logistics

MDPI

Article

Adopting Technological Innovations in the Air Cargo Logistics Industry in South Africa

Adedotun Joseph Adenigbo *, Joash Mageto and Rose Luke

Department of Transport and Supply Chain Management, University of Johannesburg, Johannesburg 2006, South Africa; joashm@uj.ac.za (J.M.); rluke@uj.ac.za (R.L.)
* Correspondence: ajadenigbo@uj.ac.za

Abstract: *Background:* The air cargo logistics industry has been deemed reluctant to adopt new technologies for their business operations. So, this study aims to examine the adoption of technological innovations in the air cargo logistics industry in South Africa. The specific objective is to emphasise the effects of technologies on air cargo logistics operations to address the reluctance to adopt technological innovations in the industry. *Methods:* A questionnaire survey was conducted randomly on three hundred and seventy-three (373) cargo agents at the OR Tambo International Airport. The data were subjected to a nonparametric test with Kruskal–Wallis, exploratory factor analysis and regression analysis to explore the effects of technologies for prompt adoption and implementation of emerging innovations that enhance quality service delivery. *Results:* The study found that promptly adopting emerging technological innovations in the air cargo logistics industry promotes efficient operations, improves warehousing, and enhances cargo delivery services for customer satisfaction. Also, the study established that technologically driven operations and warehousing are significant determinants of quality service delivery in the air cargo logistics industry. *Conclusions:* This study encourages the prompt adoption and implementation of technological innovations for improved quality service delivery, customer satisfaction, and loyalty in the air cargo logistics industry.

Keywords: technological innovations; air cargo; logistics; technological adoption; service delivery

Citation: Adenigbo, A.J.; Mageto, J.; Luke, R. Adopting Technological Innovations in the Air Cargo Logistics Industry in South Africa. *Logistics* **2023**, *7*, 84. https://doi.org/10.3390/logistics7040084

Academic Editor: Robert Handfield

Received: 30 August 2023
Revised: 12 October 2023
Accepted: 9 November 2023
Published: 16 November 2023

1. Introduction

The air cargo logistics industry is part of the services offered in the aviation sector. The industry fulfils a segment of the supply chain system for the seamless distribution of goods to meet consumers' demands. This study defines air cargo as goods carried by aircraft, whether chartered or commercial, under customs-bonded airway bills. Many scholars, such as [1], have referred to air cargo as a by-product of passenger traffic, where airlines traditionally load cargo into the belly holds of their passenger aircraft. Air cargo operation is observed as an efficient means of transportation because of its capacity to handle high-valued and time-sensitive goods [2,3]. However, the turn of global events resulting from the COVID-19 pandemic and the booming e-commerce demand have reshaped the outlook of the air cargo logistics industry for the future. The International Air Transport Association [4] emphasised how e-commerce accelerates transformation in the global air cargo logistics industry with 15% of volume in 2019 and 18% of total retail sales in 2020.

Ref. [5] compared cargo volume for February 2019 with February 2018 and stated that the air cargo industry experienced a weakened demand, with a fall of 4.7%. Ref. [5] also reported that the air cargo market capacity increased by 2.7% yearly. The record shows that it was the slowest annual growth rate in three (3) years. In contrast, other studies had anticipated that air freight volumes would continue to increase by around 3% annually until 2025 and likely after 2030 [6]. According to [7], air cargo traffic will increase by 4.3% annually for the next 20 years.

Recent technological advances are poised to impact air cargo operations for efficient supply chain management to ensure the seamless distribution of goods with automated

coordination of air cargo flow. For stakeholders in the logistics industry, digitisation with ICT and IoT is becoming unavoidable [8] for seamless supply chain operations in air cargo distribution. The requirement to adopt new technological innovations has prompted severe concerns for stakeholders in the air cargo logistics industry. The concerns border on the reluctance for the prompt adoption and implementation of emerging innovations in the industry due to the cost of technological acquisition and negative attitude to change. Nevertheless, the impact of technology on industries worldwide cannot be overemphasised. Its influence is highly significant to have transformed how companies conduct their businesses. The air cargo industry is no exception, as emerging technological innovations are fast becoming major driving forces. Thus, stakeholders in the air cargo logistics industry are under severe pressure to digitise their current operations to remain relevant due to the increasingly widespread technological innovations [4].

Notwithstanding, the reluctance to adopt and implement emerging technological innovations in the air cargo logistics industry prevails [9]. As a result, the air cargo industry is often lamented as lagging in digitisation behind passenger air transport [10]. The air cargo industry is slow to adopt digitisation to modernise distribution although technological applications are required for data and cargo management systems across all distribution stages [11,12]. Similarly, ref. [13] stated that adopting new innovative technologies continues to be slow and less than optimal across organisations. The traditional human behaviour to resist change [14] and the huge cost of acquiring new technologies account for the attitudinal reluctance of air cargo stakeholders to adopt and implement new technological innovations promptly. So, this study identifies and emphasises the effects of technological innovations in improving air cargo service delivery with the aim of addressing the reluctance or slowness in adopting technological innovations in the air cargo logistics industry.

To this end, this study aims to provide convictions for the prompt adoption of technological innovations in the air cargo logistics industry by identifying the significant effects of technologies on air cargo service delivery among stakeholders in South Africa. The focus is to reduce the reluctance to adopt technological innovations created to facilitate the seamless distribution of cargo for economic development in South Africa. This paper's main question is as follows: what is the effect of adopting emerging innovative technologies in the air cargo logistics industry in South Africa? The goal is to address the level of reluctance and slowness of the industry to adopt and implement emerging technologies for handling air cargo operations. The study contributes to the existing knowledge by emphasising the effects of technological applications in the air cargo logistics industry to promote attitudinal change for prompt acceptance, adoption, and implementation of emerging technological innovations. Importantly, this study provides evidence to persuade prompt adoption of technological innovations in the air cargo logistics industry. The need for prompt adoption of advanced and emerging technologies in the air cargo logistics industry is to address problems such as the disintegration of the supply chain system [15]. The authors of [16] also highlighted other problems, such as cost-ineffectiveness, the prevalence of paperwork, and limited data management systems. The problems remain prevalent in the industry when emerging technologies can accelerate progress and transform the landscape for efficient air cargo service delivery. So, the study argues that adopting technological innovations in the air cargo logistics industry offers efficient operations for quality customer service delivery.

The literature on adopting technological innovations has focussed on the airline subsector of the air transport industry in South Africa. Such studies include [17], self-service bag drops [18], and airlines [19]. Very little research has been conducted on technological innovations in the air cargo logistics industry. So, this study focuses on the air cargo logistics industry, which is yet to have in-depth research studies on adopting technological innovations in South Africa.

