Statistical Evaluation of Aviation Outcomes According to Economic, Tourism and Life Satisfaction Indexes: Turkey Application

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Abstract – Turkey is an intercontinental transfer point with its geopolitical location and advanced airport infrastructures. Thanks to its strong airline companies, Turkey flies to many destinations around the world and provides significant economic gains. For these reasons, there are many factors affecting the aviation sector, which has a strategic importance. For a developed, strong and dynamic aviation sector, it is of great importance to analyse these factors correctly and to establish a sustainable aviation system. In this paper, according to TUIK data, airline statistics in Turkey are evaluated according to tourism, economy and life satisfaction indices. The impact of tourist trips, economic conditions and people's happiness levels on the aviation sector has been investigated by statistical analysis and the correlation between them has been determined. In the study, 28 different indicators were taken into account and the SPSS program was used in the application study. In the analysis between 2012 and 2023, it was determined that there is a high correlation between the total number of passengers, tourist trips and tourist expenditures. In addition, there is a high correlation between the dollar exchange rate and the travel expenditures of the citizens residing in the country and there is a high correlation between the length of stay of tourists and the number of trips made by plane. In addition, the aviation sector has been analyzed with different inferences on many issues and suggestions have been made for its development. The results show that the aviation sector is of strategic importance.

Keywords – Sustainable Aviation, Statistical Analysis, Aviation Sector, Performance Indicator, Correlation.

I. INTRODUCTION

The aviation sector has a major global impact on the economy and tourism. Turkey has a strategic geopolitical and geographical location, providing a great advantage in tourism and passenger transportation. With the development of aviation technologies, touristic destinations can be reached in shorter times, faster and safer. For this reason, the tourism sector is snowballing and there are significant improvements in the economic indicators of countries. Examining the aviation sector, which is directly related to many factors, in terms of tourism, financial and life satisfaction is of strategic importance in terms of determining the investments to be made in the sector and developing ideal policies.

The data published by the Turkish Statistical Institute (TUIK) provides a detailed platform for identifying the factors that have a direct and indirect impact on the aviation sector. Tourism revenues and expenditures, economic indicators and individual happiness surveys are important inputs to this platform.

In addition, these data are also utilized to determine the impact of the change in inputs over time on aviation.

The aviation sector is a means of transportation that should be examined by considering sustainable development goals. Observing ecological balances, minimizing harmful gas emissions to the environment, maximizing energy efficiency and evaluating aviation investments in this context are of great importance for sustainable aviation. In order to correctly evaluate the potential of Turkish Aviation and to associate economic and touristic achievements with sustainability, sector data must be interpreted correctly.

In this article, the data of the air transportation sector in Turkey for the period 2012-2023 are evaluated by considering the indicators of touristic, economic, life satisfaction and population density. The results, the factors affecting the number of passengers (nop) and touristic activities are revealed and policies to increase the success performance are presented. Table 1 demonstrates some of the studies on the subject.

Table 1. The articles on the subject

	Author Information	Subject
[1]	Bakır and Atalık	The impact of relationships between customers' citizenship on the aviation industry
[2]	Ilkhanizadeh and Karatepe	Evaluation of corporate social responsibility in terms of job loyalty, career satisfaction and voice performance and application on aviation sector
[3]	Kaya et al.,	Evaluation of households' expenditure performance in the aviation sector due to liberalization and an application on Turkey
[4]	Özkan et al.,	Enhancing Prosocial behavior in the aviation industry in terms of Leadership, Ethics and Social Responsibility
[5]	Karaman et al.,	Evaluation of the aviation sector in terms of sustainability in line with global indicators
[6]	Humza and Hacioglu	Improving the positive experience of passengers at Turkish airports
[7]	Davras	Classification of sightseeing places in winter tourism in terms of customer satisfaction
[8]	Peksatici	Evaluation of competition policies of domestic airlines in Turkey
[9]	Acar	The impact of employees on service quality at airports in Turkey
[10]	Arsu and Ayçin	Evaluation of OECD countries under various performance indicators using MCDM techniques
[11]	Haksevenler et al.,	Examination of civil aviation implementations in Turkey from a global perspective in line with the aim of sustainable aviation
[12]	Guliyev	Determination of the establishment and progress of companies in the aviation sector according to parametric modelling technique
[13]	Lee et al.,	Evaluating the relationship between developments in tourism and the level of happiness based on the literature
[14]	Yavas and Dedeoglu	The effect of environmental conditions on domestic customers in Turkey
[15]	Serengil	Evaluation of communication in times of crisis under the criteria of Rational and Emotional Utility
[16]	Zachariah	Literature survey on the problems of estimating the number of passengers in the aviation industry
[17]	Megne Tchoupe	Evaluation of service satisfaction and customer loyalty in the aviation industry
[18]	Ozkaya and Demirhan	Evaluation of tourist movements in Europe and Asia under sustainability constraints using MCDM techniques
[19]	Mert	Determining the impact of fears of COVID-19 on employees in the aviation industry
[20]	Al-Shraideh	Evaluating the relationship between safe flight and passenger satisfaction with business intelligence method
[21]	Şahin and Taşkesen	A survey study on demand forecasting research in transportation and tourism
[22]	Uyar et al.,	Impact of competitiveness index on tourism sector
[23]	Eti and Mızrak	Evaluation of the companies serving in the civil aviation sector in Turkey in terms of customer satisfaction using text mining method

