FACTORS AFFECTING AIR CARGO OPERATION DURING A PANDEMIC: A CASE STUDY OF THE AIR CARGO INDUSTRY IN CHINA

YANG JUKUN

AN INDEPENDENT STUDY SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE OF MASTER OF BUSINESS ADMINISTRATION PROGRAM IN GENERAL MANAGEMENT
FACULTY OF BUSINESS ADMINISTRATION
RAJAMANGALA UNIVERSITY OF TECHNOLOGY THANYABURI
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(Mr.Yang Jukun)

Independent Study Title	Factors Affecting Air Cargo Operation during a Pandemic: A Case Study of the Air Cargo Industry in China
Name - Surname	Mr.Yang Jukun
Major Subject	General Management
Independent Study Advisor	Assistant Professor Putthiwat Singhdong, Ph.D.
Academic Year	2023

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ABSTRACT

The COVID-19 pandemic has had a significant impact on the air cargo industry, leading to disruptions in supply chains and financial losses. This study aimed to investigate the factors affecting the success of air cargo operations during a pandemic, with a focus on the air cargo business in China. The research objectives included assessing the financial impact on air cargo operations, investigating the effect of imposed government restrictions and border closures, exploring how airport selection and flight schedules influence air cargo performance, and determining ways in which the air cargo industry can prepare for potential crises in the future.

To achieve these objectives, a quantitative research method was adopted, and data were collected from secondary sources, including academic journals, industry reports, and news articles. The findings revealed that financial impacts, government restrictions, border closures, airport selection, and flight schedules all significantly affected the success of air cargo operations during a pandemic.

The study highlights the need for flexible planning and critical determination of airport locations to ensure smooth operations during a crisis. It also provides insight into how air cargo carriers can handle the challenges that may be experienced during a pandemic. The results of this study will enable stakeholders in the air cargo industry to expand their air cargo operations and possibly make it a primary business rather than a mere byproduct.

Keywords: Pandemics, air cargo, marketing strategies

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Yang Jukun

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CHAPTER 1

INTRODUCTION

1.1 Research Background and Problem Statement

Air transport is a reliable and fast means of public transport which enables connection across international boundaries. Air transport industry majorly comprises of air passenger transport, air freight and air cargo (Gadgin et al., 2020). Air passenger transport involves the movement of people through air (using airplanes). Air freight and air cargo are somehow similar though specific differences exist. Air freight refers to goods or items transported in a cargo hold and are shipped by air. Air cargo is defined as goods shipped by air, using an air cargo shipment service or a logistics provider (Feng & Shen, 2015). Air freight cannot go into passenger planes; it is transported on specified cargo planes. Air cargo can be transported on passenger planes as luggage. The air transport industry has caused the establishment of cohesion across several countries in the world, thus enabling ease of conducting international businesses. (Choi et al., 2006). However, the industry is at a high risk when a pandemic struck the world. In such a case, movement of passengers across or into countries that are affected would be minimized. (Daon et al., 2020). Transportation of goods would however not be affected much thus not a great impact on air cargo.

The airline industry is deeply affected by health related pandemic, the most recent one, COVID – 19, was not an exception. The outbreak of this virus caused a sudden decline of airlines' activities, the most severe one being closure of most international transportation activities (Schwartz et al., 2020). The sharp depreciation in passenger flight demand which was caused by the adverse effects of the pandemic forced almost all flight companies in China to stop operating a good number of passenger aircraft. This situation was similar across all airlines in the world and this period recorded the most decline in business operations for air transport companies (Khatib et al., 2020). The landing of most passenger aircraft would also mean that a decline in air cargo transport would be witnessed. This situation affected the air cargo industry as the demand was too high to be catered for by the number of freight planes in operation.

The worldwide social isolation against covid-19 started by shutting down Wuhan on January 23, 2019. The lockdown continued for several months despite putting in place containment measures to minimize the rate at which the virus spreads (Muhammad et al, 2020). One of the containment measures was to limit air transport services (Zhang et al., 2020).

Air cargo suffered mild depreciation during the covid-19 epidemic. The continuous demand caused progressive growth in cargo transportation. Air Cargo was most likely able to go through the recession easily and bounce back to business compared to air passenger transport (Gudmundsson et al., 2021). This situation was witnessed with the growing percentages for air cargo as compared to that of passenger transport. Figure 1 below shows the comparisons of air cargo traffic and air passenger traffic by growth percentages from the onset of the pandemic.

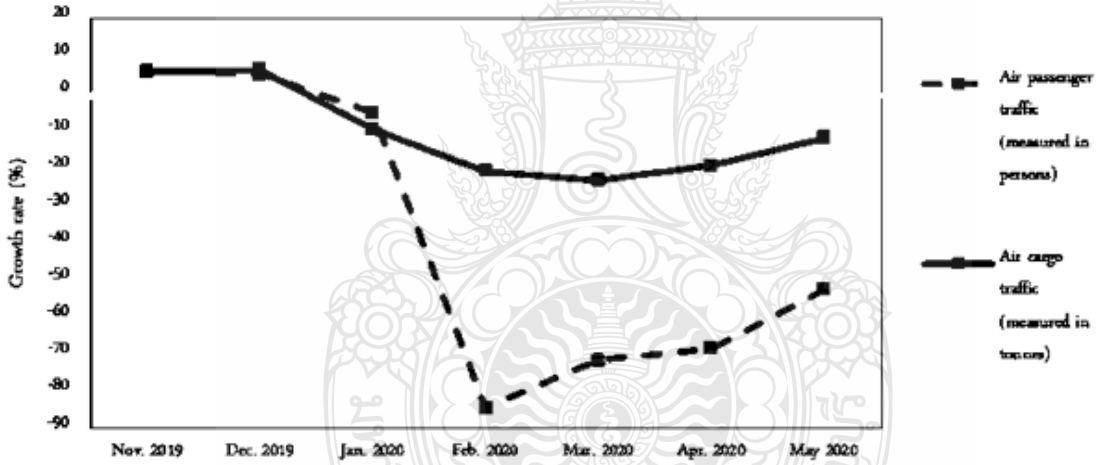

Figure 1.1 Chinese airlines' air cargo traffic and air passenger traffic by growth rate recorded year after year from November 2019 to May 2020.

As a result of the prolonged spread of the COVID-19 virus which caused increased losses to airlines, several companies shifted their attention to cargo transport. With the demand for cargo having been established, the companies considered cargo as a way of tolerating the losses experienced by passenger transport (Tanrıverdi et al., 2022). The airlines applied strategic logistics to be able to expand their cargo capacity. The strategies applied include; putting into operation wide body aircraft that had been grounded. This method, even though it seemed traditional, recorded positive effect on

sustaining the airlines not only in China but also across the world. Other changes that airlines have adapted to improve its air cargo transportation is by utilization of passenger aircraft, improved use of charter flights and increasing demand on flexibility in multi-lateral and bi lateral regulations (Bugayko, 2020). New logistics and standards continue to put in place to ensure improvement in the sector. The table below shows the number of air cargo planes in different airlines in China.

Table 1.1 Freighter scales of all-cargo airlines in China recorded in May 2020.

Airline's name	**No. of cargo aircraft**	**Type of aircraft**					
		B737F	**B747F**	**B757F**	**B767F**	**B777F**	**A300**
Uni-top Airlines	10		3				7
Air China Cargo	15		3	4		8	
China Southern Cargo Airlines	16		2			14	
Suparna Airlines	12	9		3			
China Central Longhao Airlines	6	6					
China Postal Airlines	27	20		7			
SF Airlines	58	17	2	31	8		
YTO Cargo Airlines	12	7		5			
China Cargo Airlines	9		3			6	
Tianjin Air Cargo	4	4					
China air cargo	1			1			

The operation of air transport is affected by several factors. These factors revolve around; government regulations, economic constraints, distance or destination, weight and volume (Merkert et al., 2017). Outbreak of a pandemic often cause unexpected negative impacts on air transport. This makes it another factor, though unpredictable, that

affects success of airlines. These factors are universal to both air passenger transport and air cargo transport. This paper focuses majorly on factors affecting air cargo operation during a pandemic. It will most intensive factors which include; government restrictions, financial impact, airport selection and schedule. The research paper will study air cargo business in China to give an implication of how different factors causes losses to an airline especially during a pandemic.

Purpose of the study

There is need to establish logistics for crisis management in the air cargo industry. This study, which focuses on determining the factors that affect successful operation of air cargo during a pandemic, aims at elaborating these factors and establishing possible solutions. This research paper will enable stakeholders in the air cargo airline companies to get more insight in regard to air cargo. This ideas will enable them expand on air cargo transport and possibly make it a primary business rather than a mere by product. Moreover, from the most resent blow caused by COVID -19 outbreak, this paper will highlight on the need to have flexible plane schedules and critical determination of airport locations. This study will also enable air cargo airlines staff to understand how to handle possible challenges that may be experienced during a pandemic.

According to past research, a number of factors have been established as those influencing performance of airlines, with very little emphasis on air cargo transport. Factors such as government support, technology and corporate performance have been studied at large. A research gap has been established in the case when a pandemic occurs and the need to direct interest in air cargo as is done for air passenger transport. Therefore, this research will investigate factors that causes air cargo industry to experience severe effects during a pandemic.

1.2 Research Objectives

The general objective for this study is: to determine factors affecting the success of air cargo operation during a pandemic.

The specific objectives for this study are;

1. To assess how financial impact affect air cargo operations during a pandemic.

2. To investigate the effect of imposed government restrictions and border closures on air cargo movement.
3. To find out how airport selection and flight schedule influence air cargo performance during a pandemic.
4. To determine ways in which air cargo industry can prepare for potential crises in the future to minimize extreme losses.

Research Questions and hypothesis

The main research questions for this study are:

RQ 1: Does financial impacts affect operations of air cargo during a pandemic?

RQ 2: Does imposed government restrictions influence movement of air cargo during a pandemic?

RQ 3: Does border closure influence movement of air cargo during a pandemic?

RQ 4: How does airport selection influence air cargo performance during a pandemic?

RQ 5: How does flight schedule influence performance of air cargo during a pandemic?

1.3 Research Scope

This research is a study about airlines performance with emphasis on air cargo performance during a pandemic. This research uses China's air cargo industry as a case study to establish an understanding of the elements that affect the successful performance of air cargo in the midst of a worldwide pandemic. The population of interest for this study are the airlines in China that operate air cargo transport and those that does not. Both categories of airlines are included in the study so that conclusive comparisons can be made and appropriate conclusions and recommendations drawn from the same. The study sample will be determined using a sample size determination formula which is explained as follows;

The following steps will be followed to estimate an appropriate sample size;

1. Determine the scope of air cargo businesses in China.
2. Estimate the confidence interval.
3. Estimate the confidence level.

4. Calculate the standard deviation (the value 0.5 is most appropriate for standard deviation when the values are not known).

