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Environmentally Sensitive Management Approach Within the Scope of Carbon-Free Airport: The Case of Sivas Nuri Demirağ Airport

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ABSTRACT

The aviation industry has been developing continuously from past to present. This development is not only limited to airplanes but is effective in all fields of aviation. In this context, the increase in the number of passengers and flight points has increased the importance of airports. These increases have led to various additional requirements at airports such as airport positioning, large grounds, large facilities and technological systems. In addition to the fact that airports play an important role in the economic and social development of the region where they are located, the effects of environmental pollution are increasing. Environmental pollution is not only regional; The fact that it causes long-term global environmental effects has made it necessary to control the activities within the airport. For this reason, in Turkiye, the General Directorate of State Airports Authority aims to control the possible effects of ongoing activities at airports on the environment, to leave a more livable world to the next generations with the measures taken against global warming and climate change, and to provide sustainable airport management. Because of this, the carbon-free airport Project was started. In this study, information is given about the "Carbon-Free Airport Project" and the applicable principles of the project are mentioned. For this purpose, Sivas Nuri Demirağ Airport was inspected, which is one of the few airports within the scope of this project in Turkiye, and suggestions were made in light of this information.

Keywords: Airport, Carbon-free airport, Environmentally sensitive management, Civil aviation

Karbonsuz Havalimanı'' Kapsamında Çevreye Duyarlı Yönetim Anlayışı: Sivas Nuri Demirağ Havalimanı Örneği

Süreç

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ÖZ

Havacılık sektörü, geçmişten günümüze sürekli gelişim göstermektedir. Bu gelişim sadece uçaklarla sınırlı kalmayıp, havacılığın her türlü alanında etkili olmaktadır. Bu bağlamda yolcu sayısının ve uçuş noktalarının artması, havalimanlarının da önemini arttırmıştır. Bu artışlar, havalimanı konumlandırması, büyük araziler, büyük tesisler ve teknolojik sistemler gibi havalimanlarında çeşitli ek gereksinimlere yol açmıştır. Havalimanlarının bulundukları bölgenin ekonomik ve sosyal gelişiminde önemli rol oynamalarının yanı sıra çevre kirliliği etkileri de artmaktadır. Çevre kirliliğinin sadece bölgesel değil; uzun vadeli küresel çevre etkilerine de yol açması, havalimanı bünyesindeki faaliyetlerin kontrol altına alınmasını gerekli kılmıştır. Bu nedenle Türkiye'de, Devlet Hava Meydanları İşletmesi (DHMİ) tarafından havalimanlarında devam eden faaliyetlerin çevreye verebileceği olası etkileri kontrol altına almak, küresel ısınma ve iklim değişikliğine karşı alınan önlemlerle sonraki nesillere daha yaşanabilir bir dünya bırakmak ve sürdürülebilir havalimanı işletmeciliğini sağlamak adına ''Karbonsuz Havalimanı Projesi'' başlatılmıştır. Bu çalışmada ''Karbonsuz Havalimanı Projesi'' hakkında bilgi verilmiş olup, projenin uygulama esaslarına değinilmiştir. Bu amaçla Türkiye'de bu proje kapsamındaki sayılı havalimanlarından biri olan Sivas Nuri Demirağ Havalimanı yetkililerinden bilgi toplanmış ve bu bilgiler ışığında önerilerde bulunulmuştur.

Anahtar Kelimeler: Havalimanı, Karbonsuz Havalimanı, Çevreye Duyarlı Yönetim, Sivil Havacılık

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Introduction

In recent years, problems such as rapid consumption of natural resources, climate change and global warming, with the increase in the world population, have seriously adversely affected societies. For this reason, carbon emission sources that cause global warming should be properly managed by relevant international organizations. In line with these developments, international and national organizations authorized in the aviation sector have also determined the standards and rules, and they continue to work within the scope of these standards and rules.

The Carbon-Free Airport Project, initiated by the General Directorate of State Airports Authority (DHMI) in Turkiye, has also been implemented in terms of protecting the environment, ensuring environmental balance, and minimizing the damage caused by airports to the environment. This project covers the environmental aspects and management processes resulting from the activities of the airport and/or terminal operators operated within the scope of the General Directorate of State Airports Authority and public-private cooperation, as well as the ground handling, maintenance, fuel and catering establishments that have individual facilities on the air side.