The second section defines the 28 TUIK indices that affect or are estimated to affect the aviation sector and states the problem under consideration. The third section presents information on the statistical techniques used and the fourth section evaluates the results. In the fifth section, an overall assessment of the paper is made and recommendations are made for the aviation sector.

II. PROBLEM

In this article, the total number of travellers and the aircraft landing and taking off (alt) on domestic and international routes are associated with 6 different topics and their sub-topics. A data pool was created based on TUIK data for the period 2012-2023 and statistical methods were employed to investigate the factors affecting the aviation sector [24]. The architecture of the problem is depicted in diagram 1.
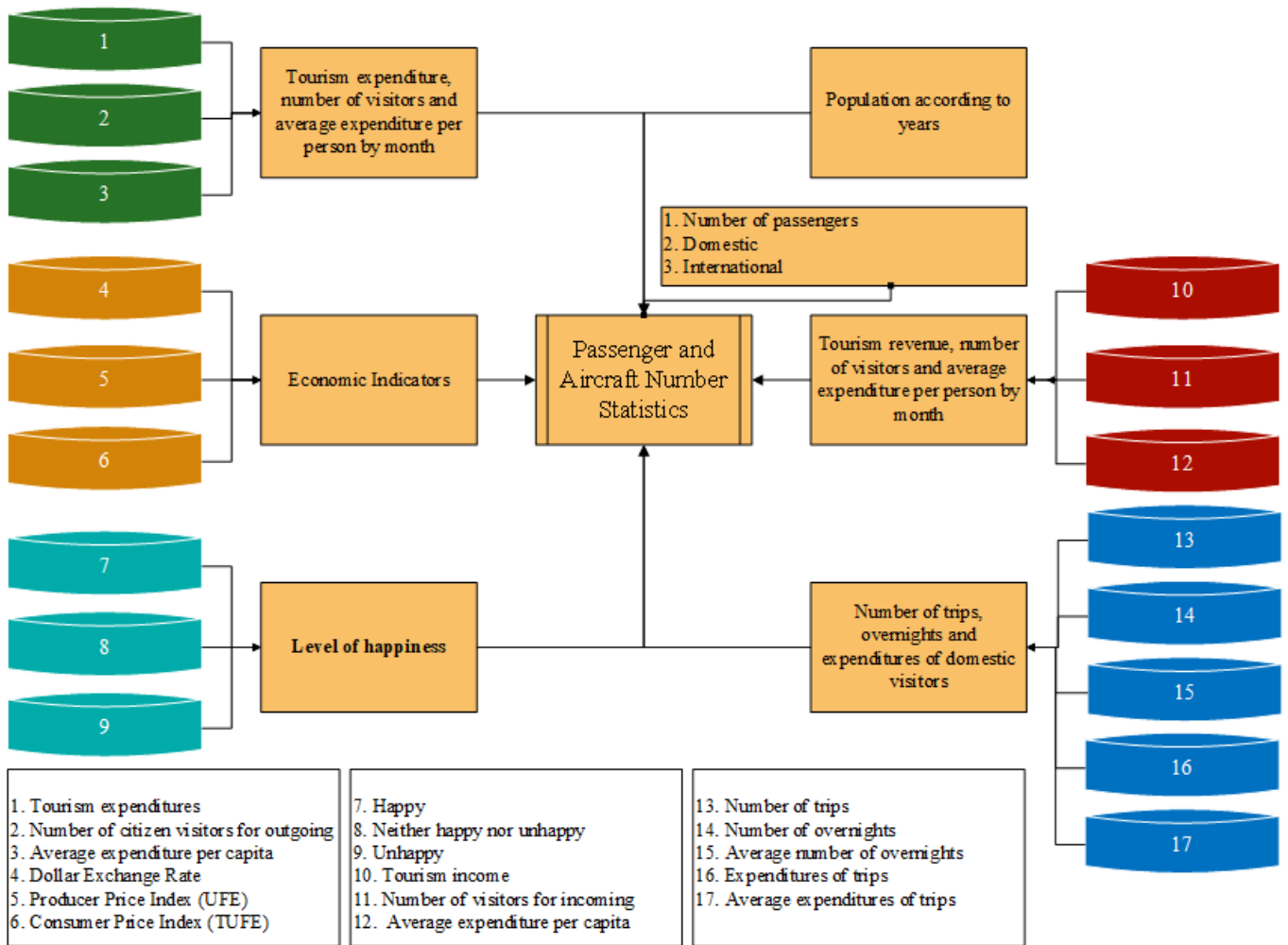