The paper is structured such that after this introductory section, Section 2 provides the review of the literature, Section 3 dwells on the method used for the study, Section 4

presents the results of the analysis, Section 5 provides a detailed discussion of the results, and Section 6 concludes the study with policy implications and future study.

2. Literature Review

Over the years, much research has been conducted on airlines and passenger traffic at airports. However, most researchers consider air cargo a subsidiary of passenger operations, and airlines mostly carry cargo in the belly of their passenger aircraft. However, the recent COVID-19 pandemic revealed the importance of cargo to airlines and airport operations beyond its consideration as a by-product of passenger traffic. The ban on passenger movement during the pandemic highlighted that cargo traffic could substantially make airline and airport operations. So, according to [20], studies that address different problems in the air cargo industry focus on the airline, freight forwarders, and supply chain perspectives. The studies reviewed by [20] have none that focused on technological innovations in the air cargo industry. Notwithstanding, the empirical review for this study explores the effects of technological applications in the air cargo logistics industry and highlights the knowledge gap about the scarcity of studies that address the reluctance to adopt technological innovations in the industry, especially in South Africa.

2.1. Effects of Technological Applications in the Aviation Logistics Industry

The logistics industry is broad, with studies focusing on the need to apply technological applications in different aspects of operations such as RFID adoption [21], technology forecasting framework [22], inventory management [23], humanitarian logistics [24], digital marketing [25], digitisation [26], automation of warehousing [27,28], supply chain management [29], and [30] explored the implications of adopting industry 5.0 for smart logistics, etc.

In the aviation sector, most studies focus on the effects of technological innovations on airline operations. For example, ref. [31] found that technologies significantly influence air transport's safety, efficiency, capacity, capability, environment, and financial outlook. Ref. [32] also found that digital technology applications impact airline operations by enhancing passengers' flight experience. Ref. [33] stated how technological innovations have helped reshape the aviation industry by making it more efficient, safe, sustainable, and agile. Ref. [34] examined the effects of innovative technologies to provide comfortable, smart, and safe air travel in Asia. The passengers' perception of technological innovation and adoption during the COVID-19 pandemic was assessed by [35] in China and emphasised the effects of technological adoption on improved airline service delivery.

For the air cargo industry, there is a scarcity of studies focussing on the problems of adopting technological innovations in the air cargo logistics industry. However, studies have also emphasised the effects of technological innovations in handling and distributing cargo. For example, ref. [36] stated that emerging technological innovations have become an important part of cargo delivery for integrating supply chain operations due to globalisation. Ref. [37] affirmed that technological applications in air cargo supply chain management serve as a digital solution to simplify distribution processes. Ref. [38] also highlighted the effect of applying digital technologies in the cargo shipping business. The effect of applying blockchain technology in utilising airport resources for optimal service delivery was identified by [37]. Information technology infrastructure can provide a platform for all agents in the air cargo industry to collaborate online for service delivery [12].

So, it is apparent from the literature that technological applications are important to the air cargo logistics industry for seamless distribution with increased effectiveness in real-time delivery. Despite the importance of technological innovations to the air cargo logistics industry, to the best of our knowledge, no literature addresses the reluctance to adopt emerging technologies promptly. This supports the claim of [39] that empirical studies on the effects of 4IR adoption in the airline industry in South Africa are scarce.

Specifically, empirical studies that relate technological innovations and their effects on air cargo operations are lacking in South Africa. It implies that researchers in South Africa

have not considered the benefits of the air cargo industry to the country's development. Ref. [39] recently examined the effects of 4IR technologies adoption in the South African airline industry on the dynamics in the labour markets. Also, ref. [19] examined the surviving strategies of the South African airline industry with the adoption of smart technologies. The studies were devoted to the airline industry and imply the need to fill a knowledge gap about the effects of adopting technological innovations in the air cargo logistics industry in South Africa.

Hence, stakeholders in the air cargo industry need to be persuaded to adopt and implement emerging technologies for their operations promptly. So, this study presents the effects of adopting and implementing emerging technological applications in the air cargo logistics industry to encourage the timely deployment of technological innovations.

2.2. The Air Cargo Industry in South Africa

The air cargo industry in South Africa is versatile and contributes substantially to the growth and development of the country. South Africa has the United Arab Emirates, United Kingdom, Kenya, Qatar, and Germany as the busiest air cargo routes [40]. The air freight industry in South Africa generated a huge sum of 5.1 billion Rands in 2016 to contribute substantially to the country's economic growth [41]. In 2021, the South African air cargo industry had a total revenue of USD 0.2 billion [42]. South African airports' cargo traffic ranked second after Egypt in the African continent [43]. Three (3) major implications for the air cargo industry in South Africa are: 1. there is major air trade and exchange between South Africa and other countries in Asia, Europe, and within the African continent; 2. the air cargo industry significantly contributes to the annual revenue and growth of South Africa; and 3. South African air cargo traffic is substantial for trade and exchange in Africa.

The implications indicate the importance of the air cargo logistics industry to economic development. It also shows the connectivity of the distribution of goods across the world's continents for global trade facilitation. It finally reflects the importance of cargo traffic to airport and airline operations. The implications provide the need for studies that focus on the air cargo logistics industry in South Africa, as it not only contributes to the country's development but also influences the global trade relationship and promotes airports and airline operations.

3. Methods

This study adopted the survey research design for data collection and analysis. The research design is exploratory. The philosophy behind the research is positivism, which aims at quantifying data for exploratory analysis used in this study. The research study area was O. R. Tambo International Airport (OR Tambo), Johannesburg. O.R. Tambo is a major airport regarding cargo volume and traffic in Africa, with substantive cargo traffic in the continent. O.R. Tambo International Airport leads the remaining twenty-one (21) airports as the largest and busiest airport in South Africa. According to the Airports Council International (ACI) data, OR Tambo International Airport was ranked third (3rd) with 304,018 Tonnes in African cargo handling after Cairo and Jomo Kenyatta international airports [44].

The study used cargo agents, also known as freight forwarders, as the population for the research. The employees of the cargo agents' companies with offices at the Agent Building of the airport's cargo terminal form the study population. In all, ninety-seven (97) companies were contacted for this study. The study purposively sampled five (5) from each company to a total of four hundred and eighty-five (485) population. The selection aims to ensure that the general manager/manager, two partners and two other employees were included from each company in the survey. The simple random sampling technique was adopted to administer a questionnaire to the respondents. The random sampling technique was adopted for its capacity to provide an equal chance for each member of the population

to be sampled. Random numbers using MS Excel were generated and assigned to each questionnaire before administration.

