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Thesis Msc Urban, Port and Transport Economics

From click to clearance: The effect of e-commerce order processing on customs clearance at airports

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Abstract

In the increasingly digital world we currently find ourselves in, e-commerce continues to grow. Transportation of e-commerce goods requires a different approach of operating than traditional logistics. This exploratory study focuses on gaining an in-depth understanding of the impact of the e-commerce goods flow on the efficiency and effectiveness of customs clearance at airports, with a focus on order processing activities in both an integrated and traditional supply chain. Eight semi-structured expert interviews in the field of air cargo, e-commerce, logistics integrators and/or customs clearance are conducted to gain insight into the different perspectives of this supply chain. On the consumer side, research has been conducted into consumer satisfaction of e-commerce shipping companies, with a sample of 110 participants. Although there is little literature on the influence of e-commerce order process activities on customs clearance at airports, the study shows that indeed collaboration can increase efficiency, which is in line with the literature on supply chain integration. This study indicates that e-commerce order processing significantly influences the efficiency and effectiveness of customs clearance, due to high volumes and lack of sufficient data sharing. These findings implicate that the different parties of the supply chain should focus on early data sharing.

Keywords: e-commerce, customs clearance, air cargo, order processing, supply chain integration, consumer satisfaction

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Contents

1 Introduction

1.1 E-commerce in the supply chain

An increasing number of individuals is opting to conduct their business via the internet, and online shopping is becoming increasingly more common. In the first half of 2023, 78% of the Dutch population, aged 12 years and older, made online purchases, which is a remarkable rise compared to 46% in 2012. This percentage increased annually, with a peak during the COVID-19 pandemic (Centraal Bureau voor de Statistiek, 2023). These products ordered online, generally referred to as e-commerce goods, require transportation; either by air, by rail, by inland vessel, by seagoing vessel or by road (Centraal Bureau voor de Statistiek, 2022). Consequently, the global rise of e-commerce has an impact on supply chains. Companies in the transportation sector are normally reluctant to accept digitization. However, the outbreak of the COVID-19 pandemic necessitated a rethink of strategy due to disruptions in the supply chain. Partly because of the increase in e-commerce, logistic companies were under pressure and technology-driven solutions were sought (Kissin, 2023).

During the COVID-19 pandemic, air freight reached extraordinary levels. Partially due to the intensely high demand from e-commerce and the transportation of vaccinations and tests. Higher costs and longer transportation times for cargo transported by sea also contributed to the increase in demand for air freight (Dempsey et al., 2021). According to IATA, e-commerce accounted for 15% of air cargo volume in 2019, and this percentage only increased during the COVID-19 pandemic (International Air Transport Association, n.d.). The continued growth of e-commerce leads to an increasing demand for faster deliveries to meet consumers expectations. This raises complexity of order processing of both e-commerce companies and logistics providers, as well as driving a long-term shift to air transportation. Craig Smyth, chief executive of Worldwide Flight Services, claims that the air cargo industry is undergoing a structural and permanent shift. Although air cargo has always played a small role in the global supply chain, its significance has grown in recent years (Telling, 2022).

After consumers have placed an online order, the e-commerce companies such as Amazon, Alibaba, and Shein can select from a variety of transportation modes to deliver the products to the end-consumers. For cross-border e-commerce, companies usually have a choice between surface transportation options like sea freight, as well as air freight. Especially with the demand for quick deliveries by consumers, air transport has an important advantage over ocean freight. Ocean freight takes an average of three weeks, whereas air freight merely takes one to four days (Maersk, 2022). Within air transportation a distinction can be made between traditional air cargo, integrators, and postal operators (International Air Transport Association, 2019). Integrators are logistic companies that

handle goods from the beginning to the end of the supply chain, instead of only from airport to airport (Airports Council International, 2020). Those integrated logistics companies like DHL, FedEx, and UPS play a crucial role in the e-commerce supply chain with their own air fleet. This is mostly due to the fact that integrated carriers manage the entire supply chain, from the individual shipping the product to the final recipient. This is a significant distinction from a traditional air cargo supply chain which usually provide external logistics services (Lakew, 2014).

1.2 Research question

In the increasingly digital world we currently find ourselves in, e-commerce continues to grow. In this altering industry it is of great importance to stay ahead of the trends (McLaren, 2023). Transportation of e-commerce goods requires a different approach of operating than traditional logistics. Speed is an important key factor and integration with business partners along the supply chain is crucial (International Air Transport Association, 2021), which explains the growing popularity and prominence of integrated logistics providers in supply chains (Maersk, 2023). E-commerce supply chains need to be more digitalized than traditional supply chains. Logistics integrators play a crucial role in fulfilling this, since their supply chain focus gives them the knowledge, processes and connections to implement digitalization, which can contribute to shortened delivery times and lower costs (Bloomberg, n.d.). From the consumer side, supply chain integration therefore offers benefits that may improve consumer satisfaction. However, on the industry side, integration is critical both within the supply chain and with customs clearance. Cross-border transportation involves three main factors: reliability, visibility, and ease of customs clearance (Kuehne+Nagel, n.d.). In terms of reliability and flexibility, air freight offers advantages in terms of speed, security and control, ensuring efficient handling of changes (Maersk, 2022).

Hence, e-commerce supply chains require a different approach than traditional supply chains, where collaboration and integration within the supply chain are crucial. Logistics integrators can play a major role in this, given the comprehensive pipeline vision they have across the entire supply chain. A gap in the literature can be seen in this, since it is quite unknown how the movement of goods through e-commerce affects customs clearance at airports, and what role logistics integrators can play in this. This brings up the research question:

"How does e-commerce order processing influence the efficiency and effectiveness of customs clearance at airports?"

Given the limited time frame of this study, the topic is narrowed to order processing, since this involves each party, from the beginning to the end of the supply chain. This

is because order processing influences consumer satisfaction as well as the efficiency and effectiveness of customs clearance. In addition, order processing contributes to cooperation between the various parties in the supply chain, or a logistics integrator can play an important role in this. To respond to the research question, four sub questions have been formulated. Due to time constraints and feasibility of the research, most insights have been gained from experience with Schiphol Airport. Schiphol Airport is, together with the airport in Maastricht, a major center for cargo in the Netherlands. In 2022, 93% and 7% of all air freight in the Netherlands was received by Schiphol Airport and Maastricht Aachen Airport, respectively. In 2023, 98% of all air cargo in the Netherlands went through Schiphol Airport, because of a temporary closure of Maastricht Aachen Airport for runway renovations (Centraal Bureau voor de Statistiek, 2024). The following sub questions must be addressed:

1. *"How does order processing in e-commerce goods flows differ from traditional goods flows, and what is the influence of these differences on customs clearance?"*
2. *"How do e-commerce consumer's delivery time expectations and order complexity affect customs clearance efficiency at airports?"*
3. *"How does e-commerce order processing affect e-commerce shipping companies' consumer's satisfaction?"*
4. *"What are the current main challenges in customs clearance at airports, regarding the e-commerce goods flows?"*

Given the increase in e-commerce in recent years in general, but specifically in the air freight sector, it is important to gain more insights into the influence of e-commerce on logistics flows. This is mainly because transporting e-commerce goods requires a different approach than traditional cargo, especially due to the high speed expected by consumers and order complexity and its influence on customs clearance. Therefore, it is crucial for airports to understand how e-commerce affects the airport, particularly regarding customs clearance. Logistics integrators can play a crucial role in the e-commerce supply chain, since they handle all aspects of the handling of e-commerce goods from beginning to end. It is crucial to comprehend the role of their e-commerce activities and its impact on customs clearance. The practical relevance of this research is to gain insight of their role, and in this way to increase the efficiency of customs clearance of e-commerce goods transported by these logistics integrators at airports, such as Schiphol Airport. For Schiphol Airport it is still unknown what the influence is of the relatively new flow of goods that e-commerce entails. From a scientific perspective, this research contributes to a better understanding of how the increase in e-commerce goods affects the overall volume of cargo handled by airports. Moreover, there is little literature on the impact of e-commerce on the air freight industry.

1.3 Supply Chain Framework

This study makes a distinction between an integrated e-commerce supply chain and a traditional supply chain, both of which are shown in Figure 1. Although this study mainly focuses on transport, the term supply chain is used in this study, since it also includes the customs efficiency and consumer satisfaction of the last mile delivery of these supply chains, and not just transportation. In both supply chains customs clearance is involved physical as well as digital. The airport, in this example Schiphol Airport, plays a facilitating role by, among other things, making slots available, opening the airport, and providing warehouses. A distinction can be made between operational and commercial relationships in the air cargo supply chain (De Haan, 2022). This study focuses on both relationships. When it comes to consumer satisfaction of the last mile delivery, the focus is on commercial relationships, while physical transport and the efficiency of customs clearance is focused on operational relationships.

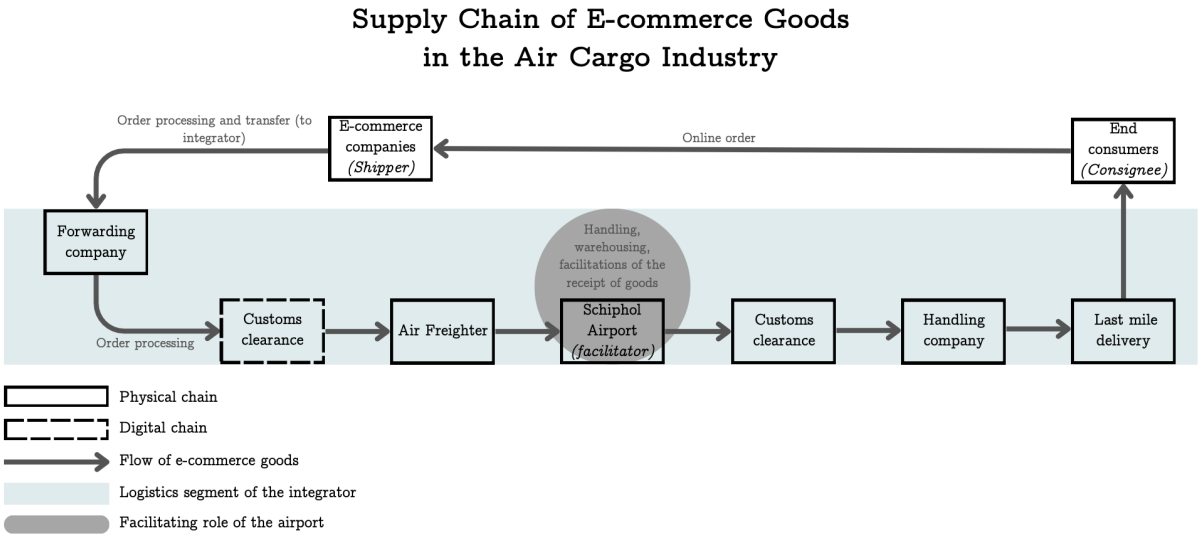

Figure 1: Differences between the considered supply chains

The integrated supply chain operates as follows: The (end) consumer places an order with an e-commerce company, such as Amazon, Alibaba or Shein. This e-commerce company packages the order and hands it over to the logistics integrator. This is where the logistics segment of the integrators starts, which is the light blue part in Figure 1. The logistics integrator then oversees the remaining part of the delivery to the end consumer, serving as a freighter, handler and ensuring last-mile delivery. This also includes contact with customs clearance. This chain emphasizes the more pipeline view along the supply chain from the logistics integrator, while in a traditional supply chain there are separate chains (Interviewee 3, 2024).

In a traditional supply chain, each chain is an individual (logistics) service provider, with collaboration and transfer occurring between the chains. For this study, the forwarding

company takes care of the transport from the e-commerce company, including customs, to the aircraft, in this figure the "Air Freighter". In a traditional supply chain, the "Air Freighter" is often either a full freight carrier or a combination carrier, while in the integrated supply chain this is an aircraft from the own fleet of the integrator (De Haan, 2022). The handling company takes care of the ground handling from the airport and the last mile delivery is the final transport from the warehouse to the end consumer.

The supply chains have been simplified for this study. In the actual air freight industry, more parties are involved.

1.4 Structure

The rest of the paper is structured as follows: First, a literature review is conducted, with a focus on the different concepts that are covered in this study. The methodology section then outlines the research design and procedures. The data gathered is subsequently analyzed and the results are presented. The final chapter contains the discussion, limitations of the study and suggestions for further research.

2 Literature Review

This section provides an explanation of the e-commerce concept and discusses how logistics integrators operate within the air freight industry. The impact of e-commerce on airports and air freight have not been adequately investigated in the literature yet. However, there is some literature regarding logistics integrators' role at airports. Initially, a general explanation of e-commerce will be provided, along with linkages between different types of e-commerce and global air freight. Furthermore, it is discussed how supply chain integration can contribute to improve logistics service quality, and what role logistics integrators can play in the air cargo supply chain. Finally, customs clearance at airports is briefly discussed.

2.1 E-commerce

The literature uses various definitions to explain e-commerce. E-commerce, according to Chaffey (2007, p. 14), is all forms of electronic transactions, both financial and informational, that takes place between organizations and stakeholders. Garrett and Skevington (1999) state a broader perspective, describing e-commerce as a comprehensive subject that includes every aspect of trading, including the development of commercial markets, ordering, management of supply chains, and money transfer. As highlighted by Javalgi and Ramsey (2001) speed, connectivity, and the flow of goods, services and information are crucial in e-commerce. Furthermore, Yu et al. (2017) note that supply chain management and logistics have been significantly affected by the success of e-commerce.

There are many different types of e-commerce since the concept of e-commerce is broad. However, a distinction can be made between the major types of e-commerce, which are business-to-business, business-to-consumer, customer-to-customer, customer-to-business, and customers-to-administration e-commerce (Taher, 2021). In the logistics sector the two most relevant types of e-commerce are business-to-business (B2B) and business-to-consumer (B2C) (Yu et al., 2016). B2B e-commerce is defined as business transactions that take place over the internet and involve the use of new information and communication technologies (Janita & Miranda, 2013). Consequently, whereas B2B factors mainly focus on conducting e-commerce operations with trading partners, the key differences with B2C factors are that the motive is shared by both businesses and consumers (Gibbs et al., 2003).

Additionally, there is a difference between domestic and cross-border e-commerce. Although the term cross-border e-commerce varies in terminology, it always refers to the movement across a national border, either through the actual flow of goods or financial transactions (Gomez-Herrera et al., 2014). There are various explanations that cross-border e-commerce differs from domestic e-commerce logistics. Giuffrida et al. (2017) provide

a number of reason for this. First, higher delivery times and larger distances make the distribution network riskier. Additionally, differences in culture and legal constraints need to be considered. Furthermore, this type of e-commerce requires an entirely different approach to logistics. Consumers expect a quick and effective form of logistics (Hsiao et al., 2017). Given its fast speed, the aviation industry can be a prominent player in the cross-border e-commerce business. Therefore, the rapidly expanding e-commerce world is a major driver of growth in the aviation sector (Van Asch et al., 2020).

According to Sheth (2020), advances in technology, including those in e-commerce, have a significant impact on consumer behavior and increase the number of online purchases. Additionally, throughout the COVID-19 pandemic, e-commerce transactions have only increased. During the pandemic, consumer insights indicated a shift in the market towards e-commerce. The rise of online purchasing after the pandemic provides new opportunities to benefit from this success (Kim, 2020). The uncertainty regarding air freight at the beginning of the COVID-19 period is highlighted in the paper of Suau-Sanchez et al. (2020). On the one hand, it showed a shift towards cargo, as a result of the rise of e-commerce, which benefited integrated express carriers such as UPS, FedEx and DHL. However, the entire supply chain reoriented, which might involve a switch to alternative forms of transportation in some markets. The paper of Shen and Sun (2023) also highlights the supply chain disruption caused by the pandemic; both supply and demand as well as the logistics infrastructure became unbalanced. In case of a disruption in the supply chain, Belhadi et al. (2021) conclude, after examining the automotive and airline industries, that mitigating risks and maintaining business continuity are crucial for both sectors. Overall, all of these studies highlight the uncertainty and disruptions in supply chains that the COVID-19 pandemic has caused. At the same time, it has led to an increase in e-commerce, which has benefited integrated carriers in the air freight sector.

2.2 Supply chain integration

The quality of logistics services is crucial in the field of cross-border e-commerce (Niu et al., 2019). One important quality factor in e-commerce is the quality of delivery services, with an emphasis on affordable and quick delivery (Morganti et al., 2014). The quality of these logistics services can be improved through integrating air cargo into the supply chain. This is because of the fact that the speed of transportation is one of the main advantages of air freight over the other modes of transportation (Zhang & Zhang, 2002). The integration of the air freight sector into the logistics industry is of great importance, as it offers the opportunity to complement other modes of transportation and therefore facilitate door-to-door deliveries along the supply chain (Yuan et al., 2010). According to Flynn et al. (2010), supply chain integration may provide effective and efficient flows within the supply chain, providing optimal value to the consumer. This implies that a

manufacturer collaborates with all partners within the supply chain, and manages both intra- and inter-organizational processes.

One of the ways of this integration, according to the article of Jayaram and Tan (2010), is the integration of companies with third-party logistics companies. In their article, the company integrates third-party logistics into their supply chain, while the third-party logistics provider handles transportation and warehousing, charging a fee for these services. Examples of this integration given in the article belong to information services both for transactional activities and business intelligence. The benefits of supply chain integration have long been recognized, and this also applies to the added value of using third-party logistics. For instance, improving customer service and decrease costs can both be achieved through supply chain integration. Moreover, research indicates that successful companies often work with third-party logistics providers for information management as well as transportation (Power, 2005).

