The Impact Of Customer Focused Innovative Technologies On Passenger Growth For A Domestic Low-cost Carrier Airline

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Abstract

The technological innovations that are increasingly available to air travel have significantly grown over the years since the deregulation of the airline industry within South Africa and the African continent. Within the low cost carrier sector of the airline industry, the competition is tough and longevity of the low cost airline is prompted by the innovative ideas that direct customers to the "no frills" sector of air travel. This research study aims to determine the impact of customer focused innovative technology implementations on the passenger numbers of a low cost carrier airline in South Africa. The research focuses on one domestic low cost carrier known to be technologically forward thinking and consistently uses advanced technology in the competitive market within which it operates. An overview of the business models used by low cost carriers across the world is explored with a focus on the selected carrier in South Africa. The data is time series in nature where the granger causality statistical model is employed to assess how the customer technology projects affect the customer numbers. The results indicate that there is a causal relationship over time between the implementation of technology and the growth of passenger numbers.

Keywords
Low cost carrier airlines, customer focused technology, airline deregulation, airline distribution systems, granger causality

1 Introduction

In 1991 the deregulation of the South African airline industry opened doors for the entry of low cost carrier (LLC) airlines to operate in the domestic transport environment. Since August 2001, when the first low cost carrier airline began operations, several other LCC airlines have entered the domestic market thereby increasing the competitiveness of the airline industry (Mhlanga, 2017). In South Africa the competition is even more intensified as both full service and low-cost carriers are in competition for the same market (Fernando, Mat Saad and Sabri Haron, 2012), the same routes and operating from the same hubs. This suggests that LCC's have to do more to remain competitive and sustainable in order to service.

While low cost carriers (LCCs) are operating in a growth market for budget air travel, placing pressure on full-fare airlines, there is much to be considered for the success of their continued operation , including revenue optimisation and improving customer relations (Kelemen, 2003). To this end, LLCs have relied on high volumes and reduced cost structures to be able to attract more passengers at lower fares who would normally use other modes of low cost transportation such as buses and trains (Lubbe, 2011).

Information Technology (IT) has become recognised by organisations as a means to gain a competitive advantage by providing new and useful services to their customer base (Feeny and Ives, 1990). Many companies invest and transfer vast amount of resources (i.e. money, human capital, facilities, time) for their self-service technologies (SST's) to provide and enhance their services. They, thus, need to extract as much benefits in return for their efforts. Therefore, providing, maintaining and increasing the customers' actual usage of SST is very important for the companies (Gures et al., 2018).

Technology is, thus, an innovative tool that an LCC can use to enhance its operations, product offerings and maintain relevance to its consumers. LCCs have, seemingly, been aggressively putting their biggest emphasis on innovating new technologies with cost saving potential. Technological advances have, thus, made innovations in passenger processing (including in-flight entertainment) possible, at a continuously increasing pace particularly over the past ten years. Few other industries, other than travel, depend on many partners to collaborate with closely to deliver their products. By using Information Communication Technologies (ICTs) travel organisations are able to differentiate their product offerings by customising and adding value in line with individual customer requirements (Buhalis, 2004).

There is, however, an indirect and complex underlying relationship between ICTs and profitability that is a challenge to quantify and generalise (Buhalis, 2004). Unlike full service airlines, that generally provide inclusive services in their ticket fare, LCCs also stress their innovation on ancillary revenue streams (Rothkopf and Wald, 2011). At the core of the success of using innovative technologies, it is, therefore, important to build a framework to support the technology innovation strategy for the low cost airline business model. The combination of the technology innovation strategy and the business model leads to competitive advantage (Baden-Fuller and Haefliger, 2013).

Airlines, hence, need to consider such innovations and how they can derive value from them. The main questions the airlines have had to ask themselves are (Belobaba et al., 2009) whether investment in these new technologies will reduce costs, improve productivity and/or increase revenue and whether implementation can lead to greater passenger satisfaction and even improve brand loyalty.