A questionnaire was designed to collect data on the effects of the adoption of advanced technological applications in the air cargo logistics industry in South Africa. The choice of using a questionnaire to collect data for the study is because of its ability to structure and standardise responses that can be quantified for statistical analysis. The questionnaire was administered with the assistance of four (4) research assistants, who were duly trained to collect the data for the study. The questionnaire contains two (2) sections. Appendix A.1 seeks the respondents' background information, and Appendix A.2 seeks the opinion of the respondents about the effects of adopting advanced technological applications in air cargo logistics in South Africa. The initial questions in Appendix A.2 attempt to establish the stakeholders' responsiveness to adopt technological innovations. The other questions were presented on a 5-point Likert Scale about the effects of adopting technological applications in the air cargo logistics industry for the respondents to consider in order of significance. The order follows 1—Not Significant to 5—Highly Significant. The variables for the study were extracted from [45] the measurement framework for assessing disruptive innovations. The questionnaire used to collect data for the study is attached as Appendix A.

The questionnaire contains preliminary questions highlighting stakeholders' responses and the adoption of technological applications in the air cargo industry. For the main issue of the study, the questionnaire presents eighteen (18) items in the 5-point Likert scale for respondents to rank in order of significance. The items are the effects of technological applications in logistics operations. The items include integrated operations, efficient operations, reluctance to adopt, improved operations, technology diffusion, simplified handling process, reduced shipping time, order accuracy, reduced transport cost, inventory accuracy, reduced clearing time, improved warehousing operations, equipment utilisation, forecast uncertainty, monitor demand variability, improve cargo supply, and delivery within time. The items were extracted from literature such as [6,31,32,36–38]. The questionnaire was administered to cargo agents and returned three hundred and seventy-three (373) copies of the questionnaire with valid responses. The sample size had a 76.9 percent success rate in the data collection process.

Firstly, the data collected with the initial questions in part B of the questionnaire were analysed using Kruskal–Wallis to test if there is a significant reluctance to adopt technological innovations in the air cargo logistics industry in South Africa. The data for the remaining questions in Part B of the questionnaire were subjected to Exploratory Factor Analysis (EFA) for dimension reduction. The goal of the technique is to reduce the variables to a few of the most significant ones that best explain the effects of adopting emerging technological innovations in the air cargo logistics industry in South Africa. EFA determines whether reduced unobserved common factors can represent the observed covariances or correlations in the variables. The technique estimates the factor loadings of the items to determine the number of common factors that can adequately describe the correlations between the observed variables [46].

Principal Axis Factoring (PFA) was employed in implementing EFA. For a decision on the correctness of the analytical output, the procedure for conducting EFA statistically includes techniques using Kaiser–Meyer–Olkin (KMO) and Bartlett tests, communalities, extraction of variance using principal axis factoring, correlation matrix, and factor rotation (with varimax) technique [47].

The final output of the EFA identified efficient operations, warehousing operations, and improved service delivery as the most significant effects of adopting emerging technological innovations in air cargo logistics. This takes the analysis further by subjecting the three identified effects to regression analysis. The idea is to determine how efficient operations and improved warehouse operations contribute to service delivery in the industry. Service delivery is chosen as the dependent variable because the goal of developing technological innovations is to enhance service delivery for increased customer satisfaction. As customer satisfaction enhances customer loyalty, it is ideal that it will

convince stakeholders in the air cargo logistics industry to adopt emerging technological innovations promptly.

The regression model was built to determine the extent to which efficient operations and warehousing affect service delivery in the air cargo logistics industry in South Africa. The data for the regression analysis were generated by transforming the items that load on each of the common factors extracted by EFA into new variables by their mean values.

The model was represented as follows.

$$Y = a + \beta 1X1 + \beta 2X2 + \varepsilon$$

where

Y = Service Delivery (dependent variable);
a = Constant;
$X1$ = Efficient Operations (independent variable);
$X2$ = Warehousing (independent variable);
β = Coefficient of the independent variables;
ε = Error term.

So, the model for this study takes the form.

$$Service\ Delivery = a + Efficient\ Operations(X1) + Warehousing(X2) + \varepsilon$$

The coefficients of the variables were determined in their unstandardised form to determine the influence of improved warehousing and efficient operations on service delivery in the air cargo logistics industry in South Africa.

4. Results

The study applied the Kruskal–Wallis test to determine the existence of reluctance to adopt and implement new technological innovations in the air cargo logistics industry in South Africa. Table 1 shows the mean ranks and test statistics to indicate if there is a significant reluctance to promptly adopt emerging technological innovations in the air cargo logistics industry in South Africa. Table 1 shows that the highest mean rank of 329.87 is associated with "Least Responsive/Adopted". The test statistics indicate that a Kruskal–Wallis value of 219.920 is significant, with $p < 0.000$ for the response to the adoption of technological innovations in the air cargo logistics industry in South Africa. The significant value ($p = 0.000$) implies that the null hypothesis stating that there is no reluctance to the adoption of technological innovations in the air cargo logistics industry in South Africa is rejected. It implies that there is low responsiveness to the adoption of emerging technological innovations in the air cargo logistics industry in South Africa.

The output in Table 2 shows that the data is suitable and adequate for the analysis with the results of KMO and Bartlett's tests. The KMO test showing 0.584 indicates that the sample is adequate for EFA. Also, Bartlett's test of sphericity is significant at 0.000 with an approximate Chi-Square value of 2665.901, showing that the data is suitable for the exploratory factor analysis (See Table 2). This study considered the KMO value of 0.58 with Bartlett's test at $p = 0.000$ as appropriate, following the suggestion of [48] that a KMO over 0.5 has a substantial correlation for data suitability for EFA. Also, ref. [49] stated that a KMO greater than 0.5 is considered suitable for EFA. According to the sample size, ref. [50] suggested that a KMO value between 0.5 and 0.6 is acceptable for a sample size above 100.

The communalities estimate of the data presented in Table 3 shows that the variance in the variables can be ascribed to the common factors. The variance of each variable estimated by the analysis makes the communalities of the data. The model's communalities represent the sum of the squared loadings of the initial and extracted values of the variance of each variable. The extracted values presented in Table 3 show that all the variables have an acceptable variance to explain the variability in the common factors that serve as the

effects of adopting advanced technological applications in the air cargo logistics industry in South Africa.

Table 1. Kruskal–Wallis test of responsiveness to adopt technological innovations.

