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Chapter Title	Sustainability Indices for Airport Sustainability Evaluation
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Abstract	Demand for air transport is increasing steadily with technological advances and the increase in the global trade. Parallelly, there is an ambition for continuous growth and increase of infrastructure capacity by aviation companies, government agencies, and business circles. The understanding of sustainability, which takes into account the environmental and social impacts as well as economic concerns for businesses, is becoming widespread. The airline transportation industry is one of the sectors that come to the fore due to the magnitude of its environmental impacts.

Airports, on the other hand, are an important focal point to examine sustainability impacts, especially air pollution and noise, due to landing and takeoff and many activities taking place in between. In this study, a new set of airport sustainability indices is developed by using extant research and expert opinion.

Keywords

(separated by '-')

Aviation management - Airport - Sustainability - Environment - Index

Sustainability Indices for Airport Sustainability Evaluation

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and Tahir Hikmet Karakoç

Nomenclature

GRI	Global Reporting Initiative
IATA	International Air Traffic Association
MCDM	Multi Criteria Decision-Making
UN SDG	United Nations Sustainable Developments Goals

1 Introduction

Technological advances and the development of global trade increase the demand for air transportation. Due to this increase in demand, the air transport sector is among the sectors that grow steadily.

According to the IATA, the number of passengers traveling annually will grow by an average of 3.7% every year and will reach 8.2 million in 2037, almost doubling compared to 2017 (IATA, 2018).

The increase in air transport demand requires extra growth in capacity and new infrastructure expansions. However, due to growth, problems such as additional air and environmental pollution, noise, land use and construction, and urban traffic cause both local and international concerns and reactions (Graham & Guyer, 1999).

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The understanding of sustainable aviation, which states that environmental and social impacts should be taken into account as well as economic concerns in the development of air transport services, has gained prevalence in this direction.

In order for businesses to evaluate their sustainability performance both by themselves and by all stakeholders, it is important to determine the change in their performance over time and the situation compared to other businesses. For this purpose, the use of sustainability indices is important.

Although there are a limited number of studies in the literature evaluating the airports in terms of performance, service quality, and environmental impacts, there exist very few studies on sustainability indices that consider the three basic pillars of sustainability, namely the economic, environmental, and social dimensions.

1.1 Airport Sustainability Indices and Indicators

Environmental capacity in airports, especially in big cities, has now taken precedence over physical capacities (runways, aprons, terminal areas, taxiways, etc.). Noise, air pollution, land use around the airport, wastes left to the environment, traffic in the land transportation connection, etc. are the main issues of these effects (Graham & Guyer, 1999).

In the literature, the issue of CO₂ emissions, which has the highest share in air pollution caused by aviation, is examined in detail. In addition to the air pollution caused by aviation activities in the general environment, the effects on the air of the residential areas around the airports are also the basis of research (Irvine et al., 2016).

The degradation of the ozone layer is seen as one of the most threatening phenomena awaiting humanity for the future. The airline industry has an important role in the formation of this problem, and this share is increasing in parallel with the growth of the industry (Upham et al., 2003).

In order to control the emissions that cause climate change, limits and future reduction targets are set by some airports. In this context, managing the traffic effectively has gained importance in airports (Irvine et al., 2016).

The most effective method in providing solutions to the criticisms directed at airports in terms of sustainability and environmental aspects is to communicate transparently with the public about the plans and practices of the airports (Upham et al., 2003). For this purpose, sustainability reports are published, and it is not possible for an airport establishment or expansion project to progress without agreeing with the relevant stakeholders (Freestone, 2009).

GRI Sustainability Reporting Frame is the most common sustainability reporting tool for large airport operators as well as for large and important businesses. For this reason, the sustainability reports of the large airports on the GRI Database for the past years were a very important data source for this research (GRI, 2021).

The sustainability data reported with these reports provide both quantitative and qualitative data in terms of evaluating business sustainability performances.

United Nations Sustainable Development Goals (UN SDG) also constitute an important base for every sustainability report (UNDP Turkey, 2021). These goals are also considered during the indicator determination phase of this research.

There are limited number of articles on the use of indices for airports to cover the three main dimensions of sustainability, and these articles have been examined in detail. In addition, studies that partially cover these three dimensions and include the use of indices on service quality, economic, environmental, and social sustainability at airports are also examined in detail.

2 Methodology

Both quantitative and qualitative research methods are used for this research.

For this purpose, an extensive literature research for determining the sustainability indices for airports was performed. Among the indices studied and used in the said studies, the most common and effective ones were analyzed.

Additionally, sustainability reports of large airports that publish annual reports were analyzed from the GRI Database and airport websites. UN Sustainable Development Goals were also considered during the indicator determination phase.

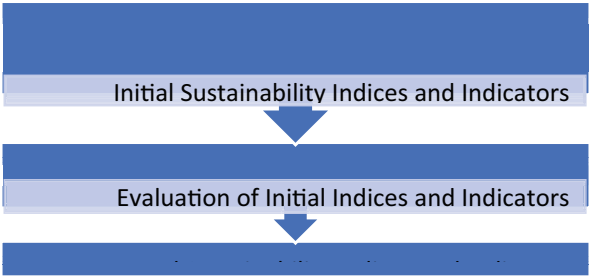
Based on the literature review and GRI reports, a unique set of indices and indicators that can perfectly reflect the sustainability status of airports is proposed. The research model is given in Fig. 1.

3 Results and Discussion

The sustainability issues in airports are spread over a wide range, and it is very difficult to make an assessment by covering all of them. In this respect, it is important to select indices and metrics that are sufficient to produce coherent knowledge on the subject.

As a result of the literature research and the review of the airport sustainability reports, an original index set (Table 1) was created. This set, which forms the basis of

Fig. 1 Research model



t1.1 **Table 1** Airport sustainability index set

t1.2	Social index Customer satisfaction Employee well-being and involvement Employee satisfaction Human rights and abuse Corporate governance and business ethics Social responsibility projects Supporting local people	Environmental index Waste management Water pollution Noise management Energy management Emissions and air pollution Resource usage Environment friendly building design Systematic efforts Green outdoors
	Economy index Direct economic contributions Growth Indirect economic effects Debt status Distribution of economic value to stake- holders Efficiency and innovation	Operational indicators Number of passengers Aircraft movements, number of landings, and takeoffs Annual cargo carried Annual allocated passenger km, ton-km Aircraft movement per fate

86 this study, consists of economic, environmental, and social sustainability indices and
87 supporting operational indicators. Operational indicators, although not considered as
88 an index, have the feature of shaping all the indices.

89 **4 Conclusion**

90 Airports create large sustainability impacts, both locally and globally. Managing
91 these effects sustainably can only be possible by comparing airports with the use of
92 certain sustainability indices.

93 Currently, indices used for airport sustainability evaluation are very few, and
94 there are very few studies on this subject in the literature.

95 In this study, by using a literature review, GRI reports, and expert opinion, a
96 unique set of sustainability indices and indicators for airports is proposed.

97 Later, research can involve the use of suitable MCDM (multi-criteria decision-
98 making) methods to determine the weights of each index and indicator, which has
99 not been applied to the sustainability of airports.

100 Additionally, the index set can be tested with the case studies on some sample
101 airports using real airport data.

102 Both airport managements and all airport stakeholders can benefit from the
103 comparative information to be obtained through the use of sustainability indices
104 and indicators developed as a result of this research. It will also contribute to the
105 scientific literature on aviation management and sustainability.

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