Enhancing Airlines Operations through ICT Integration into Reservation Procedures: An Evaluation of Its Prospects in Nigeria

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Authors' contributions

This work was carried out in collaboration between both authors. Author GNO designed the study, performed the statistical analysis, wrote the protocol and wrote the first draft of the manuscript. Authors GNO and IAN managed the analyses of the study. Author IAN managed the literature searches. Both authors read and approved the final manuscript.

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ABSTRACT

Aims: The need to counter the challenges posed by manual reservation system became increasingly imperative as the complexity and demand for air travel expanded. The development of computerized reservation system came as management solution to the increasing number of commercial airline companies which put more pressure on their management to continually seek profits, reduce cost, and increase revenues in a competitive environment that only provides marginal profit. This study objective is to find out if there is any relationship between the use of Airline Reservation System and the performance of an airline. The study attempts to evaluate the impact of ICT enhanced reservation procedures on the performance of airline industries with a hope that the information provided will guide airline operators and policy makers in their bid to sustain productivity and maintain efficiency.

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Study Design: The study adopts an exploratory framework to assess the impact of Airline Reservation System on the performance of airline companies.

Place and Duration of Study: The target populations have offices located in Sam-Mbakwe International Cargo Airport Owerri, Imo state.

Methodology: Using survey data collected from airline staff, airline passengers and reservation agents of six airlines in Sam-Mbakwe international Cargo Airport Owerri, Imo state, this study rejects the hypothesis that *there is no significant relationship between the use of airline reservation system and the performance viz a viz its returns on assets* and also rejects hypothesis 2 which states that *the correlation between the performance of an airline (Return on Asset) and the use of the Airline Reservation system is zero.*

Results: The study result showed an R^2 value of 0.8583 for hypothesis 1, which strongly expresses the trend component of the relationshipand therefore supports the alternative hypothesis which states that *there is a significant relationship between the use of airline reservation system and the performance viz a viz its returns on assets*. Furthermore, the result from the SPSS coefficients analysis shows that for a one unit rise in the number of users of the airline reservation system there is a corresponding .961 rise in the returns on the assets which further indicates a greater performance level, hence accepting Ha 2 which states that "*the correlation between the performance of an airline (return on Asset) and the use of an Airline Reservation System is not zero*" and rejecting Ho 2.

Conclusion: The paper examines the prospects of these findings for airline companies operating in Nigeria.

1. INTRODUCTION

Air transportation is one of the most important services that offer both significant social and economic benefits. A major player in the air transportation industry is the airline. Current records indicate that there are more than 900 commercial airlines around the world, with a total fleet of nearly 22,000 aircraft [1]. The increasing number of commercial airline companies has put more pressure on their management to continually seek profits, reduce cost, and increase revenues in a competitive environment that only provides marginal profit.

Before the evolution of ICT in airline reservations, the manual reservation system had to be used in selling paper tickets to passengers at the airport and ticketing agent's office. Unreserved passengers have had little choice but to wait in queues at congested ticketing halls to buy their ticket. This process gave rise to considerable queues, passenger's discomfort, and at the same time posed a number of operational and administrative problems to the airline industry including system down-time, lost revenue, fraud, cumbersome reporting and accounting, high maintenance cost, Inability to accommodate the pressure that is mounted on the airline by the passengers in getting their seat, wrong allocation of seat number to passengers, error in allocating a seat to more than one passenger, improper keeping of the reservation seat information, and wrong handling of the information that lead to misplacement of the information. This as noted by [2] was a challenge to the aviation industry which witnessed a soaring demand in air travel in the years following world war II.

Manual ticketing and reservation system is marred with the inability to accommodate the pressure that is mounted on the airline by the passengers in getting their seat, wrong allocation of seat number to passengers, error in allocating a seat to more than one passenger, improper keeping of the reservation seat information, and wrong handling of the information that lead to misplacement of the information. It used printed cards based on different series of ticket stock classified by destination, time, class, and route. The sale required several number of service staff manning several service kiosks with a long queue of people waiting to buy the tickets and make their reservations. These kiosks where destination and route specific so lines for popular destinations could not be located across a number of kiosks, but where limited to single long line. Additionally, monitoring of ticketing staff performance was very difficult, as there were no means to check opening time and hourly per staff transaction. So instead of focusing on the primary task of selling tickets effectively a large amount of effort was expended at backend job like inventory and distribution.