	Adoption of Technological Innovations	**N**	**Mean Rank**
Responsiveness to adopt Technological Innovations	1—Highly Responsive/Adopted	201	126.35
	2—Moderately Responsive/Adopted	102	196.61
	3—Least Responsive/Adopted	55	329.87
	4—Not Responsive/Adopted	15	310.50
	Total	373	
Test Statistics [a,b]			
		Responsiveness to Adopt TI	
Kruskal–Wallis H		219.920	
Df		3	
Asymp. Sig.		0.000	

[a.] Kruskal–Wallis Test; [b.] Grouping Variable: Adoption of TI.

Table 2. Tests of data adequacy and suitability for EFA.

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		0.584
Bartlett's Test of Sphericity	Approx. Chi-Square	2665.901
	Df	153
	Sig.	0.000

Table 3. Communalities of variables.

	Initial	**Extraction**
Integrated Operations	0.968	0.618
Efficient Operations	0.973	0.688
Address Reluctance	0.653	0.275
Improved Operations	0.892	0.545
Technology Diffusion	0.853	0.445
Simplified Handling Process	0.873	0.683
Reduced Shipping Time	0.716	0.433
Order Accuracy	0.767	0.512
Reduced Delivery Time	0.741	0.601
Reduced Transport Cost	0.934	0.700
Inventory Accuracy	0.695	0.389
Reduced Clearing Time	0.680	0.367
Improved Warehousing Operations	0.961	0.829
Equipment Utilisation	0.856	0.600
Forecasts Uncertainty	0.947	0.810
Monitor Demand Variability	0.831	0.719
Contribute to Cargo Supply	0.938	0.747
Delivery within Time	0.879	0.686

Extraction Method: Principal Axis Factoring.

The items with values less than 0.400 after extraction may not contribute significantly to the reduced factors that represent the effects of adopting technological innovations in the air cargo logistics industry in South Africa. The items are address reluctance (0.275), reduced shipping time (0.433), and inventory accuracy (0.389). The varimax rotation of the analysis will produce values that determine the contribution of each of the items to the common extracted factors.

The analysis took critical steps to identify the number of common factors that represent the effects of adopting technological innovations in the air cargo logistics industry in South Africa. The model specifies that the number of common factors is restricted to a maximum of three (3). So, the extraction was conducted using principal axis factoring with varimax rotation to identify the latent variables that make the common factors. The values were rotated according to size and suppressed to the least coefficient of 0.500. The percentage of the total variance that explained the common factors accounts for 59 per cent of the factors serving as the effects of adopting technological innovations in the air cargo logistics industry in South Africa (see Table 4).

Table 4. Total variance explained for adopting technological innovations.

Factor	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	8.074	44.858	44.858	7.732	42.954	42.954	4.056	22.531	22.531
2	1.979	10.994	55.852	1.572	8.733	51.687	3.479	19.328	41.859
3	1.852	10.287	66.138	1.343	7.461	59.148	3.112	17.289	59.148
4	1.043	5.795	71.933						
5	1.024	5.688	77.621						
6	0.834	4.634	82.255						
7	0.772	4.290	86.545						
8	0.633	3.519	90.064						
9	0.482	2.677	92.741						
10	0.385	2.141	94.882						
11	0.312	1.731	96.613						
12	0.169	0.941	97.554						
13	0.130	0.720	98.274						
14	0.104	0.580	98.854						
15	0.090	0.498	99.351						
16	0.062	0.344	99.696						
17	0.047	0.259	99.954						
18	0.008	0.046	100.000						

Extraction Method: Principal Axis Factoring.

Table 4 provides an understanding of the proportions of the variance in the variables that make each common factor that serves as the effect of adopting technological applications in the air cargo logistics industry in South Africa. The percentage of the eigenvalues explains the total variation in the data that a factor represents.

The final output of the analysis is the rotated factor matrix presented in Table 5. It indicates the three (3) major effects of adopting advanced technological innovations in the air cargo logistics industry in South Africa. The major items of the data are well loaded on each extracted factor, serving as the major effects of adopting technological innovations in the air cargo logistics industry. The loadings of each item on the factors show that items "reduce shipping time" and "address reluctance" have values less than 0.500 and have no contribution to the common factors serving as the effects of adopting advanced technological innovations in the air cargo industry in South Africa.

A critical examination of the result in Table 5 shows the correlated values of each item on the common factors. The items with the highest loading factors on each of the common factors have an efficient operation (0.780) on Factor 1, warehousing operations (0.767) on Factor 2 and improved service delivery (0.769) on Factor 3. Following the highest values of the items, the significant effects of adopting emerging technological innovations in the air cargo logistics industry in South Africa were named efficient operations and improved warehousing operations for factors 1 and 2. Factor 3 was named improved service delivery.

Table 5. Rotated factor matrix of the effects of adopting technological innovations in the air cargo logistics industry.

	Factor		
	1	**2**	**3**
Efficient Operations	0.780		
Integrated Operations	0.732		
Simplified Handling Process	0.728		
Monitor Demand Variability	0.704		
Technology Diffusion	0.667		
Forecasts Uncertainty	0.614		
Improved Warehousing Operations		0.767	
Equipment Utilisation		0.704	
Inventory Accuracy		0.616	
Improved Operations		0.601	
Reduced Transport Cost		0.565	
Reduced Clearing Time		0.550	
Reduced Delivery Time			0.769
Order Accuracy			0.669
Delivery within Time			0.657
Contribute to Cargo Supply			0.650
Factor Name	Efficient Operations	Improved Warehousing	Improved Service Delivery

Extraction Method: Principal Axis Factoring. Rotation Method: Varimax with Kaiser Normalization.

The study further analysed the data using a regression model to determine the relationships between the extracted common factors serving as the effects of adopting technological innovations in the air cargo logistics industry in South Africa. The analysis aims to determine the extent to which the adoption and application of technological innovations enhance service delivery in the air cargo logistics industry. The model summary in Table 6 shows that the R Square value of 0.365 indicates a strong relationship between the variables. It indicates that 36.5% of the quality service delivery in the air cargo logistics industry can be explained by efficient operations and improved warehousing derived from adopting and implementing emerging technological innovations.

Table 6. Model summary of the effect of technological innovations in the air cargo logistics industry.

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	0.604 [a]	0.365	0.361	0.86118

[a.] Predictors: (Constant), EffOpe, ImpWar.

The ANOVA test of the significance of the data for regression analysis shows F = 106.273 at p = 0.000. (See Table 7). The result implies that the effects of adopting technological innovations in the air cargo logistics industry will enhance service delivery. The test has quality service delivery as the dependent variable, while efficient operations and improved warehousing were the independent variables. The hypothesis tests if efficient operations and improved warehousing significantly influence quality service delivery in the air cargo logistics industry. Table 7 shows a significant relationship between quality service delivery, efficient operations, and improved warehousing as the effects of adopting technological innovations in the air cargo logistics industry.