The main objective of this research study is to determine whether there is a relationship between the implementation of innovative customer-oriented technologies and the growth of passenger numbers of Standard Air between 2007 and 2017.

2 Case Company

The case airline studied in this paper, which will be referred to as Standard Air, started operations in 2001 as South Africa's first low-fare airline. When it entered the market in that year it had a domestic market share of 4% which had grown to a level of about 20% in 10 years (Lubbe, 2011). The airline was able to fill its available 750 000 seats per year in a short time period (Paelo and Vilakazi, 2016).The airline operates on major domestic routes from its hubs at O.R. Tambo International Airport and Lanseria International Airport both in Johannesburg (Comair Limited, 2018). Today the airline identifies as more than just an airline, offering customers an entire travel experience. Its ancillary offerings such as car hire, hotel bookings, holiday packages and chauffeur-driven airport cabs can all be booked online, in one easy transaction (Comair Limited, 2018).

In 2012, the airline implemented a new technology to manage its airline reservation system. This technology is an airline solution that offers a broad range of software and data solutions to help airlines market themselves, sell products, serve customers and operate more efficiently (Sabre Airline Solutions, 2018a). These encompass an airline reservations system, and a full suite of marketing and commercial planning software and enterprise operations solutions. Sabre provides its services to about 225 airlines globally including low-cost carriers, primarily through Software as a Service (SaaS) and hosted models platforms (Sabre Airline Solutions, 2018).

Using the Airkiosk system, in 2006, Standard Air set a trail of airline marketing "firsts" and fast became the largest online retailer in South Africa. By account of Airkiosk, the airline was the first airline in Africa to offer Online reservations changes, low fare finder calendar-based searches, ancillary product sales on the web and web based hold and pay later option among others (Lubbe, 2011).

Standard Air sees its technology future as providing for enhanced platform robustness, scalability and flexibility. The convergence of customer access technology and devices (mobile and desktop) is achieved through merging of

technology standards with software being used across multiple platforms, deployment and adoption of wireless technology and increased capability of mobile devices (Lubbe, 2011).

3 Methodology

3.1 Study Design

The research design approach for this paper was to follow a causal research design and was quantitative in nature as the information collected was numerical (hard data) (Neuman, 2014). Singh (2007) points out that, in quantitative research, the key aim is to determine the relationship between an independent variable and other sets of dependent variables in a sample population. A retrospective record review of technology implementations information, revenue data and passenger numbers was collected and analysed. According to Neuman (2014), this type of study is used to attempt to verify a relationship or hypothesis under investigation. The following hypotheses, aligned with the objectives, were investigated:

Null Hypothesis (H_0): Customer focused innovative technology has no impact on the passenger growth of low-cost carrier airline
Alternative Hypothesis (H_1): Customer focused innovative technology has an impact on the passenger growth of low-cost carrier airline

The variables associated with testing these hypotheses were booking numbers of passengers per month (pax) and associated revenues, ICT projects, marketing campaigns.

3.2 Data

For this research the data was collected from the Finance, e-Commerce and Project Office departments of Standard Air. The data that was required were the booking numbers of passengers per month (pax) for Standard Air and the revenue for the matching month. These were collected from the Finance department. The number of ICT projects that were deployed in a particular month was collected from the project office. These projects had to be specific to customer focused innovation. Also collected from the e-Commerce department were the recorded marketing campaigns that Standard Air ran for each month.

Standard Air's financial year starts from the 1st July to the 30th June the following year. This research reviewed the information gathered by calendar year for a period of 10 years from January 2007 to December 2017. Each department approached was requested to provide the needed data from January 2007 to December 2017 from their records. Records for each month were collected where they existed. Where the data was not found, a value of zero was recorded.

The data was then inputted into an observation grid (Table 1 below) which was categorised by the year, the month, the number of technology implementation, passenger numbers (tickets purchased), revenue (value of the tickets sold) and campaigns/marketing initiative data for the identified study period. After collection, the data was processed so that it was made responsive for analysis where the relationships and/or variances whether supporting or conflicting with the hypothesis were assessed (Kothari, 2004).

