

Research Article**OPPORTUNITIES AND CHALLENGES OF VACCINE LOGISTICS IN AIRFREIGHT
COMMUNITY DURING COVID-19*****Simon Yuen and Calvin Cheng**

College of Professional and Continuing Education, The Hong Kong Polytechnic University, Hong Kong, China

Received 25th July 2022; Accepted 20th August 2022; Published online 30th September 2022

Abstract

Undoubtedly, COVID-19 pandemic is causing the global hygiene issue; and is leading to a huge demand for vaccines to solve the problem. Since there are different standards of transportation and storage methods for different vaccines, it is the largest challenge for the existing logistics industry. Also, it is leading a new business environment (both opportunities and challenges) the airfreight. Firstly, there is a new business opportunity for the airfreight industry under the COVID-19 and it can lead to a recovery of the air transport industry and reduce the downturn situation for the industry. Then, there are two challenges that the Air Transport Industry worldwide are facing, capacity issues and global distribution of the vaccine delivery (temperature control). In the process of delivering vaccines, airline companies can develop opportunities in the long term and short-term. In the short term, it can help the airline company have a rise in profit. In the long-term, the new system researched in response to this shipment of vaccines can be used to meet future challenges and to carry out different exchanges and cooperation with other countries in the future through vaccine delivery. For refrigerated container suppliers, the opportunity for them to complete vaccines express has enhanced the technology in upgrading the design of containers and gaining revenue. The challenge for them is the cost is high as they need to spend a lot of money to improve the system. Although there are challenges, the improved technology can be used to transfer other medical equipment in the future. In this study, several opportunities and challenges for different parties such as the air transport industry, airline industry and refrigerated container suppliers are discussed. Moreover, it has also discussed the impact of the air cargo business after the shipment of vaccines. For example, decrease the downturn situation of the air transport industry, encourage cooperation between different countries and improve technology on container development and temperature control.

Keywords: Vaccine, Logistics, Airfreight, COVID-19.

INTRODUCTION

COVID-19 pandemic is spreading globally, all the industry and economy has been affected (IATA, 2020a). This study focuses on the aviation industry, especially the air cargo business. According to the International Air Transport Association (IATA) shed light, the global cargo volumes are down only 0.5% in December 2020, and the overall performance in 2020 fell by 10.6% which is the largest decline that started in 1990. To resume normal economic activities globally, one of the ways is vaccines that may effectively suppress the pandemic. But the problem is how safe and efficient to deliver to destinations, it is a big challenge that has never been seen before. This study will discuss the transportation process including the arrival of vaccines, the opportunities, and challenges of each party like the airline, and also the impact of the air freight community. Moreover, several recommendations will be mentioned.

LITERATURE REVIEW**The process of Vaccine Logistics and distribution**

Since the logistics of the COVID-19 vaccine is a big event in the world, it needs to be planned, organized, and implemented thoughtfully by vaccine supply chains (Figure 1). The process will divide the parts of preparation, shipment, storage, and monitoring for discussion.

***Corresponding Author: Simon Yuen,**

College of Professional and Continuing Education, The Hong Kong Polytechnic University, Hong Kong, China

(a) Preparation

To cope with the huge demand, Airlines (as example of Cathay Pacific) created a vaccine task force promptly for handling the vaccine shipment operation accompanied with existing knowledge and experience. Not only that, Airlines like Cathay Pacific (Cathay Pacific, 2021a) also reserved 20 dedicated freighters and cargo bellies of passenger aircraft for supporting the task of vaccine distribution.

(b) Shipment

The solution of vaccine distribution will integrate two cargo products from Cathay Pacific which called "Pharma LIFT" and "Priority LIFT", one of the products is controlling temperature as stable status, and the other one is express processing service to make sure the vaccine delivery to the destination as soon as possible. Moreover, Cathay Pacific launched the new track-and-trace system called "Ultra Track" which allows forwarders to monitor the condition of the vaccine like the temperature, humidity in real-time (Cathay Pacific, 2021a).

(c) Storage

The Cathay Pacific Cargo Terminal (CPCT) gets a certificate about Center of Excellence for Independent Validators in Pharmaceutical Logistics (CEIV Pharma) accreditation from IATA which is providing the trust in vaccine delivery compliance with consistent standards of safety and security, and the terminal can temporarily hold and transit 7 million vaccines per day. Also, it releases the new cold room storage that can handle a further 1.6 million to cope with the high demand for vaccines globally.

