Forecasting the Demand of Domestic Sectors that Contribute 80% of SAUDIA Domestic Capacity

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Abstract - **Domestic Air Travel demand in KSA has dramatically grown in recent years after the introduction of 3 new carriers resulting in the renewal of domestic air transportation. Air Travel demand forecast is a key element for an airline company to plan its short term or long-term business plan. Historical demand from 2013 to 2018 was studied to forecast future demand. Trend Analysis (Linear - Exponential Growth - Quadratic), Winter (Additive - Multiplicative), and Exponential Smoothing (Single - Double) and multi regression were used to forecast demand from 2020 to 2025.**

Keywords: Forecasting, Time Series, Regression Analysis, future demand, Air Travel Demand.

I. INTRODUCTION

Forecasting is one of the main rules in building future schedule for any airline network. It helps in identifying the potential for certain market and the pattern of demand. However, forecasting future demand epically with high competition in domestic market will help Network planning department in SAUDIA identifying the potential in current served sectors and optimizing the SAUDIA schedule by having the right aircraft in the selected market for each month. This research Helps SAUDIA in optimizing operation schedule by forecasting the future demand in selected sectors to prevent SAUDIA severing high capacity in over served market as well as accommodate new capacity in promise sectors.

1.1 Research Problem

Since 2017 SADUIA airline is not the only carrier that serving Saudi Arabia domestic market as before. FLY NAS was launched in 2007 to be the first low cost carrier and start competition with SAUDIA Airline to offer different airline services to domestic passengers, Low cost airlines are the airlines that sell the ticket with less price compare to premium airline with less service, currently there are 3 low cost airline serving Saudi Arabia domestic markets which are (Flynas, Nesma Airlines, Flyadeal).

Domestic market size is stimulated each year due to high competition between airlines. At the same time SAUDIA is

losing market share in high capacity market due to high competition between carriers and offering more capacity. Nevertheless, Saudi airline is losing traffic in any market that low cost airline expanding in. so SAUDIA Airline is facing low cost carrier threats.

There are several factors effect in losing demand which are:

1. Time of departure and arrival of each flight
2. Total capacity of each segment
3. Market size
4. Ticket price

Porter's Five Forces Framework is a tool for analyzing competition of a business. It draws from industrial organization economics to derive five forces that determine the competitive intensity and, therefore, the attractiveness (or lack of it) of an industry in terms of its profitability.

1.2 Research Scope Management

Helps SV in optimizing operation schedule by forecasting the future demand in selected sectors to prevent SV severing high capacity in over served market as well as accommodate new capacity in promise sectors. This will enhance the overall market performance, increase the profitability, and reduce cost by optimizing capacity in other sectors that serve SV network.

1.3 Importance of Research

Forecasting is one of the main rules in building future schedule for any airline network. It helps in identifying the potential for certain market and the pattern of demand. However, forecasting future demand epically with high competition in domestic market will help Network planning department in SAUDIA identifying the potential in current served sectors and optimizing the SAUDIA schedule by having the right aircraft in the selected market for each month.

Forecasting tools has been chosen mainly for following reasons:

- Successful strategical decision either by expanding or shrink the operation in certain market.
- Helps in aircraft deployment for each sector depend on future demand which will enhance the performance and increase the profitability for domestic market.
- Select needed aircraft capacity for next 5 years plane order.

1.4 Research Objectives

- Forecast Saudi Arabia domestic market demand to identify future expected booking and share for SAUDIA.
- Identify the seasonality of Domestic market to redeploy the equipment in each month.
- To determine the best forecasting technique to be used for forecasting.
- Improve SAUDIA Airline strategic plane for aircraft delivery and domestic strategy.

1.5 Expected Findings

In the end of this research, it is expected to identify the best methodology to forecast domestic air travel demand. Also forecast future demand from 2020 to 2025 for selected market and identify the seasonality for each market. Moreover, identify the best technique for each sector with lowest error.