3.3 Sampling

Standard Air belongs to a parent company that has several subsidiary companies under its umbrella. The sample data only included data for the low cost airline between January 2007 to December 2017 and did not include any data that relates to other airline brands. This was the target sample population and formed the sampling range that adequately matches the study's purpose and data (Neuman, 2014). This research employed simple random sampling.
Determining a large enough sample size, allowed for the assumption that the inconvenient variables were evenly distributed among the groups increasing confidence in the equivalence of those groups (Marczyk et al., 2005).

Table 1: Excerpt of the observation grid of the data collected

Year	Month	Pax*	Revenue	ICT Projects	Campaigns
2007	July	129,988	63,556,192	0	0
2007	August	124,254	60,819,267	0	0
2007	September	137,076	73,861,465	0	0
2007	October	134,700	69,581,166	0	0
2007	November	134,993	71,373,546	0	0
2007	December	152,016	89,769,275	0	0
2007	January	129,153	65,109,246	0	0
2007	February	127,088	59,169,720	0	0
2007	March	141,402	74,335,948	0	0
2007	April	145,657	80,387,044	0	0
2007	May	124,213	53,531,876	0	0
2007	June	118,719	58,905,367	0	0
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2017	July	254,438	193,523,909	0	1
2017	August	242,006	193,882,685	2	0
2017	September	267,416	199,276,106	0	0
2017	October	295,092	227,368,707	1	0
2017	November	266,586	187,664,384	2	1
2017	December	288,492	252,672,573	0	1
2017	January	253,396	188,159,929	0	0
2017	February	252,943	180,565,846	0	1
2017	March	282,045	224,094,160	0	0
2017	April	279,911	237,032,928	0	0
2017	May	271,403	182,041,940	0	1
2017	June	253,537	167,993,628	0	0

*passenger numbers

3.4 Analysis Technique

Exploratory data analysis (EDA) is a known statistics and scientific approach to data analysis for improving the understanding and receptiveness of the results. Some tools and techniques of EDA have been used for data visualisation such as histograms, density plots and scatter plots among others to explore distribution patterns. Commonly used to show frequency distributions are histograms which show how often the number in each class appears in a continuous data set (Li Vigni et al., 2013).

To be able to understand the quality of the observed data, an exploratory analysis was conducted to check for missing values, skewness of the data, and correlations between the observed variables and the data plots over time. This was done through the use of histograms and density plots. These density plots are types of histograms that represent the distribution shape of numeric variables and illustrate the probability density function of the variable. They visualise the data over a continuous time period (Ross, 2011).

Regression analysis was used to assess significant relationships between dependent variable and independent variable and/or indicates the strength of impact of multiple independent variables on a dependent variable. Regression analysis was used because in real world terms, one variable is unlikely affected by only one other variable. Therefore, to better

predict variable [A], consideration of other possible variables that may influence variable [A] should be made (Jackson, 2009).

Granger causality is a theoretical framework based on conditional independence of assessing directional dependencies between time series. The Granger causality model was used as it was formulated for linear modules and in some cases to identify the appropriate patterns of interactions for multiple non-linear time series (Chen et al., 2004). Granger causality is normally tested in the context of linear regression models and measures the statistical dependence between the past of a process and the present of another process and is based on the premise of conditioning in the probability theory. The theory suggests that "a cause must occur before the effect , and that causality is relative to the knowledge that is available" (Amblard and Michel, 2013).
As Granger causality was formulated for linear models, its direct application to nonlinear systems has varying suitability, depending on the specific problem. For some cases, the linear Granger causality is able to identify the right patterns of interaction for multiple nonlinear time series, but in some other cases, it may unfortunately fail to do so (Chen et al., 2004). The technique of identifying causal relations among multiple linear time series is based on linear prediction theory. Granger -causality is typically tested in the context of linear regression models. This research considered the bivariate linear autoregressive model of two variables X_1 and X_2 (Seth, 2007).