2.3 Logistics integrators

Despite the fact that supply chain integration frequently entails working with logistics integrators for the transportation of cargo by air, there are two different kinds of airlines within the air cargo supply chain, according to Feng et al. (2015). On the one hand, there are combination airlines, which focus on both passenger transport and the transport of cargo in the bellies of those aircraft. On the other hand, all-cargo carriers, also called integrated express carriers, focus on door-to-door shipping with their own air and ground fleet. These global integrators control the complete supply chain, from the person shipping the product to the end user. In addition to managing the entire delivery network – both air and ground – those shipping carriers also provide end users with package delivery services (Malighetti et al., 2019b). The rise of those logistics integrators, such as FedEx, DHL, and UPS, as well as their hub-and-spoke networks, have been crucial in transforming the air freight sector (Matsumoto & Domae, 2019) and, as a result, it led to a change in the global economy. Because of their reliable and quick delivery services, these integrators became a crucial link in the entire supply chain (Alkaabi & Debbage, 2011).

A distinction can be made between different types of logistics providers. The literature often discusses third-party logistics providers or fourth-party logistics providers. A third-party logistics (3PL) provider, as defined by Hertz and Alfredsson (2003), is an external party that handles the logistics part and serves as the link between the buyer and the shipper or supplier. Jayaram and Tan (2010) also emphasize the aspect of transport and warehouse services provided by 3PLs in the supply chain. Besides, there are also fourth-party logistics (4PLs) providers. Win (2008) highlights that 4PLs ensure integration within the supply chain by coordinating customer demand using resources from the 3PLs, with a strong focus on value creation. Due to similarities in the services provided by both

third-party logistics service providers and fourth-party logistics providers, the terms are sometimes used interchangeably. However, the main distinction between the two terms is that 4PLs are accountable for supply chain coordination in addition to providing just operational and logistics services (Selviaridis & Spring, 2007).

Although there are differences between 3PLs and 4PLs, these logistics integrators are nonetheless crucial to the air cargo supply chain. Logistics integrators experienced a shift from B2B to B2C business models because of the explosive growth of retail e-commerce and the subsequent rise of quick delivery (Malighetti et al., 2019a). Research by Malighetti et al. (2019b) shows that the three main integrators – DHL, FedEx, and UPS – all have hub-and-spoke networks, which requires both robustness and flexibility. FedEx has the most developed network when it comes to overall capacity, while DHL has implemented further developments in terms of connections and airports (Bombelli, 2020). Airports might benefit from these networks of various integrators. First, the presence of an integrator indicates to other companies that the market is in high demand. And the presence of an integrator at the airport guarantees the transportation of substantial amounts of cargo to and from the airport. Furthermore, they often rent large warehouses, use capacity of other freighter airlines, and generate employment opportunities. Therefore, the presence of logistics integrators is an essential factor for airports and furthermore airports may generate revenue from the e-commerce activities of logistics integrators (Van Asch et al., 2020). This is also evident from research by Merkert et al. (2017). This article states that the significant growth in the air cargo industry is mainly due to the extreme growth of logistics integrators, who enable door-to-door supply chains. Additionally, the authors mention that the presence of such logistics integrators offers advantages for airports. This is due to their presence at airports and the services they provide, yet it is also because of the networks they create and the fact that multinationals and distribution centers are close to the airports, which in turn increases the demand for air cargo. Although there is little literature on the role and influence of logistics integrators at airports, the existing literature emphasize the importance of logistics integrators' existence as well as their e-commerce related activities.

2.4 Logistics service quality and consumer satisfaction

Compared to traditional logistics, the logistics of e-commerce products is more complex, partly due to the small and irregular orders. Furthermore, the logistics service is provided directly to the final consumer, having high expectations regarding delivery. These factors make logistics a crucial component in the e-commerce sector (Yu et al., 2016). It has been acknowledged for a long time that the quality of logistics services enhances consumer satisfaction and also supports companies receive a competitive advantage (Mentzer et al., 2001). Also the article of Vakulenko et al. (2022) emphasizes how essential differentiation is

for logistics integrators to satisfy consumer expectations, especially in the rapidly expanding e-commerce sector. This is consistent with the insights provided by Meidutė-Kavaliauskienė et al. (2014), who also provide insight into consumer satisfaction with logistics services. They also highlight the importance of consumers satisfaction for achieving competitive advantage. The authors argue that to build a long-lasting relationship, a service provider must deliver a service that meets up to the consumer's expectations.

For e-commerce companies, logistics integrators can play an essential role in providing these services that are necessary for improving consumer satisfaction levels. They can serve as the intermediary between the receiving party, which is the end user, and the offering party, which in this case are the e-commerce companies. Research by Jie et al. (2015) shows that especially flexibility of these service providers is of great importance to create consumer satisfaction. From a consumer's point of view, speed and quality are expected (Tarn et al., 2003). This is further supported in the study of Murfield et al. (2017), into consumer satisfaction of omni-channel consumers, which emphasizes that logistics service providers need to prioritize speed and reliability. And these important factors can be provided by global logistics integrators, who can deliver high quality and speed with their own fleet (Hertz & Alfredsson, 2003). Parasuraman et al. (1988) state that consumer perception is a useful instrument for assessing the service quality of a company. In the article of Parasuraman et al. (1988), ten dimensions are defined that measure service quality, and it concludes by defining a refined scale of five dimensions: tangibles, reliability, responsiveness, assurance, and empathy. While the dimensions of Parasuraman et al. (1988) focus specifically on retailing organizations, Mentzer et al. (2001) have created a more comprehensive framework by extending and modifying this framework for the logistics sector. They have defined nine dimensions that can be used to evaluate logistics service quality in terms of consumer satisfaction. The nine dimensions are: personal contact quality, order release quantities, information quality, ordering procedures, order accuracy, order condition, order quality, order discrepancy handling, and timeliness. These concepts contribute to the consumer satisfaction of consumers in the logistics sector.

2.5 Order processing in e-fulfillment

Achieving profits for e-commerce retailers depends on cost minimization and revenue maximization. Online shopping results in higher fulfillment costs compared to physical shopping. Hence, it is imperative for e-commerce retailers to optimize these fulfillment decisions. From their point of view, choices about pricing have an impact on revenues, whereas choices about fulfillment have an impact on product distribution and thus, expenses. Since both factors directly affect the balance between supply and demand, the prices of the products they offer are closely linked to the fulfillment decisions (Lei et al., 2018).

The literature presents various definitions of e-fulfillment. According to Agatz et al.

(2008), the four supply chain stages - sales, delivery, warehousing, and purchasing - form the e-fulfillment process, which involves the final delivery of the physical products to the consumer. Pyke et al. (2001) make a further distinction in e-fulfillment, by specifically looking into order fulfillment, which consists of the steps from the moment a consumer purchases the product to the moment the product fully meets the consumer's expectation. In the article, the authors distinguish between five different processes of e-commerce order fulfillment, which are order capture, order processing, pick and pack, ship and after-sales service and returns handling. This suggests that e-fulfillment includes every step within the logistics process of online sales, while order processing focuses on all steps necessary for handling and delivering the product.

Since e-commerce consumers have high expectations for prompt delivery, some e-commerce companies decide to depend on third-party logistics service providers for the delivery part in the order fulfillment process (Tarn et al., 2003). Leung et al. (2018) attributed the increase in outsourcing to the demand-driven distribution model and the complexity of orders. In addition, it emphasizes that, given the irregularity of e-commerce orders and the expected tight delivery requirements of e-commerce companies, the e-commerce order fulfillment process of logistics integrators must be efficient.

2.6 Customs clearance at airports

The rapid development of cross-border e-commerce affects global trade and therefore also influences airports. The article of Wang et al. (2021) highlights how important it is for retailers to know how long it takes for their product to clear customs in the nation to where it is being shipped. This emphasizes the importance of quick customs clearance at airports. Additionally, it has been showed that an efficient customs clearance process benefits trade and, consequently, the economy overall (Elliott & Bonsignori, 2019). The expanding e-commerce sector depends largely on express delivery from international express carriers that have their own air fleet. Furthermore, integrators, airlines and cargo handlers see a prolonged customs clearance process as a barrier to the growth of efficient and open trade, which can affect the airport choice (Zhang & Zhang, 2002).

2.7 Conclusion

The e-commerce goods flow is characterized by electronic transactions (Chaffey, 2007, p. 14), in which speed, connectivity, and flows of goods, services and information are key (Javalgi & Ramsey, 2001; Hsiao et al., 2017). E-commerce goods require for this reason a different approach of logistics than traditional cargo, and due to the high speed in the aviation industry, e-commerce is a major growth of this sector (Van Asch et al., 2020). In the e-commerce sector, quality and speed of the end delivery are important (Niu et al., 2019; Morganti et al., 2014). Supply chain integration can contribute to an effective and

efficient flow, and can ultimately improve the quality of logistics services and therefore the quality of last-mile delivery (Yuan et al., 2010; Flynn et al., 2010). 3PLs can play a role in this (Jayaram & Tan, 2010), given that these logistics integrators operate along the entire supply chain (Malighetti et al., 2019b). There is a difference between 4PLs and 3PLs, with the main distinction being the coordination role of 4PLs (Selviaridis & Spring, 2007).

E-commerce orders are small and irregular, and the services are delivered directly to the end consumer (Yu et al., 2016). The quality of logistics services can positively contribute to consumer satisfaction (Mentzer et al., 2001), and since logistics integrators can provide last-mile delivery, they can play a role in ensuring logistics service quality. Due to their flexibility, their services are of great importance in creating consumer satisfaction (Jie et al., 2015), and their own fleet allows them to deliver speed and quality (Hertz & Alfredsson, 2003). Partly due to the high expectations of consumers, e-commerce companies often outsource their order fulfillment process to 3PLs (Tarn et al., 2003), which, according to Leung et al. (2018), is often the cause of order complexity. The e-commerce goods flow also impacts customs clearance at airports. For airports, it is important to have a fast customs clearance process. One the one hand, to remain attractive for retailers (Wang et al., 2021), and on the other hand, to remain attractive as an airport for the overall economy (Zhang & Zhang, 2002; Elliott & Bonsignori, 2019).

Although there is little to none literature on the influence of the e-commerce goods flow on airports, and specifically on the customs clearance at airports, there is literature on the separate parts of this issue. It is generally recognized that the rise of e-commerce has a major impact on the transportation sector, and the air cargo industry in specific, and that, partly due to high consumer expectations in terms of speed and quality, it requires a different approach of logistics than traditional cargo. In the literature, the role of logistics integrators is described as valuable when it comes to these two points. However, no to little research has yet been conducted into the role of logistics integrators in the e-commerce flow of goods specifically. Because consumers also have an influence on the e-commerce supply chain, it is very important that the supply chain is examined from both sides. On the one hand, consumer satisfaction of end consumers and on the other hand, the efficiency and effectiveness of customs clearance. Given the order complexity of e-commerce orders, the order fulfillment process is often outsourced from the e-commerce companies. This research aims to generate insights into the influence of e-commerce order processing on the efficiency and effectiveness of customs clearance at airports, and thus fills a gap in the existing literature, where the different parts are often looked at separately. By looking specifically at order processing, perspectives are obtained from the industry side as well as the consumer side. Although the existing literature on the individual components is often outdated, these studies are still valuable because the fundamentals in the air cargo industry have not changed. This research therefore supplements the existing literature by specifically looking at the influence of e-commerce on customs clearance at airports.

3 Methodology

The aim of this study is to get an in-depth understanding of the impact of the e-commerce goods flows on the efficiency and effectiveness of customs clearance at airports, with a focus on order processing activities in both an integrated and traditional supply chain. Since there has not been a lot of research done on the impact of e-commerce order processing activities, and particularly the role that logistics integrators can play in this, the objective of this exploratory study is to find and generate new insights. Consequently, the majority of this study is qualitative in order to gain a comprehensive understanding that will ultimately lead to an answer to the following research question:

"How does e-commerce order processing influence the efficiency and effectiveness of customs clearance at airports?"

This section will provide an overview of the methodology of the study. First, the methodology and research design are described. After that, an expanded overview of the qualitative part and the quantitative part of the study is provided.

3.1 Research design

The research strategy of this study is mixed methods, combining qualitative semi-structured expert interviews with a quantitative structured survey. A mixed methods study collects and analyzes data using both quantitative and qualitative methods. The results complement each other and ultimately create a more comprehensive answer to the research question (Creswell et al., 2004). The majority of this study is qualitative, with the structured quantitative survey questions partly derived from the insights gained from the qualitative semi-structured interviews. Therefore, this study can be characterized as an exploratory sequential mixed-methods design, in which the qualitative data and results form the basis for the collection of quantitative data (Fetters et al., 2013). McKim (2017) examines the value of mixed-methods as a research design, compared to using a single research method. The author highlights that using a combination of approaches provides a more comprehensive understanding and perspective than using only one approach. In addition, the author states that the use of a mixed-methods approach contributes to a better understanding and confidence in the findings and increases the validity and precision of the research. The theoretical drive of this study is exploratory and mainly qualitative. Given these characteristics, this type of study, according to Schoonenboom and Johnson (2017), is inductive. As per Thomas (2006), inductive analysis is the process of thoroughly analyzing unprocessed data in order to find themes, concepts, or models through data interpretation.

In short, the research methodology is as follows. First of all, qualitative research is conducted to gain a better understanding on the e-commerce supply chain in air freight.

The emphasis here is to comprehend the entire e-commerce supply chain and the differences between an integrated and traditional supply chain, in order to identify what role logistics integrators may play in optimizing the e-commerce supply chain. On the other hand, the emphasis is on the efficiency and effectiveness of customs clearance at airports, examining the part that order processing plays in this. This is done using semi-structured interviews, in which both the perspective of the logistics integrators and the airports, for this study Schiphol Airport. The interviews are conducted with experts in the field of air cargo, logistics integrators, e-commerce, and/or customs clearance. Subsequently, the insights resulting from the semi-structured interviews are used to guide the direction of the survey and the questions, which focus on consumer satisfaction of e-commerce shipping companies. The following sections will specifically discuss the different phases of this research.

3.2 Semi-structured interviews

Eight semi-structured interviews are conducted in order to provide an answer to the sub questions 1, 2 and 4, which are as follows:

Sub question 1: *"How does order processing in e-commerce goods flows differ from traditional goods flows, and what is the influence of these differences on customs clearance?"*

Sub question 2: *"How do e-commerce consumer's delivery time expectations and order complexity affect customs clearance efficiency at airports?"*

Sub question 4: *"What are the current main challenges in customs clearance at airports, regarding the e-commerce goods flows?"*

Saunders et al. (2009, p. 437) distinguish between standardized (structured) and non-standardized interviews. In the case of qualitative research, non-standardized interviews are used, with a further distinction being made between semi-structured interviews and in-depth interviews. Semi-structured interviews have been chosen for this research given the exploratory nature of this research. According to Saunders et al. (2009, p. 438), predetermined themes and a few predetermined questions pertaining to these themes define semi-structured interviews. It gives some flexibility in terms of asking the questions in a different order and delving deeper into the answers provided by the respondent.

A total of eight interviews were conducted, spread over the months of May and June. The field in which the respondent works determined the direction of the interview. The questions were then adapted to the perspective of the airport, logistics integrators, or customs clearance. The interview process is iterative in nature. Based on the answers given by interviewees in previous interviews, the insights gained were further explored in follow-up interviews. The goal of an iterative process is ultimately to create more depth in

the insights, and thus provide a complete answer to the research question (DiCicco-Bloom & Crabtree, 2006). The questions therefore differed per interview and the predetermined questions were also deviated from when a respondent went in a different direction than expected.

The potential interviewees were approached via LinkedIn or e-mail. However, during the interview process, certain respondents also helped connect with other interviewees. Prior to the interviews, the interviewee was asked whether the interviewee agreed to the recording of the interview and the use of the transcript in this study. In addition, they were asked if they were comfortable with their name and the name of their organization being mentioned in this study. Each interviewee gave permission for this. Every interviewee shares their own opinion on the topic and does not speak for their organization. None of the statements made can therefore be considered as the opinion of the organization where they work.

The interviews took place face-to-face or via Teams, depending on the interviewee's preference. In the end, one interview was conducted in person, and the other interviews were conducted via Microsoft Teams. One of the interviews took place with two interviewees at the same time. Two of the interviews were in English and the rest of the interviews were in Dutch. The interviews vary from 31 to 48 minutes per interview, with an average duration of 40 minutes. Table 1 provides an overview of the semi-structured interviews. Table 8 in Appendix A.1.1 provides a more detailed overview of the conducted interviews.

	Interviewee	**Function**	**Date**
1	Olaf van Reeden	Cargo Partnerships Director at Schiphol Cargo	May 17, 2024
2	Henk Venema	CEO DHL Global Forwarding Western Europe	May 24, 2024
3	Johan Star	Projectmanager SCMP at Royal Schiphol Airport	May 29, 2024
4	Martijn Kuiken	Business Owner PGTS at Air Cargo Netherlands	June 6, 2024
5	Christopher Hodge	E-commerce Marketing Manager at FedEx	June 10, 2024
6a	Maurice Saes &	Director International Networks &	June 13, 2024
6b	Arno Rosbag	Customs Manager at DHL eCommerce	
7	Mike de Wolff	Compliance Consultant at Aero Express B.V.	June 13, 2024
8	John Stoten	Global Clearance Solutions Specialist at FedEx	June 18, 2024

Table 1: Overview of the conducted interviews

3.2.1 Data collection

In order to obtain respondents for the semi-structured interviews, convenience sampling, which is a type of non-probability sampling, was used. This method of sampling was chosen to be able to approach representative respondents within the limited time of this study. In qualitative research, convenience sampling is frequently utilized. Convenience sampling is a method of sampling in which respondents are selected based on convenience

for the researcher and the extent to which they meet the predetermined criteria (Acharya et al., 2013). Potential interviewees were contacted by email or LinkedIn. Specifically, individuals with experience in the field of air cargo, logistics integrators, e-commerce and/or customs clearance at Schiphol Airport were approached. One of the requirements is that the potential interviewee has relevant work experience in one of these fields. Age, gender, education and other moral characteristics had no influence on approaching people.