II. BACKGROUND AND LITERATURE REVIEW

2.1 SAUDIA Background

Currently SAUDIA network is serving 86 markets which segregated to 26 domestic destinations and 65 international destinations with an average of 230 departures per day for international and 340 for departures domestic. With 26 domestic airports the number of passengers is increasing annually by an average rate (CAGR) 4%. Moreover, with new JED airport SAUDIA is expecting to have same share of 2018 with an increasing in number of domestic passengers, at the same time huge improvement in transit passenger (international to international, Domestic to international, Domestic to Domestic). This increasement is due to high capacity that new JED airport could accommodate per hour which gives SADUIA huge opportunity to increase the operation from and to JED.

2.2 Literature Review

Forecasting is defined as making predictions about future by using quantitative, qualitative and heuristic methods with the help of past data [1]. Forecasting are used in most area such as: supply chain management, production, economy,

weather and, etc. Especially, after the enhancement in industry service, serving the right product or service in the right time for the right market has become very important. to forecast the future demand, several forecasting methods are developed. Demand forecasting for the provided seats is very important for airlines to maximize the revenue by setting the appropriate fare levels for those seats.

The product and inventory for the airline industry is seat, which is an expensive, the demand for the inventory is almost uncertain, the capacity is constrain and difficult to increase, for mentioned reasons the important of forecasting the expected demand is very high for airline industry mangers.

At the same time the increasing competitiveness in the airline sector, forecasting the demand becomes major tool for any airline. [2]

There is a crucial need for accurate forecasts of passenger traffic in the commercial airline industry it helps in decision making for seating allocation, hiring to accommodate summer demand, ordering material that has long delivery lead time, budgeting advertising expenditures, and so on.

Airports use forecasts of passenger traffic for terminal area facilities planning and projection of aircraft movements by type at peak periods for runway capacity analysis. The quantitative airline traffic forecasting techniques are divers, including regression and exponential smoothing. However, these techniques have several specific. [3]

Like other service industries, air travel is a highly seasonal business. It tends to be stronger during the summer months compared to the winter months. As leisure and holiday travelers take advantage of school holiday periods and better weather conditions for travelling and holidaying (passengers that travel to visit friends and relatives do so extensively during festive seasons, such as Christmas, Lunar New Year, Easter, and the Mecca pilgrimage). They travel on the weekend for other entertainment event and sporting or taking the advantage of long weekends. [4]

One of the key elements for short- term or long-term business plan is the accuracy of estimating air transport demand. [5]

Decision making is the aim of forecasting; hence, the selected forecasting method must consider the characteristics of the data under study. Time series methods are the most common method for forecasting. They are used for forecast trend and seasonality components. Exponential smoothing techniques (Williams et al., 1998) and ARIMA are amongst

the most generally used to forecast transport demand (Bermudez et al., 2007; Milenkovic et al., 2016). [6].

III. MATERIAL AND METHODS

During past few years, a significant transformation of Saudi finical structure, rapid increase in all component of aggregate demand, also the contribution of non-oil sectors to gross domestic product was increased.

There are two main factors that effecting airline industry demand and revenue which are:

- Economic and demographic factors.
- Airline services related factors.

3.1 Economic and demographic factors

Based on airline experts and literature review, economic and demographic factors might affect airline industry performance and demand. Economic and demographic factors are summarized in following sections with statistical analysis for each variable that could affect and stimulate airline market demand. Economic and demographic factors consist of:

- Gross Domestic Product
- Consumer Price Index
- Per Capita Income
- Total Expenditures
- Total population

3.2 Airline related factors

Based on review of literature and by interviewing experts on this field, a list of factors related to Airline service that might influence the air travel demand are summarized in the following: points

- Capacity
- Average Coupon/Ticket Value
- Yield
- Frequency

3.3 Time Series Methods

Monthly passenger traffic data from 2013to 2018 are used to forecast future traffic from 2020 up to 2025. Several techniques are used: Trend Analysis (Linear - Exponential Growth - Quadratic), Winter (Additive - Multiplicative), and Exponential Smoothing (Single - Douple). Also, the following accuracy measures are calculated: MAD and MAPE for each forecast technique. Each selected sector will be forecasted based on its own historical demand. The Pro-Forecaster software is used to forecast future demand.