Fig. 1 Schematic illustration of the problem

III. METHOD

In this study, "Correlation (cor) Analysis" using "Pearson's Correlation Coefficient" was used to determine the association between the volume of passengers and aircraft shown in Figure 1 and other variables. In this way, the meaningfulness of the cor between variables was discussed and analyzed at 95% confidence level. The level of relationship according to Pearson's coefficient is shown in table 2 [25,26].

Table 2. Correlation Range and Relation Level

Correlation Range	Relation Level
[-0.25-0] & [0-0.25]	Very Weak
[-0.49,-0.26]&[0.26,0.49]	Weak
[-0.69,-0.5]&[0.5,0.69]	Medium
[-0.89,-0.7]&[0.7,0.89]	Strong
[-1,-0.9]&[0.9,1]	Very Strong

Through this analysis, the factors that affect the nop and the number of alts, the degree of impact of these factors and the factors that have no or low impact have been identified. It is predicted that the Turkish Aviation Sector will develop further by eliminating the negative aspects and strengthening the positive aspects.

IV.   STATISTICAL ANALYSIS

TUIK data between 2012 and 2023 were analyzed in the SPSS program and the conclusions are depicted in table 3.

Table 3. Correlation Range and Relation Level

		Passengertotal		DomesticLanding		DomesticTakeoff		InternationalLanding		InternationalTakeoff	
		Pearson Correlation	Sig. (2-tailed)	Pearson Correlation	Sig. (2-tailed)	Pearson Correlation	Sig. (2-tailed)	Pearson Correlation	Sig. (2-tailed)	Pearson Correlation	Sig. (2-tailed)
	Passengertotal	1		,881(**)	0,000	,881(**)	0,000	,929(**)	0,000	,925(**)	0,000
	DomesticLanding	,881(**)	0,000	1		1,000(**)	0,000	,644(*)	0,024	,636(*)	0,026
	DomesticTakeoff	,881(**)	0,000	1,000(**)	0,000	1		,644(*)	0,024	,636(*)	0,026
	InternationalLanding	,929(**)	0,000	,644(*)	0,024	,644(*)	0,024	1		1,000(**)	0,000
	InternationalTakeoff	,925(**)	0,000	,636(*)	0,026	,636(*)	0,026	1,000(**)	0,000	1	
1	Tourismexpenditure	,784(**)	0,003	,611(*)	0,035	,611(*)	0,035	,788(**)	0,002	,792(**)	0,002
2	Numberofcitizenvisitorsoutgoing	,915(**)	0,000	,782(**)	0,003	,782(**)	0,003	,867(**)	0,000	,868(**)	0,000
3	Averageexpenditureprcapitaoutgoing	-0,085	0,793	-0,200	0,532	-0,202	0,530	0,020	0,950	0,022	0,946
4	Dollarexchangerate	0,311	0,326	-0,065	0,841	-0,065	0,841	0,552	0,063	0,559	0,059
5	Happy	0,242	0,448	0,469	0,124	0,469	0,124	0,023	0,943	0,022	0,947
6	Neitherhappynorunhappy	-0,234	0,464	-0,443	0,149	-0,443	0,149	-0,031	0,924	-0,029	0,929
7	Unhappy	-0,220	0,493	-0,452	0,140	-0,453	0,140	0,001	0,998	0,001	0,997
8	Tourismincome	,679(*)	0,015	0,282	0,375	0,282	0,375	,878(**)	0,000	,882(**)	0,000
9	Numberofcitizenvisitincoming	,866(**)	0,000	0,542	0,069	0,541	0,069	,978(**)	0,000	,979(**)	0,000
10	Averageexpenditureprcapitaincoming	-0,564	0,056	-,789(**)	0,002	-,790(**)	0,002	-0,296	0,351	-0,287	0,365
11	UFE	-0,001	0,997	-0,222	0,488	-0,222	0,488	0,173	0,590	0,173	0,591
12	TUFE	0,269	0,398	-0,091	0,778	-0,091	0,777	0,506	0,093	0,512	0,089
13	Numberoftrips	,708(*)	0,010	,839(**)	0,001	,839(**)	0,001	0,490	0,106	0,482	0,113
14	Numberofovernights	0,454	0,138	,736(**)	0,006	,737(**)	0,006	0,160	0,620	0,151	0,639
15	Averagenumberofovernights	-,795(**)	0,002	-,581(*)	0,048	-,580(*)	0,048	-,833(**)	0,001	-,830(**)	0,001
16	Expendituresoftrips	0,411	0,185	0,042	0,896	0,042	0,896	,629(*)	0,028	,637(*)	0,026
17	Averageexpendituresoftrips	0,310	0,328	-0,065	0,842	-0,065	0,842	0,549	0,064	0,558	0,059
18	populationcount	0,177	0,581	-0,009	0,978	-0,009	0,979	0,295	0,352	0,295	0,352

The results in Table 3 focus particularly on the relationship between aviation statistics and other factors. It is possible to draw many inferences from this table, some of which are expressed below.