The viewpoint of the airport was the main topic of the first interview. Here, gaining knowledge about the impact of the e-commerce flows at Schiphol Airport and recent developments in the air cargo sector was the main objective. The interview with interviewee 3 further discussed current projects at Schiphol Airport, aimed at digitalization and the importance of the various parties in the air cargo supply chain. The focus of the interviews with interviewees 2, 5, 6a, 6b, and 8 is on the function of freighters and logistics integrators in the air cargo supply chain, as well as how customs clearance is related to it and how e-commerce affects it. These interviewees are experts in air freight, e-commerce, or customs within the organizations they work, which are DHL or FedEx. The interviews with interviewee 4 and interviewee 7 are focused on customs clearance in the air cargo supply chain. Both interviewees have a lot of experience in the field of customs clearance.

3.2.2 Data preparation

The interviews were recorded, with the interviewees consent, and the automatic transcription features of Microsoft Teams were used to transcribe the interviews. This was promptly done after the interview, either on the same day or the following day. After the transcription process, the text was coded. For this, the qualitative data analysis software, ATLAS.ti. was used. The transcript of the interviews can be found in the Supplementary Document. The code book is in Appendix A.1.3.

3.2.3 Data analysis

After transcribing the interviews, the process of coding followed. This is required to analyze the data, and thematic analysis and inductive coding have been used to do this. The thematic analysis method, according to Braun and Clarke (2006), is used to identify and analyze patterns, referred to as themes, within a dataset. This method is different from other qualitative techniques that look for themes within a dataset because it does not require theoretical and technological knowledge. The authors then distinguish between an inductive or deductive approach to identifying themes. The data of this study is coded using the inductive approach, in which themes are derived from the data itself rather than assigning it to specific and predetermined codes. In the end, 117 distinct codes resulted from the coding, which are categorized into 10 themes, which are in Appendix A.1.2.

3.3 Survey

A structured survey was used to collect data to answer the third sub question:

Sub question 3: *"How does e-commerce order processing affect e-commerce shipping companies' consumer's satisfaction?"*

The goal of the survey is to gain insight in the consumer's satisfaction of e-commerce shipping companies. E-commerce businesses forward the orders that consumers place to logistics integrators, who facilitate door-to-door logistics. It is crucial to comprehend consumer expectations since fulfilling them will benefit the supply chain in the long run. Consequently, this will improve the efficiency and effectiveness of customs clearance at airports. Since this is an exploratory study, the survey is aimed at generating insights. The survey focuses at how delivery services' order processing can have an impact on the e-commerce shipping companies' consumer's satisfaction. The insights from the expert interviews are used to formulate relevant questions for the survey. The survey includes various aspects of order processing by logistics integrators/delivery services, such as consumer contact, quality of information, problems, and speed of delivery.

3.3.1 Data collection

The survey was designed and data was collected via the online tool Qualtrics. The target group is anyone who has experience with ordering online. Therefore, it was decided to send the survey to a general and accessible public, rather than defining a specific target group. The survey was sent to various Whatsapp groups, and posted on Facebook, Instagram and LinkedIn. After excluding 12 respondents who failed the attention check and after removing 39 incomplete responses, the final sample is ultimately made up of 110 respondents. The survey was made available from June 11, 2024 till June 18, 2024 for exactly one week, after which it was deactivated. The entire survey can be found in the Appendix A.2.

3.3.2 Framework

This survey focuses on the level of satisfaction that consumers of e-commerce companies have with logistics integrators and their service quality. Since this survey concerns logistics integrators specifically, and not all types of logistics companies, the survey only focuses at the following five dimensions of the Service Logistics Quality Framework of Mentzer et al. (2001), which has already been mentioned in the literature review section, as they are considered relevant to the service quality that logistics integrators provide: personal contact quality, information quality, order condition, order discrepancy handling, and timeliness. Ultimately, the answers of these five dimensions and their designed items should determine the consumer satisfaction of logistics integrators' services. Figure 2 shows

the simplified framework used for this survey, with the items of Mentzer et al. (2001). Consumer satisfaction regards to the services offered by logistics integrators and is related to the consumers of e-commerce companies.

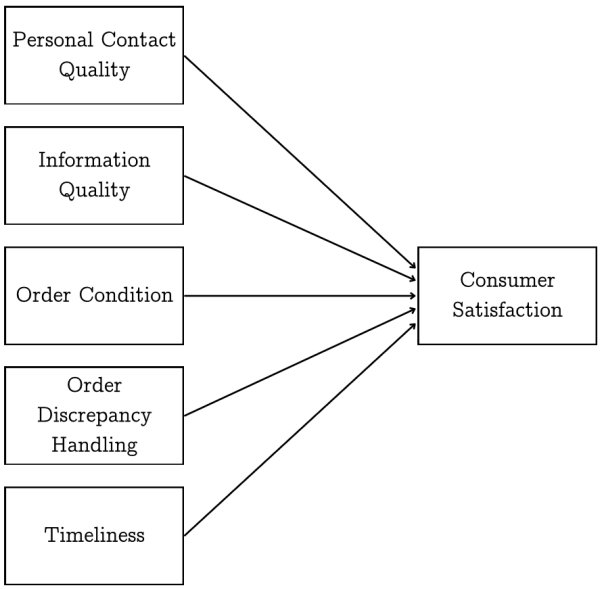

Figure 2: Framework Survey Consumer Satisfaction
Source: Based on the LSQ framework of Mentzer et al. (2001)

3.3.3 Construction of the survey

The survey starts with an introductory page, which emphasizes that participation in the survey is entirely voluntary, that the data gathered will be kept confidential, and that respondents are free to exit the survey at any time. Finally, a statement to participate is given. When respondents agree, they proceed to the next page where the purpose of the survey is briefly described. This is followed by part I of the survey, which is about online shopping experiences. These questions are aimed at gaining insight into the experience respondents have with online ordering and focus on delivery options, frequency, home delivery, and consumer preferences. Some of these questions are answered using a five-point Likert scale. For example, one of the questions from this part is "To what extent do delivery options influence your decision to place an order with a specific online shop?". The answer options for this question range from 1 = "No influence at all" to 5 = "Significant influence". This part of the survey also contains a slider scale question that examines how important consumers feel about delivery characteristics, including speed, accuracy and reliability.

Part II to part VI of the survey focus on the five dimensions previously stated, which are derived from the article of Mentzer et al. (2001). Every part starts with a brief introduction, in which respondents are asked to consider a particular scenario, that has to do with both delivery and that specific dimension. Each part focuses on one dimension

and contains three items. The items are, as in Mentzer et al. (2001), given on a five-point Likert scale, where 1 = "Strongly disagree" and 5 = "Strongly agree". Although these five dimensions are based on the framework of Mentzer et al. (2001), the items in the survey are adjusted and specifically designed for this study, and are therefore unique.

Part II is about the dimension "Personal Contact Quality". Mentzer et al. (2001) describe this as the contact between the consumers and logistics company. The survey focuses on communication with customer service, solution orientation, and friendliness. Part III is about the dimension "Information Quality", which is about how consumers perceive the details that the supplier provides about the products that they can select from (Mentzer et al., 2001). For this study, this dimension has been interpreted as the extent to which logistics integrators share relevant information regarding delivery with consumers. Part IV is about the dimension "Order Condition". In both the article by Mentzer et al. (2001) and for this study, this is defined as the physical condition of goods upon delivery of the order to consumers. This part of the survey also includes an attention check, where respondents are asked to give the answer "Strongly agree", to improve the quality of the data. All participants with another answer were excluded from the data. Part V focuses on the dimension "Order Discrepancy Handling", which is about how companies handle order discrepancies after delivery (Mentzer et al., 2001). In this study, this dimension is focused on the role of logistics integrators in case that order faults or other potential issues arise. The emphasis of the items is on accuracy of processing, communication when such an error has occurred and the perception about the logistics integrators. The last dimension of Mentzer et al. (2001) that is covered in this survey, part VI, is "Timeliness". This is the reliability and speed with which an order is delivered to consumers.

Part VII is about consumer satisfaction. This part of the survey is measured with three items, the same of those that were used in the study of Mentzer et al. (2001). The difference is that the questions in this survey are formulated to specifically focus on logistics integrators. The items are "What is your general impression of the services provided by logistics integrators?", "Which word describes your feelings about logistics integrators in general?" and "How satisfied are you with the services provided by logistics integrators in general?". The items are, as in Mentzer et al. (2001), given on a five-point Likert scale, where for the first item, 1 = "Terrible" and 5 = "Excellent", and for the second and third item, 1 = "Very dissatisfied" and 5 = "Very satisfied".

The last part of the survey, part VIII, is about the demographics. The respondents were asked to provide information about their gender, age, highest education level they achieved, nationality and employment status. At the end of the survey, the respondents are thanked for their participation.

3.3.4 Data preparation

Prior to conducting the data analysis, certain steps have been taken to clean the data. First of all, respondents who did not finish the survey, or who did not pass the attention check are eliminated from the data, to improve data integrity. In addition, it was checked if there was missing data. Every respondent with incomplete answers was excluded for the data. Moreover, the responses, which were given using a Likert-scale, were transformed into numerical values. The following scale applies: Strongly disagree = 1, Somewhat disagree = 2, Neither agree nor disagree = 3, Somewhat agree = 4, and Strongly agree = 5. Item 3 of the Order Discrepancy Handling concept was incorrectly formulated in the survey, with a negative meaning rather than a positive meaning, as were all other items. As a result, the Likert-scale scores have been reversed for this item, resulting in: Strongly agree = 1, Somewhat agree = 2, Neither agree nor disagree = 3, Somewhat disagree = 4, and Strongly disagree = 5. For the five dimensions, measured using the framework of Mentzer et al. (2001), the Cronbach's alpha is then computed to verify the validity of the items intended to evaluate consumer satisfaction.

3.3.5 Data analysis

The statistical software Stata Version 17.0 is used for the data analysis. Descriptive statistics are used for the analysis of Parts I and Part VIII. A factor analysis is then performed for Parts II through VI, which relate to the five dimensions. Each dimension's impact on consumer satisfaction is examined. Finally, questions linked to consumer satisfaction in general have been examined to determine how respondents evaluate the general service of logistics integrators.

3.4 Conclusion

In order to obtain the most comprehensive understanding of the air cargo supply chain and the impact of e-commerce goods flows, both the industry and consumer perspectives are examined. To get an in-depth knowledge of the air freight industry, eight semi-structured expert interviews were conducted, with a particular emphasis on the impact of e-commerce and customs clearance. The consumer side is highlighted through a structured survey aimed at the consumer satisfaction of e-commerce shipping.

4 Results - Qualitative Interviews

This section provides an analysis of the data gathered through eight semi-structured interviews with experts in the field of air cargo, logistics integrators, e-commerce, and/or customs clearance. In order to provide a comprehensive analysis for each sub question, the interviews were coded and then classified per theme. The themes are then classified by relevance for each sub-question. This is shown in Table 9 in Appendix A.1.2. In this section, the relevant themes are analyzed in detail for each sub-question. Appendix A.1.3 provides a comprehensive overview of the codes, including an example and the frequency of each code.

4.1 Difference between e-commerce and traditional goods flows

To give an answer to the first sub question *"How does order processing in e-commerce goods flows differ from traditional goods flows, and what is the influence of these differences on customs clearance?"*, the following themes are analyzed: (Customs) documentation in the air cargo industry, Different players in the supply chain and the role of logistics integrators, Digitalization in the air cargo industry, Economic effect of the e-commerce increase, and Impact of e-commerce goods on logistics and operations. The focus of this analysis is to gather information about the differences between a traditional supply chain and an e-commerce supply chain, the different parties involved, the general effect of e-commerce on logistics and operations, and digitalization. The insights from the interviews will be discussed for each theme below.

4.1.1 (Customs) documentation in the air cargo industry

There is a difference between physical and digital goods flows in the air cargo supply chain. Respondent 6a emphasizes the complexity of the supply chain due to all of its links. Interviewee 1 believes that customs cannot be viewed as a single link because it incorporates several digital flows throughout the entire chain. Dutch customs is progressive in this regard, because they are far advanced in the field of digitalization, which is emphasized by most Dutch interviewees.

There are two kind of documents used in air freight: the CN38 document for postal and the Air Waybill for general cargo. Nowadays, the CN38 document is also frequently used for e-commerce packages. Interviewee 2 highlights the importance of enhanced visibility in the e-commerce goods flow, potentially by introducing a new document flow. More insight will also be valuable for airports such as Schiphol Airport. Interviewee 3 also emphasizes the inefficiency of document flows and sending e-commerce packages between regular postal. E-commerce enterprises are currently having difficulties with the extensive document requirements of the customs document system for cross-border

shipping. Better integration of this data and documentation into order processing systems could improve efficiency throughout the supply chain, as this data can be used from end to end. Interviewee 8 emphasizes this even more, saying: *"Digitalization is the driver. (...) The more that develops from and order perspective (...), the better."* (2024).

This is where logistics integrators may have an advantage over cooperating separate links, given that they oversee the entire chain and thus have access to a lot of data, which is also said by interviewee 1. However, interviewee 5 states that logistics integrators also encounter documentation issues. Interviewees 6a and 6b both emphasized the fact that missing data is common and that efficiency can be increased by having the data collected beforehand. Early data availability and sharing is crucial for the supply chain's many logistics links as well as customs.

4.1.2 Different players in the supply chain and the role of logistics integrators

An e-commerce supply chain with an integrator has a pipeline structure with integrated systems, while a traditional supply chain forms a network with many transactions between the different links, according to interviewee 3. Because logistics integrators integrate much more systems and tools, the process generally goes faster, including customs clearance, which is emphasized by interviewee 5. He also highlights the fact that individual links are less efficient because they require a lot of information transfer. Interviewee 6b notes that these transfers result in more contracts and conditions. The integration gives logistics integrators the advantage of a standardized network, but less flexibility, according to interviewee 6a. Yet logistics integrators can contribute to chain efficiency, because they do not have to deal with all those transfer moments, according to interviewee 1.

Interviewee 1 states that the Dutch customs views itself as an integral part of the entire air cargo supply chain and also wants to make an active contribution to keeping the air cargo process as attractive as possible. This is also emphasized by interviewee 3, who notes that there is a lot of cooperation, especially in the field of digitalization. However, interviewee 4 indicates that in terms of customs clearance there is not much difference between a traditional supply chain and an e-commerce supply chain with an integrator, but there is in terms of speed and door-to-door deliveries.

Logistics integrators take care of integration into the supply chain and by providing a standardized network, according to interviewee 6a. Interviewee 5 also mentions this: *"The package never leaves our network for the most part (...) and the value of working with a company like FedEx is that the data in the package moved together and it's all integrated (...)."* (2024). Yet logistics integrators do not own the goods, according to interviewee 2 and 7, they provide door-to-door delivery with their network. However, according to interviewee 5, logistics integrators occasionally work with 3PLs and 4PLs, which softens the distinction between a traditional and integrated supply chain. Interviewee 7 says that capacity issues are the reason behind this outsourcing.

4.1.3 Digitalization in the air cargo industry

Interviewee 1 views the e-commerce flow as a digitalized process rather than a new flow of goods. Additionally, interviewee 2 emphasizes the fact that the flow of goods has always existed and indicates that the channel through which the goods are sold has especially changed. According to interviewee 3, Schiphol Airport supports projects to increase efficiency and effectiveness aimed at digitalization in order to improve the flow of goods. The air freight industry was a paper industry until a few years ago, as stated by interviewee 1. The COVID-19 pandemic and the amount of e-commerce flows from China have accelerated digitalization in this sector. The logistics integrators' order processing has also been digitalized in recent years, according to interviewee 5, in order to speed the process. As a result, interviewee 6a highlights the digitalization advantage that these companies have. However, in a world where digitalization is becoming increasingly important, the right way to unlock that information across the entire chain is still lacking. As stated by respondent 6a, this might actually guarantee a better end-to-end proposition for consumers and various links in the supply chain.

4.1.4 Economic effect of the e-commerce increase

Air freight can be seen as a free market where slots are bought, according to interviewee 6b. Interviewee 3 also emphasizes the fact that there are market forces in this industry. According to interviewee 1, airports must adjust to developments in worldwide trade, such as the rise of e-commerce, in order to continue being attractive to the cargo industry. The airport mainly offers capacity, which is nowadays one of the limitations for freighters and logistics integrators. According to interviewee 2, the growth of e-commerce introduces an additional player to the supply chain, who also requires capacity. Slot capacity is currently one of the main challenges for Schiphol Cargo, which limits the number of full freighter flights that can operate, according to interviewee 1. Due to the lack of certainty, freighters sometimes divert to airports without these issues, according to interviewee 4. Interviewee 6a further highlights the importance of the flexibility in the e-commerce flow of goods for freighters. Nonetheless, it is important for Schiphol Airport to receive as much cargo as possible and to remain the gateway to Europe. According to interviewee 1, Schiphol Airport has always been attractive as an airport, partly due to the tight cooperation with customs throughout the entire supply chain. Interviewee 2 further emphasizes this by saying that Dutch customs play a major role in European policy because of this.