$$\mathrm{X}_1(\mathrm{t}) = \sum_{j=1}^{p} A_{11j} X_1(t - j) + \sum_{j=1}^{p} A_{12j} X_2(t - j) + E_1(t)$$

$$\mathrm{X}_2(\mathrm{t}) = \sum_{j=1}^{p} A_{21j} X_1(t - j) + \sum_{j=1}^{p} A_{22j} X_2(t - j) + E_2(t)$$

where p is the maximum number of lagged observations (the model order), the matrix A comprises the coefficients of the model; the contributions of each lagged observation to the predicted values of X_1(t) and X_2(t) , and E_1 and E_2 are residuals (prediction errors) for each time series.

4 Results

4.1 Exploratory Data Analysis

To be able to understand the quality of the observed data, an exploratory analysis was conducted to check for missing values, skewness of the data, and correlations between the observed variables and the data plots over time. This was done through the use of histograms.

From the Fig 1 below it can be seen that the Campaigns frequency histogram shows right skewed distribution. This indicates that there is a natural limit that constrains outcomes to one side. In the dataset there are higher frequency of the zero value. The Pax frequency histogram has a bimodal distribution indicating that there are two distinct groupings of passenger numbers.

From Fig 2 below it was seen that the Projects frequency histogram showed a right skewed distribution. This indicated that there was a natural limit that constrains outcomes to one side. In the dataset there was higher frequency of the zero value. The Revenue frequency histogram had a bimodal distribution indicating that there were two distinct groupings of passenger numbers.

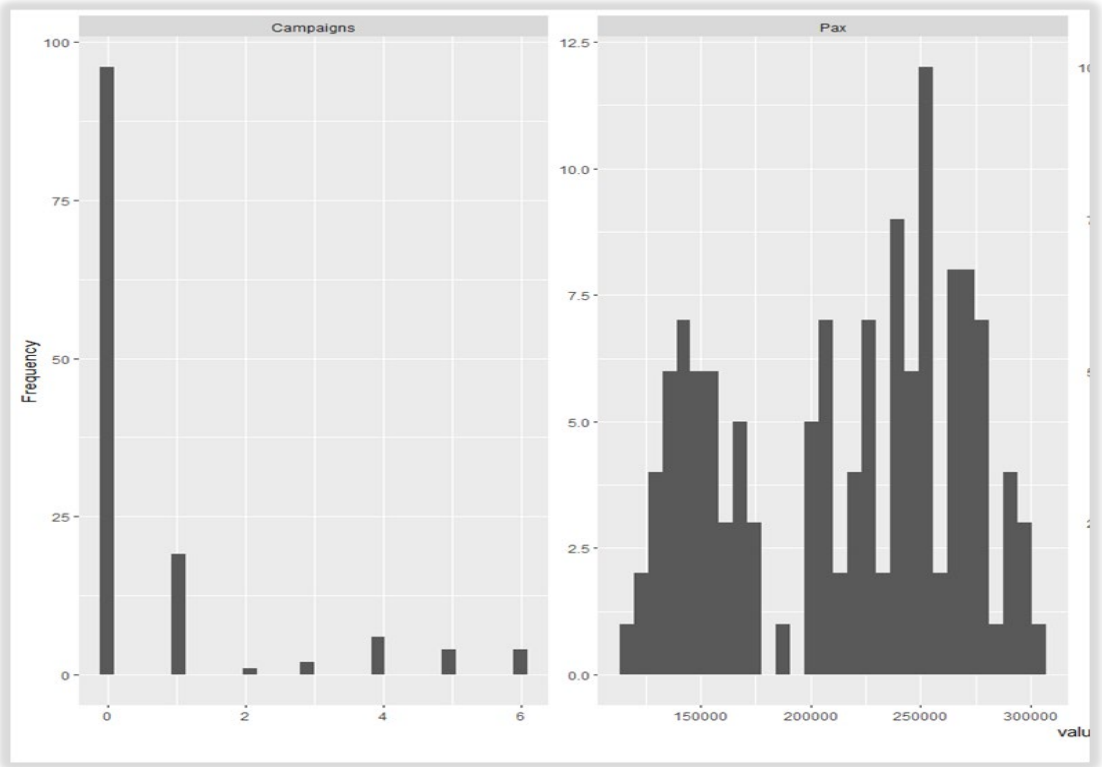

Figure 1: Histogram of Frequency and Value of the Campaigns and Pax (Passenger numbers) variables