The coefficient of the effects of adopting technological innovations in the air cargo logistics industry presented in Table 8 shows the regression coefficient estimates that determine the extent of the relationship between quality service delivery, efficient operations, and improved warehousing that technological innovation enhances. The model's estimated coefficients for this study are provided under "Unstandardised Coefficients B". The coefficients indicate the predicted change that each explanatory variable has in the dependent variable. The estimates are determined when each variable is increased by a

unit conditional upon all the other variables remaining constant. Therefore, the effect of adopting technological innovations in the air cargo logistics industry quality service delivery will tend to increase by 49.8% and 24.4% for every unit increase in warehousing and efficient operations.

Table 7. ANOVA [a] of the effects of technological innovations in the air cargo logistics industry.

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	157.632	2	78.816	106.273	0.000 [b]
	Residual	274.406	370	0.742		
	Total	432.038	372			

[a.] Dependent Variable: SerDel. [b.] Predictors: (Constant), EffOpe, ImpWar.

Table 8. Coefficients [a] of adopting technological innovations for air cargo quality service delivery.

Model		Unstandardised Coefficients		Standardised Coefficients	T	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	0.842	0.203		4.138	0.000		
	ImpWar	0.498	0.059	0.446	8.397	0.000	0.608	1.644
	EffOpe	0.244	0.060	0.215	4.041	0.000	0.608	1.644

[a.] Dependent Variable: SerDel.

The VIF statistics of the model indicate collinearity level in the analysis. The tolerance values of 0.608 are greater than 0.100 to imply that there is no multicollinearity in the model. The VIF values of 1.644, respectively, indicate that the variables are not correlated. Hence, the analysis output is assumed to be reliable for informed policy decisions.

So, the model for the study is defined as

$$Service\ Delivery = 0.842 + Efficient\ Operations(0.244) + Warehousing(0.498) + \varepsilon$$

The model predicts that improved warehousing and efficient operations will guarantee quality service delivery from the benefit of adopting technological innovations in the air cargo logistics industry. It implies that applying technological innovations in the air cargo logistics industry improves service quality delivery for customer satisfaction.

5. Discussion

Logistics challenges can be addressed by streamlining the supply chain connected by data platforms from order fulfilment to uninterrupted and optimal cargo distribution for efficient service delivery. This will mean providing a distribution system with a reduced delivery cost at optimal loading delivery capacities for customer satisfaction. The goal is to make technology support the flow of goods such that customers can trace their goods throughout the delivery process, even in the air, for maximum service satisfaction. This study has found that the major effects of adopting emerging technological innovations in the air cargo logistics industry are providing the lead for efficient operations, improving warehousing operations, and supporting quality service delivery. The ultimate finding of the study is that the application of technological innovations leads to quality service delivery in the air cargo logistics industry.

Each factor is believed to singly or jointly significantly affect the air cargo logistics industry in any country. The operational efficiency of cargo is pivotal to supply chain management and can drive customer-focused services in the air cargo industry. The efficiency in operations regarding air cargo logistics focuses on examination, clearing, handling costs and seamless distribution within the supply chain system. The application of technology provides efficiency by reducing the volume of manual handling of processes in the distribution management of cargo by the least waste of time and effort. According

to [51], the efficiency of cargo supply operations via technological applications drives service quality with automation, diversification, collaboration, and digitisation. The finding of this study about operational efficiency supports the conclusion of [6] that implementing technological applications and innovations in the air cargo logistics industry has brought significant improvements in operational efficiency with electronic air waybills for quality service delivery. It implies that the prompt adoption of emerging technological innovations in the air cargo logistics industry is important because of its capacity to enhance service delivery and customer satisfaction.

Warehousing has remained a significant aspect of the supply chain system for distributing and delivering goods from the origin to the destination. The warehouse plays an intermediary role in handling goods for delivery. It indicates that improved warehousing operations are required for satisfactory customer service in the air cargo logistics industry. This study found that technological innovations for warehousing operations significantly affect air cargo logistics in South Africa. This corroborates [52] that warehousing technology boosts air cargo logistics operations by reducing errors and costs for improved customer service delivery. Also, ref. [53] stated that technology applications contribute to warehousing operations with improved inventory management for the logistics industry. The technological innovations in the air cargo logistics industry enhance the innovative warehouse operations management for information connectivity, process automation and sustainability [54]. This study provides insight into the need to adopt emerging innovative warehouse technologies in the air cargo logistics industry for quality service delivery in the air cargo logistics industry.

The hallmark of the result is that applying technologies in the air cargo logistics industry in South Africa will significantly improve service delivery to customers. This will be achieved by supporting the timely delivery of goods to customers. It implies that technological innovations in the air cargo logistics industry enhance customer satisfaction due to the time and cost reduction in cargo delivery. The result also supports [55], who found the need for air cargo service improvement via technological applications for payment transactions and airline product promotion to increase customer loyalty. According to [56], the air cargo service quality technology sections include customer service, import and export, project management, administration, and warehousing. Thus, technological innovations in the air cargo logistics industry improve service delivery for customer satisfaction in the air cargo logistics industry in South Africa. Adopting and applying technological innovations in the air cargo logistics industry ultimately enhances quality service delivery and customer satisfaction. Customer loyalty and patronage for air cargo services will increase with the adoption and application of technological innovations in the air cargo logistics industry. So, the need for prompt adoption and implementation of technological innovations is important for quality service, customer satisfaction, and loyalty.

6. Conclusions and Recommendations

Technological advancements have continued to affect industries in magnificent ways. However, the response rate to adopting and implementing emerging technological innovations results from the need to determine the outcome of technological applications in most industries. This study attempts to highlight the significant effects of technological innovations to address the reluctance to adopt emerging technologies in the air cargo logistics industry in South Africa. The study data were collected with a questionnaire administered to freight forwarders to attach a level of significance to each of the items that make the effects of technology in the air cargo logistics industry. The data were subjected to the Kruskal–Wallis test, exploratory factor analysis and regression analysis. In summary, the study found that applying technological innovations in the air cargo logistics industry promotes efficient operations, improves warehousing, and enhances cargo service qualities for customer satisfaction. Furthermore, the study established that technologically driven operations and warehousing are significant determinants of quality service delivery in the air cargo logistics industry. This emphasises the need for a prompt response to adopt and

implement emerging technologies in the air cargo logistics industry to deliver high service qualities for customer satisfaction and loyalty.