4.1.5 Impact of e-commerce goods on logistics and operations

The e-commerce boom is one of the newest developments in global trade, as mentioned in the theme above. Interviewee 7 observes that this implies a growing proportion of e-commerce in overall air freight. Interviewee 3 also points out the influence of e-commerce

and emphasizes the increase in volume as well. Interviewee 1 notes the challenge associated with this increase in volume. Considerations need to be made about possible process changes, and whether the e-commerce boom can be seen as an opportunity or a challenge. Interviewee 2 expects that the flow of e-commerce will only increase in the near future, which will put pressure on the capacity of the different parties in the air cargo e-commerce supply chain.

The significant rise in volumes is primarily due to the shift from business-to-business to business-to-consumer, which is characteristic of the e-commerce flow. Interviewee 6a states that as a result, there are more delivery addresses, which puts more pressure on handling, according to interviewee 3. In addition, the e-commerce flow is characterized by fluctuations in volumes, according to interviewee 8, which poses challenges for the physical handling of goods. This volume increase is not just noticeable in the last mile of the supply chain, but also in the area of customs control, according to interviewee 6b. Both interviewee 1 and interviewee 2 emphasize that there are more declarations for the same the amount of freight, because there are more individual packages rather than a consolidated load of freight. Interviewee 4 also emphasizes the influence of the smaller shipments and notes that this is the main difference with general cargo.

In addition to the increase in volume, high speed also plays a crucial role in the e-commerce supply chain. Interviewee 7 emphasizes that the challenges with e-commerce orders have to do with both volume and speed. *"Many companies see a lot of marketing value in keeping the lead time between ordering and delivery as short as possible."* (2024), said interviewee 2. This is also mentioned by interviewee 4, who emphasizes that parties strive for maximum speed of processing.

4.2 Consumer expectations and order complexity

The second sub question is: *"How do e-commerce consumer's delivery time expectations and order complexity affect customs clearance efficiency at airports?"*. There is just one theme relevant for this sub question: Deliveries of e-commerce orders. The focus is mainly on the consumer side and its influence on the air freight industry. It mainly looks at the impact of door-to-door deliveries and the speed at which consumers expect to receive their orders, and how this affects the supply chain. The influence on customs clearance is highlighted in the themes belonging to sub question 4.

4.2.1 Deliveries of e-commerce orders

The final consumers are crucial to the e-commerce supply chain since they place the orders from major e-commerce companies and have specific expectations about the quality of services provided by the supply chain. Regarding this, Interviewee 5 stated the following: *"I think e-commerce recipients are extremely demand more than B2B recipients."* (2024). He

is mainly referring to expectations regarding delivery times. Interviewee 5a also emphasizes the high expectations of consumers, especially with regard to speed and predictability. Interviewee 4 states that although logistics integrators may improve speed within the logistics chain, this will not immediately impact the speed of customs clearance. According to Interviewee 3, logistics integrators have the advantage of having their own advanced IT systems that ensure effective tracking and tracing.

However, e-commerce businesses frequently handle consumer contact rather than logistics integrators or other chain participants. While last-mile deliveries and services are offered by logistics service providers, e-commerce businesses usually handle the fulfillment process. The interviews show that DHL does not position itself as just a logistics integrator. DHL consists of various business units, with DHL Global Forwarding ensuring capacity with its own fleet and chartered network, while DHL eCommerce focuses more on last-mile delivery, according to interviewee 2. Interviewee 2 also emphasizes that the major e-commerce companies, especially those from China, such as Shein, Temu and TikTok, manage the entire fulfillment process in-house. They outsource various parts of the process, but they still oversee management. Interviewee 5a confirms this as well, saying that DHL eCommerce only communicates with end users only after the customs clearance process and network injection in Europe. The entire preliminary phase is in the hands of the e-commerce companies.

According to the interviews, last-mile delivery and customs clearance are the key factors influencing order complexity. The biggest challenges in the field of e-commerce, according to interviewee 5a, are expected to be volume growth, associated complexity, and customs regulations and legislation. As stated by interviewee 8, consumers frequently order items that are prohibited because they are unaware of the legislation and regulations regarding the import of e-commerce goods. This significantly affects the customs clearance process. He also emphasizes that the amount of individual packages, each of which requires its own declaration, makes customs clearance more difficult. Interviewee 7 adds that e-commerce orders currently have a bad reputation, which means that the orders are subject to inspections. According to interviewee 5, the challenge with last-mile delivery is the different delivery addresses of the e-commerce orders, which lowers efficiency and increases costs.

4.3 Customs clearance at airports

Relevant themes for sub question four, *"What are the current main challenges in customs clearance at airports, regarding the e-commerce goods flows?"*, are: Cooperation with customs interests, Customs management and regulation, Customs workload and challenges, and Role of airports (Schiphol) in the e-commerce supply chain. When analyzing these themes, the emphasis is mainly on the influence of the e-commerce flow on customs

clearance. In addition, the focus is also on the role that airports can play to make the entire supply chain more efficient, with an emphasis on cooperation with customs.

4.3.1 Cooperation with customs interests

Custom authorities play a significant role in the e-commerce supply chain. Customs have been integrated into the air cargo supply chain in the Netherlands and there is a good cooperative relationship with the various parties in the air freight world. However, according to interviewee 1, customs are viewed as an obstacle in many nations. Interviewee 4 also confirms this and indicates that customs in the Netherlands pays attention to the interests of the business community, but there are major differences how this is handled across Europe. Interviewee 8 emphasizes the importance of a joint approach among European countries: *"So the idea is to take when you've negotiated something that simplified all the customs authority themselves, (...), is to try and convert the simple term to other nations, to get them to try and use the same sort of process."* (2024).

Regarding increasing the efficiency of customs clearance, according to interviewee 7, it mainly comes down to the relationship of trust with customs. There is currently a lot of distrust regarding e-commerce orders, which means they are subject to many controls. Strengthening the bond of trust could reduce the number of inspections, which is beneficial to the efficiency of customs clearance.

Looking at the collaboration throughout the chain, interviewee 6a labels the e-commerce supply chain as complex, especially because of the links that lie with the customs brokers. This is also highlighted by interviewee 5, who indicates that a lot of information transfer has to take place when there is a supply chain with separate links. Some examples were also given in the interviews. For example, interviewee 6a describes the role of DHL eCommerce as follows: when the e-commerce package enters their network, data enrichment plays a role and they transfer the necessary data to a third party, a broker, who manages the export declarations to customs. Interviewee 8 outlines the same process for FedEx, but adds that they sometimes just check the data and provide it to the customs authorities themselves, emphasizing the importance of having data and sharing it with stakeholders. From the airport's perspective, interviewee 1 indicates that Schiphol, with the Smart Cargo Mainport Program, ensures cooperation between partners, focused on digitalization, and that customs benefits greatly from the development of these processes.

4.3.2 Customs management and regulation

In the field of e-commerce, regulations play a crucial role in the customs clearance. According to interviewee 4, e-commerce companies are currently having difficulties providing data because of the complicated regulations and legislation. With regard to the future, Interviewee 7 says the following: *"The government is of course already working on a whole*

new legislation from the EU, (...). E-commerce companies are actually more or less forced into a straitjacket, which means they have to provide reliable data." (2024). Interviewee 6b additionally addresses the new EU rules that will apply from 2028. Creating an EU data hub should encourage cooperation between European countries and simplify regulations. Interviewee 5 adds that access and exchange of the correct data can ensure faster customs clearance and also may decrease costs.

According to interviewee 4, the most important challenges facing customs in the Netherlands at the moment are the reliability of the IT systems and the European connection. Interviewee 7 adds another concern, stating that Dutch customs still views e-commerce as general cargo and lacks a clear understanding of what the flow actually entails. The speed of customs clearance is still too low for what the parties expect from this flow of goods, and prioritization is an area for improvement.

4.3.3 Customs workload and challenges

Customs are currently an asset for Dutch aviation and for the Dutch air cargo industry. According to interviewee 1, staffing is one of the issues customs face in keeping up with the volume of declarations associated with the flow of e-commerce. Interviewee 7 states that there has been a shortage of employees at Dutch customs. This is confirmed by several interviewees. For instance, interviewee 3 indicates that additional handling is necessary due to enormous quantities in the e-commerce flow, which requires more staff members. Interviewee 4 also emphasizes the extra checks that come with the high volumes, which all comes down to the capacity and staffing that customs has to deal with.

However, interviewee 4 states that Dutch customs are currently not experiencing capacity problems, because the system is set to high volumes. The main problem lies with the IT system, as already explained in the previous theme. As previously said in the theme "Impact of e-commerce goods on logistics and operations," it emerges yet again that the main challenge is the high amount of customs declarations resulting from the numerous individual packages. The fact that individual items in the e-commerce flow are frequently of low value is a frequent aspect of this topic, and according to interviewees 7 and 8, the issue for customs is whether the value of the package matches the data provided. Interviewee 5 continues that this discrepancy causes a lot of delay in customs clearance.

4.3.4 Role of airports (Schiphol) in the e-commerce supply chain

Currently, airports, in this case specifically Schiphol Airport, play a limited and mainly facilitating role in the air cargo industry. Interviewee 3 describes Schiphol Airport as a facilitator of an air freight marketplace. Interviewee 4 adds to this by saying the following: *"Schiphol supports with regard to facilitating, getting speed, and safety and security, and sharing data. (...). But it is not the case that Schiphol is the director of the processes."*

(2024). Interviewee 8 further discusses the facilitating role of airports, which focuses on the movement of goods, emphasizing that it is crucial that the digital link between the declaration process, the presence of the packages and customs clearance takes place in one place.

According to interviewee 2, safety is also crucial. Schiphol is expected by all parties to be a secure location for the goods, preventing theft. Interviewee 1 indicates that various parties expect that the airport in general should play a greater role in air freight. As stated by interviewees 2 and 7, the primary expectations of freighters from the airport is greater slot capacity, which is challenging because of current government policy. Interviewee 4 further states that freighters demand slot certainty and that Schiphol's flexibility in this area is somewhat restricted. As noted by interviewee 6a, this is also in line with the flexibility that freighters expect in terms of slot capacity.

Interviewee 1 emphasizes that Schiphol Airport is currently struggling the most with a shortage of slots. According to him, it is therefore important for Schiphol Airport to maintain its superior network function in order to remain attractive as a cargo port. Currently, the airport's focus is on passengers, and interviewee 4 states that if more emphasis is placed on cargo, it may provide added value for Schiphol Airport and the Dutch economy.

4.4 Conclusion

The eight semi-structured expert interviews revealed a consistent thread: the urgency for sharing data across the entire air cargo supply chain. Digitalization has played a significant role in the air freight industry, and especially in the area of e-commerce freight flow. The various parties in the supply chain currently have appropriate IT systems and data. However, sharing this data at an early stage with interested parties in the chain can increase the efficiency of the entire e-commerce air freight chain. The code "Data sharing and transparency" is therefore the most common code in the analysis of the interviews, followed by the code "Customs efficiency". An overview of the most commonly used codes can be found in Appendix A.1.4.

5 Results - Quantitative Survey

To give an answer to sub question 3 *"How does e-commerce order processing affect e-commerce shipping companies' consumer's satisfaction?"*, an online survey is conducted. This section provides the results obtained from the online survey and is structured as follows: First, a data description is provided, which also includes the demographic information of the respondents. The online shopping experience of respondents is then discussed. Finally, a factor analysis is performed to delving further into the Logistics Service Quality framework, to gain insight into the consumer's satisfaction of e-commerce (shipping) companies.

5.1 Data description

The data from Qualtrics was first imported into Stata Version 17.0, a statistical software for data science. This comprises a dataset of 161 respondents. The data was then cleaned by deleting 39 respondents that did not complete the survey and by deleting 12 respondents who gave any answer other than "Somewhat agree" to the control question and thus did not pass the attention check. This results in 110 usable respondents on which this analysis is based, giving N = 110.

5.1.1 Demographics

Out of 110 respondents, 64 are female and 46 are male, representing respectively 58.18% and 41.82%. The largest age group among the respondents is between 18 and 24 years old, which accounts for 48.18% (N = 53). The other age groups are relatively equally distributed: the age group 25 - 34 years is 12.73% (N = 14), the age group 35 - 44 years is 13.64% (N = 15), the age group 45 - 54 years is 10.00% (N = 11), and the age group 55+ years is 13.64% (N = 15). Only 2 respondents are under the age of 18 years, which represents 1.82% of the total respondents. Appendices A.3.1 and A.3.2 contain the tables with the information about gender and age obtained from Stata.

A distinction was also made between the respondents' educational levels in addition to their gender and age. The findings are as follows. The majority of the respondents, 47.27%, obtained the highest level of education at WO (N = 52), followed by 32.73% at HBO (N = 36). Only 8 respondents have completed only secondary school, which refers to the levels VMBO, HAVO and VWO. Table 13 in Appendix A.3.3 shows the complete distribution of the respondents' educational levels.

The respondents were also asked about their nationality. There are 108 Dutch respondents, accounting for 98.18%. 1 respondent is Belgian, and 1 respondent states that his or her nationality is different from the options provided in the survey. Finally, respondents were questioned about their current employment status. The majority of the respondents,

49.09% (N = 52) are employed full time, followed by 28.18% (N = 31) of which the employment status is student. Appendices A.3.4 and A.3.5 show the distributions of nationality and employment status respectively.

5.2 Online Shopping Experience

To acquire a better understanding of the online shopping experiences of the respondents, the survey included six questions about topics such as frequency of online shopping, experiences with delivery services, and factors that may be considered important.

According to the Stata analysis, the majority of the respondents, 58.18%, place orders on a monthly basis (N = 64). Weekly ordering is the second largest category, accounting for 20.91% of the respondents (N=23). Only one respondent has never ordered online, as seen in Table 2. This table additionally shows the frequency of online ordering per age category. 29.09% of the respondents are in the age range of 18 to 24 years and order on a monthly basis. Ordering on a weekly basis is less common within this age group. Only 10.00% of respondents aged 18 to 24 ordered weekly (N = 11). Table 2 shows the rest of the distribution of online ordering frequency and percentages per age category.

Age Category	**Delivery Frequency**					**Total**
	Never	**Less than monthly**	**Monthly**	**Weekly**	**Almost daily**	
Under 18	0	0	0	2	0	2
	0.00%	0.00%	0.00%	1.82%	0.00%	1.82%
18 - 24	0	9	32	11	1	53
	0.00%	8.18%	29.09%	10.00%	0.91%	48.18%
25 - 34	1	1	10	2	0	14
	0.91%	0.91%	9.09%	1.82%	0.00%	12.73%
35 - 44	0	2	8	4	1	15
	0.00%	1.82%	7.27%	3.64%	0.91%	13.64%
45 - 54	0	0	8	2	1	11
	0.00%	0.00%	7.27%	1.82%	0.91%	10.00%
55+ years old	0	7	6	2	0	15
	0.00%	6.36%	5.45%	1.82%	0.00%	13.64%
Total	1	19	64	23	3	110
	0.91%	17.27%	58.18%	20.91%	2.73%	100.00%

Table 2: Age category percentage that selects a particular delivery frequency

When making an online order, respondents were also asked how frequently they select home delivery. The majority of respondents, 42.73% (N = 47), choose home delivery in most cases. 32.73% (N = 36) of the respondents always choose home delivery. Just 1.82% of participants (N = 2) claimed that they never select for home delivery. The rest of the distribution can be found in Appendix A.4.1.

Of the respondents who order on a monthly basis, 45.31% (N = 29) of respondents in that category always choose home delivery, and 31.25% (N = 20) of respondents in that category choose delivery in the majority of the cases. Additionally, of the respondents who order weekly, the majority of respondents in that category, 65.22% (N = 15), prefer

home delivery most of the time. Table 3 below depicts the distribution of home delivery frequencies among respondents within each delivery frequency group.

Home delivery	**Delivery Frequency**					**Total**
	Never	**Less than monthly**	**Monthly**	**Weekly**	**Almost daily**	
Always	1	8	20	7	0	36
	100.00%	42.11%	31.25%	30.43%	0.00%	32.73%
Most of the time	0	3	29	15	0	47
	0.00%	15.79%	45.31%	65.22%	0.00%	42.73%
About half the time	0	1	6	1	2	10
	0.00%	5.26%	9.38%	4.35%	1.82%	9.09%
Sometimes	0	6	9	0	0	15
	0.00%	31.58%	14.06%	0.00%	0.00%	13.64%
Never	0	1	0	0	1	2
	100.00%	5.26%	0.00%	0.00%	4.55%	1.82%
Total	2	19	64	23	3	110
	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%

Table 3: Frequency of Home Delivery by Delivery Frequency Category

Respondents were also questioned to what extent shipping options influence their decision to place an order with a particular online store. The emphasis in this question is on the shipping alternatives provided by a specific online shop. The majority of respondents, 30.00% (N = 33), claimed that it had some influence on their decision to place an order. However, 19.09% (N = 21) of respondents claimed it had a significant influence on their decision, while 10.91% (N = 12) said it had no impact at all. The rest of the frequencies and percentages are shown in Table 17 of Appendix A.4.2.