5. Convert the confidence level into a Z score. Read the value of the Z score on standard normal distribution tables.

Moreover, the selected sample will ensure there is no bias in whichever aspect, inclusivity of all factors and able to give a clear representation of the population. The study focuses on causative factors, both qualitative and quantitative. It is manipulated by the researcher and is the causal variable. A dependent variable or explanatory variable on the other hand, is the variable that depends on other factors (independent variables). In research, it is presumed the effect. The study will also include a mediator variable. A mediator variable is intermediate in the causal sequence that relates a dependent variable to an independent variable. These variables include: financial status and growth rates, government restrictions (quantified based on extent of distance or period of time), airport selection criteria, flight schedules and, preventive measures.

1.4 Definition of Terms

The definitions as following provide understanding of vocabulary in this research study:

Air cargo capacity: it is the load space available for cargo in a passenger plane (Amaruchkul et al., 2011).

Logistics; it is the process of coordinating movement of resources, that is, materials, people, equipment and inventory, from one location to another desired storage location (Gudehus & Kotzab).

Risk; it is the exposure of an organization or a company has to factor or factors that lowers its profits thus leading to fail.

1.5 Conceptual Framework

A conceptual frame work defines expected relationship between variables and defines study objectives as well as maps out how the variables draw conclusions. The independent variables in this study are; financial constraints, government restrictions and, airport selection criteria. The dependent variable for this research is growth rates, for both

finances and cargo quantity transported. Flight schedule is a mediator variable in this study since it occurs as a result of other variables. Financial constraints have a direct effect on growth rates (financial growth rates), government restrictions directly influence both financial growth rates and cargo quantity growth rates. Border closer also directly affects the industry's growth rates. However, this factor features in because of the Covid-19 pandemic. As a result of closure of borders, there was need for airlines to impose government restrictions on different flights. For this reason, border closer acts as an intermediary between government restrictions and growth rates. Airport selection criteria directly affects cargo quantity growth and financial growth rates. Movement restriction can reveal the negative impact it causes on air cargo's income or profit. Financial constraints show direct relationship between cargo rates and financial growth rates. Flight schedule have indirect effects on the dependent variable, it is controlled by the independent variables.

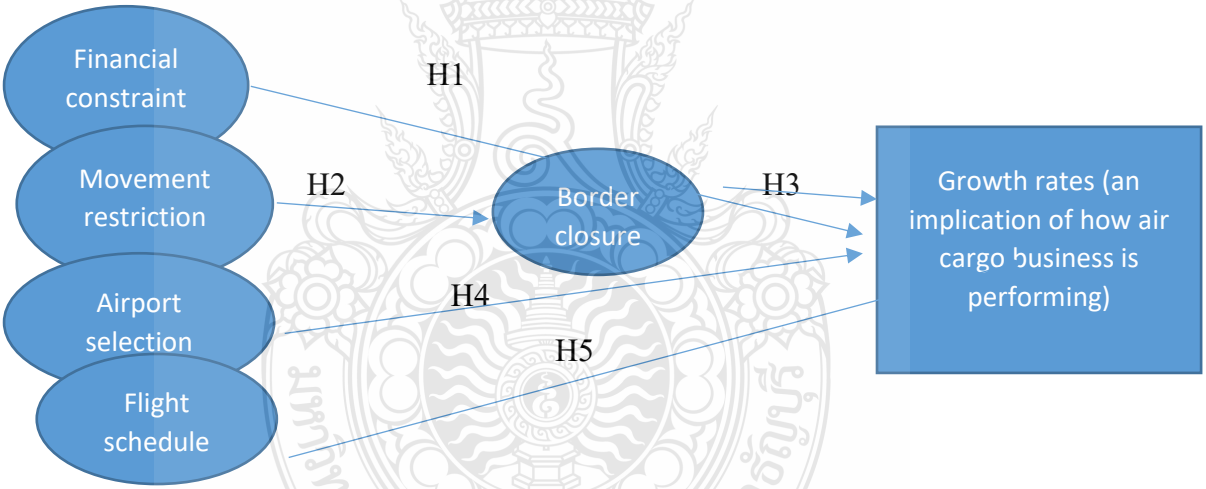

Figure 1.2 Research framework

Hypothesis

H1: There is a positive relationship between financial impact and air cargo performance during a pandemic.

H2: There is a positive effect of imposed government restrictions on air cargo operation during a pandemic.

H3: There is a positive effect of border closure on the successful operation of air cargo business during a pandemic.

H4: Airport selection has a positive effect on air cargo transport thus affecting performance of the industry.

H5: Flight schedule has a positive effect on the success of air cargo operation during a pandemic.

1.6 Research Contributions

Managerial contribution

This section outlines the benefits of this research paper to airlines' managers. The study of factors affecting the success of air cargo operation during a pandemic will be important to managers in the following ways:

- This paper would enable an airline manager to understand how changes in finances or financial impact would affect the performance of the company. This study will outline how aviation companies are getting out of recession caused by COVID-19. This is crucial information on how to manage finances at a time when the economy status of a country is low.
- Managers of airlines will have much to learn from this paper with regards to airport location and flight scheduling. These factors would highly worsen a containment situation especially during a pandemic. However, this cannot easily be changed by individual airlines since the only way to establish proper movement across different destinations is by scheduling flights.
- The main aim of conducting a research is to come up with solutions to recurring problems. This study not only focuses on identifying factors that affect success of air cargo during a pandemic but also how the companies can prepare for future crisis (establishing strategic measures to curb losses during a pandemic). Such information is crucial to managers since they are at the top most of organization chart, thus they should be equipped with relevant knowledge which they will then pass down to other employees.
- Managers will be able to gain concepts on how they can change cargo transport from being an airlines by product to making it a primary business.

Theoretical contribution

This section explains how academicians or researchers can make use of this research paper. The benefits of this research paper to researchers include:

- Researchers are able to clearly understand the factors that affect performance of air cargo in China thus they understand what exactly to consider when establishing an innovation in the air cargo industry. This paper is an eye opener to several areas that need to be researched on.
- This paper has majorly focused on the effects of COVID-19 pandemic on air cargo. It is thus very informative on how the worldwide pandemic affected air transport, the lessons learnt and the control measures that can be put in place to avoid severe losses in the air transport industry.
- Researchers interested in planning and marketing can learn various aspects from this paper. One, ways in which airlines can renovate passenger aircrafts to accommodate an increasing demand of cargo. Two, establishing demand driven services in the airline industry.

CHAPTER 2

REVIEW OF THE LITERATURE

The study on "factors affecting air cargo operation during a pandemic" is meant to clearly outline how air cargo operations are undertaken, the challenges witnessed by the process and ways on how to deal with these challenges. This chapter will review previous literature that relates to operations of air cargo specifically in China but also making comparisons with other leading air cargo companies in type world. Also, since air cargo is majorly business based, a SWOT analysis will be captured. This will explain the strengths, weaknesses, opportunities and threats concerning the business and also give directions on how to handle these aspects in order to improve the business status. This study aims to evaluate particular objectives (which have been stated in the previous chapter), therefore, this chapter will also include a review of literature which relate to the specific objectives. The objectives revolve around how finances affect air cargo business, influence of travel regulations that are imposed in the case of a pandemic, the reasoning behind airport selection and flight schedule with respect to air cargo operations and, favorable techniques to be embraced when a crisis strikes. Finally, a summary of the entire chapter will be included at the end.

2.1. Historical background information of air cargo in China

Air cargo was first used to carry mail from a post office between Oudh in the British ruled India and the United Province of Agra. Towards the end of the 20th century, several types of items such as heavy machinery parts, medicines, daily essential items and regular goods were moved using air cargo (Popescu et al., 2010). New and affordable cargo airlines begun operations across Europe and in the United States. Air cargo has since recorded immense growth capacity and business performance. In the past century, there has been huge adjustments in the aero technology domain thanks to massive technology advancements. Today, aircrafts can carry huge amounts of load in a single flight. Advancement in tracking technology has enabled on-time tracking of shipment (Forster & Regan, 2001). This makes the whole process more transparent and accessible

to many. This aspect boosted the confidence of many entrepreneurs who have since seized this opportunity to explore new markets. Air cargo now transports almost everything from clothes to electronics, food stuffs and many more. It plays a vital role in global trade.

In China, air cargo is primarily shipped in passenger aircraft, therefore the operations are majorly concentrated in the major cities, that is, Shanghai, Hong Kong and Beijing where there is high passenger demand. Air cargo through put in the cities have since improved tremendously since the past two decades with growth rates at: 471% in Beijing, 1527% in Shanghai and 404% in Guangzhou (Wang et al., 2011). This expansion was not only initiated by economic growth but also by increase in connections. Major airports in China established better connections to both international and domestic networks (Paleari et al., 2010).

2.2 Air cargo operation process

The processes of shipping air cargo is clearly defined and it is ultimately time defined. It requires coordination and collaboration from several parties including; trucking companies, freight forwarders, shipping companies, shippers, warehouse agents, airlines, customs, airport terminals and consignees (Agarwal et al., 2009). The process is also information intensive, that is, for the shipping to be successful, exclusive communication has to be made by all persons involved in the process regarding information of the goods to be shipped. Shipping air cargo involves electronic agents for customs declarations, tracking cargo status, querying flight schedules, and bookings (Leung et al., 2000). In developed economies, shippers mainly outsource their logistics functions to a logistics service agent. The agents are mostly classified as per the type of product/service they deal with. Agents mainly specialize in three categories; provision of one logistic service, provision of a range of services and provision of logistic services for the whole shipment process (Yang et al., 2010). Freight forwarders have a unique role among these agents. They basically responsible for management of a shipment aside from acting like contact with other agents for the client. Forwarders are a critical element in the provision of logistic services hence an important element of managing supply chains (Burkovskis, 2008).

In china, a high percentage of transporters deliver cargo to gateway airports through in-house resources (first party service providers), thus resulting in poor use of such resources. Integration of trading, marketing and distribution are key aspects in managing supply chain, however, these sectors are under China's state control with little or no integration (Wong & Bernroider, 2015). This aspect severely affects domestic firms since they ideally require a wide scale nationwide distribution network. These firms must outsource distribution to logistics providers, who cooperate with other local service providers to form a distribution network. This situation results to high supply chain related costs, thus creating a considerably high efficiency gap (Wang & Cheng, 2010).

Advantages and disadvantages of air cargo

It is obvious that great advancements have been made in the sector of air cargo operation but not everything is under control. The industries has a number of pros and cons but the advantages overweigh the disadvantages. Advantages of air cargo include; one, timely delivery. Air cargo takes way much less time to transport goods (a few days) as compared to either road, rail or sea, which take almost a month. Two, reliability; air cargo is among the most reliable method of transporting goods since the planes or flights adhere to a standard schedule and the process witnesses just a few occasional delays. Three, Cheaper insurance premiums; the premium for insuring a consignment is much lower for air cargo since the goods are transported much quicker and the possibility of an accident or mishap is much lower. Four, security: airports are regarded a secure place with several security layers overlooking every corner. Therefore, consignment transported undergoes multiple security checks hence very minimal chances of being damaged or misplaced. Lastly, less warehousing requirement; air cargo carries less load in one go thus fastening the clearance process, which will imply that the goods move much quicker through customs. These factors show that air cargo can be managed easily thus minimizing stockpiling issues (Merkert et al., 2017).

