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Digital Transformation of Air Cargo: Barriers and Opportunities

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Abstract

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The topic of this thesis is digital transformation of air cargo, and this research aims to identify drivers and barriers of change as well as solutions for the future. Main themes of this research have been visible in form of new innovations, articles and researches as well as from an industry bodies such as IATA, for some years now. There have been efforts within the air cargo industry to move towards a more digital world, but still adaptation lags behind and funding is limited. At the same time e-commerce and COVID-19 are transforming the air cargo industry with challenges requiring rapid changes.

Literature review of this research consists of knowledge on air cargo and air cargo supply chain, first providing knowledge of the value of air cargo, forces and constraints for growth followed by introduction the common concepts, processes and stakeholders. Most importantly, literature review explains the data transfer within the air cargo supply chain and provides some examples of future digitalization of the air cargo industry. Literature review is based on industry articles and researches conducted.

Research methodology consists of qualitative in-depth interviews conducted with aviation industry professionals, with decades of experience from different parts of the air cargo supply chain. Interviews were conducted during the fall of 2020 and sample size for this research was five participants.

Based on the results from the interviews, the most common drivers of change were the rapid rise of e-commerce and the current COVID-19 pandemic. Most notable problems were fragmentation of the supply chain as well as lack of funding for new innovations and developments. However, also solutions for these problems were identified in forms of data-sharing and collaboration. These factors create many opportunities and the literature review of this report introduces the shift from traditional EDI systems used in air cargo into APIs as the enables of collaborative supply chains of the future. Data sharing being one primary solution as it hosts major opportunities in the shift from fragmented arcanely lead industry into transparent and collaborative future. In aim for a brighter future and digital transformation, air cargo industry has seen global standards set, partnerships created and innovations formed.

Keywords
Air Cargo, Supply Chain, Data Transfer

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1 Introduction

Air cargo acts as a trade facilitator in the global economic development. The global economy is dependent on the goods that are being transported by air worldwide. Air Cargo facilitates millions of jobs worldwide and is accounting for approximately 35% of the world trade measured by value. A massive 7.4 billion postal parcels are sent each year with increasing numbers as e-commerce is growing by day. (IATA 2020.) Online trade is a massive growth driver for the air cargo industry as a whole. E-commerce will be revolutionizing the expectations of customers as well as air cargo logistics. The air cargo industry is leaning towards a digital revolution due to the rapid growth of e-commerce making the industry's complexity, fragmentation and need for change, painfully visible. (Etim 2019.)

Passenger air travel has taken its first steps into digitalisation in early 1960s to make capacity visible and accessible. (Owen 2018.) This development resulted in customers being able to book their own flights online in 1996 which resulted in a crisis for travel agents. Greater benefits lied in this transformation as it lowered costs, allowed more convenience for customers, allowed better use of capacity for airlines by increasing load factors. Revenues have grown, prices for customers have reduced while utilization has increased. (Joyce 2013.) Air cargo has a whole different story. IATA (2020) report suggests that huge amount of cargo bookings are still done by phone and email and researches have shown that wait time for quotes can be up to 2-3 days which seems incredibly slow in an industry that should be driven by speed and efficiency. Making a booking can take hours and still they rarely include a guaranteed space on a designated flight. There are many steps in the current air cargo process and IATA (2020) study shows, that as the information and data moves through the stakeholders, typical booking is re-typed 97 times during the process which increases the possibility of mistakes massively. These manual processes are far thought in passenger traffic with drastically better load factors, in comparison to air cargo, which has had a load factor of steady 50%. (IATA 2020.) Traditional business models can be considered to be outdated and the industry is due for long-awaited transformation. (Air Cargo News 2017.)

The previously mentioned reasons create a problem statement for this research. As the inadequate data transfer methods are still widely being used within the industry although many better options would be available, (Silling 2018.) adaptation is still notoriously slow. (Whelan 2018.) This research aims to find out the reasons driving the change and barriers for digital transformation as well as some solution suggestions for the future of air cargo industry.

1.1 Objectives

The objectives for this research are:

- To identify drivers of change for the current air cargo supply chain
- To investigate the challenges in the current supply chain
- To identify solutions regarding the problems in the current supply chains

1.2 Research questions

Research question and secondary research questions formed to support the research objectives are following:

- What are the key drivers of change in the current air cargo supply chain?
- What are the biggest challenges in the current air cargo supply chain
- What are some of the solutions to solve the current problems in the field?

1.3 Research structure

This study uses qualitative research methods, combining in-depth interviews with secondary data from relevant sources such as IATA, ICAO, relevant academic articles as well as academic research. As the topic cannot be numerically measured or quantified, the qualitative method was optimal choice as it allows the interviewees to share their expertise without limiting it with a questionnaire. Data was collected from the previously mentioned, relevant academic and industry sources as well as in-depth interviews with industry professionals whom have decades of experience from the field of air cargo. These methods form a relevant and credible base for this research.

This thesis consists of seven different chapters. Following Introduction on chapter one, the second chapter, first of the literature review aims to define air cargo followed by carrier types and air cargo commodities. The second chapter also includes the value of air cargo as well as some forces and constraints for the industry's growth to give the reader a better understanding of the industry as a whole. The third chapter aims to go deeper into the air cargo industry, introducing supply chain process, stakeholders and documentation used. By this, the aim is to further the understanding to be able to understand the complexity of the current processes. Both of the previous chapters aim to provide basic understanding of the industry and how it works in order to get a better understanding of the fourth chapter, which aims to demonstrate the core of this research: data and data transfer in the air cargo supply chain. The fourth chapter, last of the literature review also introduces the messaging standards, collaborative ways for data sharing in form of API technology. Fifth

chapter, empirical part of the thesis consists of the research methodology, including the chosen research methods, interviews and research process. The sixth chapter includes the results of the in-depth interviews conducted during the fall of 2020 while the seventh, and final chapter includes discussion of the results, conclusions as well as some suggestions for further research and own learning process.

To conclude, this thesis aims to provide the reader with understanding of field of air cargo and what is the current situation on the industry with its flaws and triumphs. The set research objectives aim to identify key drivers for change within the industry, current problems in the air cargo supply chains and some relevant and plausible solutions for the previously mentioned. Firstly, on the following chapter, the reader is provided with knowledge on the carrier types and commodities, value of air cargo for global economy, the growth drivers and constraints which limit the growth of the sector as well as the volumes.

2 Air Cargo

This chapter consists of definitions for some of the main concepts of this thesis. Air cargo is defined, followed by introduction to different carrier types and commodities air cargo carries handle. Additionally, the value of air cargo for globally is identified as well as some of the forces and constraints for air cargo growth are named in this chapter.

IATA (2020) defined that all of goods carried or to be carried by an aircraft are classified as air cargo. Air freight, airmail and air express are all forms of air cargo. Air cargo is transported by either freighters or in the bellies of passenger aircraft. Over 52 million metric tons of goods are being transported by air per year by airlines. It represents more than 35% of the global trade by value and one percent of world trade by volume. This is equivalent to 6.8 trillion USD worth of goods every day. As these numbers suggests, the value of air cargo is significant for trade competitiveness on a global level. (IATA 2020.) The following chapters explain the different air carrier types in more detail.

2.1 Air Cargo Carrier Types & Commodities

From the start of the 20th century, transporting cargo as well as passengers has changed due to the advancements in aircraft design. Currently, there are four different methods of air cargo transportation: passenger airlines, all-cargo carriers, combination- and express carriers. (Huang 2018.) Maynard, Clawson, Cocanougher & Walter (2015) also name four types of carriers for air cargo in their report: passenger airlines, all-cargo carriers, express carriers as well as combination carriers.

Passenger airlines provide cargo services by selling the capacity in the belly compartments of the aircraft. (Maynard et al. 2015.) It is becoming more and more popular for traditional passenger airlines to be offering their space in the belly compartment for cargo. However, passenger airlines have restrictions on weight and space which plays a factor when choosing on which cargo they will accept. Passenger airlines offer a convenient option since they have regular operations which allows a speedy deliver at its best. (Huang 2018.)

All-cargo carriers carry only cargo and no passengers. (Huang 2018.) In other words, all-cargo carriers limit their services to transporting cargo, excluding passengers from their offering. This factor has many advantages in the type of cargo they can carry. (Maynard et al. 2015.) These carriers have less limitations as their aircraft of choice is more flexible for different kinds of goods being transported. Wide-body and containerized cargo aircrafts allow plenty of room for heavier and larger shipments. (Huang 2018) Freighters are better

option for transporting high-value goods because they are able to provide highly controlled transport, direct routes, reliability, and capacity consideration. In conclusion, these features allow freighter operators to offer a high service value and in result, generate more than 90% of the total air cargo industry revenue. (World Air Cargo Forecast 2018-2037.)

Carriers that have passenger and cargo aircraft in their fleet are described as combination carriers. (Maynard et al. 2015.) Combination carriers use passenger aircraft as well as combi-aircraft designed specifically to have additional freight capacity and, in some cases also air freighters. They often operate with limiting their business to express packages, mail as well as palletized freight on scheduled passenger services or operating their cargo service with own dedicated aircraft. Typically, the combination carriers are also national carriers with their own domestic hub-and-spoke systems. They are often using their own hubs as regional gateways that connect to international services. To conclude, combination carriers have flexibility to shift from belly capacity to freighters on routes that demonstrate strong cargo capacity while still offering the frequency and coverage of typical passenger network. (Huang 2018.)

The integrated express carriers offer a service from door-to-door. These types of carriers are heavily depending on cargo hubs and strong logistics network. The main selling points are automated and speedy sorting and extensive delivery capabilities. (Huang 2018.) Integrated express carriers are mainly transporting smaller packages with express delivery, however nowadays they also offer heavy freight transportation in increasing numbers. (Maynard et al. 2015.)

As there are different types of carriers for air cargo with different capacities and features, there are also different commodities that are carried by these operators. Air cargo commodities can be divided into four categories: capital intensive, temperature sensitive, time constraint and short product life cycle based upon the characteristics of goods and types of services required. Various different types of goods are transported by air, for instance: IT components, tech goods, perishable goods including food and agricultural products, weapons, explosives, Dangerous Goods Regulations (DGR), metal elements, live animals, cars, machinery, devices, human remains, value shipments, human organs for transplants etc. all the way to e-commerce commodities. (Now Cargo 2020.) Guidebook for Air Cargo Facility Planning and Development report recognizes the most common air cargo commodities to be of either high value, relatively lightweight and time-critical. Some of the examples are named to be aerospace equipment, pharmaceuticals, jewelry, consumer electronics and perishables which include but are not limited to flowers, fruit, vegetables and seafood. (Maynard et al. 2015.) Both agree, that air cargo shipments

are mostly shipments that are high in value in comparison to other modes of transport and shipments that are time-sensitive. The value of air cargo is further explained in the following chapter.