Another question examined on how the availability of a specific delivery service, such as offering only DHL as a delivery option, impacts the decision to purchase from an online store. This question emphasizes on delivery services rather than the flexibility and speed of shipment, and thus the alternatives, as stated in the previous question. The majority of respondents, 38.18% (N = 42), said it had no influence on their decision at all, while 26.36% (N = 29) said it had a little influence. While only 6.36% (N = 7) of respondents claim it has a significant influence on their decision to buy from an online store. The rest of the results can be found in Table 18 of Appendix A.4.3. This indicates that respondents place less emphasis on the availability of specific delivery services than on the alternatives for delivery options that focus speed and flexibility, when compared to the preceding question on the impact of delivery options.

Respondents were also asked about their experience with different delivery services. Figure 3 shows the results. This figure indicates that every respondent has used the PostNL delivery service at least once. The second best-known delivery service among respondents is DHL, with 108 respondents having experience with it. FedEx is the least familiar, with only 16 respondents indicating they have experience with it.

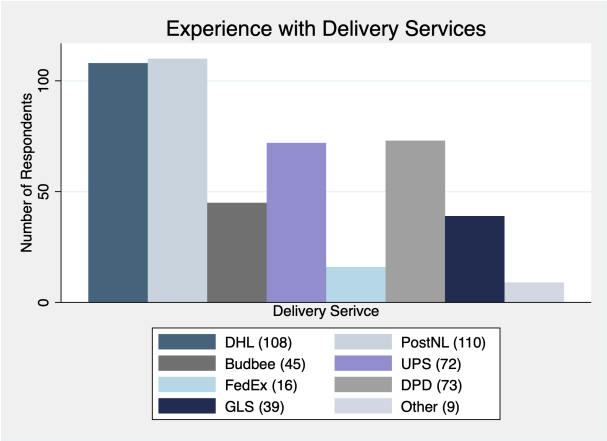

Figure 3: Experience with Delivery Services

Finally, respondents were asked to rate the importance of key factors in the delivery of an order. Where 0 indicates no importance and 10 indicates extremely high importance. The results are presented in Table 4. It is clear that among the respondents, the delivery element condition of order upon arrival is the most important delivery aspect, with an average score of 9.07. The minimum score for this aspect is 5, indicating that every respondent considers it to be at least somewhat important. In addition to the state of the order upon arrival, respondents place a high value on order fulfillment accuracy, giving it an average score of 8.63. Conversely, with just an average score of 5.80, sustainability appears as the least important aspect among the respondents. The lowest score given for this delivery aspect is 0, indicating that certain respondents do not consider it important at all, but with a maximum value of 10, some respondents consider it as extremely significant. This delivery characteristic has the greatest standard deviation, indicating that respondents' views of its importance vary a lot.

Delivery Aspect	**N**	**M**	**SD**	**Min**	**Max**
Speed of delivery	110	8.11	1.32	4	10
Accuracy of order fulfillment	110	8.63	1.54	3	10
Condition of order upon arrival	110	9.07	1.19	5	10
Ease of order tracking	110	7.01	1.94	1	10
Flexibility in delivery options	110	6.77	2.04	0	10
Sustainability	110	5.80	2.57	0	10
Customer service response	110	7.22	1.90	0	10
Communication and updates during transportation	110	7.02	2.15	0	10

Table 4: Importance Ratings of Delivery Aspects

5.3 Consumer Satisfaction

Consumer satisfaction was measured using five concepts from the Logistics Service Quality framework of Mentzer et al. (2001) in order to evaluate consumer satisfaction among delivery services and to determine where there are points for improvement in the logistics chain. This section first examines each of the five concepts and then presents descriptive

statistics. The internal consistency and reliability of each concept are then assessed using Cronbach's alpha. A factor analysis follows to determine whether the five concepts together form consumer satisfaction. Finally, the measurement of consumer satisfaction is specifically discussed.

5.3.1 Descriptive Statistics

For each of the five concepts, the frequency (N), mean (M), standard deviation (SD) and minimum and maximum values are given in Table 5.

Concept	N	M	SD	Min	Max
Personal Communication Quality	110	3.33	0.88	1.00	5.00
Information Quality	110	3.99	0.69	1.33	5.00
Order Condition	110	3.88	0.70	1.67	5.00
Order Discrepancy Handling	110	3.26	0.63	1.67	4.67
Timeliness	110	4.15	0.53	2.67	5.00

Table 5: Descriptive Statistics per LSQ concept

The respondents give the concept of order discrepancy the lowest score, with an average score of 3.26, indicating that they neither agree nor disagree. The concept of timeliness obtains highest scores from respondents, with an average of 4.15, indicating that respondents generally agree with the timeliness items.

5.3.2 Cronbach's alpha

Cronbach's alpha, α, is a measure of internal consistency and determines the extent to which certain items measure the same construct (Cronbach, 1951). Especially when Likert scales are used, it is of great importance to calculate the Cronbach's alpha to determine the internal consistency. The closer the value is to one, the more internally consistent the items used to measure a particular construct. An $\alpha > 0.80$ is considered as good, $\alpha > 0.70$ is considered acceptable and $\alpha > 0.60$ is considered as questionable (Gliem et al., 2003). The Cronbach's alphas are calculated separately in Stata for each of the five concepts. The results are shown in Table 6 below.

Concept	Average Interitem Covariance	Number of Items	Alpha
Personal Contact Quality	0.5842	3	0.7602
Information Quality	0.3664	3	0.7634
Order Condition	0.3597	3	0.7448
Order Discrepancy Handling	0.1170	3	0.2994
Timeliness	0.1222	3	0.4325

Table 6: Cronbach's Alpha for Consumer Satisfaction Concepts

As shown in Table 6, the concepts of Personal Contact Quality, Information Quality, and Order Condition have an acceptable Cronbach's alpha, indicating a good internal

consistency. However, the scores of the concepts of Order Discrepancy Handling and Timeliness result in extremely low Cronbach's alpha.

Item 3 of the Order Discrepancy Handling concept was incorrectly formulated in the survey, with a negative meaning rather than a positive meaning, as were all other items. As a result, the Likert-scale scores have been reversed for this item. Despite this adjustment, the concept's α, with a score of 0.2994, remains extremely low, indicating very poor internal consistency. When item 3 is not included when calculating α, it increases to 0.4283, which is still insufficient for the internal consistency of the concept. This could be due to incorrect item scaling or the fact that the concept is measured using only three items. According to Gliem et al. (2003), the use of more items could result in a higher α. In accordance with Gliem et al. (2003), the α for the Timeliness concept is 0.4325, which is considered as unacceptable. Therefore, it is further explored what happens to the α when specific items are excluded. When the third is eliminated, the α decreases to 0.2315. When the second item is removed, the α decreases to 0.2510. And when the first is removed, the α increases to 0.5294. According to Gliem et al. (2003), an alpha of 0.5294 is still considered as poor. However, the increase in Cronbach's alpha when item 1 is deleted may imply that item 1 was wrongly formulated. In the following part, we analyze the low values of the two α using factor analysis.

5.3.3 Factor Analysis

First, the Cronbach's alpha was calculated for the five concepts together. This is equal to $\alpha = 0.6622$, which according to Gliem et al. (2003) means a questionable internal consistency. For this reason, a factor analysis is performed to determine whether the items of the concepts measure what actually needs to be measured. Each of the five concepts was measured with three items. The Kaiser-Meyer-Olkin (KMO) test gives an outcome of 0.7406; see also Appendix A.5.1. This number is acceptable, making the data appropriate for factor analysis (Shrestha, 2021). Table 19 in Appendix A.5.1 shows inadequate values for Order Discrepancy Handling and Timeliness.

Following the KMO test, the Bartlett's Test of Sphericity is conducted. This is done by interpreting the output of the factor analysis in Stata. The results can be found in Appendix A.5.2. The LR test can be interpreted as the Bartlett's Test of Sphericity, as there is no specific Stata command for it. This shows that Prob $> \chi^2 = 0.0000$, which indicates that the Bartlett's Test of Sphericity is significant ($p < 0.05$) and the data is suitable for the factor analysis (Shrestha, 2021).

The factor analysis shows that only Factor 1 and Factor 2 have an eigenvalue of > 1.00, therefore these factors have been retained according to the rule of thumb (Shrestha, 2021). The first two factors explain 80.99% of the total variance. The following section investigates the correlation between both of these factors and consumer satisfaction. Appendix A.5.3 shows how each item affects each of the two factors.

5.3.4 Consumer Satisfaction

To determine the relationship between the two factors and consumer satisfaction, a multiple correlation test is done. The results can be seen in Table 7.

	Factor 1	**Factor 2**
Consumer Satisfaction	0.5035	-0.0153
	(0.0000)	(0.8738)

Table 7: Correlation between Consumer Satisfaction and Factors

The correlation between consumer satisfaction and Factor 1 is 0.5035 ($p = 0.0000$), indicating a positive and significant correlation. The correlation between consumer satisfaction and Factor 2 is -0.0153 ($p = 0.8738$), and therefore negative and insignificant. Higher scores on Factor 1, and thus on the items that impact it, may result in higher consumer satisfaction. The impact of the various items on the factors (Appendix A.5.3) is summarized per concept in Appendix A.5.4. It can be concluded that the concept of Information Quality has the most beneficial impact on consumer satisfaction, with Order Condition and Personal Contact Quality following next. The concepts of Order Discrepancy Handling and Timeliness have less influence on consumer satisfaction.

Regarding delivery services and door-to-door deliveries in the supply chain, consumers were lastly questioned on their general level of satisfaction. In general, respondents evaluate consumer satisfaction at 3.7, indicating that consumers have a moderately to positive view of logistics integrators when it comes to door-to-door delivery. Appendix A.6 includes all of the results. First, a question about respondents' general impressions was asked. This shows that the majority of the respondents, 54.55% (N = 60), position the services as good, followed by 31.82% (N = 35) of the respondents who rate the services as average. While the first question refers to the overall impression, the second question focuses on respondents' feelings regarding the services. 58.18% (N=64) of respondents are somewhat satisfied, while 10.0% (N=11) of the respondents are extremely satisfied. The third question focuses on satisfaction. 64.55% (N = 71) of respondents are somewhat satisfied, and 10.00% (N = 11) of the respondents is stating that they are extremely satisfied.

5.4 Conclusion

In conclusion, the delivery services that respondents are most familiar with are PostNL and DHL, the latter of which can be regarded as a logistics integrator. The delivery aspects Condition of order upon arrival and Accuracy of order fulfillment are considered most important, while respondents consider Sustainability to be least important. The factor analysis shows that the Information Quality concept has the most beneficial impact on consumer happiness, followed by Order Condition and Personal Contact Quality. Overall, respondents consider the service of logistics service providers to be reasonably good.

6 Conclusion

The aim of this study is to get an in-depth understanding of the impact of e-commerce goods flows on the efficiency and effectiveness of customs clearance at airports, with a focus on order processing activities in both an integrated and traditional supply chain. For this study, the definition of both an integrated supply chain and a traditional supply chain has been simplified, with the distinction mainly related to the role of logistics integrators. In an integrated supply chain, the role of logistics integrators is significantly greater, where they manage the entire supply chain. The traditional supply chain is seen as a chain with separate links, different parties involved, and which involves much more information transfer. The end consumer is the initial and final point of both supply chains. Customs clearance is a part of both the physical and digital flows, and the airport plays a facilitating role in the supply chains. Since there has not been a lot of research done on the impact of e-commerce order processing activities, and particularly the role that logistics integrators can play in this, the objective of this exploratory study is to find and generate new insights. Eight semi-structured expert interviews in the field of air cargo, e-commerce, logistics integrators and/or customs clearance are conducted to gain insight into the different perspectives of this supply chain. On the consumer side, research has been conducted into consumer satisfaction of e-commerce shipping companies, with a sample of 110 participants.

6.1 Discussion

This section discusses the findings and literature to ultimately answer the research question of this study:

"How does e-commerce order processing influence the efficiency and effectiveness of customs clearance at airports?"

The findings of the semi-structured expert interviews generally showed that the e-commerce supply chain in the air cargo industry is more complex than it initially appears. The sub questions will be addressed first through discussion in order to provide a comprehensive answer to the research question.

6.1.1 Sub question 1

Sub question 1 *"How does order processing in e-commerce goods flows differ from traditional goods flows, and what is the influence of these differences on customs clearance?"* is analyzed based on the findings from the eight semi-structured interviews. The purpose of this sub question is to generate insights about how order processing differs in e-commerce and traditional goods flows, and the impact on customs clearance. The expert interviews

show that the primary difference between these flows is related to the complexity of the e-commerce orders. The use of the postal document for e-commerce orders makes distinguishing the flows difficult. Visibility and early access to data should increase the efficiency of the e-commerce flow. Integration of this starts with the order process. Logistics integrators have an advantage here since they oversee the entire chain, and their integrated systems result in less information transfer. This has also been confirmed in previous research by Leung et al. (2018), where the outsourcing for an efficient order process to external parties, as logistics integrators, is dedicated to the irregularity of e-commerce orders and the expected tight delivery requirements of e-commerce companies.

The rise of e-commerce has accelerated digitalization in the air cargo industry. The interviews indicate that the channel changed because of digitalization rather than that e-commerce is a newly developed flow. Different market forces ultimately lead to a shift from B2B to B2C, leading to more individual packages and delivery addresses. This has also been investigated by Malighetti et al. (2019a), who emphasize that logistics integrators experienced a shift from B2B to B2C business models because of the explosive growth of retail e-commerce and the subsequent rise of quick delivery. Capacity issues at Schiphol Airport are caused in part by an additional player that the e-commerce goods flow brings. For freighters in the traditional supply chain, airport flexibility is of great importance, while logistics integrators have less flexibility due to contracts. However, Schiphol Airport remains attractive due to its close ties with customs. This is in line with the literature, which describes that fast customs clearance is important for airports to be attractive to retailers (Wang et al., 2021). Additionally, efficient cooperation between the airport and customs clearance can guarantee that supply chain parties select an airport faster (Zhang & Zhang, 2002). The challenge for customs lies with the volume growth and the higher expected speed of stakeholders in the e-commerce flow of goods.

To answer the sub-question, the biggest difference between e-commerce and traditional goods flows is in complexity. Due to the limited visibility into the e-commerce flow of goods and the use of the postal document, little distinction can be made between the e-commerce flow and the traditional flow of goods. In addition, order processing of e-commerce goods is more complex due to the individual and smaller packages. For customs, the e-commerce flow leads to more declarations for the same amount of cargo and less predictability.

6.1.2 Sub question 2

Sub question 2 *"How do e-commerce consumer's delivery time expectations and order complexity affect customs clearance efficiency at airports?"* is also analyzed by the expert interviews. The purpose of this sub question is to gain insight into how consumer expectations, in terms of speed and complexity, influence customs clearance. According to the interviews, B2C consumers have more expectations than B2B ones, particularly when it comes to reliability and delivery times. The interviews additionally indicate that the

e-commerce giants manage the fulfillment process and outsource just parts of it. However, according to research by Tarn et al. (2003), many e-commerce companies outsource their fulfillment process to 3PLs. The fact that this is now much less the case may be due to the emerging e-commerce giants from China, a new emerging sector, which has undergone many developments in recent years. According to the interviews, logistics integrators can play a role in outsourcing by ensuring speed, tracking and tracing, and door-to-door deliveries, which ultimately affects consumer satisfaction. This is also confirmed in the literature, where it is emphasized that the flexibility, speed and quality that logistics integrators can offer can contribute to consumer satisfaction (Hertz & Alfredsson, 2003; Jie et al., 2015). However, the findings show that the role of logistics integrators does not have a direct influence on the efficiency of customs clearance. According to the interviews, the biggest challenges in e-commerce order processing have to do with last-mile delivery. One the one hand due to the different delivery addresses, and on the other hand at customs clearance due to the complexity of laws and regulations. This is consistent with the research of Yu et al. (2016), which explains that the difference between e-commerce and traditional logistics lies in complexity, due to small and irregular orders, and due to high expectations of consumers in terms of delivery.

To answer the second sub-question, it can be stated that consumer expectations regarding delivery times and the order complexity of e-commerce orders have a major influence on the supply chain, and therefore also on customs clearance. However, the role of logistics integrators here has no direct influence on customs clearance.

6.1.3 Sub question 3

Sub question 3, *"How does e-commerce order processing affect e-commerce shipping companies' consumer's satisfaction?"*, focuses on the consumer side of the e-commerce air cargo supply chain. The findings were obtained from a survey, distributed to consumers of e-commerce companies, about the logistics service quality of delivery services, including logistics integrators. The survey mainly focused on the logistics service quality, obtained from the framework of Mentzer et al. (2001). From the results the most important concepts regarding consumer satisfaction are Condition of order upon arrival and Accuracy of order fulfillment. It can therefore be concluded that it can be useful for delivery services to focus on these factors if they want to increase their consumer satisfaction. This shows that consumers care about the quality of their orders and its accuracy. Tarn et al. (2003) research also shows that quality is indeed one of the aspects of what consumers expect. Moreover, Parasuraman et al. (1988) describes in his research into consumer perception that reliability and assurance are among the most important aspects. In general, respondents give the delivery services an overall score of 3.7 (on a scale of 1 to 5), which can be seen as moderately to positive view of logistics integrators when it comes to door-to-door delivery. There is still room for improvement for delivery services. Mainly improving the quality

and the accuracy in the order processing of logistics integrators and other delivery services can therefore increase the quality of door-to-door deliveries, which directly addresses the sub question.