The disadvantages of air cargo are: first, high operational costs; air cargo is more expensive compared to other transportation modes. Airplanes are expensive machines thus air transport companies must account for the money invested in buying and maintaining aircraft fleet when determining shipping fees. Second; high risk; air transport is the riskiest means of transport because of its speed. Compared to rail or road, it is much

likely that goods can survive accidents but less likely to survive a plane crush. Third, limited capacity; air cargo are transported in passenger planes, so the cargo space is limited and cannot contain bulky and heavyweight goods. Fourth, limitation on certain products; liquid products that cannot handle high altitude and weather cannot be shipped through air. Other goods are also restricted based on a company's regulations. Lastly, dependence on weather; airplanes are unable to operate in adverse weather conditions such as storms, fog, thunderstorms, cyclones (Hellermann, 2006).

2.3 Air cargo supply chain

A cargo supply chain is the network of all resources, organizations, individuals, technology and activities that are involved in shipping cargo. Air cargo supply chain encompasses every aspect from order of the goods to delivery of products to the consignee (Sales, 2016). An air cargo supply chain is useful in helping one to understand three process of shipping goods through air transport. Moreover, a defined supply chain streamlines the whole shipment process since every party involved understands the designated roles and when to perform them. Transporting cargo involves a number of steps; one, shipping. This stage involves assembling the shipment, making it ready for transport and ordering transport. Two, forwarding out; this step involves all the process conducted by the shipper to ensure the goods are cleared and ready to be moved to the transporter. Three, air transport; involves checking, clearing and transporting the shipment to the required destination. Four, forwarding in; at this point the goods have already arrived at the required destination and they are cleared for collection by the consignee. Lastly, consignment; the final stage involves receiving the shipment, unpacking goods and checking goods with the administration (Nsakanda et al., 2004). The process of shipping goods through air may differ slightly based on destination, agents used and type of product being shipped. However, most air cargo companies have a template supply chain for cargo. The supply chain is pictured below;

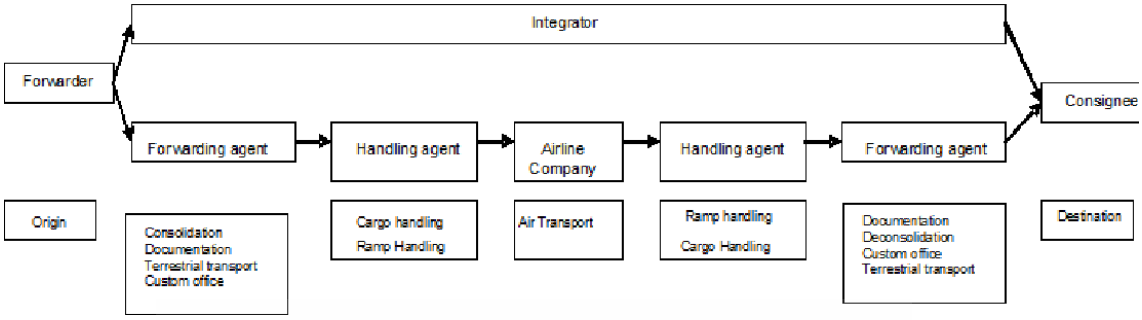

Figure 2.1 Air cargo development

Source: Pérez Bernal, M., Val Blasco, S., Larrodé Pellicer, E., & Sainz González, R. (2012). Optimization of the air cargo supply chain.

2.4 China's Air cargo SWOT Analysis

Like any other Air Cargo worldwide, Air Cargo china came to a crucial period to adapt to the COVID-19 pandemic which adversely affected its operations. To critically asses the factors that affects china's air cargo during the pandemic, it is critical to carry out SWOT analysis while considering the specific environment and situations. Examination of these factors are vital for its current and future operations as they may assist in illustrations and layouts further development of the air cargo.

Strengths of air cargo industry in China

High Level of expertise for special cargo and economic development.

For instance, in 2019 the country transported about 7.534 million tones. Statistically, this represented an increase of about 0.019 or 1.9 percent compared to the previous years. The special handling of special cargo and the country's economic growth has seen the industry have a constant growth trend over the last decade. Although during the pandemic a lot of China's air cargo operations were affected, the small cargo they had were still being handle with high expertise levels (Xue et al., 2021). According to Li, 2020 air cargo is also seen as a display of a country's macroeconomic movement. In the past few years, China's air cargo growth has been mainly influenced by the country's rapid economic growth. The pandemic had adverse effects on the country's economy, ranging from increasing unemployment rates, decrease in national imports and exports, reducing GDP, to slow industrial growth. During this period air cargo operations were greatly affected. The pandemic led the country to start prioritizing of transiting its

economy from a high growth rates to a much stable and balanced one. China's air cargo market is still expected due to increasing consumption demands globally.

The expansion of airlines that only deal with freights.

Over the years, China's air cargo has been dedicated on the proliferation of airlines that only deal with freights (freight-only airlines). Freight-only aircrafts plays a vital in ensuring that air transport services are efficient and safe. Currently, there 175 freight-only airlines in the country (Li, 2020). 97.14% of those freighter aircrafts are operated by specialized cargo airlines. The first freight-only airline in the country was created in 1997 by a national postal enterprise called China Post. The airline is called china Postal Airlines. Later, another three freight only airlines were created by the government between 1998 and 2003. They include China Southern Cargo Airlines, Air China Cargo, and China Cargo Airlines. According to Chow, 2010 from 2004 a number of diversified ownership enterprises started operations in the industry. Recently in 2009, a private delivery courier company, SF created SF Airlines (SF Airlines, 2018). Later in 2014, another private delivery courier named YTO created YTO Cargo Airlines. The two airlines have developed rapidly over the years having high returns and handling large amounts of cargo (Li, 2020). In 2019, just before the onset of COVID-19 pandemic, SF bought supply chain business belonging to DHL in China. This saw SF evolve from an express delivery to a supply chain entity (SF Airlines, 2018). Some E-commerce organizations, for example, JD and Cainiao have promoted their operations in air logistics. In future, the country's airlines are mostly likely going to follow a subsidiary plan. During the pandemic, a lot of passenger planes were not operational and these affected airlines flying both cargo and passengers than freight-only airlines.

Weaknesses of air cargo industry in China.

Inadequate air cargo volume.

Most airlines in China use passenger aircrafts and cargo aircraft to transport air cargo. In the last decade, cargo aircraft have only accounted for 0.045 of the total fleet scale (Sun et al., 2021). Although passenger aircrafts' belly holds have played a significant role in the country's air cargo service, there is still deficient capacity in the air cargo. For instance, in 2019, the country's airlines finished 51.4 percent of global air

cargo traffic by cargo aircraft and 48.6 percent by belly holds (Sun et al., 2021). This was not the same case with the local air cargo traffic. Aircraft's belly holds accounted for about 70 percent of the domestic air cargo traffic, leaving cargo aircraft with a small amount to handle. During the peak of the pandemic, especially the shutdown of Wuhan saw a sharp drop in flight executions; this caused an adverse deficiency of cargo volume, mainly aircraft's belly holds volume (Li, 2020). The deficiency of the country's airlines' global cargo volume/capacity looked more severe as the pandemic expands in 2020. During the period, the demand for personal protective and medical equipment increased worldwide.

Minimal involvement in the global market.

Chinese suppliers in the air freight have not been competitively participating in the multinational market. The total cargo traffic of outbound and inbound China is only 30% (Li, 2020). This happens especially during the Chinese New Year, during this period the multinational cargo service mostly goes into an off-peak season leading to a cut in cargo flights to China by many foreign airlines (Wang & Li, 2022). During the onset of the pandemic, this scenario worsened the situation when the country needed large amounts of personal protective and medical equipment from abroad. Several air passengers from different parts of the world, especially from Europe and USA were called to transport the equipment donated by other nations as luggage. After a certain period when the pandemic's epicenter moved away and the country became an important donor and supplier of prevention materials such as masks, most airlines in the country opened up global cargo flights. They converted passenger aircrafts to cargo aircrafts. This measure has significantly help in lessening of the previous deficiency of global cargo volume in the country.

Opportunities for China's air cargo

New Technologies

The emergence of new technologies such as digital platforms, automation, block chain, IoT, big data and drones has created a substantial opportunity for China's air cargo. Digital platforms such as websites and social media platforms have made it easy for several airlines to advertise their brands and also communicate directly with their clients (Norris, 2019). During pandemic when minimal contact was needed between

people, digital platforms helped a lot in communication between different parties in the air cargo industry as most things were done online. The online communication enabled smooth transactions between the parties. During the same period, some new devices such as drones were used and are still being used to transport preventive and medical materials. In China, cargo drones were commonly used in providing accurate and contactless delivery at different destinations. For example, on 12-02-2020, Wuhan Jinyintan Hospital received a 70 kilograms of medical materials from SF air cargo industry by using drones.

E-commerce growth

With the entrance of eBay, Alibaba, and Amazon FBA in the logistics industry, an integrated approach for air cargo transport regulation and planning has been put called for (Norris, 2019). The Chinese digital framework has experienced immense development growth over the last years. From less than 1% in 2010 to 42% of the international e-commerce market in 2020. For example, in 2010, Chinese citizens used express delivery for less than two pieces annually (Li, 2020). Due to the tragic growth, in 2019 they used the delivery services for more than 45 pieces annually. YTO and SF express delivery enterprises used this opportunity to open and expand their air cargo capacity and services. With the promotion of transnational e-commerce to boost international trade, there will be a renewed input for the country's air cargo industry. There has been an establishment of 18 pilot free trade zones and 51 cities as cross border e-commerce import. During the pandemic many new cargo ways.

Support from Government and other Agencies.

The development of the Chinese air cargo depends on several factors; government policies is one of the critical factors. The government of China recognized the inadequacy of air cargo capacity in the country (Li, 2020). The state authority has taken key steps in issuing new directives and policies to ensure that air cargo in China, especially the air cargo capacity is improved. This will enhance competiveness in the global logistics market. The pandemic revealed the problems in the Chinese air cargo industry; thus the government has been working to do away with factors that negatively affect air cargo efficiency (Sun et al., 2021). For instance, during the pandemic the government issued directives for Chinese airlines to carry equipment to Wuhan.

Threats to air cargo growth in China.

Trade Protectionism

This factor has been damaging international trade due to its restrictive nature (Norris, 2019). Apart from the pandemic, trade protectionism has been affecting China's economy. The most common one is the US-China trade war that heightened during former U.S president Donald Trump's era (Li, 2020). It has led to a decline in the demand of air freight markets between the two countries and their close allies. President Donald Trump put high tariffs on imported aluminum and steel to discourage importation of the materials (Norris, 2019).

Pandemics

China's air cargo industry has experienced two major pandemics, the 2003 SARS and COVID-19. The impacts of the SARs were not as severe as the COVID-19 effects (Sun et al., 2021). COVID-19 is more infectious and spread quickly making it hard to control (Xue et al., 2021). During the epicenter of the pandemic, the country's air cargo industry faced a more challenges such as additional operational costs and stiff competition in the industry than in 2003. Several enterprises faced financial constraints during this period (Xue et al., 2021). From the two pandemics, it is evident that epidemic control needs require more robust actions that translate to additional costs.