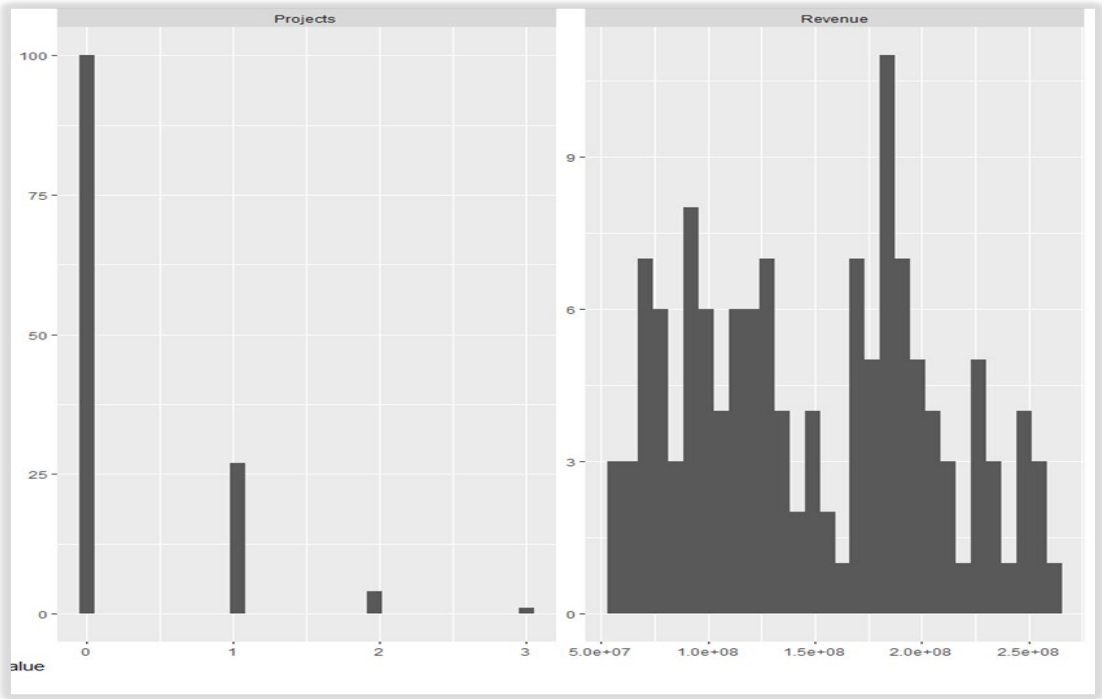

Figure 2: Histogram of Frequency and Value of the ICT Projects and Revenue variables

4.2 Correlation Matrix

The correlation matrix in Fig 3 below shows how each of the variables relate to each other variable by measuring the strength of the linear relationship In the correlation matrix below we can see that at 0.94, Pax and revenue show a strong positive linear relationship. The relationship between Pax and Campaigns (0.18), Pax and Projects (0.03) and Revenue and Projects showed a none to extremely weak positive linear relationship. On the other hand, the relationship between Campaigns and Revenue (-0.03) and Campaigns and Projects (-0.03) both showed a none to extremely weak negative linear relationship.

Figure 3 : Correlation Matrix of the multiple variables

4.3 Line Plot for Revenue

The revenue line plot in Fig 4 below indicates a positive upward trend over time showing that revenue was improving over time. This graph is similar to the Pax graph and aligned as expected to the strong positive linear relationship between Pax and Revenue as seen in the correlation matrix.