6.1.4 Sub question 4

The last sub question, sub question 4, *"What are the current main challenges in customs clearance at airports, regarding the e-commerce goods flows?"*, has been examined based on the findings obtained from the expert interviews. The focus of this sub question is mainly on customs clearance at airports, which has not been thoroughly studied yet in the context of the e-commerce goods flow. When looking specifically at the role of Schiphol Airport and Dutch customs, the interviews show that there is close cooperation due to the integrated role of customs in the air cargo supply chain. However, the findings show that customs are seen as an obstacle in many countries, and there are major differences in cooperation with customs between European countries. The interviews show that a coordinated European approach can streamline the complex process and that a good relationship of trust between various parties and customs may improve efficiency.

Furthermore, early sharing of accurate information might enhance efficiency. One challenge is the speed of customs clearance regarding e-commerce goods. Because the e-commerce flow is still considered as general cargo, the speed of handling is currently lower than what parties expect. While speed, according to research by Wang et al. (2021), is crucial in the e-commerce supply chain, explaining that it is an important aspect for retailers to know how long it takes for their products to clear customs. In addition, the interviewees mentioned that the challenge in the e-commerce goods flow is in high volumes and extra checks, which require more handling. Dutch customs are seen as an asset for the Dutch air cargo industry, and the attractiveness of Schiphol Airport. This is also evident from the literature, with research by Elliott and Bonsignori (2019) showing that efficient customs clearance contributes positively to trade and thus to the entire economy. Schiphol Airport currently plays a facilitating role, with the emphasis more on passengers than cargo. According to the interviews, the biggest challenge for the airport lies with the slot capacity and it is important that the network function is maintained to remain attractive as a cargo hub.

To answer the sub question, it is crucial that parties involved in the e-commerce air cargo supply chain exchange reliable and accurate data at an early stage, to improve customs efficiency, but also the entire supply chain efficiency. The biggest challenge is the expanding quantities and extra controls that the flow of e-commerce requires. Efficiency can be improved by a close relationship between the parties and customs, and European collaboration can help to speed up the customs process.

6.1.5 Research question

An in-depth understanding of the current situation of the influence of the e-commerce goods flows in the air cargo industry is provided by the insights gathered from the interviews and the discussions of the sub questions. This indicates that the effectiveness and efficiency of customs clearance at airports is affected by the order processing of e-commerce goods. The main points that emerged from the results are the impact of high and volatile volumes, high speed and complexity due to consumer expectations, collaboration between parties in the supply chain, and data sharing.

One of the most discussed topics was the high volume of e-commerce goods flow, characterized by small, individual packages, and irregularity. For customs, this leads to more declarations and additional checks, which require more handling and therefore has a major impact on the efficiency and effectiveness of customs processing. The small and individual packages are the result of the shift from business-to-business to business-to-consumer. B2C consumers have higher expectations of logistics service quality than B2B consumers, especially when it comes to speed and reliability. The findings imply that consumers find it particularly important that there is quality and accuracy of order processing, when it comes to door-to-door deliveries. This emphasizes the importance of both the consumer side and the industry side, since the order process is essential to both sides of the supply chain. The interviews showed that collaboration between the different parties is of great importance to increase efficiency throughout the entire e-commerce air cargo supply chain, with efficient and early data sharing being an essential part. Logistics integrators can play a role here by providing integrated systems that increase data visibility and reduce the number of information transfers, which starts with the order process. Specifically aimed at customs efficiency, the role of logistics integrators is limited. Conversely, transparency as well as a cooperated European approach to make clearance less complex, can both have a positive influence on the efficiency and effectiveness of customs clearance.

Overall, the high volumes, and the associated declarations and extra checks, along with high consumer expectations, increase the pressure on customs in the air cargo industry. The formerly paper-based air cargo industry has been greatly digitalized in recent years, which means that most parties have access to extensive data. However, this data is not shared sufficiently and in a timely manner to make optimal use of it. To improve efficiency across the entire chain, data sharing should be a key component of the e-commerce air cargo supply chain. Obtaining and sharing this data starts with the order process, which emphasizes its importance in the chain. To give a short and concise answer to the research question of this study, concluding from the results and discussions, it can be stated that e-commerce order processing has a significant influence on the efficiency and effectiveness of customs clearance.

6.2 Implications and Recommendations

This study provides valuable insights into the effect of the e-commerce goods flow on the customs clearance of airports. The insights obtained from the expert interviews and the online survey imply that the e-commerce supply chain is complex, partly due to the information transfers and high consumer expectations. In order to keep up with the e-commerce goods flow, early data sharing must therefore become crucial to this chain in the near future. This is consistent with the literature, which states that supply chain integration, so collaboration between parties, is important to provide efficient and effective flows, and ultimately the optimal value for the end consumer (Flynn et al., 2010). This research adds that integration is mainly necessary in the field of data sharing, and especially important in the rapidly changing e-commerce world.

This study is relevant to different parties in the supply chain, including airports, custom authorities, logistics integrators, and other logistics service providers. The results from this study demonstrate that efficiency may be improved by collaborating with different partners in the supply chain. Airports can play a role here by encouraging cooperation between the various parties, with a focus on data sharing and building a relationship of trust with customs. For customs it is necessary that they identify the e-commerce goods flow, especially taking into account the high volumes and especially high lead times. It is important that there is insight into the difference between general cargo, postal cargo and e-commerce cargo. To ensure speed, customs must have the capacity to handle the considerably bigger volume of e-commerce in the future. According to the literature, this will also lead to more effectiveness and efficiency, which is needed for airports to continue being an attractive location for e-commerce companies (Wang et al., 2021). Logistics integrators can increase their role in the e-commerce supply chain, due to their advanced and integrated IT systems and the ability to decrease the number of information transfers, which improves efficiency. However, because the e-commerce giants currently often manage the entire supply chain, the role of logistics integrators is not yet that great in the e-commerce supply chain. These e-commerce companies now often handle the fulfillment part of the process. By focusing more on the fulfillment part of the supply chain, logistics integrators may be able to take a more integrated role that emphasizes order accuracy and quality throughout the whole chain.

6.3 Limitations and future research

While this study provides valuable insights into the influence of the e-commerce goods flow on the air cargo industry, there are several limitations. This study uses a mixed methods approach, consisting of qualitative semi-structured interviews and a structured online survey. The first limitation, with regard to the interviews, is the subjectivity of the results of the semi-structured interviews. Each expert shares his experience and views

the situation from his own perspective, which varies depending on the role that the party plays in the supply chain. Moreover, only eight expert interviews were conducted, due to time constraints, which reduces reliability. It is therefore suggested for future research to conduct more expert interviews, whereby multiple experts are interviewed per role in the supply chain, in order to obtain a broader and more representative picture of the supply chain.

One of the limitations of the online survey is generalizability, given that 98.18% of respondents have a Dutch nationality. As a result, the survey, aimed at gaining insight into the consumer side of the e-commerce supply chain, mainly focuses on the Dutch market. To get a more complete picture of the consumer side in general, the survey should be conducted in a more diverse group of people.

Moreover, only the influence of order processing was examined. One of the limitations of this is that the various aspects of order processing have not been discussed in depth. On the other hand, there are many more factors in the e-commerce supply chain that might influence the flow of goods, and thus may have an impact on efficiency and effectiveness. It is therefore recommended that future research focus more on the various aspects of order processing, or look at other aspects, such as peak times, sustainability, crime, drop shipping or influence of return orders.

Furthermore, two aspects clearly emerged from this exploratory study. Therefore, enough insight has been gained that future studies can explore further. One of these aspects mainly focuses on improving customs efficiency at airports and the other on improving supply chain efficiency. This research mainly focused on Europe, and the expert's most experience was with Schiphol Airport, which is therefore one of the limitations of this study. Therefore, it is recommend for future research to further examine the difference between countries when it comes to customs efficiency at airports. One of the common insights to improve efficiency of customs clearance is more transparency in the process of other countries, and stronger cooperation between countries, specifically European countries. The specific areas where this cooperation needs to improve most in order to enhance customs efficiency can be the subject of future research. Looking specifically at supply chain efficiency, this study mainly showed that data sharing is not optimal. It is therefore appropriate to discuss this further. Future research might focus on visualizing the data that is currently accessible in the supply chain. This should focus on creating insights into the data that needs to be shared to improve supply chain effectiveness.

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A Appendix

A.1 Interviews

A.1.1 Overview conducted interviews

	Interviewee	Function	Date	Language	P/MT	Duration
1	Olaf van Reeden	Cargo Partnerships Director at Schiphol Cargo	May 17, 2024	Dutch	Microsoft Teams	32 minutes
2	Henk Venema	CEO DHL Global Forwarding Western Europe	May 24, 2024	Dutch	In person	31 minutes
3	Johan Star	Projectmanager SCMP at Royal Schiphol Airport	May 29, 2024	Dutch	Microsoft Teams	40 minutes
4	Martijn Kuiken	Business Owner PGTS at Air Cargo Netherlands	June 6, 2024	Dutch	Microsoft Teams	48 minutes
5	Christopher Hodge	E-commerce Marketing Manager at FedEx	June 10, 2024	English	Microsoft Teams	44 minutes
6a	Maurice Saes	Director International Networks	June 13, 2024	Dutch	Microsoft Teams	39 minutes
6b	Arno van Rosbag	Customs Manager at DHL eCommerce				
7	Mike de Wolff	Compliance Consultant at Aero Express B.V.	June 13, 2024	Dutch	Microsoft Teams	42 minutes
8	John Stoten	Global Clearance Solutions Specialist at FedEx	June 18, 2024	English	Microsoft Teams	47 minutes

Table 8: Overview of the conducted interviews

A.1.2 Themes and codes

Theme	Codes
(Customs) documentation in the air cargo industry	*Air cargo supply chain, Air Waybill, CN38 document, Customs transparency, Data sharing and transparency, Digital good flows, Documentation, Physical good flows*
Cooperation with customs interests	*Custom delay, Need for cooperation with customs, Network, Role of customs clearance*
Customs management and regulation	*Compliance check, Customs competition, Customs control, Customs cooperation, Customs efficiency, Customs future, Customs opportunity, Customs supervision, Declaration, Embargo, Regulation, Risk oriented control*
Customs workload and challenges	*Capacity, Customs capacity, Customs challenge, Customs staffing, Developments, E-commerce distrust customs, Missing data, Product coding, Undervalued products*
Deliveries of e-commerce orders	*Business-to-business, Business-to-consumer, Consumer ignorance, Consumer interaction, Consumer satisfaction, Delivery services, Delivery time expectations, Door-to-door deliveries, Free shipping expectation, Fulfillment, Lower cost, Order complexity, Service quality*
Different players in the supply chain and the role of logistics integrators	*3PL, 4PL, Customs clearance companies, Dependencies among stakeholders, Different links, E-commerce challenge integrator, E-commerce companies, E-commerce opportunity integrator, E-commerce vs. traditional good flows, Freighters, Handling, Integration, Integrator differentiation, Last mile, Order processing, Outsourcing, Role of logistics integrators, Supply chain cooperation, Supply chain coordination, Supply chain efficiency, Transparency, Transport network*
Digitalization in the air cargo industry	*Artificial Intelligence, Digitalization, Need for digitalization, Need for forecasting, Need for process change, Process change*
Economic effect of the e-commerce increase	*Attractivity, Connectivity, Economic developments, Economic feasibility, Economic impact, Geopolitics, International trade, Market forces air freight, Sustainability*
Impact of e-commerce goods on logistics and operations	*Channel, E-commerce boom, E-commerce opportunity for airports, E-commerce threat for airports, E-commerce threats for supply chain, Fluctuations in volume, Future e-commerce, High cost relative to product, High involvement in e-commerce processes, Higher volumes, Lead times, Limited direct involvement in e-commerce processes, Low value products, Lower cost expectation, Need for flexibility, Small packages, Transport capacity, Transport challenge*
Role of airports (Schiphol) in the e-commerce supply chain	*Added value for airports, Airport challenges, Airport opportunity, Airport safety, Airport strategy, Business optimization, Competition among airports, Infrastructure facilitator, Market positioning airport, Need for certainty, Role of (Schiphol) Airport, Schiphol as a hub, SCMP, Slot capacity, Strategic Investment, Unique Selling Point*

Table 9: Themes and Corresponding Codes

A.1.3 Code Book

The following pages contain the code book, with all codes used, associated themes, example quotations and the frequency of the codes.

Table 10: Code, Theme, Example Quote, and Frequency

Code	Theme	Example Quote	Frequency
3PL	Different players in the supply chain and the role of logistics integrators	"Third party logistics provider dat dat zegt het al. Als je het niet zelf doet, geef het aan een andere party en dat dat zijn wij."	3
4PL	Different players in the supply chain and the role of logistics integrators	"Een 4 PL hangt daar nog weer boven dus een 4PL die monitort echt."	2
Added value for airports	Role of airports (Schiphol) in the e-commerce supply chain	"Want ik denk dat de toegevoegde waarde voor de BV Nederland veel malen groter is vanuit de vracht."	3
Air cargo supply chain	(Customs) documentation in the air cargo industry	"Je hebt gewoon de fysieke stromen en je hebt en je hebt digitale stromen en daar zit nou een douane in."	18
Air Waybill	(Customs) documentation in the air cargo industry	"Met een Air Waybill moet je per zending ook een aangifte insturen."	11
Airport challenges	Role of airports (Schiphol) in the e-commerce supply chain	"Daar zie ik wel de grootste uitdaging in."	10
Airport opportunity	Role of airports (Schiphol) in the e-commerce supply chain	"Ik kan ook zeggen van wanneer het ergens misgaat, betekent dat een opportunity elders."	4
Airport safety	Role of airports (Schiphol) in the e-commerce supply chain	"Dus Schiphol ondersteunt met betrekking tot het faciliteren, van het krijgen van snelheid, en safety en security, en het delen van data."	2
Airport strategy	Role of airports (Schiphol) in the e-commerce supply chain	"Je zit met het probleem dat Schiphol, is in eerste instantie volledig gefocust op passagiers."	9
Artificial Intelligence	Digitalization in the air cargo industry	"So, we try to provide tools where, you know, using things like machine learning."	5
Attractivity	Economic effect of the e-commerce increase	"Je wil dat Nederland wel aantrekkelijk is als importland."	7
Business optimization	Role of airports (Schiphol) in the e-commerce supply chain	"Die procesoptimalisatie, het vooruit blijven lopen, om zo soepel mogelijk die processen af te wikkelen."	3
Business-to-business	Deliveries of e-commerce orders	"It's quite efficient and it you know it's in terms of carbon, it's quite efficient as well 'cause it's one stop 3 packs."	9

Continued on next page

Table 10 – Continued from previous page

Code	Theme	Example Quote	Frequency
Business-to-consumer	Deliveries of e-commerce orders	"In B2C, generally you know we're doing a pack one single pack to one single address."	11
Capacity	Customs workload and challenges	"De capaciteit wordt bepaald door de airlines."	3
Channel	Impact of e-commerce goods on logistics and operations	"Het is het kanaal wat veranderd is."	3
CN38 document	(Customs) documentation in the air cargo industry	"Het hele CN 38 document voor het transport van post."	8
Competition among airports	Role of airports (Schiphol) in the e-commerce supply chain	"Als je vergelijkt met onze Cargo concurrenten."	12
Compliance check	Customs management and regulation	"Ons systeem doet allerlei compliance checks."	6
Connectivity	Economic effect of the e-commerce increase	"Dan blijft dat een USP, dan blijft Nederland steeds nog steeds aantrekkelijk."	8
Consumer ignorance	Deliveries of e-commerce orders	"The person who's receiving the goods knows nothing about the regulations."	1
Consumer interaction	Deliveries of e-commerce orders	"We staan in die zin in contact met consumenten via onze receiver tools zoals we dat noemen."	15
Consumer satisfaction	Deliveries of e-commerce orders	"If they have things that you know, customer says I'm willing to pay to have it overnight."	1
Custom delay	Cooperation with customs interests	"En, dat blijft het af en toe dat het toch ja best wel lang duurt."	6
Customs capacity	Customs workload and challenges	"Het vraagt natuurlijk wat van systeem, omdat er veel meer aangiftes worden gegenereerd."	13
Customs challenge	Customs workload and challenges	"What are the goods and how complicated are they to make a declaration."	45
Customs clearance companies	Different players in the supply chain and the role of logistics integrators	"Maar dat doen wij dan weer, door te zorgen dat de kwaliteit van de data en de aangifte op een heel hoog niveau is."	5
Customs competition	Customs management and regulation	"De Nederlandse douane kan al meer aan dan andere landen."	1
Customs control	Customs management and regulation	"Op het moment dat een fysieke controle is"	32