2.2 Air Cargo Value & Forces and Constraints

Air cargo represents less than 1 percent of global trade by tonnage, while transporting more than $6 trillion USD worth of goods every year which equals to more than 35 percent of global annual trade by value. Such a large distance between tonnage and value shows air cargo's position in transporting goods that require a high level of speed, reliability, and security. (Boeing 2018.) Global Shippers Forum report about the Value of Air Cargo to the Global Economy suggest that air cargo reflects the health of the global economy. While it marks for a rather small percentage, two to three percent, it still holds a significant amounts of countries total exports and imports which is estimated to be between 23-40%. High-value trade links are supported by air cargo and it is essential for international markets and trade. (GSF 2015.) Both agree, that while air cargo volumes in weight are not significant in comparison to other modes on transport in global trade, the main differentiator is the value of the goods being shipped by air. One factor that can contribute in changing this is the growth of e-commerce.

Online trade, e-commerce, is a massive growth driver for the air cargo industry. Market research company Forrester forecasted annual growth rate of 17% between 2017-2022 for cross-border e-commerce with sales reaching as high as 627 billion USD. (Haber 2018.) There are many other factors that contribute to the growth of air cargo. As mentioned before, the key driver for growth is world and regional Gross Domestic Product (GDP) growth, which directly links with the growth and potential decrease in volumes of air cargo. (Boeing 2018.) There are other major factors driving the growth. For example, there are new commodities emerging that need transportation worldwide, shipper utilization is increasing as well as the number of points from and to – cargo is being transported. (Boeing 2018) While the growth drivers of the industry can paint a bright future for the air cargo industry, there are also factors that constraint the potential growth.

In addition to e-commerce being a growth driver, it also creates its own constraints. It has presented challenges in both safety and security, customs processes and capacity management. IATA has issued a directive for the air freight market to proactively find collaborative solutions to address these problems. (Haber 2018.) Even so, there are many other constraints that this old industry has which all create some obstacles and limitations for growth. Governments have set trade restrictions which are limiting the number or monetary value of the goods that a country can export or import during a certain period of

time. These quotas are used in international trade to regulate trade volumes. Oil and fuel prices set another obstacle for the growth, as it drives up the price of air cargo. (Boeing 2018.) Capacity limitations have posed a challenge for the industry and therefore many facilities are operating at maximum capacity and are not able to keep up with growing volumes. (CAAS 2018.) To conclude, capacity limitations pose as a major constraint and challenge regarding growth. The volumes for air cargo in 2019 are included in the following chapter.

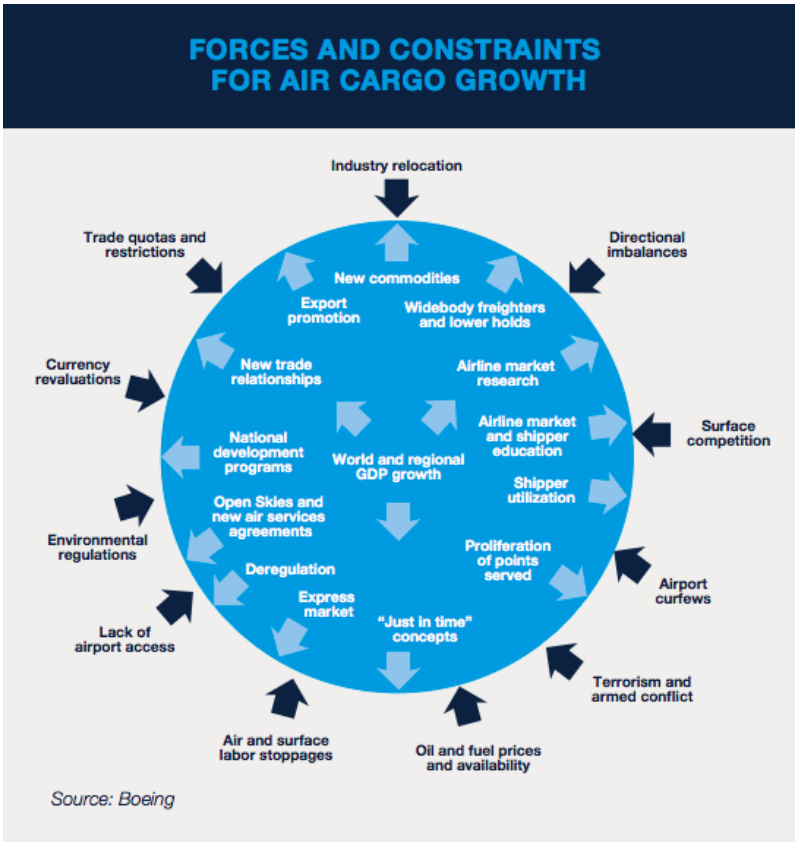

Figure 1. Forces and constraints for Air Cargo growth. (Boeing 2018)

2.3 Air Cargo Volumes

According to IATA Air Freight Market Analysis from January of 2019, kick-off for the year began on a weak note considering the volumes. The industry-wide Freight Tonne Kilometers (FTKs) indicated the slowest annual rate of growth in three years with 1.8% lower percentage in comparison to January 2018. (IATA Economics 2019.) World ACD, air cargo market data provider reported that worldwide revenues dropped by a massive 11,7% in 2019 compared to 2018. (Lennane 2020.) The loss of the past growth reflects how the decrease in freight demand correlates from the weakness in global trade and economic indicators, both of which are key demand drivers for the air freight industry. IATA Analysis suggest that annual FTK growth would not increase in the near future and may even get weaker near-term. One of the reasons for these numbers are also the

growth in capacity which outpaces the demand. Industry-wide Available Freight Tonne Kilometres (AFTKs) have grown by four percent year-on-year. January 2019 was the 11th month in which the annual capacity was outpaced by the demand. This all correlates to the result of fallen load factor (-2.8%). (IATA Economics 2019.) The table below indicates the regional market details for the air freight in January 2019. This table also demonstrates some of the strongest regions for the industry, Asia Pacific (35.5%), North America (23.6%) and Europe (23.3%) of the total market share. (IATA Economics 2019.)

Table 1. Air Freight Market Detail – January 2019 (IATA Economics 2019.)

Air freight market detail - January 2019

	World share[1]	January 2019 (% year-on-year) FTK	AFTK	FLF (%-pt)[2]	FLF (level)[3]	2018 calendar year (%year-on-year) FTK	AFTK	FLF (%-pt)[2]	FLF (level)[3]
TOTAL MARKET	***100.0%***	**-1.8%**	**4.0%**	**-2.7%**	**45.1%**	**3.5%**	**5.4%**	**-0.9%**	**49.1%**
Africa	*1.7%*	1.0%	8.2%	-2.5%	35.4%	-0.8%	1.7%	-0.9%	37.8%
Asia Pacific	*35.5%*	-3.6%	4.1%	-4.0%	50.1%	1.8%	4.9%	-1.7%	55.5%
Europe	*23.3%*	-3.1%	2.8%	-3.1%	50.1%	3.3%	4.4%	-0.6%	54.3%
Latin America	*2.6%*	0.0%	-0.7%	0.2%	29.9%	5.9%	3.5%	0.8%	33.9%
Middle East	*13.3%*	-4.5%	4.1%	-3.8%	42.1%	3.9%	6.2%	-1.1%	48.8%
North America	*23.6%*	3.3%	5.0%	-0.7%	40.0%	6.4%	6.7%	-0.1%	41.0%
International	***87.4%***	**-3.0%**	**2.6%**	**-2.8%**	**49.6%**	**3.6%**	**5.3%**	**-0.9%**	**54.5%**
Africa	*1.6%*	1.3%	9.0%	-2.8%	36.2%	-0.6%	3.9%	-1.7%	38.4%
Asia Pacific	*31.5%*	-4.8%	1.9%	-3.9%	55.5%	2.0%	4.7%	-1.6%	62.1%
Europe	*23.0%*	-3.0%	2.5%	-2.9%	51.7%	3.3%	4.4%	-0.6%	56.0%
Latin America	*2.2%*	-0.6%	-2.3%	0.7%	39.2%	5.7%	2.4%	1.4%	43.7%
Middle East	*13.3%*	-4.5%	4.2%	-3.8%	42.3%	3.9%	6.4%	-1.2%	49.3%
North America	*15.8%*	1.6%	2.4%	-0.4%	47.5%	7.5%	7.2%	0.1%	48.6%

[1]% of industry FTKs in 2018 [2]Year-on-year change in load factor [3]Load factor level

2019 was significant for air cargo industry in many ways. Comparing the Air Freight Market Analysis from January of 2019 to same analysis from December of 2019, the future looks gloomy. December analysis suggests that industry-wide FTKs went down 3.3% in 2019 as a whole, which indicates the biggest decline since 2012 and results in the weakest outcome since the 2009 global financial crisis. Global goods trade increased by a slow 0.9% due to international trade tensions which resulted in being one of the driving factors for this result. AFTKs increased yet again (by 2.1%), which expectably decreased the load factor (by 2.6%). (IATA Economics 2020.) Paul states in an article, that 2019 indeed marked the weakest performance in the field since the global financial crisis and that underperformance was due to the slowing GDP growth. (Paul 2020.)

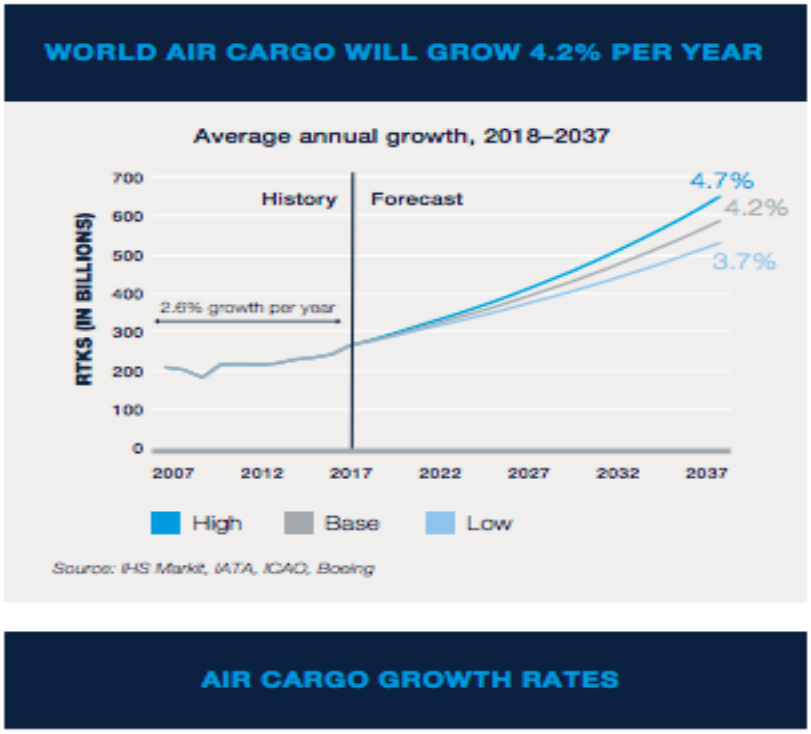

Figure 2. World Air Cargo Growth Rates (Boeing 2018)