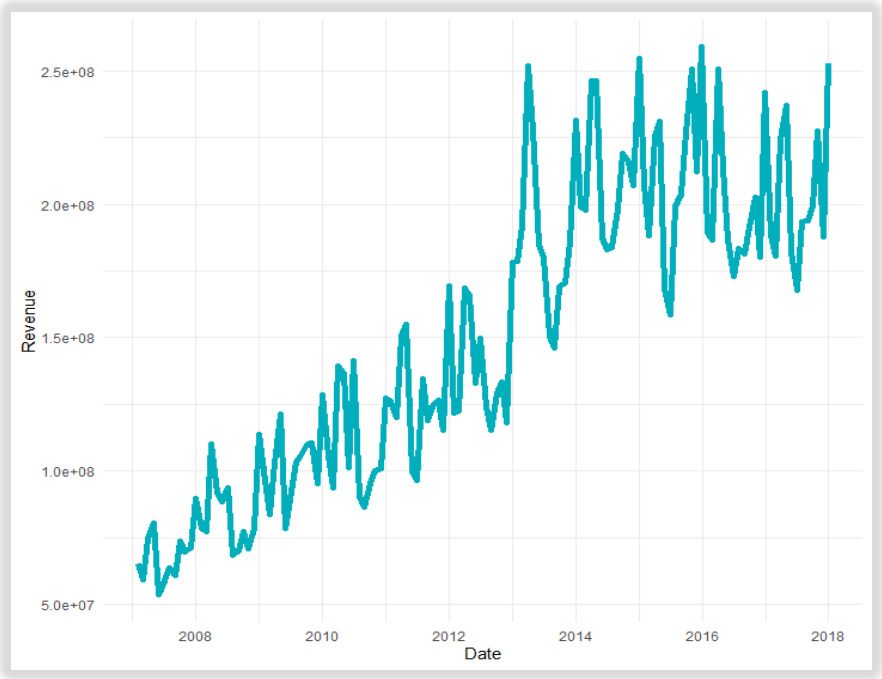

Figure 4 : Line Graph showing Revenue over time

4.4 Line plot for Projects

The line plot for projects in Fig 5 below, did not show any linear relationship through time. The values were concentrated in a straight line along 0 (zero) on the x-axis.