Continued on next page

Table 10 – Continued from previous page

Code	Theme	Example Quote	Frequency
Customs cooperation	Customs management and regulation	"You're always when you're talking about customs and international borders looking at two customs authorities."	3
Customs efficiency	Customs management and regulation	"Het is heel moeilijk om dat te handhaven en te controleren."	49
Customs future	Customs management and regulation	"Je moet op een gegeven moment wel zeker met alle veranderingen die aankomen."	6
Customs opportunity	Customs management and regulation	"Daar zit denk ik juist voor hen een kans om dat te gebruiken."	3
Customs staffing	Customs workload and challenges	"De volumes bij de douane in relatie tot manschap issues."	6
Customs supervision	Customs management and regulation	"Door die komst van die EU data hub, die samenwerking op Europees niveau."	9
Customs transparancy	(Customs) documentation in the air cargo industry	"De data op papier lijkt allemaal heel erg mooi, maar het is ja, het is niet wat ze aangeven."	4
Data sharing and transparency	(Customs) documentation in the air cargo industry	"Maar die data die ja, die kan heel goed hergebruikt worden verder in de keten."	53
Declaration	Customs management and regulation	"We zien een ongelooflijke stijging in het aantal uitvoeraangifte."	12
Delivery services	Deliveries of e-commerce orders	"Then I think on the delivery side, the biggest change we've made is all of the building out of the retail points."	3
Delivery time expectations	Deliveries of e-commerce orders	"I think e-commerce recipients are extremely demanding more demanding than B2B recipients."	11
Dependencies among stakeholders	Different players in the supply chain and the role of logistics integrators	"Andere partijen die zijn daar veel beter in."	4
Developments	Customs workload and challenges	"En ik denk dat op basis van als er uit de analyse iets komt."	1
Different links	Different players in the supply chain and the role of logistics integrators	"De schakel, de verzendende partij, tot en met zeg maar het bedrijf dat de last mile levering doet."	10
Digital good flows	(Customs) documentation in the air cargo industry	"We try to make sure all of the other data around the shipment is provided electronically."	11
Digitalization	Digitalization in the air cargo industry	"Op gebied van digitalisering is er juist wel heel veel samenwerking."	41

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Table 10 – Continued from previous page

Code	Theme	Example Quote	Frequency
Documentation	(Customs) documentation in the air cargo industry	"En dat is hoe de luchtvracht daarnaar kijkt en daar zijn bepaalde documenten voor."	30
Door-to-door deliveries	Deliveries of e-commerce orders	"Als je het hebt over door-to-door delivery, dan zou je daar iets van snelheid kunnen krijgen."	12
E-commerce boom	Impact of e-commerce goods on logistics and operations	"Ik ben erbij gebaat dat de douane de stormachtige ontwikkeling van e-commerce bij kan benen."	16
E-commerce challenge integrator	Different players in the supply chain and the role of logistics integrators	"It's very hard to forecast."	3
E-commerce companies	Different players in the supply chain and the role of logistics integrators	"When you say e-commerce companies, you mean like a Bol.com or Amazon."	12
E-commerce distrust customs	Customs workload and challenges	"Op het moment dat e-commerce een betere reputatie gaat krijgen."	6
E-commerce opportunity for airports	Impact of e-commerce goods on logistics and operations	"Enerzijds wat voor opportunity het is."	1
E-commerce opportunity integrator	Different players in the supply chain and the role of logistics integrators	"FedEx is pretty late to the game when it comes to supporting shipping of e-com so as a business we continue to learn."	7
E-commerce threat for airports	Impact of e-commerce goods on logistics and operations	"Maar anderzijds, als het een bedreiging is op de een of andere manier."	1
E-commerce threats for supply chain	Impact of e-commerce goods on logistics and operations	"Complex met veel schakels. Dat is zeker dan, als je het over douanegoederen hebt."	4
E-commerce vs. traditional good flows	Different players in the supply chain and the role of logistics integrators	"Daar zit een heel groot vercshil tussen met inderdaad traditionele luchtvracht."	39
Economic developments	Economic effect of the e-commerce increase	"Daarbij gaan we op de golven van de wereldhandel."	1
Economic feasibility	Economic effect of the e-commerce increase	"Het is economisch gezien nooit verantwoord."	5
Economic impact	Economic effect of the e-commerce increase	"Je wil dat Nederland wel aantrekkelijk is als importland."	4
Embargo	Customs management and regulation	"Wellicht wijzigingen in, weet ik veel, belasting dingen, enzovoort en minimumtarieven."	1

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Table 10 – Continued from previous page

Code	Theme	Example Quote	Frequency
Fluctuations in volume	Impact of e-commerce goods on logistics and operations	"Daardoor kregen we ineens een enorme hoeveelheid vrachtwagens voor de deur."	8
Free shipping expectation	Deliveries of e-commerce orders	"Free shipping drives the market maybe in cross-border commerce."	2
Freighters	Different players in the supply chain and the role of logistics integrators	"De capaciteit wordt bepaald door de airlines."	13
Fulfillment	Deliveries of e-commerce orders	"Dat zit echt meer in de fulfillment arena."	4
Future e-commerce	Impact of e-commerce goods on logistics and operations	"De vraag of die volumes nog zo groot zijn zoals nu, is dat betwijfel ik."	11
Geopolitcs	Economic effect of the e-commerce increase	"Geopolitiek speelt in de luchtvracht altijd een grote rol en ook hierin."	1
Handling	Different players in the supply chain and the role of logistics integrators	"En die platen gaan dan, nadat ze ingeklaard zijn, rechtstreeks naar een injectie centrum."	2
High cost relative to product	Impact of e-commerce goods on logistics and operations	"Than you've made in a profit from the shipment that's been sent by that customer."	1
High involvement in e-commerce processes	Impact of e-commerce goods on logistics and operations	"En dan komt natuurlijk interessant voor de douane en dan heb ik wel een groot belang bij de ontwikkeling van de processen."	5
Higher volumes	Impact of e-commerce goods on logistics and operations	"En dat betekent zowel volume."	39
Infrastructure facilitator	Role of airports (Schiphol) in the e-commerce supply chain	"Dus Schiphol ondersteunt met betrekking tot het faciliteren."	13
Integration	Different players in the supply chain and the role of logistics integrators	"The package never leaves our network for the most part."	26
Integrator differentiation	Different players in the supply chain and the role of logistics integrators	"I mean our fleet is you know that's really what differentiates us."	5
International trade	Economic effect of the e-commerce increase	"Komt gewoon omdat de vrachtmarkt, vandaag vlieg je naar Bolivia toe omdat daar de handel is."	6

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Table 10 – Continued from previous page

Code	Theme	Example Quote	Frequency
Last mile	Different players in the supply chain and the role of logistics integrators	"Dan wordt het meteen klaargezet om naar de last mile te gaan."	15
Lead times	Impact of e-commerce goods on logistics and operations	"Well, fortunately with a lot of customs clearance being automated today. It it's quite quick."	15
Limited direct involvement in e-commerce processes	Impact of e-commerce goods on logistics and operations	"Bij E-commerce heb je als DHL eigenlijk geen rol."	6
Low value products	Impact of e-commerce goods on logistics and operations	"Very high volumes of relatively lower value shipments."	3
Lower cost	Deliveries of e-commerce orders	"'Cause it's it's lower cost and it's less emissions."	1
Lower cost expectation	Impact of e-commerce goods on logistics and operations	"Je ziet dat daar voor 1,2,3 cent kostenvoordeel op een pakje, net zo makkelijk voor een andere oplossing wordt gekozen."	2
Market forces air freight	Economic effect of the e-commerce increase	"Dit is eigenlijk een marktwerking zeg maar."	12
Market positioning airport	Role of airports (Schiphol) in the e-commerce supply chain	"Willen ze blijven focussen op passagiers."	15
Missing data	Customs workload and challenges	"Just missing recipient data."	1
Need for certainty	Role of airports (Schiphol) in the e-commerce supply chain	"Je wil gewoon zeker weten dat ik jou freighters de komende jaren gewoon kunnen komen."	1
Need for cooperation with customs	Cooperation with customs interests	"En niet alleen Nederland, dus de douane is ook heel erg gebaat bij tijdige informatie."	29
Need for digitalization	Digitalization in the air cargo industry	"Dus die data, en dat is nog niet optimaal op dit moment."	7
Need for flexibility	Impact of e-commerce goods on logistics and operations	"En die hebben dus ook een hele grote behoefte aan flexibiliteit."	1
Need for forecasting	Digitalization in the air cargo industry	"Dat is weten wat er op welk moment op je af komt."	2
Need for process change	Digitalization in the air cargo industry	"Omdat mijn proces daar gewoon nou, misschien niet helemaal goed op ingericht is."	7
Network	Cooperation with customs interests	"Als we die netwerkfunctie houden."	12
Order complexity	Deliveries of e-commerce orders	"Als we die, als we die netwerkfunctie houden."	7

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Table 10 – Continued from previous page

Code	Theme	Example Quote	Frequency
Order processing	Different players in the supply chain and the role of logistics integrators	"Ik denk dat het niet het orderproces is wat je zo moet optimaliseren."	13
Outsourcing	Different players in the supply chain and the role of logistics integrators	"Met derde partijen die die voor onze rol spelen in die export aangiftes."	12
Physical good flows	(Customs) documentation in the air cargo industry	"Uiteindelijk is het de stroom van fysieke goederen, meer informatie, mensen en financiën."	9
Process change	Digitalization in the air cargo industry	"Dan heb ik wel een groot belang bij de ontwikkeling van de processen."	13
Product coding	Customs workload and challenges	"Alles wat je er ziet is geclassificeerd in een goederencode."	10
Regulation	Customs management and regulation	"Er is samenwerking, omdat er gewoon heel veel is bepaald door Europese regelgeving hè."	23
Risk oriented control	Customs management and regulation	"De douane die werkelijk principe risico gericht."	4
Role of (Schiphol) Airport	Role of airports (Schiphol) in the e-commerce supply chain	"Als luchthaven zegt ja, wij handelen vrachten op deze manier af en dan moet je aan deze voorwaarden voldoen."	21
Role of customs clearance	Cooperation with customs interests	"De douane controleert en controleert veiligheidsgegevens bij binnenkomst."	20
Role of logistics integrators	Different players in the supply chain and the role of logistics integrators	"You know, we're one of the largest carriers for US domestic e-commerce shipments."	37
Schiphol as a hub	Role of airports (Schiphol) in the e-commerce supply chain	"Maar de visie is inderdaad wel van, als we dit doen, dan is Schiphol een veel betere Cargo hub."	14
SCMP	Role of airports (Schiphol) in the e-commerce supply chain	"SCMP is eigenlijk een soort ontwikkelprogramma van projecten."	4
Service quality	Deliveries of e-commerce orders	"It really depends we usually do contact the shipper and we try we try to deliver the package."	3
Slot capacity	Role of airports (Schiphol) in the e-commerce supply chain	"Ik denk, wat nog wel een beperking kan zijn, is de slots schaarste neemt toe."	16

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Table 10 – Continued from previous page

Code	Theme	Example Quote	Frequency
Small packages	Impact of e-commerce goods on logistics and operations	"Nu komen er allemaal individuele, geassembleerde goederen binnen."	6
Strategic Investment	Role of airports (Schiphol) in the e-commerce supply chain	"Ik ga als een gek warehouse bouwen die ga ik verhuren en over twee jaar ziet de wereld er anders uit."	1
Supply chain cooperation	Different players in the supply chain and the role of logistics integrators	"Waar wij ook tegenaan lopen, is bijvoorbeeld de integriteit van de met data die wij van de klanten krijgen."	38
Supply chain coordination	Different players in the supply chain and the role of logistics integrators	"Dus degene die het hele proces in handen hebben, kunnen veel meer data delen."	17
Supply chain effiency	Different players in the supply chain and the role of logistics integrators	"Dat wordt straks gereduceerd tot mandjes met goederen."	15
Sustainability	Economic effect of the e-commerce increase	"Ik denk niet dat dat de boom, zoals die er nu is dat het sustainable is."	6
Transparency	Different players in the supply chain and the role of logistics integrators	"Ik denk ook dat de transparantie daarover nog niet voldoende is."	4
Transport capacity	Impact of e-commerce goods on logistics and operations	"Wij verzorgen wel capaciteit."	4
Transport challenge	Impact of e-commerce goods on logistics and operations	"Daardoor kregen we ineens een enorme hoeveelheid vrachtwagens voor de deur hier."	6
Transport network	Different players in the supply chain and the role of logistics integrators	"Ja en uiteindelijk moeten wij ons ook er ingerichten dat onze netwerken zo snel mogelijk maken."	9
Undervalued products	Customs workload and challenges	"There is a level of value verification that goes on."	7
Unique Selling Point	Role of airports (Schiphol) in the e-commerce supply chain	"Als je zegt Van USP's van Schiphol, nou, dat is natuurlijk het superieure netwerk wat we hebben."	6

A.1.4 Frequency Codes

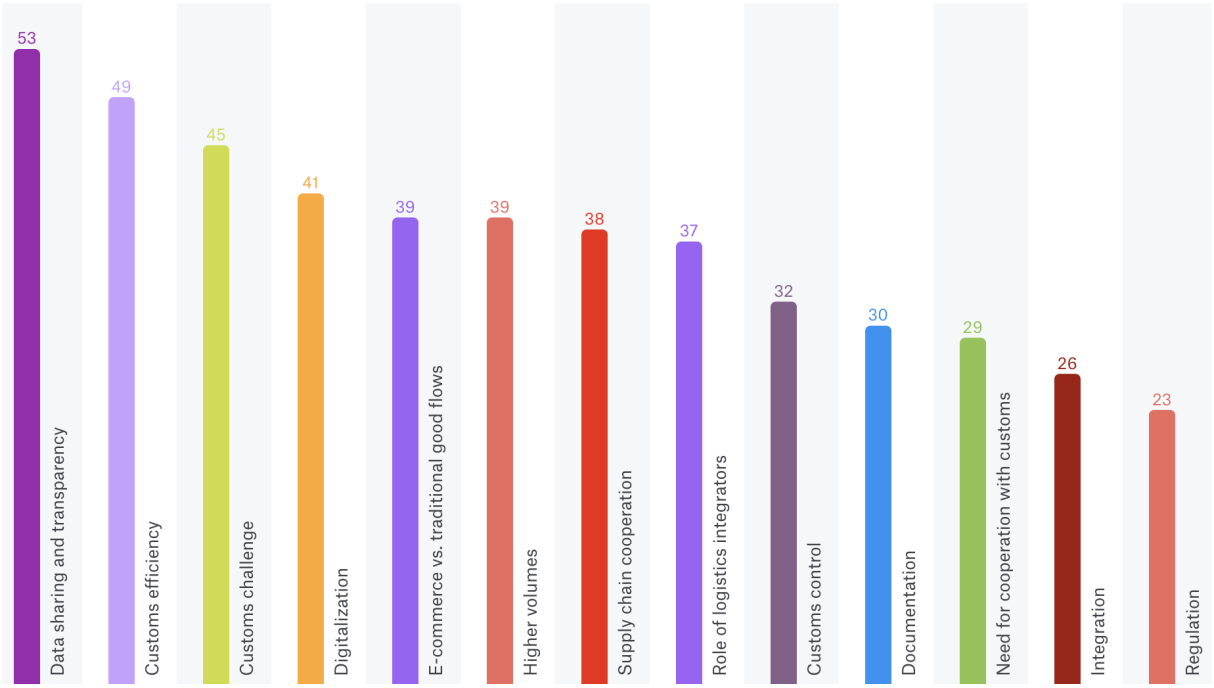


Figure 4: Frequency of the codes used

A.2 Survey

The following pages contain the survey that was distributed to all respondents.

E-commerce logistics service quality

Start of Block: Introduction to the survey

Q1 I appreciate you taking the time to participate in this study. Currently I am doing my Master's in Urban, Port & Transport Economics at the Erasmus University of Rotterdam, and writing my thesis is the final step towards graduation. It would be very helpful if you could answer the questions in this survey honestly. Please select the option that seems most appropriate to you. This survey will take approximately 5-7 minutes to complete.

Your participation in this study is voluntary. All responses will be kept private and confidential, only being viewed by me and my supervisor. It is completely free for you to decline to respond to any questions or to exit the survey at any moment.

If you have any questions about the study or the procedures, you may contact me at 509543sz@student.eur.nl
Please read the following points and select your choice below:
I have read the above information. I voluntarily agree to participate in this study.

- ○ Agree to participate (1)
- ○ Disagree to participate (2)

End of Block: Introduction to the survey

Start of Block: Introduction about the topic

Q2 *This survey is about the logistics service quality you receive when ordering something online (= e-commerce). Most of the e-commerce companies (like Bol.com, Coolblue, Amazon, Alibaba, etc.) outsource their delivery to logistics integrators (like DHL, UPS, and FedEx). These logistics integrators provide door-to-door deliveries and therefore play an important role in the e-commerce supply chain. In this survey, the logistics integrators are referred to as the* ***delivery services****.*

End of Block: Introduction about the topic

Start of Block: Part I: Online shopping experience

Q3 *Think about your own experiences with online ordering and the delivery of those packages, and please answer the following questions:*

Q4 How frequently do you shop online?

- ○ Never (1)
- ○ Less than monthly (2)
- ○ Monthly (3)
- ○ Weekly (4)
- ○ Almost daily (5)

Q5 How often do you select home delivery?

- Never (1)
- Sometimes (2)
- About half the time (3)
- Most of the time (4)
- Always (5)

Q6 To what extent do delivery options influence your decision to place an order with a specific online shop?

- No influence at all (1)
- Little influence (2)
- Neutral (3)
- Some influence (4)
- Significant influence (5)

Q7 How does the availability of a specific delivery service (for example, only DHL) influence your decision to buy from an online store?