The findings imply that applying technological innovations in the air cargo logistics industry improves operations for efficient distribution, warehousing operations for efficient handling, and service delivery for improved customer satisfaction, patronage, and loyalty. With increased customer satisfaction, patronage and loyalty, stakeholders in the industry will experience increased demand and profit. Although adopting and implementing technological innovations will increase costs (technological acquisition costs) in the short run, the profit margin will justify the costs in the long run. The profit will be derived from the increased customer demand that technological innovations enhance. So, the finding dissuades the behavioural fear of change and encourages prompt investment in acquiring new technologies for air cargo operations. Therefore, prompt responsiveness to adopt emerging technological innovations in the air cargo industry should be expected from stakeholders.

The study recommends a positive attitudinal change to prompt the adoption and implementation of emerging technological innovations in the air cargo logistics industry. This is necessary because of the effects of technological innovation to render efficient operations, improved warehousing, and quality service delivery functions to provide customer satisfaction and loyalty that leads to increased customer patronage and profit.

In conclusion, this study provides a persuasion for the prompt adoption of technological innovations with the fact that managers will enjoy higher profit margins with the effects of technological innovations in the air cargo logistics industry in South Africa. However, the government may adopt the action points by [13] on incentives for technological adoption and encourage investment in research and infrastructure for technological development in the air cargo industry.

7. Contribution of the Study

The study's findings provide a basis for the prompt adoption and implementation of emerging technological innovations in the air cargo logistics industry, thereby eliminating the industry's current reluctance to adopt technological innovations. The outcome also adds to the body of knowledge on the effects of technological innovations in any economic sector.

8. Limitations and Future Research

Notwithstanding the generalisation of the study findings, it is limited as follows:

1. The study specifically considered the air cargo industry in South Africa. Future studies need to examine the factors in other countries.
2. The study does not assess the development of technological applications for the air cargo logistics industry.

Author Contributions: Conceptualization, A.J.A.; methodology, A.J.A.; validation, A.J.A.; formal analysis, A.J.A.; writing—original draft preparation, A.J.A.; writing—review and editing, A.J.A., J.M. and R.L.; supervision, J.M. and R.L. All authors have read and agreed to the published version of the manuscript.

Funding: This research received no external funding.

Data Availability Statement: The data presented in this study are available on request from the corresponding author.

Acknowledgments: The authors acknowledge the respondents and research assistants.

Conflicts of Interest: The authors declare no conflict of interest.

Appendix A. Questionnaire

Adopting Technology Innovations in the Air Cargo Logistics Industry in South Africa Dear Sir/Ma,

This questionnaire is designed to obtain information for research purposes at the University of Johannesburg, South Africa. Your support is solicited to provide adequate and accurate information to the questions, as all information provided will be treated with utmost confidence.

Appendix A.1. Demographic Information

1. Gender: Male ( )[1] Female ( )[2]
2. Age: . . ..
3. Marital Status: Married ( )[1] Single ( )[2] Divorced ( )[3]
4. Educational Status: Primary Education ( )[1] Secondary Education ( )[2] Tertiary Education ( )[3]
5. Years of Work Experience: . . ..
6. Name of your company (Cargo Agency) . . ..
7. Your role in the company: General Manager/Manager ( )[1] Partner ( )[2] Other Employees ( )[3]

Appendix A.2. Effect of Technological Innovations in the Air Cargo Industry in South Africa

8. What is your view about the response of stakeholders to technological innovations in the air cargo industry in South Africa?

Highly Responsive ( )[1] Moderately Responsive ( )[2] Least Responsive ( )[3] Not Responsive ( )[4]

9. What is your view about the level of adoption of new technologies in air cargo logistics operations in South Africa?

Highly Adopted ( )[1] Moderately Adopted ( )[2] Least Adopted ( )[3] Not Adopted ( )[4]

10. Would you agree that technological applications affect the operations in the air cargo industry in South Africa? a. Yes, Agreed ( )[1] b. No, Disagreed ( )[2]
11. If "Yes" to question 10, can you please rank the items presented in the table below to assess the effect of technological applications in the air cargo industry in South Africa in order of significance from 1—Not Significant to 5—Highly Significant.

S/N	Factors	1—Not Agreed	2—Least Agreed	3—Fairly Agreed	4—Agreed	5—Highly Agreed
1	Integrated Operations					
2	Efficient Operations					
3	Address Reluctance					
4	Improved Operations					
5	Technology Diffusion					
6	Simplified Handling Process					
7	Reduced Shipping Time					
8	Order Accuracy					
9	Reduced Delivery Time					
10	Reduced Transport Cost					
11	Inventory Accuracy					
12	Reduced Clearing Time					
13	Improved Warehousing Operation					

S/N	Factors	1—Not Agreed	2—Least Agreed	3—Fairly Agreed	4—Agreed	5—Highly Agreed
14	Equipment Utilisation					
15	Forecasts Uncertainty					
16	Monitor Demand Variability					
17	Contribute to Cargo Supply					
18	Delivery within Time					