The manual system also, is limited in its ability to hold seat inventory for several flights over a long period of time. It could only maintain a seat inventory for a given flight at the point of departure. Going with the average traffic growth experience of World airlines of around 5% per year in the last 10 years, industry analysts [3] project that world air traffic demand will grow in the next 20 years at an annual rate of 5%, the manual system is obviously not the best operator tool for any airline intending to maintain its market share. Reservation agents could only book flight after seat confirmation and on selling a seat sends one way booking message via a telephone to the reservation office in flights originating city. Inventory is maintained on a loose-leaf folder where a clerk decreased the available seat for a flight upon receipt of a booking message from an agent. Reservation information meant for passenger's consumption is posted on boards by the airline agents. Upon confirmation of the sale of a seat, reservation agents noted passenger specific information on a Passenger Name Record Card (passenger NRC) and transfer them by telephone or teletype to the flight originating city for reconciliation with seat inventory as the departure date for the flight approached. Frequent inconsistencies in these data led to flight under/overbooking and deterioration of both customer service levels and underutilization of aircraft capacity [2].

The need to counter these challenges posed by the manual reservation system became increasingly imperative as the complexity and demand for and of air travel expanded. American airline in 1949 installed the first experimental automated booking system and since then several innovations aimed at improving the system have taken place.

1.1 Computerized Reservation Systems

The development of computerized reservation system according [4] dates back to 1950 when American Airlines decided to set up a computerized system that would allow real-time access to all its data across all its offices and travel agents. As a result, Semi-Automated Business Research Environment, or SABRE was born in 1964. It was the first computerized airline system (CRS) in the world. SABRE was developed as a joint effort between IBM and American Airlines. When created, SABRE ran on two IBM 7090 mainframes. The system was upgraded to IBM S/360 in 1972. In the 1970s and 80s multiple CRSs came up in North America.

The first non-North American CRS was developed jointly by Air France, Lufthansa, Iberia and SAS in 1987. It was named Amadeus.

1.2 Global Distribution Systems

Global Distribution System (GDS) is an application that enables interconnectedness between Airline Computer Reservation Systems and travel agency terminals [4]. It is distinct from a Computer or Central Reservation System which is a reservation system used by Airlines. The Global Distribution System (GDS) according to [4] is used by travel agents to make reservation on various airlines reservations systems. A review of airline reservation systems as present by [5] *shows that there are currently four major* GDS systems: Amadeus, Galilieo, Sabre and Worldspan.

1.3 Alternative Airline Distribution System Applications

The most traditional channels (and most costly to the airline) involve a consumer using a travel agency as an intermediary. The alternative reservation system includes the internet and the airlines websites. It is the goal of many airlines, in their effort to reduce distribution costs, to encourage their customers to book and purchase tickets directly on the airline's own website [6]. The shift to Internet distribution channels as stated by [6] provide airlines with an unprecedented opportunity to simultaneously take increased control of the distribution of their own product and further reduce distribution costs. Informationand Communication Technologies (ICTs) can provide powerful strategic and tactical tools for organizations, which, if properly applied and used, could bring great advantages in promoting and strengthening their competitiveness [7].

According to [8], Information Technology (IT) is heavily embedded in all levels of airline operations. [9] points out that airline operations supported by ICT include dispatch and coordination of flights and related resources namely crew, aircraft, passenger and freight processing, and airport facilities such as gates, ramps, baggage handling etc. From a business management and control point of view, airlines employ ICT in most functions, from administrative tasks and accounting to financial management, human resources and procurement [10]. Few other industries rely on so many partners to collaborate closely for

delivering their products and few other value chains are as elaborate as the one for travel [11]. All airlines rely heavily on ICTs for their operations and management and employ them for a wide range of business functions. As a result, ICTs can impact airline costs and operational efficiency and there is evidence that well managed ICTs can generate tremendous value for organizations [12].