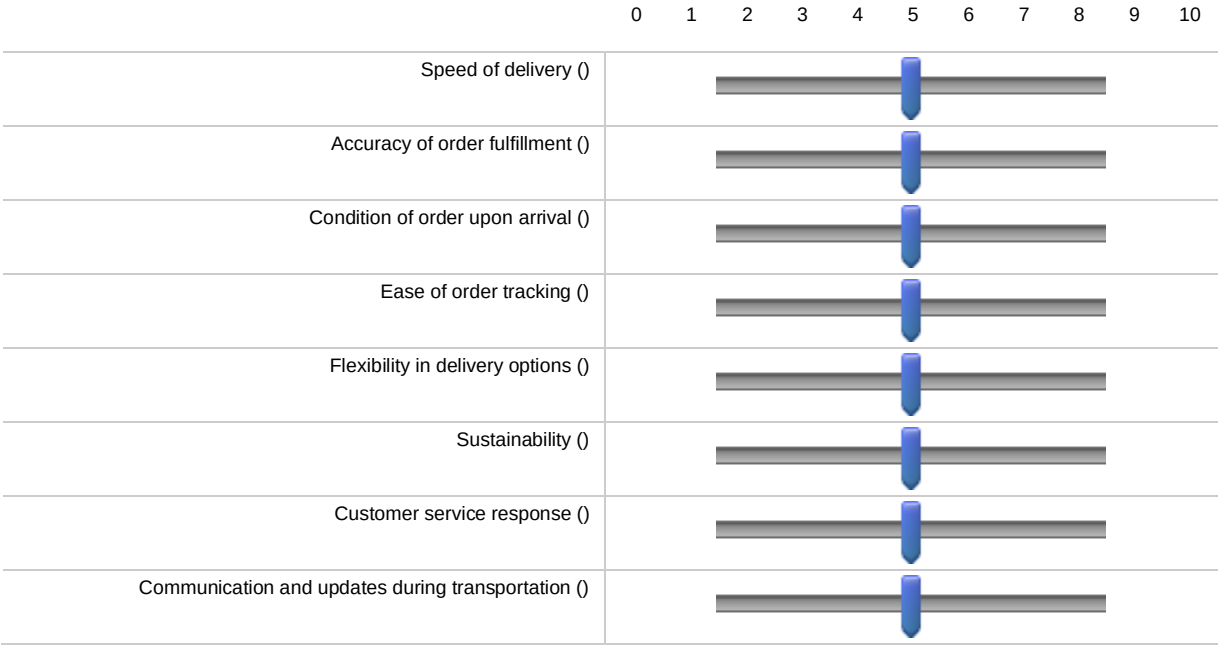
- No influence at all (1)
- Little influence (2)
- Neutral (3)
- Some influence (4)
- Significant influence (5)

Page Break

Q8 Which delivery services do you have experience with? (Multiple answers possible)

- [ ] DHL (1)
- [ ] UPS (2)
- [ ] FedEx (3)
- [ ] PostNL (4)
- [ ] DPD (5)
- [ ] GLS (6)
- [ ] Budbee (7)
- [ ] Other (8)

Q9 How important do you think the following points are when delivering an order? *(Where 0 = not important and 10 = extremely important)*



End of Block: Part I: Online shopping experience

Start of Block: Part II: Personal contact quality

Q9 *Imagine the following: You have ordered something from an online store, but something goes wrong with the delivery of your order (for example, the order does not arrive, is delivered at a different time than expected, or something goes wrong with the return). You need to get in touch with the delivery service. Think about your experiences you have had with this situation, and please answer the following statements:*

	Strongly disagree (1)	Somewhat disagree (2)	Neither agree nor disagree (3)	Somewhat agree (4)	Strongly agree (5)
The delivery services communicate clearly and openly about any changes or problems with my order. (1)	○	○	○	○	○
Problems are resolved by the contact person at the delivery service. (2)	○	○	○	○	○
The contact persons of the delivery services are friendly and helpful. (3)	○	○	○	○	○

End of Block: Part II: Personal contact quality

Start of Block: Part III: Information Quality

Q10 *Think of when you have placed an online order, and you receive a message about your order and its delivery, and please answer the following statements:*

	Strongly disagree (1)	Somewhat disagree (2)	Neither agree nor disagree (3)	Somewhat agree (4)	Strongly agree (5)
The delivery service keeps me informed about the progress of my order throughout the entire process. (1)	○	○	○	○	○
The information I receive on my order is precise and reliable. (2)	○	○	○	○	○
I believe that the information I receive from the delivery service about my order is correct. (3)	○	○	○	○	○

End of Block: Part III: Information Quality

Start of Block: Part IV: Order condition

Q11 *Think about the condition of the packages when your order is delivered by the delivery service, and please answer the following statements:*

	Strongly disagree (1)	Somewhat disagree (2)	Neither agree nor disagree (3)	Somewhat agree (4)	Strongly agree (5)
The delivery service handles the packages I have ordered with care. (1)	○	○	○	○	○
The packages I receive are usually undamaged. (2)	○	○	○	○	○
Fill in the answer "Somewhat agree". (3)	○	○	○	○	○
I am happy with the overall condition in which I receive my packages from the delivery services. (4)	○	○	○	○	○

End of Block: Part IV: Order condition

Start of Block: Part V: Order discrepancy handling

Q12 *When you order something online, it is possible that something goes wrong with your order. This could have gone wrong with the e-commerce company where you placed an order or with the delivery service. Imagine what expectations you have in this scenario, and please answer the following statements:*

	Strongly disagree (1)	Somewhat disagree (2)	Neither agree nor disagree (3)	Somewhat agree (4)	Strongly agree (5)
The accuracy with which my order is processed by the delivery service influences my happiness, especially when errors occur. (1)	○	○	○	○	○
The delivery service communicates clearly about the order problems and their solutions. (2)	○	○	○	○	○
When the wrong package is delivered, it affects my perception of the delivery service, no matter my opinion of the online store from which I purchased the product. (3)	○	○	○	○	○

End of Block: Part V: Order discrepancy handling

Start of Block: Part IV: Timeliness

Q13 *One of the expectations of e-commerce consumers when ordering online is fast delivery. Think about your expectations regarding delivery times, and please answer the following statements:*

	Strongly disagree (1)	Somewhat disagree (2)	Neither agree nor disagree (3)	Somewhat agree (4)	Strongly agree (5)
If my order is delivered on time, I will use the same delivery service next time. (1)	○	○	○	○	○
I am generally satisfied with the speed with which the delivery services process and deliver my order. (2)	○	○	○	○	○
The delivery services generally keep me well informed about the expected delivery date and time, and any delays. (3)	○	○	○	○	○

End of Block: Part IV: Timeliness

Start of Block: Part VII: Consumer Satisfaction

Q14 *Think about your own experiences you have had with logistics integrators (= delivery services that provide door-to-door services, like DHL, UPS, and FedEx), and please answer the following statements:*

	Terrible (1)	Poor (2)	Average (3)	Good (4)	Excellent (5)
What is your general impression of the services provided by logistics integrators? (1)	○	○	○	○	○

Q14 *Think about your own experiences you have had with logistics integrators (= delivery services that provide door-to-door services, like DHL, UPS, and FedEx), and please answer the following statements:*

	Extremely dissatisfied (1)	Somewhat dissatisfied (2)	Neither satisfied nor dissatisfied (3)	Somewhat satisfied (4)	Extremely satisfied (5)
Which word describes your feelings about logistics integrators in general? (1)	○	○	○	○	○
How satisfied are you with the services provided by logistics integrators in general? (2)	○	○	○	○	○

End of Block: Part VII: Consumer Satisfaction

Start of Block: Part VIII: Demographics

Q15 Please indicate your gender.

- Male (1)
- Female (2)
- Non-binary / third gender (3)
- Prefer not to say (4)

Q16 What is your age group?

- Under 18 (1)
- 18 - 24 (2)
- 25 - 34 (3)
- 35 - 44 (4)
- 45 - 54 (5)
- 55+ years old (6)

Q17 What is your highest education level (now or achieved)?

- VMBO (1)
- HAVO (2)
- VWO (3)
- MBO (4)
- HBO (5)
- WO (6)

Q18 What is your nationality?

- Dutch (1)
- German (2)
- Belgian (3)
- American (4)
- British (5)
- French (6)
- Italian (7)
- Chinese (8)
- Indian (9)
- Other (10)

Q19 What is your employment status?

- Employed full time (1)
- Employed part time (2)
- Unemployed looking for work (3)
- Unemployed not looking for work (4)
- Retired (5)
- Student (6)
- Disabled (7)

End of Block: Part VIII: Demographics

A.3 Data description - Demographics

A.3.1 Gender

Gender	Freq.	Percent	Cum.
Female	64	58.18	58.18
Male	46	41.82	100.00
Total	110	100.00	

Table 11: Gender Distribution Respondents

A.3.2 Age

Age	Freq.	Percent	Cum.
18 - 24	53	48.18	48.18
25 - 34	14	12.73	60.91
35 - 44	15	13.64	74.55
45 - 54	11	10.00	84.55
55+ years old	15	13.64	98.18
Under 18	2	1.82	100.00
Total	110	100.00	

Table 12: Age Distribution Respondents

A.3.3 Highest Education Level

Education Level	Freq.	Percent	Cum.
VMBO	3	2.73	2.73
HAVO	2	1.82	4.55
VWO	3	2.73	7.27
MBO	14	12.73	20.00
HBO	36	32.73	52.73
WO	52	47.27	100.00
Total	110	100.00	

Table 13: Highest Education Level Distribution Respondents

A.3.4 Nationality

Nationality	Freq.	Percent	Cum.
Dutch	108	98.18	98.18
Belgian	1	0.91	99.09
Other	1	0.91	100.00
Total	110	100.00	

Table 14: Nationality Distribution Respondents

A.3.5 Employment Status

Employment Status	Freq.	Percent	Cum.
Retired	1	0.91	0.91
Unemployed looking for work	1	0.91	1.82
Employed part time	23	20.91	22.73
Student	31	28.18	50.91
Employed full time	54	49.09	100.00
Total	110	100.00	

Table 15: Employment Status Distribution Respondents

A.4 Data description - Online Shopping Experience

A.4.1 Frequency of Home Delivery

Home delivery	Freq.	Percent	Cum.
Always	36	32.73	32.73
Most of the time	47	42.73	75.45
About half the time	10	9.09	84.55
Sometimes	15	13.64	98.18
Never	2	1.82	100.00
Total	110	100.00	

Table 16: Frequency Distribution of Home Delivery

A.4.2 Influence of delivery options on order decision

Influence	Freq.	Percent	Cum.
No influence at all	12	10.91	10.91
Little influence	31	28.18	39.09
Neutral	13	11.82	50.91
Some influence	33	30.00	80.91
Significant influence	21	19.09	100.00
Total	110	100.00	

Table 17: Influence on Decision Making

A.4.3 Influence of Availability on Order Decision

Availability Influence	Freq.	Percent	Cum.
No influence at all	42	38.18	38.18
Little influence	29	26.36	64.55
Neutral	9	8.18	72.73
Some influence	23	20.91	93.64
Significant influence	7	6.36	100.00
Total	110	100.00	

Table 18: Influence of Availability on Order Decision

A.5 Factor Analysis

A.5.1 Kaiser-Meyer-Olkin (KMO) Test

Concept	Item	kmo
Personal Contact Quality	1	0.8399
Personal Contact Quality	2	0.7810
Personal Contact Quality	3	0.7962
Information Quality	1	0.7990
Information Quality	2	0.7573
Information Quality	3	0.7756
Order Condition	1	0.7698
Order Condition	2	0.6912
Order Condition	3	0.7280
Order Discrepancy Handling	1	0.4053
Order Discrepancy Handling	2	0.8532
Order Discrepancy Handling	3	0.4415
Timeliness	1	0.3694
Timeliness	2	0.5378
Timeliness	3	0.7538
Overall		0.7406

Table 19: Kaiser-Meyer-Olkin (KMO) Test

A.5.2 Bartlett's Test of Sphericity

Table 20: Factor Analysis/Correlation

	Statistic	Value
Number of observations	110	
Method	Principal factors	
Retained factors	8	
Rotation	Unrotated	
Number of parameters	92	

Factor	Eigenvalue	Difference	Proportion	Cumulative
Factor1	3.76941	2.73743	0.6359	0.6359
Factor2	1.03197	0.18519	0.1741	0.8099
Factor3	0.84678	0.24336	0.1428	0.9528
Factor4	0.60342	0.14821	0.1018	1.0546
Factor5	0.45521	0.13915	0.0768	1.1314
Factor6	0.31606	0.27481	0.0533	1.1847
Factor7	0.04125	0.02836	0.0070	1.1916
Factor8	0.01289	0.06182	0.0022	1.1938
Factor9	-0.04894	0.04114	-0.0083	1.1855
Factor10	-0.09007	0.00839	-0.0152	1.1704
Factor11	-0.09846	0.01341	-0.0166	1.1537
Factor12	-0.11187	0.08070	-0.0189	1.1349
Factor13	-0.19257	0.09439	-0.0325	1.1024
Factor14	-0.28697	0.03302	-0.0484	1.0540
Factor15	-0.31999		-0.0540	1.0000

LR test: independent vs. saturated: $\chi^2(105) = 483.59$ Prob>chi2 = 0.0000

Variable	Factor1	Factor2	Factor3	Factor4	Factor5	Factor6	Factor7	Factor8	Uniqueness
PCQ 1	0.5484	-0.2430	-0.1641	0.0282	0.2749	-0.0159	-0.0127	-0.0098	0.5364
PCQ 2	0.5653	-0.4039	-0.2389	-0.0157	0.0578	-0.1113	0.0241	0.0181	0.4433
PCQ 3	0.5976	-0.3149	-0.1962	-0.1322	0.0176	-0.2355	-0.0337	0.0083	0.4308
IQ 1	0.4910	0.4010	-0.1668	-0.1019	-0.0489	-0.0101	-0.0888	0.0153	0.5493
IQ 2	0.6978	0.2471	-0.1753	-0.0829	-0.1588	0.2210	0.0308	-0.0110	0.3392
IQ 3	0.5973	0.2713	-0.2738	-0.1034	-0.0075	-0.0089	0.0818	-0.0576	0.4739
OC 1	0.5816	-0.0819	0.2450	-0.1358	-0.2544	0.1111	0.0122	0.0575	0.4961
OC 2	0.5269	-0.0557	0.5434	-0.0393	0.0674	-0.0373	0.0425	-0.0238	0.4142
OC 3	0.6397	-0.0912	0.3989	0.0266	-0.1667	-0.1079	-0.0661	-0.0434	0.3769
ODH 1	0.1537	-0.3202	-0.0972	0.4291	-0.1516	0.1879	-0.0371	-0.0191	0.6203
ODH 2	0.5580	-0.1481	-0.0485	0.1141	0.1196	0.2626	-0.0047	0.0188	0.5677
ODH 3	0.1414	0.0634	0.2376	0.0600	0.4126	0.1344	0.0156	0.0033	0.7273
T 1	0.0543	-0.0356	-0.0102	0.3631	-0.1671	-0.1474	0.1102	0.0151	0.8018
T 2	0.1554	0.2946	-0.0455	0.4102	0.0331	-0.0909	-0.0590	-0.0086	0.7058
T 3	0.5478	0.4249	0.0769	0.1881	0.1215	-0.1457	0.0162	0.0440	0.4399

A.5.3 Item influence on factors

Variable	Factor1	Factor2
PCQ 1	0.10832	-0.14184
PCQ 2	0.13876	-0.28213
PCQ 3	0.14437	-0.20298
IQ 1	0.08781	0.21995
IQ 2	0.21672	0.18976
IQ 3	0.12481	0.18111
OC 1	0.10819	-0.05901
OC 2	0.11102	-0.04258
OC 3	0.18364	-0.06498
ODH 1	0.02678	-0.15483
ODH 2	0.10992	-0.10156
ODH 3	0.03423	0.03321
T 1	0.01110	-0.02258
T 2	0.02292	0.12300
T 3	0.13153	0.30807

Table 21: Scoring Coefficients (method = regression)

A.5.4 Item influence on factors

Concept	Factor1	Factor2
Personal Contact Quality (PCQ)	0.13048	-0.20998
Information Quality (IQ)	0.14378	0.19694
Order Condition (OC)	0.13495	-0.05552
Order Discrepancy Handling (ODH)	0.05631	-0.07406
Timeliness (T)	0.05585	0.13677

Table 22: Average Scoring coefficients per concept

A.6 Consumer Satisfaction

Concept	N	M	SD	Min	Max
Consumer satisfaction	110	3.7	0.660445	1.333333	5

Table 23: Consumer Satisfaction Concept

Variable	N	M	SD	Min	Max
Consumer Satisfaction Item 1	110	3.6	0.7193269	2	5
Consumer Satisfaction Item 2	110	3.709091	0.7583838	1	5
Consumer Satisfaction Item 3	110	3.790909	0.7050988	1	5

Table 24: Consumer Satisfaction per item

CS Item 1	Freq.	Percent	Cum.
Terrible	0	0.00	0.00
Poor	8	7.27	7.27
Average	35	31.82	39.09
Good	60	54.55	93.64
Excellent	7	6.36	100.00
Total	110	100.00	

Table 25: Frequency Table Consumer Satisfaction Item 1

CS Item 2	Freq.	Percent	Cum.
Extremely dissatisfied	1	0.91	0.91
Somewhat dissatisfied	6	5.45	6.36
Neither dissatisfied nor satisfied	28	25.45	31.82
Somewhat satisfied	64	58.18	90.00
Extremely satisfied	11	10.00	100.00
Total	110	100.00	

Table 26: Frequency Table Consumer Satisfaction Item 2

CS Item 3	Freq.	Percent	Cum.
Extremely dissatisfied	1	0.91	0.91
Somewhat dissatisfied	4	3.64	4.55
Neither dissatisfied nor satisfied	23	20.91	25.45
Somewhat satisfied	71	64.55	90.00
Extremely satisfied	11	10.00	100.00
Total	110	100.00	

Table 27: Frequency Table Consumer Satisfaction Item 3