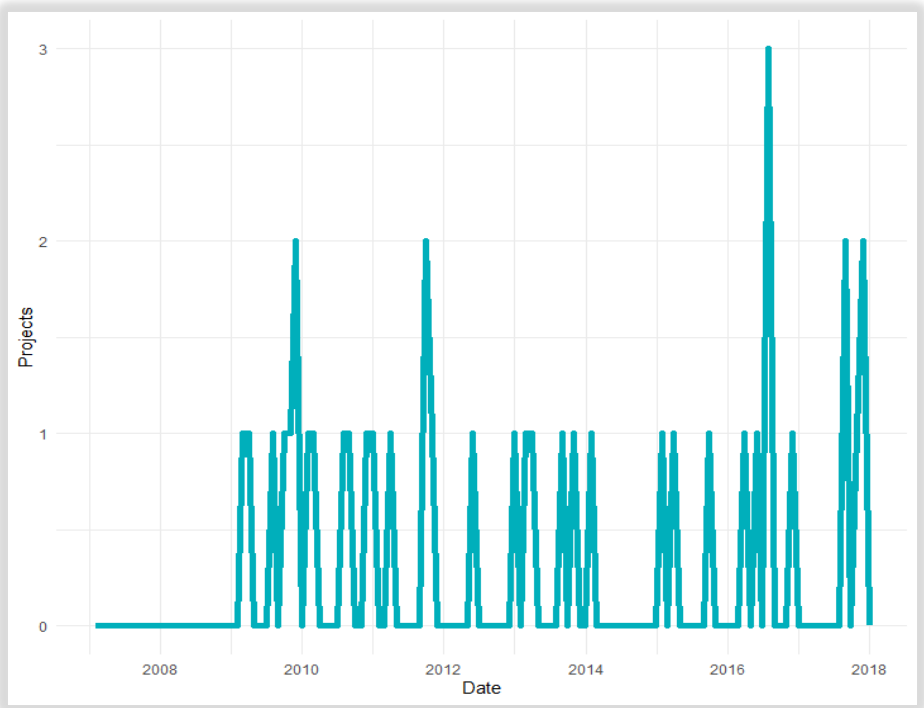

Figure 5 : Line Graph showing Implemented customer focused projects over time

4.5 Granger Causality Test

In the following Granger causality calculations, the Pax (passenger numbers) tested for, as the dependent variable and the Projects, Campaign and Revenue as the independent variables. A lag length, the shift of a time base by a given number of periods, of 1 was used as optimal. The Akaike Information Criterion (AIC) was used to determine the optimal lag for the model. The AIC calculates an estimated measure of the quality of each of the available econometric models for a given set of the data variable. The model chosen is the one where AIC is the least.

The bi-directional granger causality test was performed to asses if there was a two way causal relationship of the variables. To perform this test the independent variable became the dependant variable and vice-versa.
Table 2 is a summary of the outcomes of the granger causality tests outlined in the above text. There were two casual relationships that were identified between a dependent variable and an independent variable. These independent variables (Projects, Pax) influence the dependent variable (Pax, Revenue) respectively.

Table 2: Summary of Granger causality results

Dependent Variable	Independent Variable	p-value	Granger cause result
Pax	Revenue	0.4339	No causal relationship
Pax	Projects	0.02134	Causal relationship
Pax	Campaigns	0.6958	No causal relationship
Revenue	Pax	0.004609	Causal relationship
Projects	Pax	0.7247	No causal relationship
Campaigns	Pax	0.9858	No causal relationship

Hypothesis Testing

Null Hypothesis (H_0)
Customer focused innovative technology has no impact on the passenger growth of low-cost carrier airline
In this research the null hypothesis asserts that there is no effect of the customer focused innovative technology on the passenger booking numbers growth of the low cost carrier airline in the study. Testing the granger causality of passenger numbers (pax) with ICT projects it was discovered that the probability value (p-value) was **0.02134**. The p-value was below the significance level and therefore translated to the rejection of the null hypothesis. The rejection of the null hypothesis meant that indeed customer focused innovative technology had no granger cause impact on the passenger number growth of the low cost carrier airline.

Alternative Hypothesis (H_1)
Customer focused innovative technology has an impact on the passenger growth of low-cost carrier airline
As the p-value from the granger causality test was **0.02134**, it occurred within the range for which the alternative hypothesis was accepted**.** This meant that indeed, there was a granger causal effect of technology projects implementation on the growth of passenger numbers. The granger causal relationship of projects take 1 period (month) to be effective on the growth of the passenger numbers. Information and technology have become the airlines front line communication tool with the passengers who want more autonomy with the solutions that airlines provide. The continued efforts of the implementation of these technologies is indicative that passengers expect airlines to develop solutions that are relevant to them(Taneja, 2011).

5 Discussion

Technology has had an impact on the growth in passenger numbers in part because of the proliferation of mobile devices and the applications that can be used on these platforms. Airlines are also using innovative technology to enable ticket payments through customisation of bespoke payment engines and more accessible mobile money transfer services (M-Pesa in East Africa) for the unbanked (Bowen, 2019). The causal effect of technology on passenger or customer growth is in alignment with why many successful companies have been maximising how to drive their customers spending through technology and innovation and access a greater share of the customer's wallet (Van der Merwe, 2000). Bieger et al (2007) posited that customer value was a factor that impacted the growth of demand at a micro level and was influenced by the evolution of airline technological advances, thus supporting the outcome that

the impact on customer growth had a causal relationship with the innovative technologies implemented and the value they provided.