Internet technology and web based commerce have dramatically transformed the airline industry in the last ten years [13]. Information and Communication Technologies (ICTs) have always played a predominant role in the airline sector [14], but with the advent of the Internet and open source technology their impact is becoming increasingly more crucial and evident.The travel industry has been a leader in the use of information technology for more than 30 years and according to [15], the travel industry around the world is investing more than $10 billion a year on information technology. Airlines attempt to maximize revenue through differential pricing and yield management system. The evolution of computerized reservation system as noted by several researchers is the reason for the dramatic change in airline Revenue Management (RM). [6] states that the Increasing use of airline websites and third-party online distribution channels has provided consumers with direct access to current information about airline flight schedules, fare rules and seat availability, giving them increased choice and control over their travel planning.

1.4 Research Hypothesis

The hypotheses tested in this research may be stated in its null forms as follows:

Ho 1: There is no significant relationship between the use of airline reservation system and the performance viz a viz its returns on assets.

Ho 2: The correlation between the Performance of the airline (return on Asset) and the use of the Airline Reservation system is zero. In order to test these hypotheses, the study will examine ICT based and non-ICT based reservation procedures of some airlines in Nigeria.

If the data rejects the null hypothesis, Ho 1, it will be concluded that "*there is a significant relationship between the use of airline reservation system and the performance viz a viz*

its returns on assets". This will suggest that ailine reservation system is a core performance indicator of productivity in airline organizations since the bulk of its revenue can be consolidated by integrating the reservation systems into airline operations. If, on the other hand, the null hypothesis is upheld, it will be concluded that*there is no significant relationship between the use of airline reservation system and the performance viz a viz its returns on assets.* Similar approach will also be adopted to evaluate hypothesis 2.

2. MATERIALS AND METHODS

The study adopted a descriptive survey design which according to [16] is appropriate where the study seeks to describe the characteristics of certain groups, estimate the proportion of people who have certain characteristics and make predictions. Structured questionnaire was utilized to collect data from respondents on impact of ticketing and reservation application system on the performance of airlines in Nigeria. The target population comprised of Nigerian airline staff, airline passengers and reservation agents with offices located in Imo state. The study targeted Sam-Mbakwe international Cargo Airport Owerri. This airport was selected as the sample population due to its proximity to the researcher, disposable time for research and budgetary allowance. The demographics of respondents considered are; gender, years of service and frequency of flight for the airline passengers.

2.1 Sample Size

A total of 100 reservation staff representing about 40% of the staff of airlines and that of the travel agency visited, as well as 100 air travel passengers representing about 52% of passengers travelling through the airport per day were used which produced a total of 200 samples.

2.2 Data Collection Procedure

The study collected data from both primary and secondary sources. Primary data was collected from using an anonymously filled questionnaire distributed to respondents who were ticketing and reservation staff of airlines, staff of travel agency visited, and air travel passengers. Secondary data essentially was gotten from the review of existing document, newsletters, magazines, bulletins, journals, published research works, and the internet.

2.3 Data Analysis and Test of Hypothesis

The data collected was analyzed using frequency Tables 1 and 2, percentages and graphs which were used to present the findings. Hypotheses were tested using correlation and regression analysis.

3. RESULTS AND DISCUSSION

3.1 Analysis of Data and Presentation of Results

3.1.1 Descriptive analysis of respondents

3.1.1.1 Response rate of the respondents

From the data gathered from the sample, a total of 100 questionnaires were distributed to the Airline Staff at the Sam Mbakwe International Airport and at the offices of the airlines located in Imo state. Another 100 questionnaires was distributed randomly at the Sam Mbakwe Airport to the travelers over a period of two weeks and a total of 180 were returned given a 90% response rate. In order to avoid any form of Gender biased effect on the result, a total of 100 questionnaires were administered to the male and to the female respectively.

3.1.1.2 Analysis of the various airline reservation systems

The research tries to find out he various airline reservation systems utilized by airlines in Nigeria.

The result shows that the airline staff utilizes some of the Airline Reservation application which is divided into two broad categories;

- Global distribution System (GDS)
- The website/online reservation/booking system.

The GDS system was majorly utilized by the airline agents that act serve at the sale and ticketing centers for the entire airline. Platforms such as the Saber, Amadeus, and Galileo are the major GDS platforms utilized by these airlines. However, the website / portal reservation system is predominantly used by almost all airlines. The website is meant for users of the airline service that wish to connect directly to the airline to make their bookings and monitor the itinerary all by themselves. From the response of the respondents, it was clearly seen that all the users of the airline service mostly utilize the webportal or website. Similarly, the airline staff also utilizes the web portal reservation for personal and professional use also but the GDS platform is strictly made for the IATA approved agents of the air.