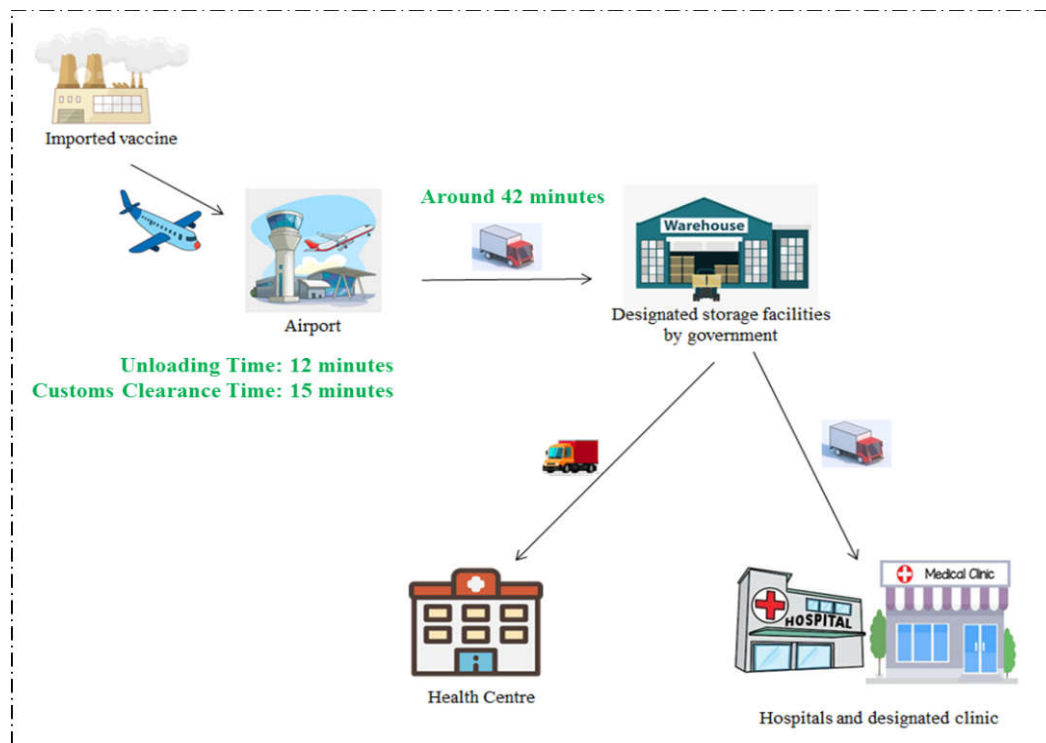


Figure 1: Vaccine Supply Chains
(The operation flow of Vaccine Logistics and Distribution)

(d) Monitoring

Apart from providing sufficient training to cargo terminal operators and the team of operations control center (OCC) internally, Cathay Pacific also requests all the suppliers follow the same capability to ensure the transport process of vaccines safety and smoothly. CPCT installed the automated devices for stamping the time and temperature of each vaccine delivery as a record (Cathay Pacific, 2021b). In summary, the vaccine can be delivered globally successfully which relies on different party's efforts to maintain the high service quality from the process preparation to monitoring stages for achieving the goal of suppressing pandemics in the world.

OPPORTUNITIES AND CHALLENGES TO AIRFREIGHT COMMUNITY

Air Transport Industry

Opportunities: There is a new business opportunity. Since the outbreak of the COVID-19, the global economy has been unprecedentedly disrupted. According to the Position Paper from IATA (2020b), it stated that around 46 million jobs that are related and supported by the air industry have been lost or are at risk. Also, as much as \$1.8 trillion in GDP related and supported by air transport could be lost. The success of the development and production of the vaccine brings a new business opportunity to the air transport industry. Due to the high demand for vaccine delivery, it brings a huge profit in transportation revenue. According to the information of the WHO (2020), it stated that the first mass vaccination program started in early December 2020 and 175.3 million vaccine doses have been administered. It also forecasts that the total demand for the vaccine is above 10 billion doses. Thus, the business opportunity can lead to the recovery of the air transport industry and reduce the downturn situation for the industry.

Challenges: Capacity is the biggest challenge. The reduction of the international belly cargo capacity affects vaccine delivery. In the past, only around 40% of air cargo was carried by dedicated cargo aircraft, while the rest was transported in the belly of passenger-carrying aircraft (Kiernan, 2021). Due to the COVID-19, the downturn in passenger traffic leads to the demand for passenger-carrying aircraft has fast dropped, and lots of the airlines have downsized their networks. Thus, the demand for dedicated cargo aircraft will increase, to replace the reduction of the international belly cargo capacity. There is also the shortage of dedicated cargo aircraft. The size of the vaccine delivery is enormous. IATA (2020b) noted that "just providing a single dose to 7.8 billion people would fill 8,000 747 cargo aircraft". Boeing (2020) noted that there are around 2,000 numbers of freighters globally. Currently, freighters are much lower when compared with the demand. Also, the difference in payload capacity of the freighters may extend the frequency of vaccine delivery. The capacity issue of the aircraft will impact the efficiency of the vaccine delivery and increase the risks of delays on the shipments crossing borders of the vaccines.