With passenger number (pax) as the dependent variable, it was discovered that the variables campaigns (0.9858) and revenue (0.4339) did not (granger) cause the growth of passenger numbers on Standard Air for the period under review. This meant that these two variable did not influence or cause the growth of passenger numbers. While low cost carrier airlines such as EasyJet saw the potential of social media platforms to engage customers, Ryanair did not use a social media as a marketing strategy for their airline. This abstention from this marketing strategy did not diminish the rising passenger number, load factors nor profits of Ryanair (Poulsen et al., 2016). As indicated by the results of the granger causality test of this research for Standard Air, marketing did not have a causal effect on the growth of passenger numbers thereby echoing some of the reasons why Ryanair did not invest in marketing as a strategic imperative to grow their passenger numbers (Poulsen et al., 2016). According to Acha-anyi (2016), in South Africa, marketing remains one of the biggest weaknesses of the airlines regardless of the marketing strategies explored. The marketing is seen to be elitist and did not adequately filter to the majority of the population. This again was further indicative that passengers continue to fly with no particular influence by marketing which in itself in South Africa targets a small demographic of the population (Acha-anyi, 2016).

A granger cause bi-directional test was performed on each of the variables Projects, Campaigns and Revenue on the Pax variable. It was determined that there is no bi-directional granger cause on the Pax variable by the projects and campaigns variables of the data set of the tested variables in the data set. However, the results do show that Pax has a granger cause effect on revenue. This result supported the reasonable logic that the greater the number of passengers booking seats, the more the revenue that is expected. Iberia Airlines showed increased market share of the customer segmentation propelled by new technologies had positive effects on revenue (Van der Merwe, 2000).
The relationship between innovation and technology and how airlines need to adapt is becoming more and more critical to understand by airline strategists. One such strategist is Fernando Estrada, chief strategy officer at Vueling which is part of the International Consolidated Airlines Group has suggested how mobile features have a positive and constructive effect on customers' travel experience. To quote Estrada, "Since then, we have added many handy features to smooth customers' travel experience, with the app receiving more than two million downloads to date, with a usage of 1.5 million every month" (Brewer, 2015).

As this market is very competitive, price is an important factor for customers but is not always the key determinant for them to make that purchase. Other factors also weigh in on their decision and these include products and services that the airline offers. With the advent of increasing mobile usage and technology advancement airlines are introducing products and services that are being facilitated by these tools to improve the customer's access to them (Kim and Lee, 2011). There is a constant need to re-think and design new innovative products and services with increased functionality. Being innovative is essential for many reasons, amongst which is to better serve customers and to meet the demands of mobile devices and smartphones users more easily and faster further building customer value (Brewer, 2015).

6 Conclusion

The main objective of the research was to determine if there was an impact of the customer focused technology projects on the growth of passenger numbers on Standard Air over the period under consideration. The passenger growth of Standard Air may be determined by various factors in the operational lifecycle of the airline. The research study took into account another variable which airlines use to deliberately target their customers, which are marketing campaigns. The marketing campaigns did not seem to have a positive impact on the growth of passenger numbers nor did they have a positive impact on the revenue growth. This suggested that from an operational perspective the efforts of the campaigns did not have an impact on improving the passenger booking numbers. It would have seemed that marketing campaigns would assist in improving passenger numbers.

Over time there was a notable positive linear relationship of passenger growth and revenue. This stands to reason as the assumption is the more passengers that are booked on Standard Air the more the expected revenue. This assumption is also highlighted in the correlation matrix that shows that there was a very strong correlation between the passenger numbers and revenue.

The granger causality test of the relationship between passenger numbers and customer innovation technology shows that there was a granger cause that the projects did have an impact on the growth of passenger number. This meant that providing customers with innovative technology that provides more information and improved access to products and services does grow the passenger numbers on a low cost carrier airline. The technology projects that have been implemented have added customer value to the passengers giving them information, ability and autonomy to make purchases of the airlines inventory.

It is therefore recommended that low cost carriers need to adapt to implementing customer innovations that can deliver relevant solutions to their customers to enhance their ticketing booking experience as well as their travel journey from the first "click" to the arrival of their destination.

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