3.1.1.3 Analysis of the benefits of the ARS

This section analyses if the Airline Reservation System has actually had any benefits by way of improved convenience of ticket reservation, time efficiency of the system , accuracy of information, reduction in the ticket fare and the prompt response to queries. The results were gathered from all the respondents as all of them actually have engaged in the use of the Airline Reservation System for the travel booking or the booking of their clients.

From the Table 3, descriptively it can be clearly seen that the implementation of Airline Reservation System has been of immense benefits to both the users of the service and the airline staff. This can be accounted for by the 90% agreement level of the convenience factor, 100% agreement level of time efficiency of the system, 100% agreement level of the accuracy of the information, the 90% level of the reduction in the ticket fare and the 100% agreement level in the prompt response to queries.

3.1.1.4 Impact of airline reservation system on the performance of the airline industry

Secondary data of the was used to determine this as the profit margin of the Airline industry from 2005 till 2012 was used to relate to the online reservation and tickets level for the same period. Below, is the result of the analysis.

Table 1. Response rate of respondents

Category	Distributed questionnaire	Returned	useful	Total	%
Airline staff	100	90	90	90	90%
Travelers	100	90	90	90	90%
Total	200	180	180	180	90%

Source: Field survey (2013)

In the Table 4 the column 1 indicate the yearly return of asset from 2005 till 2012 which is considered as a measure of the airline Performance and in this study stands as the dependent variable. The second column is the total number of passengers that travelled from the entire airport in Nigeria yearly and the third column stands as the number of the passengers that either utilized the webpage reservation system or the GDS system through the travel agents.

From Fig. 1. it can be seen that there exist a trend line which shows a corresponding growth between the ROA and the ARS passengers. The R2 value of 0.8583, strongly expresses the trend component of the relationship. This result generated the need for a correlation analysis between both variables.

From the result in Table 5, it can be seen that there is a significant (very strong) positive relationship between the use of the Airline reservation system and the Return on assets of the airline industry at a significance level of 0.01. This further answers the research question that tries to find out if there is any relationship between the Use of Airline Reservation System and the performance of the airline and finally rejects the hypothesis one that state that there is no significant relationship between the Use of the airline reservation system and the Performance viz a viz its returns on assets.

To further test the impact of the Airline reservation system on the performance of airline industry, a simple regression test was carried out in Fig. 2. The result shows a positive linear relationship between ROA and PAX using ARS.

Table 2. Identifying the various airline reservation systems

Airline	Type of ARS	Category	Class of respondent	Frequency
Arik	Web Portal	Website	Staff	10
Aero contractor	Web Portal	Website	Staff	20
IRS	Web Portal	Website	Staff	10
Med view	Web Portal	Website	Staff	10
Airfrance	Gallileo, Amadeus	GDS	Staff	20
Virgin	Amadeus/ Web	GDS/Website	Staff	20
Users	Website	Website	Users	90

Source; ☹ Field survey, (2013)

Table 3. Benefits of airline reservation system

	Convenience	Time efficiency	Accuracy of information	Reduction in Ticket fare	Prompt response to queries
Strongly agree	110	0	0	150	180
Agree	60	180	180	20	0
Undecided	0	0	0	10	0
Disagree	10	0	0	0	0
Strongly disagree	0	0	0	0	0
Total	180	180	180	180	180

Source: ☹ field survey, (2013)

Table 4. Yearly return on asset against total passenger traffic and online tickets

Year	ROA (millions)	Total PAX traffic	Online reservations/GDS
2005	127.4	8.3	7.6
2006	121.5	8.2	7.5
2007	131.6	8.4	8.1
2008	142.5	10.8	9.2
2009	145.6	12.5	12.1
2010	147.6	13.2	13.2
2011	150.2	14.6	14.6
2012	152.5	15.2	15.2

Source; FAAN Yearly Report

$$Y = b_0 + b_1 x + \infty \text{ eqn 1.}$$

Where Y represents the airline performance (return on assets)

B_0 represents the intercept on the Yaxis
B_1 represents the slope of the curve or line
X represents the Yearly Airline reservation system passengers
∞ represents the error coefficient of the observations.