2.5 Influence of government restrictions on air cargo operation during the Covid-19 pandemic

On the onset of the Covid-19 pandemic, many countries banned international travels as a way of containing spread of the virus. The unexpected removal of aircrafts' belly capacity hugely disrupted air cargo transportation. Reduction in cargo transportation experienced a sharp decline in a period less than a year. Another challenged imposed by the pandemic; in line with government restrictions was flight crew being put into quarantine after an overseas flight (Rajbhandari et al., 2020). The intensity of the disease demanded one to be observed in quarantine for a while and only be released after a covid-19 test result returns negative. As a result, the frequency of operations at the airlines would reduce remarkably (Mhalla, 2020). Despite the sudden decline in cargo operations at the onset of the pandemic, it was not so long before the situation took a positive turn. With the restrictions on passenger travel, it became evident that air cargo operations

would be an essential lifeline (Zhang & Hayash, 2022). The demand to transport various items such as medication, food stuff, equipment increased drastically. This meant that the airlines would now focus more on transporting cargo rather than passengers.

From these turn of events, airports realized a role in implementing appropriate and fast policy responses required to support air cargo transportation at that time of distress (Nižetić, 2020). The global economy was able to benefit from the continuity of air cargo business, but most importantly, the business helped a lot in fighting the raging pandemic. Since then, many researchers developed interest in air cargo sector and this has encouraged airlines to find ways of operating air cargo transportation not as a byproduct but as a primary business (Bartle, 2021).

2.6 Impact of financial status on air cargo business

Air transport is generally considered expensive because of the high cost of purchasing airplanes and a high fleet maintenance cost. Airline operations are also thorough and demands quality human resource personnel and advanced technological services. In order to acquire and sustain operations with all these requirements, the companies are forced to include these factors when determining service charges (Ullström et al., 2021). Airports have different sources of revenue; one, aeronautical revenue. This is money that airports make directly from passengers and airlines for using the airport space. It consist of terminal, landing, usage and passenger fees. These contribute almost half of an airport's revenue. Another source of revenue is commercial revenue; this are charges on non-aeronautical companies like shops, hotels, garages, car rentals and lounges for using the space on an airport's premises (Zhang & Zhang, 2010). The onset of covid-19 resulted into minimal airports operations which resulted into reduction in revenue collected. This situation was common across airports worldwide.

The need for government to provide financial support to the companies was necessitated, so that state of the economy is maintained at a reasonable level. This factor affected all airports' operations and air cargo transportation was not an exception (Warnock-Smith et al., 2021). More research and consultations are still being conducted to help handle financial crisis and also to improve operations so that more revenue is generated.

2.7 China's Air Cargo Industry Strategies to adapt to the pandemic and handle Potential Crises.

COVID-19 pandemic has been "eye-opener" to most air cargo industries worldwide as it became a concern to everyone. During the pandemic's peak, air cargo enterprises were at the forefront of transporting personal protective and medical materials due to their fast and efficient services (Li, 2020). The air cargo took a sense of social responsibility to transport these materials to different communities and hospitals. Through cooperation with different agencies, most air cargo enterprises developed efficient and convenient reaction mechanism to actively provide fast and secure services. As the epicenter of the pandemic moved away, the demand for common goods increased, most air cargo enterprises like JD increased their freight capacity (Deng, 2022). The expansion of freight capacity is also a good response for the e-commerce growth in the country.

Most enterprises adopted intelligent logistics technology during the pandemic. This adoption led to the enterprises achieving the distribution and integration of transport. For example, JD applied techniques of big data to investigate and analyze historical delivery orders and distribution in affected areas; this enabled them to forecast future order's trends. The forecast enabled it prioritize orders from the critical health centers and hospitals and therefore, achieving accurate delivery and distribution of medical equipment and supplies (Li, 2020). China's air cargo industry has a great opportunity to continue growing due to the momentum of new technology in supply chains.

Most air cargo enterprises improved their integrated service on the supply chain during the epidemic. Freight enterprises who relied on one logistics point to carry out their operations faced several challenges and difficulties during the pandemic (Deng, 2022). Enterprises such as Cainiao had efficient delivery and supply of medical equipment such as protective clothes and masks because it has its own supply chain. In order to tackle any crisis in future, air cargo enterprises should extend their operations from pure air freight to an all-encompassing supply chain. China's air cargo industry has faced competition in international markets, for air cargo enterprises to cultivate their potential, it is advisable they provide customized services (Deng, 2022). Some air cargo

enterprises such as SF have been working to strengthen their co-operation with e-commerce platforms due to the growing demand of the latter.

2.8 Impact of Airport Selection and Flight Schedule on growth rates of air cargo business

China's traditional air cargo consisted of a simple channel of transportation process. They lacked docking transportation services; but with the tragic growth of air cargo industry in the country, the logistics service supply chain had to expand (Xuanhua, 2018). In china, there are two forms of airport cargo terminals that determine the airport selection and flight schedule for different cargo aircrafts. They are freight terminal for receiving goods and freight terminal for delivery. These two points connects road and air transportation (Xuanhua, 2018).

Airport cargo terminals are responsible for the implementation of safety inspections, handling operations, temporary storage of goods, and loading of goods. Aircraft flight determines the extent of operations within a cargo terminal (Feng, 2015). China's air cargo industry still uses a single cargo terminal for several operations leading to uncontrollable operations and allowing for the inefficient operation of the terminals. In order to protect the logistics supply chain with in the industry, the airlines should monitor the loading and handling of goods within the terminals. Airport selection for an airline can severely affect its cargo operations depending on the status of the cargo terminal. In an airport where goods stay for long in the cargo stations, there will be impacts of the delays on the cargo transportation (Li, 2020). The Chinese airlines should adjust their investment in the cargo terminals to avoid interference of the logistics supply chain and also boost control of the terminals.

2.9. Indicators and Measurements

This section describes research variables applied in this study.

Financial status as an independent variable

Financial status of an airline company has direct effects on performance of its air cargo business. Therefore it is categorized as an independent variable. Covid-19

caused severe negative effects to economies all over the world. Companies finances were also grossly affected thus impacting business operations (Ullström et al., 2021).

Movement or government restrictions as an independent variable

Air cargo business operate as a transport company. When the covid-19 pandemic occurred, the transport sector was severely affected; government restrictions, especially international flights were banned. Only a few exceptional flights were given access to foreign regions. These changes definitely affected air cargo business in China ((Deng, 2022)). (Yang & Chang, 2023)The outbreak of the COVID-19 pandemic in 2020 initiated government restriction measures to contain the pandemic have led to an inevitably huge blow to the world economy and widespread challenges. Demand for air transportation was highly influenced and its effects on cargo business was hugely felt.

Growth rates as a dependent variable

The main aim of this research is to determine factors that affect air cargo business in China. Performance of a business is usually accessed by checking for growth or rather increase in finances (revenue). Also for air cargo business, improvement would be identified by an increase in air cargo capacity of a particular airline. Therefore, growth rates are a suitable dependent variable for the study (Li, 2020). Air cargo in China has recorded growth due to the special handling of special cargo and the economic growth of the country. Even though the pandemic affected most operations, expertise was applied to operate the small cargo. air cargo is witnessed as a macroeconomic movement for a country thus a measure of growth.

Airport selection criteria as a mediator variable

When selecting a suitable airport to use for either passenger or freight transport, there are a number of factors considered, for example; type of aircraft in their fleet and the routes followed. This factor would affect performance of air cargo business but not directly. Airport selection criteria relates other variables thus it is a suitable mediator variable for this research (Feng, 2015). Airlines monitor the loading and handling of goods within the terminals differently. China’s air cargo industry still uses a single cargo terminal for several operations leading to uncontrollable operations and allowing for the inefficient operation of the terminals. Therefore, one should carefully select the airport that defines its operations effectively.

Preventive measures as an independent variable

In the bid to find out what factors affect air cargo business during a pandemic, it is also wise to take lessons from a past crisis caused by a pandemic and avoid repetition of the same. This can be handled if a good number of control measures are put in place (Mhalla, 2020). Airlines should plan well and possibly expand on air cargo transport and make it a primary business rather than a mere by product. It is essential to have flexible plans and be able to adjust effectively without experiencing huge loses.

Flight schedule as a moderator variable

A moderator variable influences the strength of a relationship caused by a mediator variable. Flight schedule are controlled by many factors and it would strengthen the relationship between other variables that mediated by airport selection criteria (Feng, 2015). Flight schedule is the central component of the planning procedures of every airline. It is considered from both market-oriented view and the production view. It determines the competitive position in the cargo transport market and also passenger transport. These schedules are made earlier based on different influential factors (Derigs et al., 2009).

Variable	Finding	Source
Financial status	Air transport is costly due to the high cost of purchasing airplanes and a maintaining fleet. All aspects of specialization have to be factored into costs of cargo transportation. Furthermore, a company must ensure sustainable profits are achieved so that the business continues to flow effectively. General performance of company is measured by its financial statements.	Palepu, K. G., Healy, P. M., Wright, S., Bradbury, M., & Coulton, J. (2020). *Business analysis and valuation: Using financial statements*. Cengage AU.

Government restrictions	The outbreak of the COVID-19 pandemic in 2020 initiated government restriction measures to contain the pandemic have led to an inevitably huge blow to the world economy and widespread challenges. Demand for air transportation was highly influenced and its effects on cargo business was hugely felt.	Yang, Y., Liu, Q., & Chang, C. H. (2023). China-Europe freight transportation under the first wave of COVID-19 pandemic and government restriction measures. *Research in Transportation Economics*, *97*, 101251.
Growth rate	Air cargo in China has recorded growth due to the special handling of special cargo and the economic growth of the country. Even though the pandemic affected most operations, expertise was applied to operate the small cargo. air cargo is witnessed as a macroeconomic movement for a country thus a measure of growth.	Li, T. (2020). A SWOT analysis of China's air cargo sector in the context of COVID-19 pandemic. *Journal of air transport management*, *88*, 101875.
Airport selection	Airlines monitor the loading and handling of goods within the terminals differently. China’s air cargo industry still uses a single cargo terminal for several operations leading to uncontrollable operations and allowing for the inefficient operation of the terminals. Therefore, one should carefully select the airport that defines its operations effectively.	Feng, D. M. (2015). Study on the formation mechanism of aviation logistics airport economic zone. Port Economy, 2(2015): 35-37

Preventive measures	Airlines should plan well and possibly expand on air cargo transport and make it a primary business rather than a mere by product. It is essential to have flexible plans and be able to adjust effectively without experiencing huge loses.	Merkert, R., Van de Voorde, E., & de Wit, J. (2017). Making or breaking-key success factors in the air cargo market. *Journal of Air Transport Management*, *61*, 1-5.
Flight schedule	Flight schedule is the central component of the planning procedures of every airline. It is considered from both market-oriented view and the production view. It determines the competitive position in the cargo transport market and also passenger transport. These schedules are made earlier based on different influential factors.	Derigs, U., Friederichs, S., & Schäfer, S. (2009). A new approach for air cargo network planning. *Transportation Science*, *43*(3), 370-380.