3.4 Forecasting with Regression Analysis Model

An empirical study of domestic market demand forecasting considering factors influence on the demand. Stepwise Multi Regression Analysis will be used for companied airline and non-airline related factors. Forward selection, which involves starting with no variables in the model, testing the addition of each variable using a chosen model fit criterion, adding the variable (if any) whose inclusion gives the most statistically significant improvement of the fit, and repeating this process until none improves the model to a statistically significant extent.

Backward elimination, which involves starting with all candidate variables, testing the deletion of each variable using a chosen model fit criterion, deleting the variable (if any) whose loss gives the most statistically insignificant deterioration of the model fit, and repeating this process until no further variables can be deleted without a statistically insignificant loss of fit. The accuracy measures will be calculated also to identify the best forecasting technique.

IV. RESULT

A statistical analysis of the past 6 years demand data for the domestic market for SAUDIA, as well as the factors affecting the demand size for the same period were conducted. The domestic market traffic monthly data from 2013– 2018 has been statistically analyzed and plotted. Analysis showed that the average annual growth for the past 6 years was around 2 %. Later, time series and stepwise regression analysis were used to find the best technique for each selected sector. The best method for each sector is summarized below:

TABLE 1
Result Analysis

Market	Time series		Regression Analysis		Best Method
	MAD	MAPE	MAD	MAPE	
Jeddah- Riyadh	16,004	6%	13,486	5%	Regression Analysis
Jeddah- Dammam	7,579	7%	6,004	6%	Regression Analysis

Riyadh – Abha	5,029	5%	2,656	3%	Regression Analysis
Jeddah – Abha	4,121	6%	3,606	5%	Regression Analysis
Madinah–Jeddah	3,112	5%	2,495	4%	Regression Analysis
Riyadh – Dammam	3,156	5%	1,632	3%	Regression Analysis
Riyadh – Madinah	3,710	6%	3,296	5%	Regression Analysis
Riyadh – Gizan	3,108	7%	2,043	4%	Regression Analysis
Jeddah – Gizan	1,839	4%	1,163	3%	Regression Analysis
Tabuk -Riyadh	1,953	6%	1,637	5%	Regression Analysis
Tabuk – Jeddah	1,023	3%	1,374	4%	Decomposition Multiplicative Model
Taif- Riyadh	1,309	4%	1,589	5%	Decomposition Multiplicative Model
Riyadh- Hail	1,540	5%	1,423	4%	Regression Analysis
Riyadh – Jouf	951	4%	936	4%	Regression Analysis
Jeddah- Gassim	1,655	8%	1,300	6%	Regression Analysis
Yanbo – Jeddah	839	5%	904	6%	Decomposition Multiplicative Model
Riyadh-Gassim	985	6%	453	3%	Regression Analysis

V. CONCLUSION AND RECOMMENDATIONS

5.1 Conclusion

Several forecasting techniques and accuracy measures has been developed and compared to each other. The forecasting techniques that been developed are: Trend Analysis (Linear - Exponential Growth - Quadratic), Winter (Additive - Multiplicative), and Exponential Smoothing (Single - Double) and multi regression analysis where the standard Accuracy Measures that been used are: MAD (Mean Absolute Deviation) and MAPE (Mean Absolute Percentage Error).

5.2 Recommendations

1. Regression analysis and Decomposition Multiplicative Model are the most accurate techniques for airline domestic forecasting.
2. Seasonal demand has been presented in this study to meet each market demand by injecting more capacity in high season and reduce capacity in low season.
3. Use the best model for each sector in the future to have most accurate forecast.
4. Explore additional factors other than the factors mentioned in this study to further clarify the interaction between the demand and other factors. This would strengthen the outcome of the future research.

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