal counters 24/7, so passengers do not need to wait until airline counters open. Eventually, passengers can check in at any counter at any time, which will reduce congestion around the airport's departure floor.

4.3.4. Issues

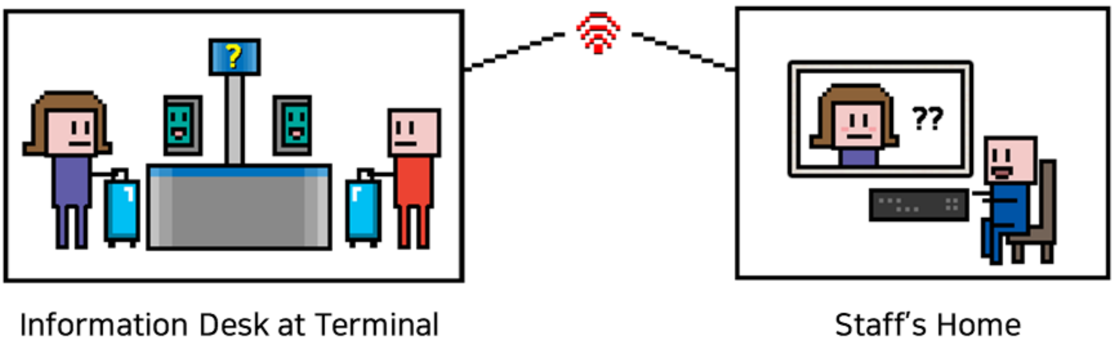
There may be issues of degradation in service quality because HCC demands that passengers perform certain roles by themselves. However, it could be counterbalanced by 24/7 joint HCC operation, which will increase passenger benefits. The staff must be well-informed of all participating airlines policies. Airport operators must design a delicate process for passengers to understand the way to check-in at HCC.

4.4. Information Desk on Cloud (IDC)

4.4.1. Needs

Late at night, many airports close some of their information desks due to relatively higher personnel expenses at night and having fewer passengers in the airport than during the day. As a result, late-night passengers often fail to find opened information desks, and even need to ask for help to look for an opened one.

4.4.2. Processes



<Figure 13>

IDC is similar to the Hybrid Check-in Counter. The remote communication technology connects passengers at empty information desks to staff at a remote help desk. The difference is that the information handled via info desks have no security issues, so cloud networks outside airports, which are often considered to have security risks, can be adopted. This means that staff can work remotely, even from home. Thus, an airport located far from a major city can hire competent staff who normally cannot commute to the airport. The 24/7 service provided by capable staff leads to the improvement of service quality as well.

4.4.3. Issues

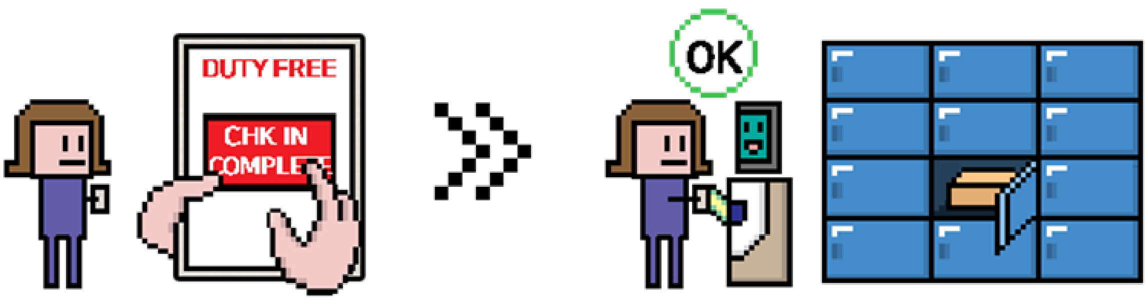
IDC requires new video communication systems to be developed to allocate remote staff to passengers. The automatic chatbot technology integrated into IDC will be helpful for providing no-waiting services to passengers.