CHAPTER 3
RESEARCH METHODOLOGY

3.1 Organization of the study

The research paper consist of 5 chapters. Chapter 1 outlines the introduction of the research paper. It covers the problem statement, research objectives, conceptual framework, hypothesis and purpose of the study. Chapter 2 is a review of previous studies that relate to air cargo performance during a pandemic. It also shows the strengths, weaknesses, opportunities and threats (SWOT) analysis of air cargo during the COVID – 19 pandemic. Chapter 3 entails the research methodology. It entails details on population, sample size, data collection methods, data analysis techniques applied and hypothesis testing. Chapter 4 presents results and discussion of research findings. Chapter 5 composes the discussion, conclusion, and research implication, limitations of the research and areas of further research.

Research steps and process

This chapter represents the research methodology applied to test the hypothesis and prove the conceptual framework in chapter 1. The methodology part of this paper studies the specific purpose that focuses on China's air cargo issues during the COVID-19 pandemic period, which is the main topic for this research study. Research methodology is fundamental in any study because it explains the methods used for the purposes of understanding the main research context. This research study uses blended data procedure or composite method for the fulfillment of the study. Each factor in the study must be covered with a proper methodological rationale; this makes it necessary to construct the prevailing methodology technique in a particular method. The chapter is divided into different sections. This section includes population and sample group, and data collection method. The third part describes the indicators and measurement (variables) employed in the study. The fourth section describes the research instrumentation; questionnaires for data collection, statistical tools and methods used to data entry and analysis.

3.2. Research Design

The research paper will use both quantitative and qualitative methods to study, "Factors affecting China's air cargo operations during the pandemic." Quantitative analysis approach is used because the research problems can be traced to the ideas of the related theories and the literature review. Quantitative approach is applied to measure the characteristics of some the key variable such as financial constraints and travel/government restrictions.

In this paper, the quantitative approach is conducted through a survey of the Chinese airlines. Survey research is vital in ensuring reliability, objectivity, and generalizability while choosing the study sample. The Survey method uses a particular statistical techniques and standardized questionnaire to test the hypothesis concerning the relationships between particular variables (Loan, 2015). In survey method, the researcher is seen external to the study and the survey results are expected to be similar or replicable irrespective of who conducts the study. According to Bryman & Bell, 2007 Survey study involves generation of hypothesis based on theory, research design, instrument of analysis, data collection and analysis, and making inferences.

Quantitative approach uses mathematical and statistical techniques to spot facts and casual links to allow for the generalization of result to a larger population within familiar boundaries of error. This approach processes data beginning from a theory, then to data collection and then finally findings.

To achieve the fourth objective of the study, "to determine ways in which air cargo industry can prepare for potential crises in future to minimize losses" this research will employ quantitative research method. To evaluate the fourth objective stated above, the survey will collect opinions of the official and management team of the Chinese cargo airlines. This will provide an in-depth insights to the research and also proliferate new concepts for the research. There are several approaches to qualitative research depending on the type of the study one is carrying out. These approaches are flexible and often focus on retaining the deep meaning during data interpretation (Bhandari, 2023). Although the approaches have some similarities, they emphasize on different perspectives and aims. This research will employ narrative research; researchers explore how the participants tell their stories to understand the participant's view of their issue based on their experiences

(Bhandari, 2023). Surveys will be used to collect this type of data where questionnaires with open-ended questions are available.

3.3 Unit of Analysis

Study Population

The population of interest for this study are the airlines in China that operate air cargo transport and those that does not. Both categories of airlines are included in the study so that conclusive comparisons can be made and appropriate conclusions and recommendations drawn from the same. Chinese air cargo industry has been constantly developing over the last couple of years making it one of the main air cargo industries worldwide. There are a number of airlines in the country that are actively involved in the cargo business, either through freight-only plans or passenger aircrafts. Operations of these airlines were severely affected by the pandemic making it an area of interest to handle for most researchers. The research population includes all the nine carriers' operating air cargo flights in the country at the end of 2020. They include China Postal Airlines, Suparna Airlines, Air China cargo, SF Airlines, Loong Air, YTO Cargo Airlines, Central Airlines, Tianjin Air Cargo, and Longhao Airlines. From the Chinese airlines operating air cargo flights, only three are cargo-only carriers. They include YTO Cargo Airlines, SF Airlines, and China Postal Airlines (Deng et al., 2022). These three airlines belong to local Chinese logistics companies; YTO Express, SF Express, and China Post Group, respectively. YTO Cargo airlines and SF Airlines are privately owned while the other one (China Postal Airlines) is owned by the Chinese government.

Table 3.1 Chinese carriers operating with a local cargo timetable in 2020

Carriers	CAAC approval (year)	Freighter Fleet	Ownership	Hub
China Postal Airlines	1996	28 (B737F, B757F)	China Post Group Corporation	Nanjing
Suparna Airlines	2002	14(B737F, B747F)	Hainan Airlines	Shanghai Pudong
Air China Cargo	2003	15(B747F, B777F, B757f)	China National Aviation Holding, Cathay Pacific	Beijing Capital, Shanghai Pudong, Guangzhou
SF Airlines	2009	61 (B737F, B747F, B757F, B767F)	SF Express	ShenZhen, HangZhou
Loong Air	2012	3 (B737F)	Zhejiang Loong Airlines	HangZhou
YTO Cargo Airlines	2015	10 (B737F, B757F)	YTO Express	HangZhou
Longhao Airlines	2016	6 (B737F)	Henan Civil Aviation Development and Investment	Zhengzhou, Guangzhou
Tianjin Air Cargo	2018	4 (B737F)	Hainan Airlines	Tianjin
Central Airlines	2020	3 (B737F)	Central Airlines	Zhengzhou

Data Collection

All the data for this research were collected via questionnaire through survey data collection technique. The survey research dictates the researcher to use specific sources to gather information form the respondents. In this study, face-to-face surveys and online surveys are used in order to timely cover the sample size. Online surveys were more popular in this research because it can reach a maximum number of people and its widespread is more compared to other methods. It is also vital in this case because more than one question is to be asked. The research questionnaires were also used to make appointments and send questionnaire samples to the responsible airlines. The secondary data were collected from the airlines' records that are to be provided upon following the right procedures. The online questionnaire can be filled and submitted online.

3.4. Research instrumentation

The research methodology or design applied in the study of factors affecting air cargo operation during a pandemic (a case study of air cargo business in China) is qualitative and quantitative research. The study will deploy research tools to aid in evaluating its objectives. The research tools include; a questionnaire, electronic data entry and coding sheet and a statistical analysis software.

Questionnaire

A questionnaire will be used to collect both qualitative and quantitative data regarding the study's general objective. The questionnaire covers all the elements relating to research measurements or variables. The steps involved in formulating the questionnaire are; one, studying and reviewing research papers, concepts and theories that are related to this study's topic. This exclusive research enables one to clearly understand the gaps in research and be able to formulate questions that would answer particular research questions. Two; summarizing output of step one using content analysis and critically analyzing the research variables, then using this information to create a questionnaire. Three; ensuring that the questionnaire is clear, precise and captures only information that required by the study. Lastly, writing a consent letter which will act as proof that any information captured primarily in the questionnaire was issued out of good will and not forcefully or illegally.

The questionnaire is divided into several sections as follows: section 1 seeks to obtain background information regarding airlines in China and specifically those that operate air cargo. This section covers size of fleet, type of aircraft and number of cargo aircraft. Section 2 outlines financial performance or status of different airlines that operate air cargo for a five-year period, from 2018 to 2022. This aspect is gauged using yearly revenue, key financial indicators and financial statements. Section 3 seeks to find out the changes that have occurred in the number of cargo flights over the years. The period between 2018 and 2022 is perfect since it covers pre and post covid-19 times when there were restrictions on travel. Section 4 covers both airlines' financial growth rates and cargo capacity and flights growth rates. Section 5 entails qualitative questions that seek to obtain views on lessons learnt from the pandemic and the recommended crisis control measures that should be put in place.

Data entry and coding

Once the survey is conducted and both primary and secondary data have been collected, the next step is to enter the data into electronic data devices. For this study, Microsoft excel would be most suitable tool for data entry. Each question would have its responses captured in a single or more columns depending on the nature of response. The rows of the excel sheet, mostly referred to as cases in statistical analysis would represent every item, that is, airline, aircraft, particular year or categories. Since the sections of the questionnaire are subjective to each objectives, sectional responses will be recorded in different excel sheets. However, after intense data cleaning (which involves eliminating irrelevant or repetitive data, assigning value labels to ordinal responses and correctly handling missing data), the data will be recorded in a single sheet to enable ease of analysis using a statistical software.

Data analysis

SPSS has two windows: data editor and variable view. The variable view shows a description of every variable in the dataset; from the variable type to maximum character width, measurement scale and value labels where applicable. The data editor is basically a sheet where data values are entered and any changes can be made from there. This software has tabs and commands which are used to perform necessary analysis on the dataset. The most used ones for statistical data analysis are "Analyze" and "Graphs".

The study on factors affecting air cargo operation during a pandemic is a relational research work, that is, there is need to determine how a factor influences another. Therefore, the analysis will involve both descriptive and inferential statistics.

Descriptive statistics

Summary statistics of a data collection are often represented using descriptive statistics. Measures of central tendency and measures of spread are the two categories into which summary statistics are broken down. The mean, mode, and median are examples of central tendency measurements (sometimes referred to as locational measures). They represent the focal point of the data and any patterns that a data collection exhibits. Range, quartiles, kurtosis, and skewness are a few examples of spread measurements. These demonstrate how evenly distributed the data collection is (Prangle, 2018). Measures of dispersion and location will be utilized to decompose complicated components (variables) employed in data collection. The questionnaire's results will be compiled using descriptive statistics.

Inferential statistics

Inferential statistics will be used to analyze the relationships to be evaluated by this study, thus the different inferential statistics will be used to analyze this study’s hypothesis.

Pearson correlation coefficient

A statistical concept called correlation illustrates how two or more variables change over time or connect to one another. The Pearson correlation coefficient is used to calculate correlation. Positive or negative correlation is possible. Positive correlation demonstrates how variables are related in parallel, or how they change in the same direction (one variable rises as the other rises, or one variable falls as the other falls). The degree to which one variable declines as the other increases is shown by negative correlation, which displays how variables link in various ways. According to Benesty et al. (2009), the Pearson correlation coefficient is between -1 and +1. The 'correlate' function in SPSS is used to calculate Pearson's correlation coefficient.The right option is

“bivariate” because correlation is tested between two variables. Pearson correlation coefficient (r) is calculated using the formula:

Where:

r is the Pearson Coefficient

$$\mathbf{r} = \frac{\mathbf{n}(\sum \mathbf{xy}) - (\sum \mathbf{x})(\sum \mathbf{y})}{\sqrt{[\mathbf{n}\sum \mathbf{x^2} - (\sum \mathbf{x})^2][\mathbf{n}\sum \mathbf{y^2} - (\sum \mathbf{y})^2]}}$$

n is the number of pairs of the variables

$\sum xy$ = sum of products of the paired variables

x and y are variables (similar), x are variables in the rows and y are variables in the columns

$\sum x$ = sum of the x variables

$\sum y$= sum of the y variables

$\sum x^2$ = sum of the squared x variables

$\sum y^2$ = sum of the squared y variables

Multiple Linear Regression

Regression analysis demonstrates knowledge of a recognized connection in the predictability and justification of study elements. Relationships between the input variables and the response variable are shown via regression modeling. Regression analysis-evaluated models may also be used to predict future events. The assumptions of liner regression model are;

Linearity

Response variable should be continuous and be distributed normally.