Air cargo forecasted growth percentage was 4.2% yearly for the next 17 years before the COVID-19 pandemic as seen on the picture above. The industry was set to double in the next 17 years, growing from 256 billion Revenue Tonne Kilometers (RTKs) in 2017 to massive 584 billion RTKs in 2037. The world freighter fleet was forecasted to grow by more than 70% by 2037, some replacing retiring aircraft but mainly to fulfill new forecasted demand. (Boeing 2018.) However these forecasts have seen a major decline due to the global pandemic of COVID-19. COVID-19 has affected global trade massively for a long time, longer than any prior crisis during the past decade. It has had more profound effects than for example, the global financial crisis of 2008, which resulted at its highest, in five percent decline globally in trade volumes. In comparison to this, McKinsey Global Institute estimated that global unconstrained trade demand could see drops as high as 13-22% during the last quarters of 2020. The full extent of the disruption for the industry is not yet visible, but some predictions can be made. The severity of the crisis for the logistic industry depends on commodity, trade lanes and mode of transports. (McKinsey & Company 2020.) Globe Newswire report of Outlook on the Worldwide Air Cargo Services Industry to 2030 suggests that the market is expected to grow from 65,4 billion USD in 2019 to 67,4 billion USD in 2020 at a compound annual growth rate of 3,1%. The report suggests that the low growth is result of COVID-19 outbreak and the economic slowdown it has created. (Research and Markets 2020.) McKinsey & Company's report suggests that the crisis has resulted in new innovation in other fields, and logistic factor is no different, as there are many opportunities to innovate, enter new markets and better

position themselves against their competitors. To conclude, COVID-19 will have a lasting and significant effect on the economy, which directly correlates to air cargo volumes. The companies who are able to respond to a crisis better and manage the disruption and evolve, will be the ones who are on top when trade volumes will recover. (McKinsey & Company 2020.)

As this chapter aimed to give an understanding and overview of air cargo, different carrier types and commodities as well as the value, volumes and significance of the industry, the following chapter goes deeper in information and aims to explain the different processes and stakeholders in the air cargo supply chain.

3 Air Cargo Supply Chain

This chapter aims to introduce the supply chain of air cargo, including the very definition of supply chain, supply chain process for air cargo as well as the various documentation used in the supply chain and the different stakeholders acting as a part of it.

3.1 Supply Chain

Beamon (1998) defined the supply chain as following: ‘’Supply chain is a structured manufacturing process wherein raw materials are transformed into finished goods, then delivered to end customers.’’ (Beamon 1998.) Supply chain stands for the network of organizations that are involved, though upstream and downstream linkages, in the different processes and activities that produce value in the form of products and services in the hands of the ultimate consumer. Christopher (2011) suggests a more up to date definition for supply chain: ‘’ A network of connected and interdependent organizations mutually and co-operatively working together to control, manage and improve the flow of materials and information from suppliers to end users.’’ Mahdani (201) states that ‘’Supply Chain is an interconnected set of relationships from customer to supplier, through a number of intermediate stages, such as sourcing, manufacturing and warehousing and distribution and it is a network of companies which influence each other.’’ The process of supply chain describes the flow of goods from production to the final sale for the end-customer. (Madhani 2019.) The definitions above all determine the same things. In other words, supply chain starts from the raw materials, which are manufactured into goods that are later transported to end customer purchasing the product. All the different stages and stakeholders who are involved in these processes are part of the supply chain. Bernal et al., (2012) state in their report of Optimization of the air cargo supply chain, that the air cargo supply chain consists of both the physical- and documentation flow. The supply chain consists of the entire flow of goods from its origin to destination. (Bernal, Blasco, Pellicer & Gonzales 2012.) The following chapter introduces the documentation needed during the air cargo supply chain process.

3.2 Air Cargo Supply Chain Documentation

An ICAO report from 2020 states that there are 14 main documents used during the air cargo supply chain. (ICAO 2020.) A brief summarization of the documents and their purpose is found on the table below.

Table 2: Documents and their purpose in the air cargo supply chain (Modified from ICAO, 2020)

Document	Purpose
Cargo Manifest	Contains details of shipment loaded on specific flight: Nature of goods, weight, number of pieces, ULD used
Air waybill	Contract of carriage between shipper and aircraft operator(s) and evidence of the receipt of goods
House air waybill	Multimodal transport document created by freight forwarder offering a consolidation service
Master air waybill	Contract between freight forwarder and aircraft operator for transportation of the goods originated by more than one shipper but destined for the same destination
Certificate of origin	Form identifying origin of the goods
Consignment security declaration	Document used to establish the security status of cargo
Customs release export	A document whereby customs authority releases goods under its control to be placed at the disposal of exporting party
Customs release import	A document whereby customs authority releases goods under its control to be placed at the disposal of importing party
Dangerous Goods Declaration	Document issued to certify that dangerous goods transported have been packed, labelled, and declared accordingly
Export cargo declaration	Document providing particulars required by Customs concerning outbound cargo carried by commercial transport
Export goods declaration	Document stating goods are declared for export Customs clearance
House cargo manifest	A document containing same information as cargo manifest, but more detailed freight amounts
Import cargo declaration	Document providing particulars required by Customs concerning inbound cargo carried by commercial transport
Import goods declaration	Document stating goods are declared for import Customs clearance
Invoice	Document including price of goods, costs for freight, insurance and packing as well as delivery-and payment terms, used to determine the Customs value of goods
Packing list	Document that specifies which goods are in certain packages

The reason why the documentation is so important, is because they state the contract of carriage as well as conditions applicable to the shipping. (RGX Online 2016.) The

importance of accurate documentation is high, as even small errors can result in additional costs by delayed shipments due to documentation errors. (Swan 2015.) The table of documents and their purpose as seen above, aims to clarify the process flow of air cargo on the following chapter and provide the reader with clearer understanding of the purpose of the documentation in the air cargo supply chain.

3.3 Air Cargo Supply Chain Process

This subchapter introduces traditional air cargo supply chain process, also visualized by picture 'Air Cargo movement overview' below from ICAO report. Guidebook for Air Cargo Facility Planning and development describes the air cargo process in a following way:

> ''Inbound belly cargo is unloaded and transported to cargo facilities or from one aircraft to another aircraft, while outbound belly cargo is transported from trucks to the cargo terminal and loaded onto the aircraft prior to departure. International cargo arriving as imports may have been pre-cleared electronically or may be subject to additional inspection by regulators before being cleared to leave the airport. As with baggage handling, cargo on narrow-body and smaller aircraft is loaded individually, while cargo on wide-body aircraft is containerized.'' (Maynard, Clawson, Cocanougher & Walter 2015.)

Air cargo process steps are described in more specific manner in this subchapter. The process explanation aims to describe each step taken from the manufacturing to the actual product being received by the end customer. This process explanation aims to highlight the overall process of air cargo and subchapter 3.4 explains the stakeholders in more detailed manner.

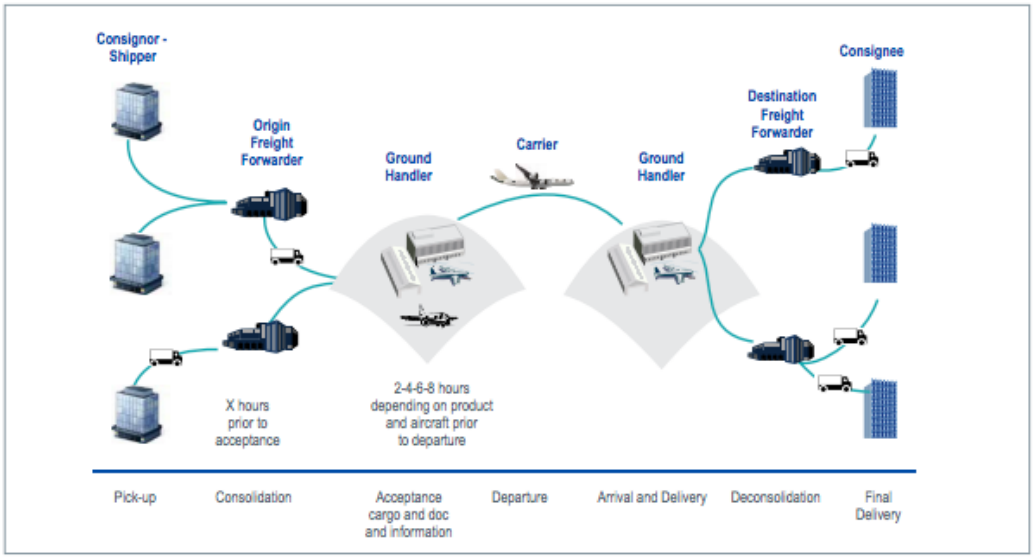

Figure 3. Air cargo movement overview. (ICAO 2020.)

1. This chapter aims to describe the steps taken before air transportation, starting from the very beginning of the air cargo supply chain process. The general trigger for air cargo supply chain is when a purchase is made by consumer. Then the order details are going through the platform to the manufacturer, which starts the process of shipping. This is when importer orders goods from a manufacturer. Then a Pro forma invoice is created. (ICE Cargo 2019.)

2. After the order has been sent by the customer, the order is accepted, and order confirmation is sent to the buyer. Then the shipment is assembled which stands for collecting of the goods for the consignee as well as preparation for packaging materials and packaging list. After these steps the order is assembled. Freight forwarding agent then prepared the required security- and transportation documentation as a preparation for the shipment. (Transco Cargo 2016.)

3. Pick-up and transportation for the shipment from the warehouse is ordered. Goods are then being picked up from the designated warehouse according to the received order which is followed by issued Proof of Acceptance (POA). (Transco Cargo 2016.)

4. Incoming checks for the shipment are prepared and followed by that the shipment is sorted according to the designated flight date its being shipped at. Prior to shipping a rechecking is conducted to ensure no errors have been made in labeling. (Transco Cargo 2016) Following the rechecking, security declarations and customs clearance documents and actual clearance is conducted.(ICE Cargo 2019.)

5. Consolidation of the goods is done according to necessary regulations after which the Air WayBill (AWB) is prepared. Air Waybill is a document that accompanies the goods that are being shipped by an international air courier. It consists information about the shipment and allows the racking of the shipment throughout the supply chain. It is also a receipt of the goods as well as a contract of carriage in between the carrier and shipper. After the AWB preparations, transportation is organized for the shipment to the airline. (Transco Cargo 2016.)