4.5. Advance Duty Free Delivery (ADFD)

4.5.1. Needs

Duty free shops are accessible to passengers only after they have completed check-in, security checks, and immigration consecutively. Consequently, even after a passenger has made a pre-purchase from off-airport shops such as internet duty free, they may fail to claim the items at the airport due to heavy congestion before entering the airside area.

4.5.2. Processes



<Figure 14>

ADFD pulls the item-claim step to outside the airside area. Passengers can claim their purchased goods right after completing check-in. Delivery staff in the airside area then accepts the claim, makes the items ready, and sends security codes to the customer. The collection process can be provided as self-service with automated lockers. Otherwise, direct walking delivery service to the boarding gate for a small fee would be another possible option. ADFD could require legal considerations regarding privacy protection and customs processes.

4.6. Declaration in the Air (DITA)

4.6.1. Needs

For arrival passengers, many states require the submission of various written declarations relevant to immigration, customs, quarantine, etc. These papers are usually distributed in the plane cabin or acquired at the arrival floor, and are submitted to government agents in person, causing congestion around the arrival floor and raising the risk of infection.

4.6.2. Processes

<Figure 15>

Electronic declaration forms on a website substitute traditional paper forms. Passengers can fill in them in a flight cabin connected to a Wi-Fi network accessible in the sky, or in a hotel room. If a state allows the interchange of private information via web service, the electronically filled forms can be verified by government agencies before the flight lands. Alternatively, a stand-alone process would also be possible when a state has strict regulations on privacy. In this case, the digitalized declarations are instantly converted into a Result QR code and are stored in the passenger’s smart phone. After arrival, the passenger activates the Result QR code and scans it at a kiosk, which then transmits the passenger’s declaration data to government agents.

5. Closing Remarks

Because of the unsustainability of the current travel bubbles in preparation for the post-pandemic future, we have proposed a shift to the smart bubble system, which can achieve the goals of both the growth of the aviation industry and prevention of pandemic spread. The smart bubble system is composed of two newly devised passenger facilitation measures, HAPIS (Health information + API) and CLASes (Contactless Airport Services), to supplement the unsustainability of the present travel bubble structure.

HAPIS is established by adding health information into API. The health check procedure is performed automatically at the very first step of the check-in processes, which helps airports to provide the same level of facilitated services to passengers as before the pandemic.

CLASes are relevant to fast travel services, which many experts have discussed to facilitate passenger processes over the past few years. The difference between CLASes and fast travel services is that the former place more importance on “contactless” value than on “speed and efficiency”. Furthermore, CLASes complement HAPIS by the prevention of virus spread inside airports, improving the sustainability of the smart bubble system.

To achieve this smart bubble system, airport operators and ACI who are most familiar with passenger processes are expected to serve much greater roles than other stakeholders. With this new version of the travel bubble structure working organically with passenger processes, we hope that the world can encounter a post-corona future where Passenger Facilitation will not be a factor compromised first, but a factor to be considered as most valued, thus allowing us to always keep the doors open to our kind neighbors tomorrow even in the midst of a pandemic crisis.

References

The Korea Transport Institute, Trend and Insight Vol.2 No.1 (2020)

https://www.mofa.go.jp/a_o/na/page22e_000929.html

IATA, Preparing Passengers for Travel, Journeys with checked baggage (2020)

IATA, https://iata.org/en/programs/safety/health/diseases

IATA, The Passenger Services Conference Resolutions Manual (2017~2019)

IATA, Passenger Data Exchange, The Basics (2013)

OECD, Tourism policy response to the covid19 (2020)

ICAO, Annex 9 to the Convention on International Civil Aviation (2017)

ICAO, Council Aviation Recovery Task Force (CART) Take-off: Guidance for Air Travel through the COVID-19 Public Health Crisis (2020)

WCO/IATA/ICAO, Guidelines on Advance Passenger Information (API) (2014)

https://foreignpolicy.com/2020/06/01/travel-bubbles-borders-flights-coronavirus-uk-france-air-bridge/

Deloitte, How Covid19 is challenging orthodoxies in airport customer experience (2020)