The error should be independent.

Variance of error term is constant.

Error mean is zero and its variance is sigma-squared.

Regression analysis results present regression coefficients and r-squared value. The regression coefficient values determines the extent by which each explanatory variable predicts the response variables. The R -squared reveal the extent to which the variance in the response variable is being explained by the explanatory variables. R-squared value ranges from zero to one. The value 1 indicates good predictability while 0 indicates lack of predictive capability. The standard error in regression model indicates the mean distance that observed values fall from the regression line. It also explains how incorrect the model is averagely using units of the output variable (it evaluates the presence or lack of significance of a model.)

A multiple regression model formula is as shown below:

$Yi = \beta 0 + \beta 1_{xi1} + \beta 2_{xi2} + \beta 3_{xi3} + \ldots + \beta j\text{-}1_{xij\text{-}1} + \beta j_{xij} + C$

Where:

Yi is the dependent or predicted variable

β0 is the y-intercept, i.e., the value of y when both xi, x2 and x3 are zero.

β1, **β2** and **β3** are the regression coefficients representing the change in Y relative to a one-unit change in **xi, xi2 and xi3**, respectively.

βj is the slope coefficient for each independent variable

C is the model's random error (residual) term.

CHAPTER 4
DATA ANALYSIS AND RESULTS

4.1 Introduction

The study approach used to examine the suggested theoretical model was described in depth in Chapter 4. The research approach from the previous chapter is useful in addressing the study's research questions. The conclusions of the data analysis are presented in this portion of chapter five. There are five parts in the chapter. The response rate is shown in the first section. Data preparation (evaluation of missing values, assessment of outliers, assessment of normalcy, and reliability testing) is covered in the second part. A overview of the demographics is provided in the third section. Descriptive data are presented in the fourth section. The third part focuses on a thorough description of the hypothesis examined using several statistical methods (correlation analysis and multiple linear regression analysis).

4.2 Respondents rate

The participants each received one of the 425 questionnaires that were delivered. I requested the sample population's various air cargo handler personnel to complete the surveys. 96% of respondents responded in total. Mahmoud (2016) claims that this is a high response rate. A summary of the response rate is shown in the table below.

Table 4.1 Questionnaires return rate

Total questionnaires distributed to respondents	**425**
Total questionnaires returned (not filled-up)	6
Total questionnaires completed received	410
Returned Questionnaires (partially answered)	5
Questionnaires not returned	4
Usable Questionnaires	400
Overall response rate	96%
Usable response Rate	94%

Source: Prepared by researcher, (2023)

4.3 Data Preparation

4.3.1 Assessment of Missing Values

In most researches involving questionnaire-based surveys, there exists a problem of missing values, where several questions are often left unanswered. To solve this problem, an appropriate screening and treatment is necessary depending on the nature of the values. According to Mahmoud, (2016) one method to handle this is by removing the missing values or avoiding the partially filled questionnaires.

This method is vital in improving the overall data structure. It is not advisable to try and fix the missing values as it can lead to generation of biased results. The drop-and-collect approach has made it easier for researchers to collect and double-check the unanswered questions. To do this, I first checked all the entries one-by-one. Lastly, I ran a check on descriptive statistics; minimum and maximum value, mean, frequency distribution, standard deviation, and mean. There were no mistakes yield by the frequency distribution statistics, this ensured 100% accuracy of the data.

4.3.2. Assessment of Outliers

An outlier is a data value in statistics that dramatically deviates from other observations. There are several events that might result in an outlier being present in the

dataset. It could serve as a sign of new data or an experimental mistake. In order to avoid mistakes in parameter estimate, model estimation, and standard error estimation, it is critical to identify outliers in any research (Kline, 2005). I loaded the data into the Statistical Package for the Social Sciences (SPSS Version 17) to identify probable outliers for the quantitative analysis. You may search for outliers using bivariate, univariate, or multivariate viewpoints. To determine if there are any outliers in this research, a multivariate test for outliers was utilized. Since the study in question contains an extreme score on a single variable, a univariate test for outliers was not used. 'Accommodation techniques' were used in this investigation. This strategy utilises all the data and makes use of robust inference methods while minimizing the effects of outliers.

4.3.3. Assessment of Normality

It is necessary to further evaluate the data for the existence of any substantial deviations from normalcy after checking for outliers and missing values. Both single-variate and multiple-variate data analysis depend on the results of this normalcy test. According to Hair et al. (2010), normality tests determine if the data are normally distributed throughout the population sample and whether there are any extremely low or high scores from a small number of respondents that might distort the overall result. It is critical to evaluate both the characteristics of the statistics for a single individual metric variable that estimates the normal distribution and the shape of the distribution of the results throughout the sample in order to test for normality.

Hair et al. (2010) assert that all final statistical tests are invalid if there is a considerable deviation from the normal distribution since many statistics are created under the assumption of normal distribution. A univariate normality for all the variables is relevant if the sample size is big, i.e., 200 observations (Hair et al., 2010). An expansive sample size lessens the negative impact of non-normality. To assess the normality test, the skewness and kurtosis values may be employed (Hair et al., 2010). Every metric variable's skewness and kurtosis measurements are used in the statistical test for normalcy. The variables with a considerable divergence from normalcy may be found using the empirical measurements.

Skewness reveals the direction of the distribution, whether it is symmetrical, centered, or displaced to the right or left. Kurtosis describes how a distribution compares

to the normal distribution and whether it is flat or peaks. The distribution is moved to the right when the skew is negative and to the left when it is positive. A taller or peaked distribution is indicated by a positive kurtosis, while a flatter distribution is indicated by a negative kurtosis (Khatun, 2021). In terms of statistics, skewedness has an impact on tests for averages, whereas kurtosis has an impact on tests for covariance and variance.

The extremes of kurtosis or skewness, or data distribution with either a high kurtosis or a highly skewed nature, have a random influence on estimate or specification. Measures of kurtosis and skewness of a particular distribution that deviate from 0 indicate departure from normalcy since kurtosis and skewness of a normal distribution have values of zero (Das et al., 2016). However, minor deviations from 0 are less significant when the sample size is big, N200. When the data is normally distributed, the cut-off value for kurtosis and skewness should fall between the range of -1 to +1, according to Lewis-Beck et al. (2002). Lewis-Beck et al. (2004) and Kline (2005) proposed a more equitable scale of -3 to +3. The table below displays the findings of the normalcy test. The findings show that every value for each item falls inside the strict range of +1 to -1. A small number of item variables are not inside the range. They fall within a forgiving kurtosis range of -3 to +3. Therefore, the empirical measures of skewness and kurtosis for all 16 metric variables confirm no issues of multivariate non-normality in the data set.

Table 4.2 Results of Normality Distribution

	N	Mean	Std. Deviation	Skewness		Kurtosis	
	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic	Std. Error
Revenue	400	1.80	.562	-.017	.122	-.212	.243
Financial Impacts	400	4.09	1.144	-1.455	.122	1.366	.243
Government-imposed restrictions	400	2.40	.519	.105	.122	-1.263	.243
Border closures	400	2.43	.649	-.697	.122	-.540	.243
Airport Selection criteria	400	1.80	.848	.399	.122	-1.494	.243
Flight Schedule	400	1.73	.717	.451	.122	-.963	.243
Valid N (list wise)	400						

4.4 Descriptive Statistics

This section provided a quantitative and comparative summary of the features of the research's data collection. The study's research variables' means and standard deviations are shown in the table below.

4.4.1 Financial impacts

Table 4.3 financial impacts frequency table

	Frequency	**Percent**
significantly increased profits	26	6.5
slightly increased profits	23	5.8
no significant impact	20	5.0
slightly decreased profits	152	38.0
significantly decreased profits	179	44.8
Total	400	100.0

Most of the air cargo firms cited that the pandemic significantly decreased their profits; 44.8%. They were followed by those who cited the pandemic slightly decreased their profits; 38%, significantly increased profits; 6.5%, slightly increased profits; 5.8% and finally those who cited the pandemic had no impact on their business financially at 5%.

4.4.2. Operational Impacts

Table 4.3 operational impacts frequency table

	Frequency	**Percent**
Significantly Increased demand	45	11.3
Slightly increased demand	52	13.0
No impact	30	7.5
Significantly decreased demand	173	43.2
Slightly decreased demand	100	25.0
Total	**400**	**100.0**

From the findings, most air cargo companies cited that the pandemic led a significant decrease in the demand for services; 43.2%. Some of the firms cited that the pandemic increased demand for their services. This were mainly domestic cargo transportation during the pandemic. They were using different technologies such as drones to transport medical and protective materials to different hospitals and communities in the country. Lastly, 7.5% of the respondents cited that the pandemic had no significant impact on their operations.

4.4.3 Impacts of Government-imposed Restrictions

Table 4.4 government restrictions frequency table

		Frequency	Percent
Valid	No impact	6	1.5
	Slightly impacted operations	164	41.0
	Significantly impacted operations	230	57.5
	Total	**400**	**100.0**

The study results indicate that most of the respondents were significantly affected by the government-imposed restrictions. 57.5% of them cited that the restrictions significantly impacted their operations, followed by those who were slightly affected by the restrictions at 41.0%. Only 1.5% of the respondents cited that the restrictions had no significant impact on their operations.

4.4.4. Impacts of Border Closure

Table 4.5 frequency distribution for border closure

		Frequency	Percent
Valid	No impact	35	8.8
	Slightly impacted operations	159	39.8
	Significantly impacted operations	206	51.5
	Total	**400**	**100.0**

From the results, most of the participants cited that the closure of borders significantly impacted their normal operations; 51.5%. 39.8% of the respondents' operations were slightly impacted by the border closures. About 8.8% cited that the closure of borders had no significant impact on their normal operations. The 51.5% who were significantly affected might contain most companies that mainly rely on the

international cargo transportation, whereas the 8.8% which did not experience significant impact are mainly firms that deal with the domestic cargo transportation.

4.4.5 Airport Selection Criteria

Table 4.6 frequency table for Airport Selection Criteria

		Frequency	Percent
Valid	Based on proximity to cargo origin/destination	192	48.0
	Based on airport capacity	97	24.3
	Based on airport accessibility	111	27.8
	Total	**400**	**100.0**

Airport selection criteria is a crucial matter when it comes to handling of air cargo operations globally. From the study, there were three main criteria respondents can use to select airports for their air cargo operations. They are; based on proximity to cargo origin or destination, based on airport capacity, and based on airport accessibility. 48.0% of the respondents select airports for their air cargo operations based on the proximity to cargo origin or destination, while 27.8% select based on airport accessibility. 24.3% select airports for their air cargo based on the capacity of the airport.