6. After the shipment arrives to the carrier or ground handling agent, preparation, handling plan and storage of the shipment is performed according to the confirmed booking. Shipments are subject to incoming and administrative checks. (Transco Cargo 2016) Goods are customs cleared according to regulatory requirements for the supplier to perform Export Declaration. (ICE Cargo 2019.)

7. Goods and documentation are then sorted according to their designated flight date. Outgoing administrative checks are performed prior to the shipment being loaded into Unit Load Devices (ULD’s), which is a pallet or container used to load luggage or freight into an aircraft. Security checks are conducted and loading plan for the flight is created. (ICE Cargo 2019.)

8. Goods are then transported into the aircraft by ramp transportation at the airport which is followed by loading of the aircraft according to the load plan which is confirmed in a load sheet. After the load sheet is approved and other pre-departure procedures are completed, the aircraft is ready for take-off. (Transco Cargo 2016.)

9. Once aircraft is landed to its destination, land transportation preparations for the goods is organized and conducted. ULD's are broken down in a warehouse, after which incoming checks of shipments and documentation is checked. Warehouse storage is designated and clearing flight manifest is conducted. Then the goods are loaded in to trucks accordingly and dispatched. (Transco Cargo 2016.)

10. This paragraph describes second to last process steps after shipment has arrived to its destination airport. Airline then notifies the freight forwarder that the shipment has arrived. Documentation is prepared for customs clearance and the import customs clearance is performed by the buyer of freight forwarder. (ICE Cargo 2019.)

11. Once the shipment has cleared customs, pick-up for the package is arranged followed by arranging delivery for the consignee including all the relevant documentation accompanying the shipment. Once the shipment is received Proof of Delivery (POD) is issued. The shipment has arrived into its final destination. (Transco Cargo 2016.)

To conclude, the process description makes the complexity of the air cargo supply chain processes obvious. An ICAO report states that the goods, moving from A to B, are handled along the supply chain by multiple entities all with varying responsibilities. (ICAO 2020.) The following chapter introduces the different stakeholders in the air cargo supply chain process.

3.4 Air Cargo Supply Chain Stakeholders

Freeman (1984) states that the earliest definition of stakeholder, comes from an internal memo report of Stanford Research Institute in 1963, which defines stakeholders as ''groups without whose support the organisation would cease to exist''. Freeman used a modified definition which states that stakeholders are those groups who are vital to the survival and success of the organization. Further points noted, that even though these definitions are organization orientated, stakeholders can be applied to more broader groups as well. (Fontaine, Haarman & Schmid 2006.) This chapter identifies the stakeholders in the air cargo supply chain and describes the role for each stakeholder.

Traditional air cargo supply chain has many stakeholders. The table below, modified from ICAO data, identifies all the different stakeholders and their role in air cargo supply chain. Not all stakeholders mentioned in the table are necessarily part of the same type of supply chain, but all stakeholders mentioned has a role in different supply chains air cargo industry has. (ICAO 2020.) As the supply chain process overview in the previous subchapter as well as the table above of stakeholders demonstrate, air cargo industry is defined by its fragmented supply chain, which includes countless of papers, regulations and stakeholders. (Airport Technology 2017.) ICAO report 'Moving Air Cargo Globally' states that the process of moving goods is from origin to destination is complex due to the

range of regulatory requirements. The cargo is handled along the chain by number of entities named on the table below, each with their own responsibilities. (ICAO 2020.)

Table 2. Modified table of air cargo supply chain stakeholders (ICAO 2020.)

Stakeholder	Role
Broker	Independent agent responsible for facilitating the movement of goods from seller to buyer. These tasks include arranging air transport or meeting customs requirements eg. Customs declarations. These brokering functions are integrated with forwarding, consolidation and warehousing functions within one single entity.
Buyer	Buyer is the purchaser of goods and in in the context of international trade is also equivalent to importer. The buyer or importer can clear the consignments themselves or utilize the services of a broker to assist with regulatory agencies.
Consignor	Entity or individual who initiates the movement or transportation of goods. Consignor is equivalent of sender. The term shipper is used to describe the entity or individual initiating the trade in goods while the consignor and shipper are separate roles, but still the same entity or individual.
Consignee	Responsible on the invoice or packing list, as the recipient of the goods at the end of transport movements.
Freight forwarder	Freight forwarder books and contracts with an aircraft operator using a form of air transport service agreement. This agreement includes the departure from origin airport and arrival to destination airport. The prime responsibility is to safeguard the interests of the shipper/consignor. Working closely with aircraft operators, their book space for shipments that are ready to travel, for which contracts and Air Waybill numbers are created. The arrangement of air shipments that prepares them for being managed in a way that they are ready for transportation by aircraft operators. A freight forwarder or logistics provider can offer the following services; preparation, storage, carriage, final delivery of goods, including regulatory documentation as well as facilitation formalities. Ancillary and advisory services related to the physical movement of goods are often offered. Rather than being the carrier of the goods their role is focused on organizing multiple carriages in various modes of transport and other services which all contribute to the supply chain as a whole. Freight forwarding services also include logistical service; modern information and communication technology combined with the carrier, handling, storage, and total supply chain management.
Ground Handlers	Subcontracted operator, acting on behalf of the freight forwarder and/or aircraft operator. The previously mentioned do not always have the necessary facilities located on the airside of airports, thus ground handlers are needed. Ground handlers are typically located on the airport, sometimes on both landside and airside while they may also locate on either of them. Ground handling services can include the following; warehouses to accept, handle, prepare and tag cargo and mail, loading and unloading, transit and storage of cargo or mail. Responsibilities of ground handlers are dealing with the operational factors based on the instructions provided by the freight forwarder or aircraft operator. When

	consignment is ready to be shipped, the freight forwarder releases the cargo with instructions to the ground handler to deliver it to the aircraft operator.
Designated postal operator	Governmental or non-governmental entity designated by the Universal Postal Union (UPU) Member State to operate postal services. Main tasks are to fulfill the obligations from UPU eg. Universal postal service obligation. Mail includes all postal items that are conveyed by designated postal operators that convey to UPU regulations. These postal operators are connected to aircraft operators for the conveyance of mail and applying security controls that are applicable to mail. These operators are protected by State legislation due to their confidential nature. In some cases, this means that mail is treated in a different manner than cargo consignments.
Airport Operator	Entity responsible for provision and security of the airport infrastructure and premises. The operator established a secure environment in which goods are moved. In some instances, they are responsible for the provision of the 'on airport' cargo services provided and dealing with potential incidents which can arise from identifying physical threat in cargo.
Aircraft Operator	Aircraft operator, more widely known as airlines and air carriers are the ones who provide the actual transportation for goods. A transport contract (AWB) ties the aircraft operator with other relevant parties for ensuring the safe and secure movement of the cargo and mail from A (eg. Departure airport) to B (eg. Arrival airport). Cargo can be transported by passenger aircraft or cargo aircraft. In some cases, air cargo can be transported by road, when the operation changes to 'road feeder service'. In these cases, the AWB still stands and road segment is considered as flight, with its own flight number.
Express Carriers	Combining the work from multiple stakeholders; broker, freight forwarder, ground handler, aircraft operator in to one single company. These operators are referred to as integrators. Express delivery is its own business model in the cargo industry. They manage end-to-end multimodal supply chains with track-and-trace information systems. These systems allow the monitoring of individual shipment through their own chain from the start to finish. These carriers often transport high-value and time-sensitive cargo which requires a time definite delivery.

To conclude, as stated previously, the air cargo process is defined by its fragmented nature, as seen on the process description and list of stakeholders. As the industry has that many stakeholders, most using their own systems (ICAO 2020.) makes the processes very complex. However, there are industry standards and data transfer methods that aim to change that statement. Air cargo industry processes are heavily relying on the exchange of digital information between the several stakeholders (IATA 2020.) introduced in this chapter. The following chapter first focuses to explain the data transfer methods between the stakeholders of the supply chain, followed by the previously stated initiatives in aim to form digital collaborations in the field of air cargo.

4 Data Transfer in the Air Cargo Supply Chain

As the previous chapters have introduced air cargo processes, stakeholders and its economic value and volumes, this chapter aims to go deeper into the thesis objective. Data transferring in the air cargo supply chain is introduced, including the different data sharing methods and messaging standards. Forms of digital collaborations efforts in the air cargo industry are introduced further in this chapter.

4.1 The role of Data and Data Transfer within Supply Chains

‘’Data is any symbol, sign or measure which is in a form which can be directly captured by a person or a machine.’’ (Clarke 1999.) Buckland states the following about data: ‘’The word ‘data’ is commonly used to refer to records or recordings encoded for use in computer, but it is more widely used to refer to statistical observations and other recordings or collections of evidence.’’ (Buckland 1991.) Data transfer, also known as data transmission, refers to an exchange of data between two parties, information that is transferred from one location to another through a chosen communication method. (Clarke 1999.)

Air cargo industry processes are relying on digital information exchanges between the several stakeholders. There are two methods to connect digitally: Host-to-Host Connectivity and Connectivity via an intermediary. An IATA report suggests that communication via intermediaries were used in 95% of communication between airlines and freight forwarders, and Host-to-Host by merely five percent. Thus, Host-to-Host method is not further explained. Connectivity via an intermediary involves data exchange through a third party that is specialized in electronic data interchange services. This is a method that is widely used in the air cargo industry and these intermediaries are known as Cargo Community System (CCS) providers. CCS providers have integrated platforms they offer to air cargo stakeholders for both data sharing and re-use purposes. (IATA 2020.) Chandra and Hillegersberg stated in their research about cargo community systems, that CCS were created to support collaboration in airports as its main purpose is to connect supply chain stakeholders to air freight communities and integrate administrative systems and support inter-organizational supply chain activities. (Chandra & Hillegersberg 2019.) These service providers must adhere to IATA messaging standards and provide their solutions in regulatory compliance. However, some of the challenges of CCS include lack of standardized business processes between stakeholders, lack of end-to-end visibility and transparency. (IATA 2020.)