Moreover, temperature control is another challenge. The delivery of the vaccines has stringent requirements for the infrastructure, such as the availability or reliability of ultra-cold supply chains. To ensure availability and reduce waste, the vaccines must be kept at a certain temperature during transportation. The recommended storage temperature of the BioN Tech and the Moderna is -70°C and -20°C , they both need to use special storage boxes equipped with dry ice to store and manage the large volumes of the vaccines (WHO, 2020). Also, especially for some countries with hot climates, or with limited ultra-cold supply chain logistics infrastructure, such as Africa. For example, some airports lack comprehensive refrigeration systems and facilities, the quality of vaccines cannot be guaranteed in those countries. Also, there is still a high risk of cold chain failures and non-functional freezers,

even if the airport has good refrigerated systems and facilities. If the temperature problems persist continually, it will affect the quality control of the vaccine and lead to a huge amount of waste.

Airline Company (As example of Cathay Pacific)

Opportunities: Cathay Pacific has raised their profit by delivering vaccines in the short run. In 2020, the global aviation industry will be affected by the COVID-19, causing many airline companies to suffer serious losses. According to the annual performance review of Cathay Pacific in 2020, there has been a serious loss occurred on cargo freight and passenger freight. On the cargo freight side, they only carried 120,218 tons of cargo and mail on December 2020, and compared to December 2019, there was a 32.3% decrease.

Moreover, the month's revenue freight tonne kilometers had fallen 23.7% year-on-year. And the loss of the passenger freight is more severe, the number of passengers carried by Cathay Pacific and Cathay Dragon dropped by 86.9% in 2020 and compared to 2019, there was an 85.1% decrease in revenue passenger kilometers. In 2021, with the successful development of vaccines and the increasing demand for vaccines from various countries. There will be a large number of flights to deliver vaccines around the world. In the short term, the freight volume will increase, and according to the prediction of IATA, the airline industry's freight revenue will triple 36% in 2021. The revenue of delivering vaccines can cover the loss of the profit from travel passengers and cargo in the short term.

To cope with the safety of delivering vaccines in the long-term, Cathay Pacific has developed two new systems to meet the challenge of delivering vaccines which are OCC and Ultra Track. The OCC monitors and tracks the cargo at all times. For example, if the vaccines begin to experience temperature deviations, delays, or damages, the OCC will take the initiative to intervene and take action to correct the problem immediately. And the Ultra Track can record different real-time data in each container, such as the temperature, vibration, and humidity. It is very suitable for transporting cargo that requires strict temperature control and easy damage, just like the vaccines. And in the long run, these two new technologies and systems can be applied to other cargoes in the future, for example, dangerous goods. The dangerous goods also require strict monitoring and tracking, to ensure the accuracy and safety of the air transportation process (Cathay Pacific, 2021b).

The airline company can gain the opportunities of exchange and cooperation with other countries through delivering the vaccines to other countries. During the delivery of vaccines, Cathay Pacific became a member of the Pharma. Aero alliance, which means Cathay Pacific is part of the pharma 'air corridor' between Brussels and Hong Kong International Airport. And both airports are two of the best-equipped global pharma hubs. They can provide high-quality transshipment options for all pharma shipments. After COVID-19, Cathay Pacific can cooperate and communicate more closely with other alliance countries under the Pharma. Aero alliance in the future air cargo business.

Challenges: First, it is how to make sure employees are good handling the vaccine. Vaccine storage and handling practices can affect the effectiveness of the vaccine. Therefore, the

airline company should make sure that their employees clear understand and follow the standard operating procedure (SOP) for storage and handling principles. Cathay Pacific has a training team to enhance the processes (Cathay Pacific, 2021a). There is a highly-trained team in monitoring the temperatures during the shipment process. For example, they need to check whether there is adequate dry ice and charging batteries for the active cool containers (Swire, 2021).

Next, it is the security issues. The pharmaceuticals are mostly targeted by violent attacks, hijackings, and robberies in the airfreight. To prevent the vaccine from being stolen or damaged, Cathay Pacific has located the shipments near the aircraft doors to allow for priority unloading and upon arrival of the aircraft (Cathay Pacific, 2021a). Also, the plane will be parked at the South Apron closest to the Cathay Pacific Cargo Terminal at Hong Kong International Airport. It can reduce the time between the parking bay and the cargo terminal. Furthermore, people can check constant updates and visibility via Cathay Pacific website. And Cathay Pacific has provided a proactive monitoring service for the vaccine. The company has 24 hours monitoring and proactive responses about the shipment status for customers.

Finally, it is about storing vaccines at the correct temperature. Cathay Pacific has several methods to make sure the right temperature of the vaccine (Cathay Pacific Cargo, n.d.). As they want to keep cargo with the desired temperature range, they would like to use cool containers. And these containers have thick insulated walls. Next, the airline company chooses the active cool container. This type of cool container has a thermostat and technology for regulating temperatures, it is suitable for bulk pharmaceutical shipments that need -10°C to 15°C.