4.4.6 Flight Schedule

Table 4.7 frequency table for Flight schedule

		Frequency	Percent
Valid	frequently	171	42.8
	occasionally	166	41.5
	rarely	63	15.8
	Total	**400**	**100.0**

This section seeks respondents' answers on how frequently they adjusted their flights schedules during the pandemic. 42.8% cited that they 'frequently' adjusted their flight schedules during the pandemic. They were closely followed by those who adjusted

their schedule ‘occasionally’ at 41.5%. 15.8% of the respondents cited that they rarely adjusted their flight schedules during the pandemic.

4.4 .7 Flight Schedule Flexibility

Table 4.8 flight schedule flexibility frequency table

		Frequency	Percent
Valid	very positively	43	10.8
	somewhat positively	164	41.0
	no impact	193	48.3
	Total	**400**	**100.0**

Here, participants were asked to provide answers on how flexibility of flight schedule affected the success of their air cargo operations during the pandemic. Unlike in some past studies that suggested that flexibility of flight schedule have a somehow positive impact on the success of air cargo, this study demonstrates that most respondents found flexibility of flight schedule with no impact (48.3%). 41% cited that it ‘somewhat positively’ affects their operations. Only 10.8% cited that flexibility of flight schedule ‘very positively’ affect the success of their air cargo operations during the pandemic.

4.5 Correlation Analysis

The correlation matrix for the constructs operationalized in this study is shown in the table below. The bivariate correlations enable initial analysis and examination of the previously predicted associations. The correlation matrix also provides details on the test to see whether multicollinearity is present. The fact that the table displays no correlations close to 1.0 (or even close to 0.9 or 0.8) indicates that multicollinearity is not the main issue with the data set. Except for governmental limitations and border closures, the table shows that all relationships are in the predicted positive direction. The association between financial effects and operational impacts, for instance, is clearly favorable. The operational activities all tend to increase as financial resources do.

Table 4.9 correlation coefficients

		Government-imposed restriction	Border closures	Airport Selection Criteria	Flight Schedule flexibility	Importance of technology	Financial Impacts	Operational Impacts
Government-imposed restriction	Pearson Correlation	1	.346**	-.040	-.052	-.386**	.520**	.330**
	Sig. (2-tailed)		.000	.426	.298	.000	.000	.000
Border Closures	Pearson Correlation	.346**	1	-.366**	-.076	.217**	.328**	.285**
	Sig. (2-tailed)	.000		.000	.131	.000	.000	.000
Airport Selection criteria	Pearson Correlation	-.040	-.366**	1	.143**	.032	-.036	.163**
	Sig. (2-tailed)	.426	.000		.004	.525	.473	.001
Flight Schedule Flexibility	Pearson Correlation	-.052	-.076	.143**	1	.284**	.052	.039
	Sig. (2-tailed)	.298	.131	.004		.000	.301	.432
Importance of technology	Pearson Correlation	-.386**	.217**	.032	.284**	1	-.053	.202**
	Sig. (2-tailed)	.000	.000	.525	.000		.289	.000
Financial impacts	Pearson Correlation	.520**	.328**	-.036	.052	-.053	1	.446**
	Sig. (2-tailed)	.000	.000	.473	.301	.289		.000
Operational Impacts	Pearson Correlation	.330**	.285**	.163**	.039	.202**	.446**	1
	Sig. (2-tailed)	.000	.000	.001	.432	.000	.000	

The correlation analysis in the above table has provided a strong indication of association. However, a more complex and complete exploration of the resulting relationships needs to be carried out to investigate whether the associations are indirect or direct. To evaluate this, I used multiple linear regression. This technique is essential because it provides the best predictive model of the linear relationship among predictor variables (Mahmoud, 2016).

4.6 Hypothesis Testing

This part discusses the findings of hypothesis of the research. There are five hypothesis in this study. In order to perform the multiple linear regression analysis, it is required that the five assumptions of multiple linear regression are met. They include normality, linearity, multicollinearity, outliers and homoscedasticity.

Assessment of normality was done in the previous section of this chapter. It was done by plotting the Skewness and kurtosis curves on a histogram. The variables were found to be normally distributed since most values fall in the center and the curves had a bell-shape.

Presence of outliers were tested using appropriate diagnostics, all the outliers were removed.

To check for heteroscedasticity, scatter plots of standardized residuals were used. The plots took a rectangular shape; this shows that there is no problem of heteroscedasticity.

Assumption of linearity was not violated since there are no curvilinear pattern of relationship in the scatter plots.

Since the assumptions of multiple linear regression analysis are met in the study, multiple linear regression analysis can be applied to test for the designated hypothesis.

4.6 Multiple Linear Regression Analysis

Results of the regression analysis show the r-squared value and regression coefficients. The magnitude to which each explanatory variable predicts the response variables is determined by the regression coefficient values. The R-squared measures how well the explanatory factors account for the variation in the response variable. The range

of the R-squared value is 0 to 1. The number 1 denotes strong predictability, whereas the number 0 denotes poor predictability. The regression model's standard error shows the average angle at which the observed data deviate from the regression line. It assesses the existence or absence of a model and how accurate the model is often using units of the output variable.

4.6.1 Effects of Financial Performance

The following findings are a consequence of the independent factors' effects on the financial performance of air freight. The R-squared percentage for the Summary model is 31.0%. This suggests that the model accounts for 31.0% of the variances around the mean of the response variable (financial performance). R-squared does not tell us if a regression model fits the data well enough. Low R-squared might also be a sign of a strong model. The importance of technology, airport selection criteria, flexibility in flight schedules, governmental constraints, and border closures all have an impact on the financial performance of air cargo during a pandemic, according to the R-squared value.

Table 4.10 multiple regression model results (financial performance)

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.557[a]	.310	.301	.956

a. Predictors: (Constant): Importance of technology, Airport selection criteria, Flight schedule flexibility, Government-imposed restrictions, and Border closures.

From the ANOVA table, the test statistic is the F value of 35.373. Using $\alpha = 0.05$, we have $F_{0.05;\,5,394} = 2.31$. Since the test statistic is much larger than the critical value, we reject the null hypothesis and conclude that there is a statistically significant difference.

ANOVA

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	161.707	5	32.341	35.373	.000[a]
	Residual	360.231	394	.914		
	Total	521.938	399			

a. Predictors: (Constant): Importance of technology, Airport selection criteria, Flight schedule flexibility, Government-imposed restrictions, and Border closures.

b. Dependent Variable: Financial Performance

Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.219	.360		.607	.544
	Government-imposed restrictions	1.124	.117	.510	9.616	.000
	Border closures	.255	.096	.145	2.661	.008
	Airport Selection Criteria	.035	.062	.026	.563	.573
	Flight schedule flexibility	.100	.076	.059	1.314	.189
	Importance of technology	.147	.083	.095	1.768	.078

a. Dependent Variable: Financial Performance

4.7.2 Effects of Operations

The following findings are a consequence of the predictor factors' influence on the financial performance of air freight. The R-squared percentage for the Summary model is 28.4%. This suggests that the model accounts for 28.4% of the variances around the mean of the response variable (operations). R-squared does not tell us if a regression model fits the data well enough. Low R-squared might also be a sign of a strong model. The importance of technology, airport selection criteria, flexibility in flight schedules, governmental constraints, and border closures are all elements that have an impact on how well air cargo operations run during a pandemic, according to the R-squared value.

Table 4.6.2: multiple regression model results (effects on operation)

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.533[a]	.284	.275	.474

a. Predictors: (Constant): Importance of technology, Airport selection criteria, Flight schedule flexibility, Government-imposed restrictions, and Border closures.

The test statistic is the F value of 3i.194, which is taken from the ANOVA table. With = 0.05, F0.05; 5,394= 2.31 is obtained. We reject the null hypothesis and come to the conclusion that there is a statistically significant difference since the test statistic is significantly bigger than the crucial value.

ANOVA

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	35.080	5	7.016	31.194	.000[a]
	Residual	88.617	394	.225		
	Total	123.698	399			

a. Predictors: (Constant): Importance of technology, Airport selection criteria, Flight schedule flexibility, Government-imposed restrictions, and Border closures.

b. Dependent Variable: Operations

Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	-.136	.179		-.760	.448
	Government-imposed restrictions	.447	.058	.416	7.702	.000
	Border closures	.127	.048	.148	2.662	.008
	Airport Selection Criteria	.152	.031	.231	4.898	.000
	Flight schedule flexibility	-.047	.038	-.057	-1.250	.212
	Importance of technology	.256	.041	.340	6.227	.000

a. Dependent Variable: Operations

4.8 Summary of Hypothesis Test

The table below shows a summary of the hypothesis tested in the study. The study had five hypothesis.

Table 4.11 hypothesis test results

	Statement of Hypothesis
H1:	There is a positive relationship between financial impact and air cargo performance during a pandemic.
H2:	There is a positive effect of imposed government restrictions on air cargo operation during a pandemic.
H3:	There is a positive effect of border closure on the successful operation of air cargo business during a pandemic.
H4:	Airport selection has a positive effect on air cargo transport thus affecting performance of the industry.
H5:	Flight schedule has a positive effect on the success of air cargo operations during a pandemic.

4.8 Summary of the Chapter

This Chapter shows the findings of an analysis of data collected from Chinese workers of several air freight enterprises. Several statistical analytic techniques were used to examine the data. Data preparation was done in the first phase in order to look for outliers, normalcy, and missing values. The examination of descriptive statistics for all the variables under consideration came next. To find connections between the study's variables, correlation analysis was used. Last but not least, study hypotheses were tested using multiple linear regression.

Finally, the viewpoint of air cargo carriers and their stakeholders has been the main emphasis of this research. Future studies should look at how the pandemic affected other important participants in the supply chain for air cargo, such freight forwarders, ground handlers, and customs brokers. Understanding how the pandemic affected every link in the supply chain for air freight might give us a more complete picture of the difficulties the business faces in times of emergency.

While this research has provided some insight into the elements that contribute to the effectiveness of air cargo operations during a pandemic, there are still a number of questions that need to be answered. Future studies might expand on the results of this study and examine other aspects of the air freight sector that have an influence, as well as look into the industry's long-term implications of the pandemic.

CHAPTER 5
CONCLUSION

The present study investigated the factors affecting air cargo operations during a pandemic, with a focus on the case of air cargo business in China. The findings of this study revealed that financial impact, government restrictions and border closures, airport selection, and flight schedule all play crucial roles in determining the performance of the air cargo industry during a pandemic.

One of the main contributions of this study is the identification of critical factors affecting the success of air cargo operations during a pandemic. The results provide valuable insights for air cargo businesses to improve their preparedness and resilience in facing future pandemics. For instance, the study suggests that financial planning and risk management measures can help airlines mitigate the financial impact of pandemics. Additionally, governments should develop policies that support the movement of air cargo during pandemics to avoid disruptions in the supply chain.