4.2 Data Standards in Air Cargo: Cargo-IMP and Cargo-XML

There are two messaging standards that allow the transfer of data in the air cargo industry: Cargo Interchange Message Procedures (IMP) and Cargo-XML. Electronic Data Interchange (EDI) is a concept which unites various standards for document exchange between different stakeholders. (Rouse 2020.) Essentially, this international standard of electronic data interchange, is a ‘’dialect’’ used for both Cargo-IMP and Cargo-XML. (Mulder 2020) Cargo-IMP is a legacy standard for exchanging cargo operation information and it has been discontinued as IATA Cargo-XML has been formed as a ‘next generation’ air cargo messaging standard. (IATA 2016.) Cargo-XML is an e-messaging standard developed by IATA, and already by 2017 was used in 90 countries. United Nations Conference on Trade and Development (UNCTAD) announced in 2017, that they will utilize Cargo-XML in aim to simplify the communication between airlines, freight forwarders and customs authorities. Cargo-XML is now integrated with UNCTAD’s customs system, ASYCUDA World. (Edicom 2017.) According to IATA, Cargo-XML was created to modernize the old messaging between stakeholders, aiming to leverage new technology to reduce cost, facilitate implementation and data exchange. (IATA 2020) Cargo-XML is more compatible with devices and smartphone application as well previously mentioned industry bodies such as World Customs Organization (WCO). Its abilities also support both multimodal- and cross-border messaging and allows smoother electronic data interchange, better process automation and overall better data quality compared to its predecessor. (Babati 2017.) To conclude, the ultimate goal with collaboration between IATA and UNCTAD is to eliminate the use of paper documents in the air cargo processes. To achieve this aim, IATA has tried to encourage better implementation of electronic systems, but this has proved to be a challenge. (Edicom 2017.)

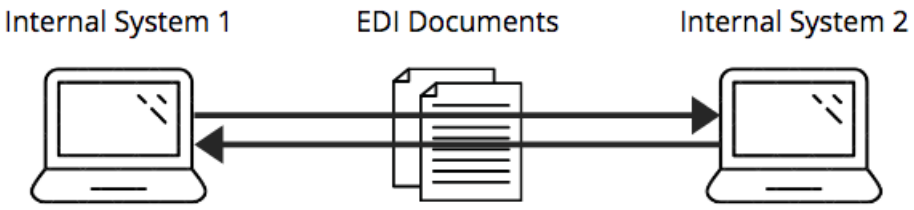

Figure 4: Demonstration of EDI modified from Weinstein (Weinstein 2020.)

IATA report states that in many instances, stakeholders with more advanced technologies and solutions are often faced with challenges when transferring information between

stakeholders across the supply chain. The same report suggests that the digital data transmission capabilities of a company often rely on the technical capabilities of their partners. As the industry moves progressively towards digitalization, the stakeholders still expect autonomy while the report suggests that digital collaboration is becoming a necessity in the future throughout the supply chain. (IATA 2016.) Therefore, McKinsey & Company report (2020) states that traditional freight-forwarders are facing pressure to modernize their systems and digitize. Considering the complexity of global air cargo supply chains, the EDI messaging standards are inadequate as it was never meant to be operated at the scale it has. (Mulder 2020.) However, the pressure to modernize has resulted in some innovation in the field of air cargo, as the following chapter suggests.

4.3 Future of Data Transfer: APIs as the Enablers of Collaboration

Application Programming Interfaces (APIs) are a way to programmatically link and interact with separate software components. (Freeman 2019.) Essentially, APIs are sets of programming codes that allow data transmission between software products and connecting them. (Altexsoft 2019.) API is becoming a new industry standard and it now contests Electronic Data Interchange, EDIs, dominance in the field of air cargo messaging. EDI is a very strict and specification-driven way of transferring data while APIs allow more customization due to its basis on a programming format, which allows data sets to receive whatever it needs to receive. API technology helps in real time performance, access to more parts of databases and wider abilities in customized processes. These all contribute in making businesses operate better and faster. (Rajamanickam 2020.) As APIs enable synchronous integration it unlocks the potential of real-time data-sharing (Babati 2019.) it could host massive benefits for fragmented air cargo supply chains. In conclusion, APIs have the ability to connect stakeholders to have access to the same real-time data through shipments entire journey through the supply chain, providing the visibility the industry has been lacking in many instances. (Rempel 2020.) There are new initiatives aiming to utilize API technology in the air cargo industry and the following chapter introduces a few examples.

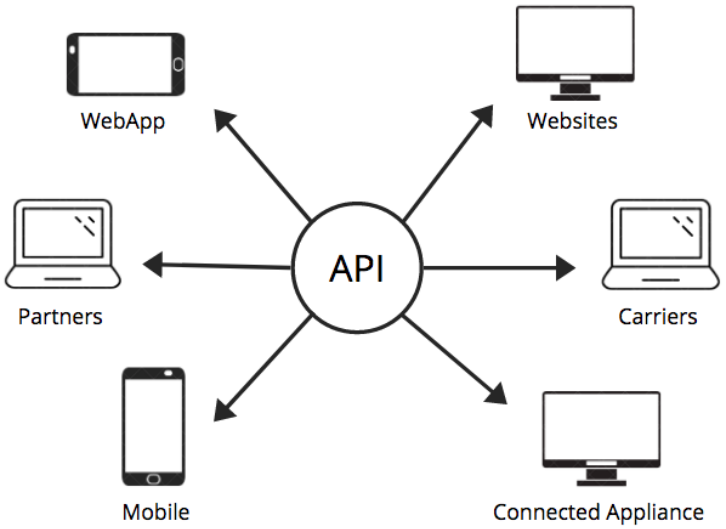

Figure 5: Demonstration of API modified from Weinstein (Weinstein 2020.)

IATA has introduced One Record, launched in 2019 with pilot projects, with aim to set a data sharing standard and support a one record view of the shipment. This standard defines a common data model which is shared via standardized and secured web-based API. (IATA 2020.) IATA's One Record aims to provide the following benefits to the industry: Data quality and control, Visibility and transparency and Plug & Play connectivity. This technology platform creates a foundation for digital cargo as it allows stakeholders to develop collaborative and automated digital services. (IATA 2020.) IATA's One Record is not the only effort aiming to benefit from API technology.

CHAMP is one of the leading suppliers of integrated IT solutions in the field of air cargo. Their aim is to help companies meet their business objectives with the help of integrated solutions. CHAMP APIs allows companies to customize and accelerate the value of their already existing products. CHAMP APIs promote efficiency, accelerated collaboration, service across channels as well as seamless data exchanges. (Champ 2020.) CHAMP Cargosystems have chosen Google Cloud to provide an API platform and so-called self-service portal. It allows CHAMP and its customers to connect to multiple back-end systems, in-house and third-party apps and marketplace portals. (Brett 2020.) It all comes with an industry standard implementation for every API and hosts a secure analysis of how the APIs are used by its customers. By this, they are aiming to understand future requirements and better serve their clients in the future. (Brice 2020.) As these examples of API technology suggest, there are technology available within the industry, but the real problems lie somewhere else.

Each stakeholder in the air cargo industry is a link, part of a global supply chain all somehow interdependent on each other. This creates a massive problem for the industry, as it means that to be able to evolve, all stakeholders must grow as one. As a result, this dependency creates a fragmented and complex processes, which simply are not efficient enough in the future. (Gauthier 2020.) While the air cargo industry is moving towards a more digital world, it has also been accused of too slow adaptation to new technology (AirCargo News 2017.) and rightfully so. Many companies see data as one of the most important assets and thus are reluctant to sharing it. Common thought is that by sharing data a company might lose its valuable asset and by it, their competitive advantage. (Gauthier 2020.) In today's world, innovation and embracing technology and collaboration within the industry requires leaders to put their fear and ego aside to open their data silos, as this could provide the efficiency and optimized processes that the industry has long awaited. To conclude, there is no magic solution to make this happen, the change requires implementation and adaptation of the latest communication standards and start collaborating. (Gauthier 2020.) Flacke (2020) stated in an article that once the industry has accepted that the key in multi-stakeholder service delivery is collaboration and the capability to share data with each other, the form in which this is done is irrelevant. The main thing is that the change is embraced. (Flacke 2020.) The time for change is now, and the ones who seize the opportunity will thrive in the future with digitally enables capabilities. (Menon 2019.)

5 Research methodology

This chapter is focused on the research methodology as well as the reasoning as to why certain methods have been chosen as more suitable than others. Chosen methods are introduced and explained, following with the chosen data collection, analysis and research process. The selection of research methods is important process as it supports the understanding of the problem as well as eventually answering the set research questions. Objectives of this research were to identify problems as well as drivers of change for the current air cargo supply chain, determining what ongoing trends the industry has and how they shape the future air cargo supply chains.

The objectives for this research are:

- To identify drivers of change for the current air cargo supply chain
- To investigate the challenges in the current supply chain
- To identify solutions regarding the problems in the current supply chains

Research question and secondary research questions formed to support the research objectives are following:

- What are the key drivers of change in the current air cargo supply chain?
- What are the biggest challenges in the current air cargo supply chain
- What are some of the solutions to solve the current problems in the field?

5.1 Problem statement

A well-formed problem statement consists of defined problem and identification of the variables investigated in the study. Problem statement provides a rationale for the study and uses research and data to confirm the need to address the problem in the study. (Miles 2017.) Any research starts with a problem statement or issue needing to be resolved.

Air cargo industry has yet to experience a revolution like passenger air travel. Massive amount of cargo bookings are still done in an old-fashioned way through phone and email. With so many steps in the process and many stakeholders, typical booking is re-typed 97 times which in itself tells how fragmented data is as it moves through the supply chain. As the inadequate data transfer methods are still widely being used within the industry although many better options would be available, (Silling 2018.) adaptation is still notoriously slow. (Whelan 2018.) The previously mentioned reasons create a problem statement for this research. This research aims to find out the reasons driving the change,

barriers for change as well as some solution suggestions for the future of air cargo industry. Data sharing and collaboration could solve many problems in the current supply chain and many companies have made efforts to move towards a new future in the industry. Utilizing technology and embracing collaborations could be great benefit to the industry as a whole and result in a long-awaited revolution for the field of air cargo.

5.2 Chosen research method

Research methodology is a science of studying how research is to be conducted as well as a systematic way aiming to solve a problem. Research methodology can be defined as a collective term for the structured process of conducting a research. Describing, explaining and predicting phenomena are all part of research methodology which aims to give the conducted work a plan of research. Research methods are the procedures, schemes and algorithms, that are used in the research, and all of the methods used during the study are termed as research methodology. Research methods aim to help data collection and finding a solution for the set research problem. (Goundar 2012.)

The selection of research methodology is important process as it supports the understanding of the problem as well as eventually answering the set research questions. Both basic and applied research can be quantitative or qualitative or both. Quantitative research aims to measure quantities while qualitative research is focused in non-numerical, descriptive reasoning, which aims to understand the meaning, feeling and situations. (Goundar 2012.) Easiest way to understand the difference between the two, is that qualitative method seeks to understand the theory while quantitative method aims to measure it. For the purposes of this research, qualitative research method was more suitable and thus introduced in more specific manner than quantitative research method. The objectives of this research being understanding future concepts and visions of air cargo supply chain and industry transformation, rather than anything specifically measurable, qualitative method suits it better. This research combines qualitative in-depth interviews with industry professionals, with secondary desktop research from relevant academic and industry articles that have already been published.