Then, Cathay Pacific can use passive containers for extra-cold shipments. This type of container can use special frozen gel packs to retain temperatures below 0°C for longer. The airline company can monitor the shipments in transportation. The containers have data recording equipment to check the condition of the goods. It can help the airline employees to monitor temperature changes. Furthermore, there is cold storage at the cargo terminal which can maintain temperatures from 15°C to below freezing and it can handle seven million vaccines every day. Finally, it is establishing a track-and-trace system (Cathay Pacific, 2021b). IT can provide real-time shipment information and notification. It has multi-dimensional readings, like GPS location or temperature.

Refrigerated Air Container Suppliers

Opportunities: The process to complete vaccine expression has improved technology since it needs high techniques to control the temperature. For example, Pfizer has made a suitcase-sized refrigerated container to help more convenience to facilitate airline delivery of vaccines (Merelli, 2021). Moreover, it helps increase the revenue as refrigerated equipment is a necessary thing in vaccine transportation so to store the vaccine at the right temperature many airlines and industries will collaborate with refrigerated container suppliers. It will expect to increase profit.

Challenges: The challenges faced are the high cost. As vaccines need to store at -70°C and this is not the normal commercial temperature of domestic cold chain logistics

warehousing. Therefore, refrigerated container suppliers need to improve existing technology. According to Xinhua net, the cost predicted will be around one million dollars. At the same time, as the cost is high, it will be a challenge for the airline industry on how to deal with refrigerated container suppliers with a preferential price (Xinhuanet, 2021). To delivery and handle vaccines successfully, it needs high technology to control temperature so refrigerated air container suppliers must invest a lot in upgrading their products to fulfill the task. As a result, it believes such technology can be re-used in the future such as using the same technology to transfer other medical equipment.

Conclusion

In general, qualify vaccine logistics and distribution has a lot of impact in the air cargo business. Firstly, the business opportunity brought to the air cargo industry can recover the business of the air transport industry and decrease the downturn situation for the industry. Secondly, for the airline industry, though vaccines transportation has encouraged cooperation and communication between local airline industries like Cathay Pacific and other alliance countries. There will be more collaboration between different countries in the future. Thirdly, for refrigerated air container suppliers, shipment of vaccines has improved the technology in shipping vaccines such as the capacity in controlling different vaccines at different required temperatures and development on the containers. After the vaccine transportation, the air cargo business can use this type of technology in shipping other medical equipment.

Finally, it has discussed the opportunity and challenge that it may face in different parties. Although there are many challenges in vaccine shipments, there are more goods than harms for the air cargo business. The success practices of vaccine logistics and distribution not only benefit to the air cargo and transport sector, but also contribute to save our life and human protection. Of course, a comprehensive guideline and plans for emergency medicals are needed to airfreight community in the future.

REFERENCES

- Boeing, 2020. *World Air Cargo Forecast 2020–2039*. Retrieved from https://www.boeing.com/resources/boeingdotcom/market/assets/downloads/2020_WACF_PDF_Download.pdf.
- Cathay Pacific Cargo. (n.d.). *Pharma LIFT*. Retrieved from <https://www.cathaypacificcargo.com/en-us/productssolutions/specialcargo/pharmalift.aspx>
- Cathay Pacific, 2021a. *A solution to the vaccine question*. Retrieved from
- Cathay Pacific, 2021b. *Behind the scenes at Cathay Pacific cargo terminal*. Retrieved from <https://cargoclan.cathaypacificcargo.com/behind-the-scenes-at-cathay-pacific-cargo-terminal>
- IATA, 2020a. *The Time to Prepare for COVID-19 Vaccine Transport is Now*. Retrieved from <https://www.iata.org/en/pressroom/pr/2020-09-09-01/>.
- IATA, 2020b. *Air Cargo Market Analysis*. Retrieved from <https://www.iata.org/en/iata-repository/publications/economic-reports/air-freight-monthly-analysis---december-2020/>.
- Kiernan, K. 2021. *Covid-19 Vaccine Delivery: Can Air Cargo Meet The Challenge?*. Retrieved from <https://www.forbes.com/sites/kristykiernan/2021/01/14/covid-19-vaccine-delivery-can-air-cargo-meet-the-challenge/?sh=6940dacc5f7b>.
- Merelli, A. 2021. *Pfizer's COVID-19 vaccine is set to be one of the most lucrative drugs in the world*. Retrieved from <https://qz.com/1967638/pfizer-will-make-15-billion-from-covid-19-vaccine-sales/>.
- WHO. (2020). *Coronavirus disease (COVID-19): Vaccines*.