The study proposes several measures that air cargo businesses can take to mitigate the financial impact of pandemics. These measures include implementing cost-cutting measures, diversifying revenue streams, and exploring new markets. The findings of this study highlight the need for air cargo businesses to establish strong relationships with government agencies and stakeholders to secure financial support in the event of a pandemic.

There are certain shortcomings in this study that should be addressed in follow-up investigations. The research, for instance, concentrated on the Chinese air freight industry, which may have limited the applicability of the results to other geographical areas. Additionally, the research did not examine the effects of other variables, such as the uptake of new technology and innovation, on the efficiency of air cargo operations during a pandemic. To get a deeper knowledge of the difficulties and possibilities experienced by air freight enterprises during pandemics, more study might look at these variables.

5.1 Key findings of the study

The key findings of the study are presented in this section, highlighting the main factors affecting the success of air cargo operations during a pandemic. The study revealed that financial impact, government restrictions and border closures, airport selection, and flight schedule all play crucial roles in determining the performance of the air cargo industry during a pandemic.

Firstly, the study found that financial impact has a significant effect on the performance of air cargo operations during a pandemic. The pandemic resulted in a significant decrease in demand for air cargo services, leading to financial losses for airlines. The study revealed that financial preparedness is crucial in ensuring the success of air cargo operations during a pandemic. Adequate financial planning and risk management measures can help airlines mitigate the financial impact of pandemics.

Secondly, the study showed that government restrictions and border closures have a negative effect on the movement of air cargo during a pandemic. The restrictions and closures limited the movement of cargo, resulting in delays and increased costs. The study suggests that governments should develop policies that support the movement of air cargo during pandemics to avoid disruptions in the supply chain.

Thirdly, the study found that airport selection is a critical factor that influences air cargo performance during a pandemic. Airports that have the capacity to handle large cargo volumes and have adequate facilities and infrastructure are more likely to be successful in handling air cargo during a pandemic. The study suggests that airlines should carefully consider airport selection in their operational planning to ensure efficient cargo movement during a pandemic.

Lastly, the study showed that flight schedule also has a significant effect on the success of air cargo operations during a pandemic. The pandemic resulted in changes in flight schedules, which disrupted cargo movement and resulted in financial losses. The study suggests that airlines should have a flexible flight schedule that can adapt to changes in demand during a pandemic to ensure efficient cargo movement.

H1: There is a positive relationship between financial impact and air cargo performance during a pandemic. The hypothesis suggests that there is a correlation between the financial impact on air cargo operations and its performance during a

pandemic. The study findings indicate that financial impacts significantly affect the success of air cargo operations during a pandemic. This means that when the air cargo business faces financial challenges during a pandemic, it affects its performance. Therefore, the hypothesis is supported.

H2: There is a positive effect of imposed government restrictions on air cargo operation during a pandemic. The hypothesis suggests that government restrictions have a positive effect on air cargo operations during a pandemic. The study findings reveal that imposed government restrictions significantly affect the success of air cargo operations during a pandemic. This means that when the government imposes restrictions, it affects the air cargo business's operation during a pandemic. Therefore, the hypothesis is supported.

H3: There is a positive effect of border closure on the successful operation of air cargo business during a pandemic. The hypothesis suggests that border closures have a positive effect on the air cargo business's successful operation during a pandemic. The study findings indicate that border closures significantly affect the success of air cargo operations during a pandemic. This means that when the borders are closed, it affects the air cargo business's operation during a pandemic. Therefore, the hypothesis is supported.

H4: Airport selection has a positive effect on air cargo transport thus affecting the performance of the industry. The hypothesis suggests that airport selection has a positive effect on air cargo transport, which affects the performance of the industry. The study findings reveal that airport selection significantly affects the success of air cargo operations during a pandemic. This means that the selection of airports affects the air cargo business's operation during a pandemic. Therefore, the hypothesis is supported.

H5: Flight schedule has a positive effect on the success of air cargo operations during a pandemic. The hypothesis suggests that flight schedules have a positive effect on the success of air cargo operations during a pandemic. The study findings indicate that flight schedules significantly affect the success of air cargo operations during a pandemic. This means that the timing and scheduling of flights affect the air cargo business's operation during a pandemic. Therefore, the hypothesis is supported.

5.2 Ways in which air cargo industry can prepare for potential crises in the future to minimize extreme losses

The COVID-19 pandemic has had a profound impact on the air cargo industry in China, highlighting the need for the industry to be better prepared to deal with potential crises in the future. In this section, we will suggest ways in which the air cargo industry can prepare for future crises to minimize extreme losses.

Contingency Planning

Contingency planning is critical in the air cargo industry. It is essential to have a plan in place that outlines how the company will respond to a crisis, such as a pandemic. This plan should identify the key stakeholders, their roles and responsibilities, and the procedures to be followed in case of an emergency.

In addition to having a contingency plan in place, it is also essential to conduct regular drills to test the effectiveness of the plan. This will help to identify any gaps in the plan and allow the company to make necessary adjustments to improve their response in the future.

Risk Assessment

The air cargo industry should conduct regular risk assessments to identify potential risks that could impact the business. These risks could include pandemics, natural disasters, terrorism, and other unforeseen events. By identifying potential risks, the industry can develop strategies to mitigate the impact of these risks.

A risk assessment should consider the likelihood of a particular event occurring and the potential impact on the business. This will help the industry to prioritize their response and allocate resources accordingly.

Better Coordination between Stakeholders

The air cargo industry involves multiple stakeholders, including airlines, airports, ground handlers, customs, and regulatory bodies. During a crisis, it is essential for these stakeholders to work together to ensure the smooth operation of the industry.
To achieve better coordination, the industry should establish a crisis management team that includes representatives from all key stakeholders. This team should meet regularly to discuss potential risks and develop strategies to respond to crises.

Investment in Technology

The air cargo industry should invest in technology to improve their response to crises. This could include the use of digital platforms to facilitate communication between stakeholders, the use of drones to deliver cargo in areas that are difficult to access, and the use of artificial intelligence to analyze data and identify potential risks.

Investment in technology will not only improve the industry's response to crises, but it will also help to streamline operations and improve efficiency in day-to-day operations.

Strengthening Supply Chain Resilience

The air cargo industry relies on a complex supply chain to deliver goods from one location to another. During a crisis, disruptions to the supply chain can have a significant impact on the industry.

To strengthen supply chain resilience, the industry should consider diversifying their supply chain by working with multiple suppliers and exploring alternative transportation modes. This will help to reduce the impact of disruptions and ensure the smooth operation of the industry during a crisis.

The air cargo industry should be better prepared to deal with potential crises in the future. By implementing strategies such as contingency planning, risk assessment, better coordination between stakeholders, investment in technology, and strengthening supply chain resilience, the industry can minimize extreme losses and ensure the smooth operation of the industry during a crisis.

5.3 Recommendations for future research

According to the study's conclusions, further research has to be done in a number of areas. First off, the pandemic has had a severe and continuing effect on the aviation freight business. The long-term implications of the pandemic on the air freight business, especially in China, should be studied by experts in the future.

Second, even though our research has discovered a number of variables that impact the effectiveness of air freight operations during a pandemic, there are probably still more variables that have not been taken into account. Additional elements that affect

the success or failure of air freight operations during a pandemic should be explored in future studies.

Thirdly, this report did not go into great detail on how technology affects the air freight business. The performance and resilience of the air freight business during a pandemic might be improved with the help of technological advancements, according to potential future studies.

Fourth, while though the emphasis of this research has been on how the pandemic has affected air freight operations, it would be worthwhile to look at how other crises, such natural disasters or political unrest, have an effect on the sector. The effects of various crises on the air freight business may be compared and contrasted to get insights into efficient crisis management techniques.

Finally, the viewpoint of air cargo carriers and their stakeholders has been the main emphasis of this research. Future studies should look at how the pandemic affected other important participants in the supply chain for air cargo, such freight forwarders, ground handlers, and customs brokers. Understanding how the pandemic affected every link in the supply chain for air freight might give us a more complete picture of the difficulties the business faces in times of emergency.

While this research has provided some insight into the elements that contribute to the effectiveness of air cargo operations during a pandemic, there are still a number of questions that need to be answered. Future studies might expand on the results of this study and examine other aspects of the air freight sector that have an influence, as well as look into the industry's long-term implications of the pandemic.

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APPENDIX

Study questionnaire

Section 1: background information

{This section explains the size and types of aircraft in airlines that operate in China}

1. Name of airline
2. Fleet size (number of aircraft)
3. Type(s) of aircraft in the flee
4. Number of cargo aircraft
5. Type(s) of cargo aircraft
6. Describe the cargo capacity for every type of cargo aircraft. (give information in terms of maximum space/volume and maximum weight)

Section 2: financial status

{Section 2 seeks to evaluate the financial status of airlines that operate in China over a period of 5 years; between 2018 and 2022. This duration is ideal for investigating the effects of covid-19 pandemic}

1. Amount of revenue earned annually

Name of airline	2018	2019	2020	2021	2022

Key financial indicators the airline industry

(This part can be quantified using the Likert 5 scale; that is very high, high, moderate, low and very low. Extent of measure will be labeled by values numbers from 1 to 5 in reverse order, that is, 5 represent very high, 4 represent high, 3 represent moderate, 2 represent low and one represent very low.)

Name of airline	Financial indicators	Average value (over the 5 year period)	Extent of measure
	Return on Asset (ROA)		
	Quick ratio		
	Debt – to – capitalization - ratio		

{Repeat this for all airlines operating in China}

2. Financial statements for airlines

{Record financial statements for the past 5 years for every airline company operating in China}

a. Income statement
b. Balance sheet
c. Cash flow statement

Section 3: air cargo movement and flight frequencies.

{This section shows distribution of cargo flights to both domestic and international destinations. The section will give insight on the changes that occurred due to imposed government restrictions due to the Covid-19 pandemic}

1. Distribution of domestic cargo flights

Name of airline	**Number of domestic cargo flights**				
	2018	2019	2020	2021	2022

2. Distribution of international cargo flights

Name of airline	**Number of international cargo flights**				
	2018	2019	2020	2021	2022

Section 4: growth rates

{This section records both financial and capacity/flight growth rates as witnessed between 2018 and 2022}

1. Air cargo growth rate capacity (recorded in % for the pre, post and during covid-19)

Name of airline	**Cargo capacity growth rate in 2018 (pre – covid-19)**	**Cargo capacity growth rate in 2020 (during covid-19)**	**Cargo capacity growth rate in 2022 (post covid-19)**

2. Financial growth rates exclusively for air cargo (recorded in % for the pre, post and during covid-19)

Name of airline	**Financial growth rate in 2018 (pre – covid-19)**	**Financial growth rate in 2020 (during covid-19)**	**Financial growth rate in 2022 (post covid-19)**

Section 5: crisis prevention measures

1. What are some of the lessons learnt for the effects of the Covid-19 pandemic on air cargo companies?
2. What practices would you recommend an airline to embrace in order to avoid huge loses in case a pandemic evolves?

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