Testing hypothesis Two ($H_{0\,2}$) that states that;

(H_{02}: the correlation between the Performance of an airline (return on Asset) and the use of an Airline Reservation system is zero

From the results above, it can also be seen that there is a very high significant relationship between both of the variables and this also shows from the SPSS coefficients Table 8 that at a one unit rise in the number of users of the airline reservation system there is a corresponding .961 rise in the returns on the assets which further indicates a greater performance level. The analysis also displays a high 'R^2' value for Table 7 which shows that the use of airline Reservation system accounts for a very strong rise in the Return on Assets of the airline. Therefore the Airline performance strongly depends on the use, applications and the full utilization of the ARS tools. Re-stating hypothesis 2: "the correlation between the performance of an airline (return on Asset) and the use of an Airline Reservation System is not zero".
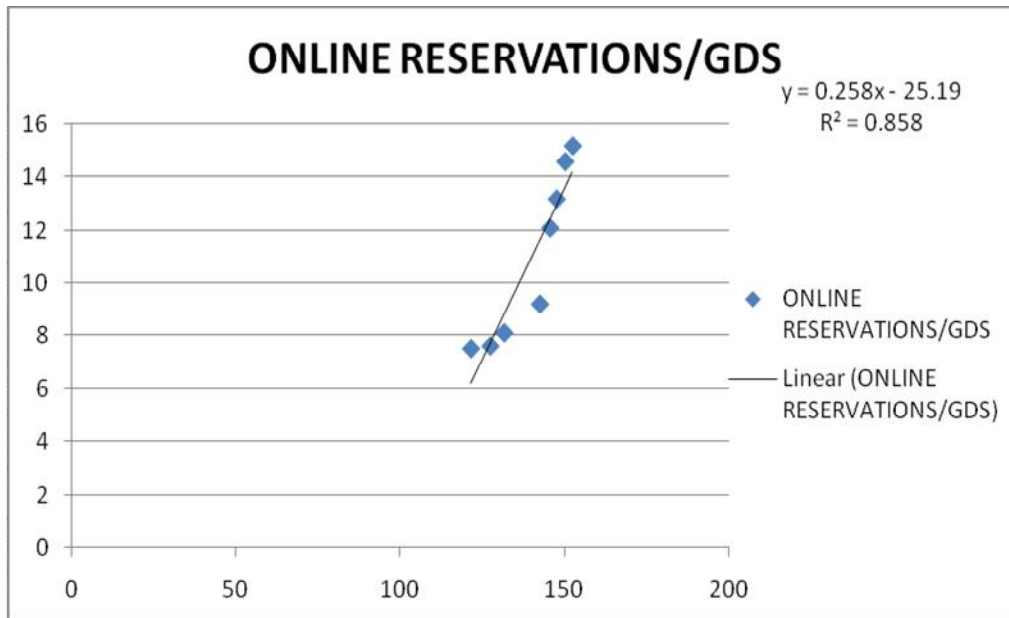

Fig. 1. Scatter diagram of the relationship between the ROA and the online reservation passengers

Table 5. Correlation between the ROA and the airline reservation passengers

Correlations		ROA	PAX using ARS
ROA	Pearson correlation	1	.989[**]
	Sig. (2-tailed)		.000
	N	8	8
PAX using ARS	Pearson correlation	.989[**]	1
	Sig. (2-tailed)	.000	
	N	8	8