5.2.1 Qualitative research

Qualitative methodology is a type of research in which you are dependent on observations and descriptions as this method is used to assess knowledge's, attitudes and opinions. (Goundar 2012.) It focuses on the subjective human experience rather than quantities. The goals of qualitative research are to understand, describe and to discover. Researcher is the primary instrument where the researcher brings their own perspective to the

selection and meaning of data. Qualitative research aims to explore and the aim is to identify patterns, themes and gaining understanding of the topic. Qualitative data is gathered using interviews, focus groups, observations and existing documents. (Center for Research Quality 2020.) For the previously mentioned reasons, qualitative research is optimal for the purposes of this research.

5.2.2 Interviews

An interview is a conversation, exchange of information and opinions, between two individuals with the purpose of collecting data that is relevant for the purpose of the research. There are three types of interviews; Structured, semi-structured and unstructured. The chosen type for this research is semi-structured in-depth interviews as they typically consist of several key questions which cover the entire scope of the research. (Formplus 2020.) One of the main factors that contributed to the planning of the interviews were the factors connected to data analysis. The need to have the interviews recorded, considering the fact that interviewees are abroad as well as overall simplicity of the interview, the chosen platform is Zoom, as it allows recording the whole, of a part of the session, which allows some time for introduction at the beginning of the meeting as well as permission for recording to be on record as well, if agreed so. Zoom also allows sharing of screen and documents (Zoom 2020.), which helps tremendously in communicating the questions for the interviewee as well as providing some visuals that assist with the introduction of the interview and topics. First steps after determining the platform, the scheduled meetings were set and invitation link with invite is sent for the interviewee. An invitation includes the basic structure of the interview as well as the research questions set including some of the critical information such as indication what this data collected is being used for. After agreeing upon an interview time, the interview is conducted accordingly. First step is to identify the participants and determine the questions used and think of the ethical consideration. Secondly, developing a protocol for the interviews is essential. This includes things such as: what to say to participants when setting up the interview and invitation for the interview, what to say in the beginning of an interview (this includes ensuing consent and confidentiality), what to say when concluding the interview. Additionally, the interview needs to be well structured with questions related to make sure that all topics are covered. In this research, chosen participants will receive an invitation by email that shows the purpose of research and why their insight would be highly valued. The invitation should also include points regarding ethical consideration and confidentiality. (Boyce & Neale 2006.)

5.3 Sampling, Inclusion and Exclusion

The primary purpose of sampling is choosing the suitable interviewees that enable that the focus of the study is appropriately researched. In this research, purposive sampling is used. Purposive sampling means participants are selected according to their knowledge and relevance in the field that relates to the topic of the research. (Foley 2018.) In this research, the sample size was five, which allows in-depth interviews to be conducted with different industry professionals each with their own perspective on the subject.

Establishing inclusion and exclusion criteria for study participants is a standard and required phase of when designing a research protocol. Inclusion criteria can be defined as the key features of the target population that the research will use to answer the set research questions. Commonly, inclusion criteria consist of demographic and geographic characteristics. Exclusion criteria are defined as features of the potential participants whom meet the inclusion criteria but could present some additional factors that might interfere with the success of the research. Commonly, exclusion criteria include factors such as participant would fail to follow-up, miss scheduled appointments for data collection and provide inaccurate data. (Patino & Ferreira 2018.) Inclusion criteria used in this research consists of aviation professional with specific industry knowledge from any area of the air cargo supply chain, male or female, availability for an in-depth interview and informed consent. Exclusion criteria applied were refusal for consent of participating in an interview, individuals with no experience from the field of aviation, and factors including the scheduling of the interviews. Although, females were not excluded as the participants of this research, all the five interviewees were male.

5.4 Research process

This subchapter includes the process of this research from data collection methods, data analysis as well as ethical consideration and both reliability and validity.

5.4.1 Data collection

Data collection is a methodical process in which gathering of data as well as analysis of specific information is conducted in hopes to offer solutions to the set research questions as well as the evaluation of the results. Data collection is a method of both collecting and measuring data which is gathered from various sources with a purpose of providing answers to relevant research questions. (Mbachu 2018.) Accurately evaluating data helps in identifying and predicting future trends. The aim was to deepen understanding on concepts as well as some other topics related to chosen field to gain good starting point to then being able to determine the relevant fields and topics for this specific research. Data

collection is classified into two, primary- and secondary data, both of which are used in this research. Primary data indicates data that is being collected for the first time (indicates the interviews) and secondary data is data that has been previously collected (referring to the secondary research that involves already existing data. (Mbachu 2018.) Two different data collection methods were used in this research: primary and secondary data.

Primary data collection by its definition means gathering raw data from its source, in this case the industry professionals being interviewed. Primary data collection stands for the whole process of original data which is collected by the researcher for a specific research purpose. Qualitative data collection can be attained from for example online forums, groups, surveys and in-depth interviews. For this research the interviews were the most suitable choice, since the information needed for this research cannot be attained from others than industry professionals. (Formplus 2020.) Interviews, a qualitative method of data collection, is being used in this research to collect in-depth responses from industry professionals. In qualitative research, there is no formal criteria for choosing the sample size, which indicates no size is too small or large to be able to achieve successful research outcomes. The size of the group may affect the richness of the data collected. (Whitehead 2016.)

In this research, the sample size was five, which allows in-depth interviews to be conducted with different industry professionals each with their own perspective on the subject. Prior to the interviews, participants were sent an invitation providing them with knowledge of the research as well as the planned questions. Folllowed by that was the agreeing of scheduling of the interview. Actual interviews were conducted using Zoom or in person interviews, both of which were recorded with the consent of participant. The planned interview structure for this research was a semi-structured interview with open-ended questions. The interviews were planned to be informal and conversational with pre-set questions that don't have a pre-set range for answering. Semi-structured interviews aim to use the set questions for discussion and ensuring that all of the research questions are covered. Semi-structured interviews leave room to follow any specific areas of interest and potential themes arising from the questions. (Whitehead 2016.) This method proved to be well-chosen, as the participants provided with a lot of different perspectives and had many opinions on the field, which resulted in some great insights from the interview data.

Secondary research or desk research is a method that uses already existing data which is summarized and categorized to support the research outcomes. The steps taken in this research will include identifying the topic of research. This is followed by identifying and

researching the sources. The desktop research used in this study includes textbooks, reports, newspapers as well as online published articles and papers. Data collection from the previously mentioned sources will then be categorised to later form the theory base for the research. Combining and comparing data is done prior the stage where it is analysed in combination with the interview results. (QuestionPro 2020.) Secondary data collection refers to gathering already existing data from eg. Published books, articles and online publications. Secondary research or desk research is a method that uses already existing data which is summarized and categorized to support the research outcomes. (Formplus 2020.)

5.4.2 Data analysis

Thematic content analysis will be used to analyse the data from the planned interviews. Such technique consists in identifying common patterns and themes in the data. Firstly, all of the data needs to be read/listened to carefully to be able to identify the common themes, which helps in the final summation of the data. The second step is to create categories and subcategories in which the answers can be divided to. After dividing the answers all of the data was further analysed and connected to the main points and research questions chosen. (Rev 2020.)

5.4.3 Reliability and Validity

Validity in qualitative research stands for the appropriateness of the chosen tools, processes and data. Determining if set research questions are valid for the hoped outcome, if the choice of methodology is valid to answer the set research questions, if sampling and data analysis are appropriate as well as weather the results and conclusions are valid for the methodology. (Leung 2015.) Both validity and reliability are used in researches to measure the credibility of the process. High reliability indicates that the results of the specific study could be replicated in the same conditions at a different time. (Golafshani 2003.) This research does not specifically aim to give a straightforward answer to a problem. The aim of this research is to understand and demonstrate what kind of factors will play in the change of air cargo, what reasons affect the change and what kind of outcomes are expected with utilization on technology. Aviation industry professionals from different backgrounds, with decades of experience in the field were interviewed to gain non-biased responses to the interview questions. In addition to this, for the secondary data collection, relevant academic industry articles, news articles as well as industry-specific professional websites were used to ensure that the results are both valid and reliable.

5.4.4 Ethical consideration

Before research is conducted, the level of ethical consideration needs to be assessed. Ethical consideration relates to different aspects; validity, voluntary participation, sampling, confidentiality and research methods. Research will comply to the research questions and conclusions must correlate with the questions and results. No individual should feel any pressure on participating in research as that is voluntary. Any individual participating in an interview, must agree that they are willingly participating in a research. Sampling means the consideration of people chosen to be in the group of participants. It needs to be explained why certain groups are chosen over others. The confidentiality of the information gained from participants must be respected during a research. Ethical consideration needs to be considered when choosing research methods; which methods fits the aims of the research, are there risks in using certain method, what are the potential restrictions and/or strengths of a certain method. This research is combining desktop research with interviews, both being ethically considered. The interviewees have agreed on participating in the research and the data collected from desktop research has been previously published publicly available information. (Add sources from notes)

6 Results

This chapter introduces the common themes arising from both primary and secondary data. Main themes are introduced while aiming to respond to the set research questions and meet the objectives which are following:

- To identify drivers of change for the current air cargo supply chain
- To investigate the challenges in the current supply chain
- How the ongoing trends shape the future of supply chains

This chapter consists of the results from the in-depth interviews with industry professionals which are aimed to answer the set research questions. The aim of the interviews was to get different perspectives from aviation professionals working in different companies from various backgrounds. Firstly, interviewees were asked about their background and their career path to give better understanding where their expertise in the aviation field is based on. All of the interviewees are aviation professionals with decades of experience from the field and are currently working in senior positions in the field. All interviewees have industry-specific knowledge from the field of air cargo and their knowledge creates a credible source for the in-depth interviews. Interviewees background specifics are excluded from the results of the report.

Table 3: Interview time, length and reference for each participant

Interview date	Interview length	Reference
5.10.2020	1h 32min	P1
3.11.2020	57min	P2
4.11.2020	48min	P3
4.11.2020	48min	P4
6.11.2020	52min	P5

6.1 Driver of change: e-Commerce

The interviewees were first asked about the effects that e-commerce has had on the air cargo industry in their opinion. All of the interviewed professionals agreed that e-commerce has had a global, revolutionizing impact on the industry, as volumes rise and business shifts from traditional business to business into business to customer. Interviewees narrated the role of e-commerce in change during the interview in the following ways:

> ''E-commerce acts as a change agent as it forces the industry to have a look at the way it works. It is a very traditional industry and e-commerce is just making that painfully visible.'' P1

E-commerce is booming and there has been a shift on how people buy and sell things. As globalisation continues, the world is getting smaller. (P2) Another interviewee (P5) had the same view: e-commerce has globally revolutionized the field of air cargo. Interviewee P5 continued that a decade ago, most of the shipment travelling by air were from Business to Business-segment, and what we have seen during the past years, is the massive volumes of goods being moved, new automated distribution centres have been built to accommodate the growth caused by e-commerce and shift from Business to Customer-segment, especially from integrator perspective. (P5) Interviewees P3 and P4 named another result from the rise of e-commerce. The rise of players such as Amazon, who moved into the logistics field will have a major impact on the package delivery market. As traditional supply chains see fragmentation, integrators more control over their supply chain and Amazon being an online-retailer providing its own logistic solutions, meaning they have control over the entire supply chain, is also game-changer rising from the growth of e-commerce.