References

1. Merkert, R. Air Cargo Logistics: The Dawning of a Golden Decade? In *Global Logistics and Supply Chain Strategies for the 2020*; Merkert, R., Hoberg, K., Eds.; Springer: Cham, Switzerland, 2023. [CrossRef]
2. IATA. What Types of Cargo Are Transported by Air? 2022. Available online: https://www.iata.org/en/publications/newsletters/iata-knowledge-hub/what-types-of-cargo-are-transported-by-air/ (accessed on 28 June 2023).
3. IATA. What to Know About Air Cargo Handling. 2022. Available online: https://www.iata.org/en/publications/newsletters/iata-knowledge-hub/what-to-know-about-air-cargo-handling/ (accessed on 28 June 2023).
4. IATA. A New Era for Air Cargo How E-Commerce Is Accelerating Logistics Transformation. 2021. Available online: https://www.iata.org/contentassets/cbf5c1736ee34466b88264fface2d6ff/executive-summary---web.pdf (accessed on 13 July 2023).
5. IATA. Air Freight Market Analysis. 2019. Available online: https://www.iata.org/en/iata-repository/publications/economic-reports/air-freight-monthly-analysis---feb-2019/ (accessed on 13 July 2023).
6. Galea-Pace, S. How Technology Is Transforming Air Freight. 2020. Available online: https://supplychaindigital.com/technology/how-technology-transforming-air-freight (accessed on 15 February 2023).
7. JetFreight. Welcome to the Future Air freight: 6 Trends Changing the Face of Air Freight Industry. 2022. Available online: https://www.jfll.com/6-trends-changing-the-face-of-air-freight-industry/ (accessed on 13 July 2023).
8. Barreto, L.; Amaral, A.; Pereira, T. Industry 4.0 implications in logistics: An overview. *Procedia Manuf.* **2017**, *13*, 1245–1252. [CrossRef]
9. Government of India. Air Cargo Logistics in India, 2012. Working Group Report. Ministry of Civil Aviation, Government of India. Available online: https://www.eiciindia.org/frontSite/MOCA%20WORKING%20GROUP%20ON%20AIR%20LOGISTICS%20REPORT.pdf (accessed on 15 February 2023).
10. Harper, L. Has Air Cargo Embraced Digitalisation during Its Moment in the Sun? 2022. Available online: https://www.flightglobal.com/airlines/has-air-cargo-embraced-digitalisation-during-its-moment-in-the-sun/150905.article (accessed on 13 July 2023).
11. Siapartners. Can Digital Transform the Air Cargo Industry? 2018. Available online: https://www.sia-partners.com/en/insights/publications/can-digital-transform-air-cargo-industry (accessed on 14 July 2023).
12. Zhang, A.; Hui, G.W.; Leung, L.C.; Cheung, W. (Eds.) IT Infrastructure Needs of the Air Cargo Industry. In *Air Cargo in Mainland China and Hong Kong*, 1st ed.; Routledge: Milton Park, UK, 2004. [CrossRef]
13. Richter, F.-J.; Sinha. Why Do Your Employees Resist New Tech? Harvard Business Review. 2020. Available online: https://hbr.org/2020/08/why-do-your-employees-resist-new-tech (accessed on 13 July 2023).
14. Ajay, L. How Innovation-Led Digitalisation Revitalised the Air Cargo Industry? 2022. Available online: https://www.stattimes.com/air-cargo/how-innovation-led-digitalisation-revitalised-the-air-cargo-industry-1346371 (accessed on 4 February 2023).
15. Forster, P.W.; Regan, A.C. Electronic Integration in the Air Cargo Industry: An Information Processing Model of On-Time Performance. *Transp. J.* **2003**, *40*, 46–61. Available online: https://escholarship.org/content/qt7d16b2pr/qt7d16b2pr.pdf (accessed on 15 February 2023).
16. IATA. Modernise the Air Cargo Handling Ecosystem. 2020. Available online: https://airlines.iata.org/2020/03/18/modernize-air-cargo-handling-ecosystem (accessed on 28 June 2023).
17. Aigbavboa, C.O.; Ebekozien, A.; Mkhize, N. An assessment of South African airlines' growth in the era of Fourth Industrial Revolution technologies: The unexplored dimension. *J. Facil. Manag.* 2023, *ahead-of-print*. [CrossRef]
18. Atcha, M.H. Airport Passenger Technology Readiness and Self-Service Bag Drop Technology Adoption at South African Airports. A Research Report Submitted to the Faculty of Engineering and the Built Environment, University of the Witwatersrand, Johannesburg, in Partial Fulfilment of the Requirements for the Degree of Master of Science in Engineering. 2020. Available online: https://wiredspace.wits.ac.za/server/api/core/bitstreams/2ab2b24b-ea46-4e11-b3e1-aaddd720ac2a/content (accessed on 26 June 2023).
19. Habiyaremye, A.; Monaco, L.; Perumal, S.; Tregenna, F. The South African Airline Industry: Surviving through Smart Innovation? 2023 Policy Brief PB 2023-03. Available online: https://www.uj.ac.za/wp-content/uploads/2021/10/sarchi-id-pb-2023-03-habiyaremye-a{-}{-}monaco-l{-}{-}perumal-s{-}{-}tregenna-f{-}{-}march-2023-1.pdf (accessed on 26 June 2023).
20. Feng, B.; Li, Y.; Max Shen, Z.-J. Air cargo operations: Literature review and comparison with practices. *Transp. Res. Part C Emerg. Technol.* **2015**, *56*, 263–280. [CrossRef]