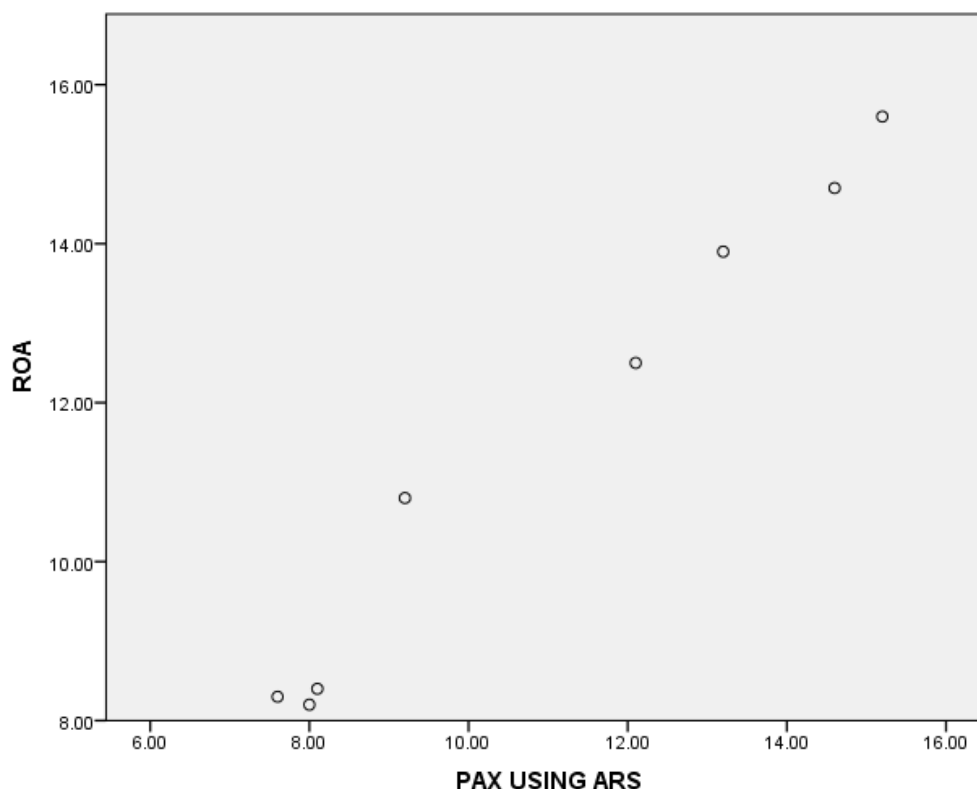*[**]. Correlation is significant at the 0.01 level (2-tailed)*

Fig. 2. A regression plot of the relationship between ROA and PAX using ARS

Table 6. Type of variables entered/removed

Model	Variables entered	Variables removed	Method
1	PAX using ARS[b]	None	Enter

a. Dependent Variable: ROA, b. All requested variables entered.

Table 7. Model summary of predictors

Model	R	R square	Adjusted R square	Std. error of the estimate
1	.989[a]	.977	.974	.49554

a. Predictors: (Constant), PAX using ARS

Table 8. SPSS coefficients[a]

Model		Unstandardized coefficients		Standardized coefficients	t	Sig.
		B	Std. error	Beta		
1	(Constant)	.983	.680		1.446	.198
	PAX using ARS	.961	.060	.989	16.087	.000

a. Dependent Variable: ROA

4. CONCLUSION

This study brought into focus how the performance of airlines in Nigeria is enhanced through integrating ICT into its Reservation System. Its task was to determine the reservation system applications used by airlines, the relationship between the reservation system and return on investment of airlines, and the benefits of the system on the overall performance of the

airline. From the findings of the study, the following conclusions are put forward:

- ❖ Airlines and passengers alike mostly utilize the websites for reservations.
- ❖ The reservation systems have benefited airlines immensely in the area of convenience, accuracy of information, reduction in ticket fares, accuracy of information and time Efficiency;
- ❖ Reservation systems have enabled airlines to increase sales by reaching out to more customers per time, reduce sales and distribution cost, as well as increase their returns on investment;
- ❖ Airlines and passengers alike encounter delays due to network failures while using the system;

It is against this background that the study concludes that reservation system applications which includes the GDS and airline websites have to a large extent impacted the performance of airlines.

5. RECOMMENDATION

Based on the study findings, the following recommendations are made:

- ➢ Airlines should embrace the reservation system and see it as a revenue booster in the long run and not a cost. Hence, they should increase their investment in the system so as to harness the numerous benefits of the system and boost their revenue base.
- ➢ There is the need for the airlines to enhance several aspects of their website quality dimensions, establish a well-designed navigation structure, easy access and personalization to ensure high level of customer satisfaction and purchase intention thereby increasing ticket sales. They should also establish self-service kiosks at airports for the printing of tickets after online booking to enable passengers enjoy the full benefits of the system.
- ➢ Passengers on the other hand should embrace any innovative step taken by airlines in respect of their reservation system as this is aimed at enhancing the overall efficiency of the system.
- ➢ Government should put up policies mandating internet network providers in the country to boost the efficiency of their network and make it more reliable.

The findings and recommendations will have implication for the efficiency and effectiveness of airline operations in Nigeria as it will establish the platform to provide efficient services required by other sectors of the economy.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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