6.2 Presented problem: Digital tools and data transfer in the supply chain

Secondly, the interviewees were asked about the biggest challenges in the current ways of working in the traditional air cargo supply chain. Interviewee P1 stated in an interview, that the current supply chain is individual dots rather than a line and the information is being pushed through the supply chain. This creates many possibilities for human errors, considering that many of the steps in the process of a shipment through supply chain still consists of manual tasks. The information is handed over repeatedly which creates unpredictability and lack of visibility through-out the supply chain. Many forwarders and bigger players in the field have modernized their systems, which generally is much easier to do within a company, for example, integrators who control their own supply chains. For many smaller companies, this is not the case. Many companies still use ancient systems that are not able to co-operate with other systems and platforms. This creates an issue of digital readiness, which many companies lack of. (P1)

> ''Traditional air cargo has a level of uncertainty in comparison of integrators, who have competitive pricing, shorter service times, transparency to customers by *track&trace*.'' P5

> ''Air cargo industry is working with three parties mainly: Forwarder, Ground Handling and Airline. The integrators, for example DHL, are able to give a data and time of delivery as well as cost for delivery and track & trace possibility. These are not available in traditional air cargo industry.'' P3

Interviewee P1 stated that a differentiation of the integrators and traditional air cargo needs to be made, as they operate with different business model. Integrators are in control of their supply chain and they have different possibilities to data sharing and having their own systems cover the entire process meaning they have end-to-end control of the process, in comparison to traditional air cargo, which includes several stakeholders throughout the supply chain, they don't have that type of control. (P1)

> ''The problem is mainly the sharing of data and as long as they act as individual companies, and the progress of doing this is so slow they will never be able to catch up with the amazons and the integrators.'' P4

> ''.. it also has to do with the core systems they are using, in air cargo industry, they are really old-fashioned. Many are talking about APIs, there is a mindset to change this, so it will take place, but it will take long time to share this data.'' P3

> ''Main problems include the integration between systems.'' P5

> ''Complexity is one of the biggest problems. There is so many stakeholders that need to be able to talk to each other. Everyone does things with a twist and sees it in a way that 'I need to do it my way to have the upper hand'…there is a complex supply chain and everyone seems to think they need to do it their way.'' P2

Interviewee P3 also mentioned that biggest problems are transparency and sharing data between all the stakeholders as well as the very old-fashioned ways of working. Interviewee P4 agreed and stated that implementation of new processes is really hard to do, as there are difficulties in sharing of data between stakeholders. Main challenge is to have transparency and sharing data. (P4) In air cargo, all stakeholders have their own systems, sometimes multiple ones, so the information flow between stakeholders is a real challenge. It was also noted by P5, that this is not as big problem for integrators as they have end-to-end transparency and system alignment within a company is much easier than between stakeholders. (P5)

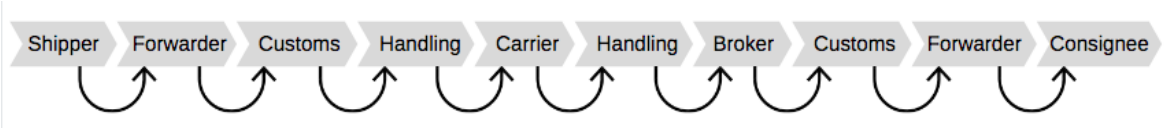

Figure 6: Supply chain stakeholders: Data transfer from one stakeholder to another.

6.3 Presented problem: Lack of funding and resources

Another problem mentioned by all interviewees (P1, P2, P3, P4 and P5) was the lack of funding for new digital developments and resources as well as the conservative market

that traditional air cargo still is. Interviewee P2 said that air cargo is a low-margin business. He also noted, that many understand the problems they should focus on and are interested in change, but in the end, they are trying to make new developments and transform processes to be more efficient with extremely limited resources. (P2) Resources is a major factor and it stops many new investments happening stated R5. Also the participant added that there are factors like resistance towards new processes and many question if they would actually work. (P5) Interviewees P3 and P4 agreed that many start a process to change and in the end the combination of conservatism and lack of resources. Many companies are aware that they would need to do something and start a project to change their processes but, in many instances it dries up before it is executed due to lack of resources. (P3 & P4) Cargo is not a field that is lucrative to invest in, as there are many other options that offer better revenue potential, said interviewee P1.

> ''It's a conservative market. They don't combine things, and they don't have a lot of money. It's a very low margin market, where handlers are in between. People are really reluctant for change, especially if you compare to the passenger side, where you have e-ticket for 20-30 years.'' P4

It is a very traditional, very old-fashioned and operationally thinking industry said interviewee P1. Another interviewee, P4 stated that it is clear, that air cargo is a very conservative business and it takes a lot of time to get things changed.

6.4 Proposed solutions: Data sharing

Interviewees were asked about potential solutions and future visions for the field of air cargo and potential industry transformation. Each interviewee made points about data sharing and its importance and potential in improving the future supply chains. Interviewee P1 explained that firstly, a digital infrastructure is needed and if you have that, you are able to build various applications on it which support data sharing. Additionally, P1 said that data safety and privacy are among the most important things regarding sharing of data and established trust is essential between stakeholders.

Interviewee P1 mentioned that a very important principle of data sharing is that it can only be done with the consent of the data owner**.** He stated, that if you have that trust and consent, then there is a possibility to solve many problems in the supply chain: coalitions can be formed, from the beginning of the chain to the end of the chain by linking everyone together, from the e-commerce vendors to governments. With a common language, set of agreements, new business models can be invented, but they all start with information sharing part. (P1)

Data sharing seemed to be a critical element when considering the solutions for current problems in the air cargo supply chain. Interviewee P1 added that, data is everywhere but the real problem is how to make the data available so it can be used in more efficient way. Interviewee P5 stated, that there are major improvements to be made regarding data sharing. Interviewee P4 stated that if companies want to have a chance to survive in the future, they should acknowledge data sharing and its potential. Interviewee P3 stated that innovators need to jump into the unknown and by data-sharing they are able to achieve transparency which ultimately will benefit the end-customer. Interviewee P1 said, that data sharing is one of the most important solutions for the current problems in the traditional air cargo and its supply chain. Interviewee P2 said that technology has been beneficial as it facilitates the communication between stakeholders. Data-solutions will take major leaps in the future for better and ideally, it would work in a way that information is typed once and it would flow into different systems, said interviewee P5.

In relation to data sharing and changes the industry has seen, application programming interface, a computing interface which defines interactions between software intermediaries, later referred to as API, was mentioned by four (P1,P2,P3,P4) interviewees, as a way to share data, connect the existing points to make the flow of information more efficient. Interviewee P1 said, that he believes the one who has the data or the best data precision, will be in the best position in the future. P4 also predicted that in the next 2-3 years we will see innovations which make the work flow more efficient, transparent and paperless by data sharing. He stated that this process will start from small steps but change is already visible. (P4)

6.5 Proposed solutions: Collaboration

Four out of five interviewees pointed out similar things regarding collaboration. Interviewee P1 stated that the tech landscape is not built for the collaboration of the future. It does not support real-time transaction. Actions companies should consider when aiming to build future supply chains could consist of the following points: Incumbents need to map their offering against market growth and consider outsourcing their IT for the ‘thinkers’ and build collaborative networks rather than trying to be the biggest no matter the cost. (P1)

> ‘’I think that coming from the previous century, we made a mess of it, and the difference we can make now is, if we orchestrate our resources much better amongst each other, we have less waste, less burden to the planet and we can make the world a better place. ‘’ (P1)

> ‘’..they should not be too afraid to work together from competition point of view, otherwise the battle will be lost to the likes of Amazon.’’ P4

Interviewee P1 also mentioned that the common nominator is that you can now work together, with different companies and collaborate, which opens many new opportunities. Interviewee P2 mentioned that priority should be finding commonality on how we engage in the current issues, for example the cool-chain of the COVID-19 vaccination, which will be important for air cargo industry. He also mentioned that each stakeholder has a role to play and everyone needs to be able to work together to ensure all the issues are being dealt with. (P2) As long as companies act as individual companies, the progress of change will be so slow that they will never be able to catch up with likes of amazon and integrators, said interviewee P4. Another point made by interviewee P3 is the fact that there are systems that are able to gather information from all stakeholders and by connecting, you can see a real benefit. Interviewee P1 said that data is everywhere but the issue is how you make the data available so it can be used. He also mentioned collaborative data infrastructure enforced by national policies and government, which has been made in the Netherlands, where a digital transportation strategy has been created and many parties invest in this together, to facilitate data sharing. Interviewee P4 and P3 said that if companies want to have a chance of survival in the future, data sharing is essential, but also, if the companies can co-operate and work together then they are able to offer something competitive to the integrators service.

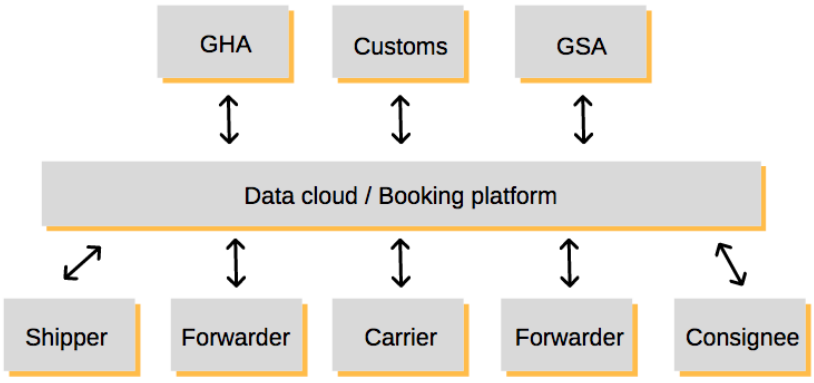

Figure 7: Data sharing: Simple Visualization (Modified from Rossand & Rasmussen 2017.)

7 Discussion

Following the analysis of results, this chapter also includes final discussion and conclusions, as well as development ideas and suggestions for further research. Own process of learning during the course of this thesis is assessed in the last subchapter. Aim of this research was to identify some of the drivers of change, problems and future solutions in the field of air cargo and its digital transformation. The in-depth interviews were conducted to learn from professionals from different perspectives and backgrounds to deepen the understanding of the current situation and future predictions for air cargo industry.