- There is a high positive cor between the nop traveling abroad and the total nop. There is a high cor between the number of arrivals from abroad and the number of alt internationally.
- There is a high level of cor between the total nop flying and the average length of stay of Turkish residents on domestic trips. This indicates that the use of airplanes for touristic purposes is high in domestic travels and that it would be very profitable for both the companies selling air tickets and the companies in the accommodation sector to work in an integrated manner and organize campaigns for passengers and companies.
- There is no significant association between the increase in the number of population and the total nop and the number of airplanes.
- There is a high cor between the average expenditures made by tourists visiting Turkey from abroad and the number of alt on domestic flights. This shows that tourists use domestic flights intensively. In this context, it is recommended to increase domestic flights by identifying the places where domestic flights are concentrated, increasing investments and campaigns for these places and directing them to alternative touristic destinations.
- There is no significant linkage between people's happiness level and airline transportation.
- There is a moderate connection between the change in the dollar exchange rate and the number of alt and landing abroad.
- There is a high cor between the average number of overnight stays of domestic residents and the number of flights landing and taking off from abroad. This implies that, with the exception of cities such as Istanbul and Ankara, passengers traveling abroad from Turkey stay in cities such as Istanbul and Ankara and make tourist trips, and then go abroad.

It is possible to increase the number of these comments and the article emphasizes the salient points. In addition, ancillary findings from the detailed analysis are presented below.

- It is possible to increase the number of these comments and the article emphasizes the salient points. In addition, ancillary findings from the detailed analysis are presented below.
- There is a high level of cor between the level of happiness and the number of domestic trips and length of stay of people residing in Turkey. It is observed that as the level of happiness increases, the number of trips and length of stay increases, while as the level of happiness decreases, people avoid traveling and staying. Considering the high level of cor between the number of domestic trips and the total nop and aircraft, the level of happiness has an indirect effect on airline transportation.
- There is a medium to high negative cor between the dollar exchange rate and the number of domestic households' travel and accommodation. Accordingly, it is determined that people avoid traveling as the dollar increases. This indirectly affects the nop and airplanes. There is a very high cor between expenditures on domestic travel and the exchange rate. Also, it is understood from the analysis results that TUFE is also a very effective factor in this regard.
- There is a high level of cor between the increase in population density and the level of happiness, dollar exchange rate change, UFE and TUFE values. It has been observed that as the population density increases, the level of unhappiness increases and the TUFE, UFE and dollar exchange rate increase. This situation indirectly had a negative indirect effect on passengers' traveling by airplane.

It is possible to increase the number of inferences, and different results or outputs can be obtained by increasing the number of data or considering different indicators. The objective of the article is to identify the factors that directly or indirectly affect the aviation sector in a positive or negative way and to raise awareness on this issue. It is estimated that a more dynamic and profitable aviation sector can be created

by airline companies and institutions operating in the aviation sector by developing policies and directing their investments in this context.

V. RESULTS

In this paper, cor analysis is used to evaluate the aviation sector in terms of tourism, finance and life index parameters. The results of the analysis show that the aviation sector has a very high direct linkage with tourism, a medium-high direct and indirect connection with economic parameters and an indirect association with the life index. In particular, the strong relationship with tourism data and its impact on economic indicators has once again demonstrated the importance and strategic position of the aviation sector. By revising the transportation network, increasing the number of touristic destinations and facilitating transportation, it is predicted that the nop will increase and more revenue will be generated. It has been determined that life satisfaction and happiness levels affect passengers' willingness to travel, which in turn has a direct impact on airline use. It should be one of the priorities of airline and tourism companies to examine this issue in social and economic terms and to bring this audience into tourism with campaigns.

Statistical results also provide us with information on sustainable aviation. It is predicted that sustainable aviation can be developed by linking the aviation sector with development policies in tourism and pursuing the goals of minimizing harmful gas emissions and using environmentally friendly technologies.

The study aims to improve airline transportation in Turkey and increase the volume of passengers and alts. In future studies, it is estimated that the factors affecting aviation will be better identified by increasing the number of data and adding different indicators and parameters. In addition, it is predicted that different learning can be developed from the data with the use of artificial intelligence and forecasting studies can be carried out for the future.

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