21. Wang, Y.B.; Lin, K.Y.; Chang, L.; Hung, J.C. A Diffusion of Innovations Approach to Investigate the RFID Adoption in Taiwan Logistics Industry. *J. Comput.* **2011**, *3*, 441–448. [CrossRef]
22. Kwon, K.; Jun, S.; Lee, Y.-J.; Choi, S.; Lee, C. Logistics Technology Forecasting Framework Using Patent Analysis for Technology Roadmap. *Sustainability* **2022**, *14*, 5430. [CrossRef]
23. Mashayekhy, Y.; Babaei, A.; Yuan, X.-M.; Xue, A. Impact of Internet of Things (IoT) on Inventory Management: A Literature Survey. *Logistics* **2022**, *6*, 33. [CrossRef]
24. Khan, M.; Khan, M.; Ali, A.; Khan, M.I.; Ullah, I.; Iqbal, M. Digitalization for Fast, Fair, and Safe Humanitarian Logistics. *Logistics* **2022**, *6*, 31. [CrossRef]
25. Ullah, I.; Khan, M.; Rakhmonov, D.A.; Bakhritdinovich, K.M.; Jacquemod, J.; Bae, J. Factors Affecting Digital Marketing Adoption in Pakistani Small and Medium Enterprises. *Logistics* **2023**, *7*, 41. [CrossRef]
26. Melesse, T.Y.; Franciosi, C.; Di Pasquale, V.; Riemma, S. Analyzing the Implementation of Digital Twins in the Agri-Food Supply Chain. *Logistics* **2023**, *7*, 33. [CrossRef]
27. Min, H. Smart Warehousing as a Wave of the Future. *Logistics* **2023**, *7*, 30. [CrossRef]
28. Tikwayo, L.N.; Mathaba, T.N.D. Applications of Industry 4.0 Technologies in Warehouse Management: A Systematic Literature Review. *Logistics* **2023**, *7*, 24. [CrossRef]
29. Romagnoli, S.; Tarabu', C.; Maleki Vishkaei, B.; De Giovanni, P. The Impact of Digital Technologies and Sustainable Practices on Circular Supply Chain Management. *Logistics* **2023**, *7*, 1. [CrossRef]
30. Jafari, N.; Azarian, M.; Yu, H. Moving from Industry 4.0 to Industry 5.0: What Are the Implications for Smart Logistics? *Logistics* **2022**, *6*, 26. [CrossRef]
31. Hansman, R.J. The Impact of Information Technologies on Air Transportation. AIAA, 2005, AIAA-2005-0001. AIAA Aerospace Sciences Conference, Reno, 10–13 January 2005. Available online: http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.455.8075&rep=rep1&type=pdf (accessed on 23 February 2023).
32. La, J.; Bil, C.; Heiets, I. Impact of digital technologies on airline operations. *Transp. Res. Procedia* **2021**, *56*, 63–70. [CrossRef]
33. Pereira, B.A.; Lohmann, G.; Houghton, L. Technology trajectory in aviation: Innovations leading to value creation (2000–2019). *Int. J. Innov. Stud.* **2022**, *6*, 128–141. [CrossRef]
34. Soonthodu, S.; Wahab, I.N.; Hassan, A. Technology Application Usage in Aviation Industry in Asia. In *Handbook of Technology Application in Tourism in Asia*; Hassan, A., Ed.; Springer: Berlin/Heidelberg, Germany, 2022; pp. 313–341.
35. Shiwakoti, N.; Hu, Q.; Pang, M.K.; Cheung, T.M.; Xu, Z.; Jiang, H. Passengers' Perceptions and Satisfaction with Digital Technology Adopted by Airlines during COVID-19 Pandemic. *Future Transp.* **2022**, *2*, 988–1009. [CrossRef]
36. Orozonova, A.; Gapurbaeva, S.; Kydykov, A.; Prokopenko, O.; Prause, G.; Lytvynenko, S. Application of smart logistics technologies in the organization of multimodal cargo delivery. *Transp. Res. Procedia* **2022**, *63*, 1192–1198. [CrossRef]
37. Poleshkina, I. Blockchain in Air Cargo: Challenges of New World. In Proceedings of the MATEC Web of Conferences 341, 00021. The VII International Scientific and Practical Conference "Information Technologies and Management of Transport Systems" (ITMTS 2021), Orel, Russia, 18–19 May 2021. [CrossRef]
38. Plomaritou, E.; Jeropoulos, S. The digitalisation in chartering business: Special reference to the role of e-bill of lading in the bulk and liner markets. *J. Shipp. Trade* **2022**, *7*, 28. [CrossRef]
39. Habiyaremye, A.; Monaco, L. 4IR Technology Adoption in the South African Airline Industry: Diffusion Patterns and Labour Market Effects. 2023 SARChI Industrial Development Working Paper Series WP 2023-04. SARChI Industrial Development, University of Johannesburg. Available online: https://www.uj.ac.za/wp-content/uploads/2021/10/sarchi-wp-2023-04-habiyaremye-a{-}{-}monaco-l-april-2023.pdf (accessed on 28 July 2023).
40. IATA. The Importance of Air Transport to South Africa. 2021. Available online: https://www.iata.org/contentassets/a1f674a2687144d9ad5298d2d4e3f7bf/iata_south-africa_report.pdf (accessed on 28 July 2023).
41. Statistica. Income from Air Transport Services in South Africa in 2013 and 2016, by Type. 2023. Available online: https://www.statista.com/statistics/1074612/income-air-freight-transport-storage-industry-south-africa/ (accessed on 28 July 2023).
42. Research & Market. South Africa Air Freight Market Summary, Competitive Analysis and Forecast, 2017–2026. 2022. Available online: https://www.researchandmarkets.com/reports/5650878/south-africa-air-freight-market-summary#:~:text=The%20South%20African%20air%20freight,kilometers%20(FTK)%20in%202021 (accessed on 28 July 2023).
43. Hajjar, B.; Kaitouni, O.D. Success Factors for developing Air cargo in African Markets. In Proceedings of the International Conference on Industrial Engineering and Operations Management, Paris, France, 26–27 July 2018; Available online: https://www.ieomsociety.org/paris2018/papers/468.pdf (accessed on 28 July 2023).
44. Further Africa. List of Busiest Airports in Africa Handling Cargo. 2022. Available online: https://furtherafrica.com/2022/08/11/list-of-busiest-airports-in-africa-handling-cargo/ (accessed on 24 January 2023).
45. Guo, J.; Pan, J.; Guo, J.; Gu, F.; Kuusisto, J. Measurement framework for assessing disruptive innovations. *Technol. Forecast. Soc. Chang.* **2019**, *139*, 250–265. [CrossRef]
46. Laudau, S.; Everitt, B. *A Handbook of Statistical Analyses Using SPSS*; Chapman and Hall/CRC Press: New York, NY, USA, 2004.
47. Ledesma, R.D.; Ferrando, P.J.; Trógolo, M.A.; Poó, F.M.; Tosi, J.D.; Castro, C. Exploratory factor analysis in transportation research: Current practices and recommendations. *Transp. Res. Part F* **2021**, *78*, 340–352. [CrossRef]

48. Nijs, V. Evaluate if Data Are Appropriate for Factor Analysis. 2019. Available online: https://radiant-rstats.github.io/docs/multivariate/pre_factor.html#:~:text=The%20KMO%20and%20Bartlett%20test,is%20correlated%20with%20other%20variables (accessed on 26 June 2023).
49. Statistische Beratung Leonardo Miljko. Exploratory Factor Analysis (EFA)–How to Interpret KMO and Bartlett's Test. 2020. Available online: https://www.statistischedatenanalyse.de/images/Exploratory_Factor_Analysis-EFA-How_to_interpret_KMO_and_Bartletts_test.pdf (accessed on 26 June 2023).
50. Shrestha, N. Factor Analysis as a Tool for Survey Analysis. *Am. J. Appl. Math. Stat.* **2021**, *9*, 4–11. [CrossRef]
51. Menon, R.R. The Technology Driving the Future of Air Cargo Handling Operations. Ibssoftware. 2021. Available online: https://blog.ibsplc.com/airline-cargo/the-technology-driving-the-future-of-air-cargo-handling-operations (accessed on 15 February 2023).
52. Mecalus, I. Warehouse Technology for Efficiency and Optimisation. 2022. Available online: https://www.interlakemecalux.com/blog/warehouse-technology#:~:text=What%27s%20warehouse%20technology%3F,of%20goods%20in%20the%20warehouse (accessed on 15 February 2023).
53. Ali, S.S.; Rajbir, K. Exploring the Impact of Technology 4.0 Driven Practice on Warehousing Performance: A Hybrid Approach. *Mathematics* **2022**, *10*, 1252. [CrossRef]
54. Zhen, L.; Li, H. A literature review of smart warehouse operations management. *Front. Eng. Manag.* **2022**, *9*, 31–55. [CrossRef]
55. Maharani, T.T.; Wahyuni, S. The Effect of Service Quality and Brand Image in the Air Cargo Industry on Customer Satisfaction and Loyalty of PT Garuda Indonesia (Persero). *Adv. Econ. Bus. Manag. Res.* **2021**, *177*, 71–83.
56. Wang, R.-T.; Yang, T.-H. Measuring the Service Quality of Air Cargo Sector: Case of China Airline. *Proc. East. Asia Soc.* Transp. Stud. **2007**, *6*. Available online: https://www.jstage.jst.go.jp/article/eastpro/2007/0/2007_0_131/_pdf (accessed on 28 July 2023).