Main themes of this research results revolved around the massive rise of e-commerce and the effects it has on air cargo industry, current ways data flows through the stakeholders in a supply chain, challenges lack of funding and resources create for the air cargo industry. Additionally some proposed solutions for the problems were identified, such as building more collaborative supply chains and utilizing technology that is available and sharing of the data to create more efficient supply chains. The interviews reflected the results from the secondary data from the desktop research in the literature review as all the themes arising from the interviews have been more or less visible in the relevant news articles from air cargo-related publications and global regulatory bodies such as International Air Transport Association, IATA. The results clearly indicate that the themes arising from the data collected are both relevant findings and all themes formed together, suggest predictions and recommendations for the future of the air cargo industry.

The results clearly indicated that in the new era of digital age, the older generation supply chains are becoming increasingly dated and new supply chain needs to answer to the demands of today and tomorrow. Some companies are focusing on improving their supply-chains and many have still failed to evolve their supply chain model due to lack of funding, which creates a dilemma. With the current global pandemic of Covid-19, the resources are likely to be even more limited than in the past, combined with the necessity to evolve current business models to overcome the current problems of fragmentation and lack of collaboration. Companies should find ways to evolve their business models to be able to have a viable company in the future as supply chain performance has a direct affect to company's income statements. (Kuntze, Lange & Seyfert 2019.)

One of the major factors contributing in creating a rather optimistic yet challenging environment for the future of air cargo is e-commerce. All interviewees agreed that e-commerce has massive effects on the field of air cargo and it can be seen as driver of

change for the industry. E-commerce has forced many stakeholders to re-evaluate their current processes, as volumes rise and the nature of the business shifts from B2B into B2C, it is becoming increasingly visible how the air cargo industry still remains old-fashioned. As the results indicated, the rise of e-commerce has seen a shift in the business models, as integrators are taking more of a hold of the segment and traditional air cargo lags behind as it is not able to meet the growing demands of express delivery. Another point rising from the interviews being e-tailers becoming their own logistic providers, like Amazon, is a game-changer that will be even more visible in the future. As one interviewee stated, if the air cargo carriers don't acknowledge their problems, they will not be any more than the asset-owners, conveyor belts in the internet of logistics. (R1 2020)

Other driver of change in addition to e-commerce is the global pandemic of COVID-19, which has been visible in the aviation-related news from the beginning of the year 2020. The COVID-19 pandemic is both a health crisis and economic shock. Current world situation would indicate that as passenger air travel revenue has experiences drastic decline, 74% globally, with more than 16,000 passenger jets (representing 55% of global fleet) are grounded worldwide. (Diamond 2020) Due to COVID-19, all eyes are on air cargo, which for many, will now be virtually the only source of revenue. Many carriers have seen air cargo as more of an afterthought rather than critical part of their operations (Diamond 2020.) and this is also a factor to reconsider now, as cargo itself could be a significant factor in reviving aviation industry with the revenue it creates and for passenger airlines, now might be the time to consider bringing freighters back to support their passenger networks.

Air cargo industry is one that is massively important as world's supply chains are depending on it, but it is still being managed in an arcane way. Like in many other industries, the best practices are challenged, and replaced by new ones. Startups have already taken many opportunities that incumbents have been ignoring and by doing that they have managed to tap into the future growth potential. (Mc Kinsey & Company 2020.) Funding of startups has allowed innovation within the industry and new businesses has risen to challenge the market in the future. Incumbents should not necessarily be afraid of the challenge, but to embrace it. For example, partnering up with start-ups is a relatively low-cost way for huge companies to either validate their idea before building it in-house or use it as a method to find lower-cost solutions externally, which is extremely important when resources are very limited.

The future cannot be seen as ‘winner takes it all’, instead the vision of the future should focus on taking the industry to next level by collaboration. The vision for 2030 logistics involves startups gaining momentum, as same day and so-called instant delivers are becoming the new normal, different ways of working are needed. Incumbents have a few options on how they can go about in the future, observing startups and researching their challengers’ services before implementing their own ones. Another model is investing, by acquiring stake in startups to create a win-win scenario as incumbents have the networks and start-ups have the tech-capabilities. Many have taken note, as collaborations between companies can be seen as a trend that has been forming during the past years, as many industry articles suggest. Each of these examples of collaboration seem to be a drop in the ocean as many companies are shifting towards more collaborative mindset and forming these beneficial partnerships that will all shape the future of supply chains. Collaboration between stakeholders, described in conclusive way by McKinsey & Company report (2020) about Startup funding: “Overarching partnerships will be increasingly important to succeed in the future, especially since processes in the industry are so intertwined. Connecting start-ups and their digital capabilities with incumbents and their physical networks can unlock substantial opportunities for all stakeholders.’’

As seen in the results, the real issue is not really technology as we have all the technology we could possibly want. The problem seems to be utilization, mindset, availability of the data and resources that are stopping many companies from making their businesses more viable to survive in the future. The data is locked in by each supply chain operator and this is not made easier by the regulatory and winner takes all-perspective the air cargo industry has. (Flacke 2020) The air cargo industry is global, fragmented and competitive field with small tech-advances but as mentioned, of the biggest barrier for change in addition to resources could be the mindset regarding adaptation to new technology. (Lennane 2020) People behind the systems are the ones who make all the difference. Therefore, one thing the industry has in some ways failed, is attracting new workforce, innovative minds whom have the potential to bring new ideas and perspective into the field of air cargo. Collaboration, not only on company levels but with universities could be beneficial for all parties. Project work allows students to develop their skills in real-life tasks and in return, results from projects may create valuable insights for a company, costing them very little which is crucial due to the funding issues. To conclude, collaborative measures not only between stakeholders, but between universities and companies could result in a win-win benefits for both parties, with students needing experience on the field and companies needing resource-sustainable solutions for the future.

One great example of slow adaptation to new technology is IATA's electric air waybill, e-AWB which was launched in 2010 in hopes that it would become the new default contract of carriage, eliminating the need to print, handle or archive paper. (IATA 2020.) The usage rate for e-AWB is as low as 66%. Companies like Amazon, Uber and AirBnB have disrupted the industry norms in their own fields by intelligently adapting digitalization and mobile technology. At the heart of these transformations is the adaptation of digital platforms that integrate to new services, connectivity and technology into a digitally enabled business ecosystem. The right digital solutions have the possibility to reduce costs, improve efficiency and allow greater speed which all should be reasons to encourage innovation in the field of air cargo. Point raised in the literature review, is that as stakeholders with more advanced technologies are often faced with challenges when transferring information between stakeholders. Digital transmission capabilities of a company are reliant on the technical capabilities of their partners. (IATA 2020.) The more advanced technology you are using results in more challenges in the future? This doesn't sound encouraging and change-forward. More like, the better technological leaps from stakeholders collectively, would result in raising up all of the stakeholders, creating more efficient and end-to-end solutions. Air cargo should take note from previously mentioned, other industries as more advanced solutions have been able to take industries to next level.

Other point to be made is sustainability. Although, sustainability is not a theme specifically arising from the data collected, it is one of the most crucial aspects of the future. The problem with greenhouse gas emissions cannot be ignored much longer. Transport is the second largest greenhouse gas-emitting sector after energy (Etim 2016.) but realistically, is air cargo logistic business truly able to go green? Yes, at least to some extent. Passenger air-traffic has already taken leaps in this regard, offering passengers carbon offsets. Offsetting includes calculating emissions of a trip and purchasing 'credits' in projects that remove or prevent equivalent amount of greenhouse gases elsewhere. (Ambrose 2019.) As the worlds populations is becoming increasingly more focused and aware on sustainability, it would not seem impossible to implement such efforts for the field of air cargo. Again, we come back to the mindset.

7.1 Conclusions and recommendations

To conclude, the current situation for the field of air cargo is quite complex, as e-commerce continues its growth and the traditional air cargo is having major growth pains as the industry is simply not built for the 'new world'. Additionally, COVID-19 brings its own constraints as the aviation field has seen the devastating impacts in many forms yet it

has also shown the importance of air cargo and it has created more interest for the field in general. There is hope for the industry as now is the time to act to ensure that the long-awaited digital transformation for the industry is achieved. There are many solutions for the evident problems for the field and stakeholders need to come together and give up their 'winner takes it all'-perspective as there is simply no room for that if you want to have a fighting chance in the future. The industry needs to come together as a whole to connect and collaborate, as transparency and data sharing within the supply chain can unlock major growth potential.

This research has created many points that could be further researched as most of the results of this research all host potential topics. All topics and themes arising from results are not analysed and researched in-depth and all of them have potential to be further researched. Few interesting topics for further research could be following:

- How the rise of e-tailors becoming their own logistic providers will affect traditional air cargo
- How the sustainability-issues in the field of air cargo could be resolved
- How to build bridges between universities and companies in the field of air cargo
- Digitalization plan for company X in the field of air cargo

My own process of learning when writing this thesis has consisted on countless of hours of research, learning new things combined with both frustrations and triumphs. Having done studies in Aviation Business-programme in addition to my chosen programme, Tourism and Event Management, my selective courses have been Air Cargo and Aviation Logistics, which both have provided some basic knowledge for my chosen thesis topic. I have worked for a ground handling company in Helsinki Airport for 2,5 years and currently work as a customs clearance agent, both of which have given me some minor perspective for the research. Initially my thesis was supposed to be done for a commissioner in the field of air cargo but due to COVID-19 pandemic starting around the same time my thesis process, there was not enough resources to support a thesis at that time. Regardless of not having a commissioner, having industry professionals as interviewees and conducting interviews and research for the first time was really challenging and interesting. At the end of this process, I can truly say I have learnt a lot about air cargo and perhaps, one of the most important learnings is that there is still much to be learned. Over all I am happy with the outcome of this thesis as it provides some insights that are relevant to the field and most of all I learned even more than I thought I would during the whole process.

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Appendices

Appendix 1. Interview questions

1. Can you tell me about your background and career path?
2. What kind of effects has the rise of e-commerce had on the air cargo industry in your opinion?
3. What are the biggest challenges in the current ways of working?
4. Who are the ones in ‘danger’ of losing their position in the future supply chain?
5. What kind of solutions could solve the current problems in the supply chain?
6. Who are the ones that can benefit from the industry transformation the most?
7. What kind of business opportunities could be arising from the industry transformation from B2B to B2C?
8. What is your vision of the future supply chain solutions?
9. How can digital logistic service providers expand their operations/services during the industry transformation?
10. What kind of weaknesses freight forwarders might have in the future? How about strenghts?
11. What kind of weaknesses freight forwarders might have in the future? How about strenghts?
12. Could air cargo carriers expand their role in the supply chain in the future? How?
13. Why do you think the investment on new technology has been so slow in the field of air cargo?
14. Has the IT system alignment developed in the field of air cargo in your opinion? In what ways?
15. Which companies would you name as pioneers considering the future of supply chains?
16. What are the biggest challenges for start-ups in the field?
17. Do you see that in the next ten years some of the frontline start-ups could become some of the largest logistic companies?