In this study, the airport sections and their environmental impacts were mentioned, information was given about the Carbon-Free Airport Project and the importance of the benefits of this project in terms of the environment was emphasized. In the last part of the study, information was given about the works related to the project at Sivas Nuri Demirağ Airport, which is included in this project.

Literature Review

Korul (2003) focused on the precautions to be taken while planning environmentally friendly airports in his study. At the airports, the place and importance of the environmental management system have been emphasized in the continuation of the necessary works in order to protect the environment with the understanding of social responsibility towards the environment they are in and to restore the ecological balance that has been disturbed as a result of its activities. In the study, it was stated that despite the increasing consumer awareness and the rapid spread of the environmental management system in developed countries, the importance of this issue has not yet been grasped in Turkiye. It has been determined that the ISO 14001 Environmental Management System has not yet been established at the airport open to international traffic. However, in order to meet the standards expected by the international aviation authorities, it has been concluded that the practices in this regard should also be developed at the airports in Turkiye.

The study by McNeill and Cancilla, (2008) revealed for the first time that triazoles can be detected in soils of small and medium-sized airports. In addition, the results show that the triazoles are present in the soil for up to one year after the defrosting process has ended. Snow cleared from runways, taxiways, and de-icing areas often piles up in specific locations, and as the snow melts, triazoles are released into the soil along with the chemicals of other aircraft de-icing fluids. In areas with snowdrifts, the risk of groundwater contamination is greater as the triazoles will leach from the soils along with the meltwater. While it is important to understand the environmental impacts of large airports, the results from this study suggest that small airports can also have an impact on triazole levels in the environment (McNeill and Cancilla, 2008).

Akpunar (2013), in his graduate study, gave information about Green Airports, which is one of the applications that will make a significant contribution to the management and reduction of carbon emissions from aviation, and emphasized the importance of the benefits of this project both in terms of airport operations and the environment. In the last part of this thesis, the carbon emission values of 34 airports in Turkiye in 2013 are three heating, electricity, carbon emissions due to the use of generators, carbon emissions due to the use of motor vehicles, carbon emission values due to the use of aircraft and backup power unit. The values in these groups were estimated by using a nonlinear regression model with the number of passengers, cargo amount, number of aircraft and terminal area values belonging to the same year. It has been obtained that the greenhouse gas emission value due to heating, electricity and generator use is explained by the defined independent variables and nonlinear regression equation at the rate of 92,7%. Using the same method, it has been observed that the greenhouse gas emission due to the use of motor vehicles is explained at the rate of 98%, and the greenhouse gas emission due to the use of aircraft and backup power units is explained as 100%.

Türkoğlu (2014) aimed to examine the environmental effects of Nevşehir Cappadocia Airport in terms of noise, emission and waste management within the scope of the "Green Airport Project" in his graduate study. In addition, in this study, suggestions are presented for Cappadocia Airport to receive the title of "Green Airport". In order to examine the effect of noise on the airport environment, noise measurements were made in Tuzköy Town and Gülşehir districts located near Nevşehir Cappadocia Airport, and these measurements were evaluated according to the legislation. It has been observed that the measurements made in the daytime and evening do not exceed the limit values in the legislation, but it has been determined that the limit values will be exceeded in case of night flights to the airport.

Gönen (2018), in his study, talked about the studies on civil aviation and the environment by giving examples from the world and Turkiye. From this point of view, it is aimed to contribute to those who are interested in the subject by making explanations about what should be done within the scope of the Green Airport Project and the Green Organization certificate. The works carried out by Istanbul Sabiha Gökçen International Airport, which

was awarded the title of "Green Organization" by completing the Green Airport Project studies, were evaluated in terms of being an example and helpful for those who are interested.

In the study of Taghizadeh et al. (2019), the emission of pollutants that occur during take-off and landing of aircraft was calculated and the effect of meteorological parameters on the emission and distribution at Imam Khomeini International Airport and Mehrabad Airport was estimated. For the evaluation of aircraft emissions, flight data of both airports between 2011 and 2016 were used and total emissions were calculated. In 2015, the highest total emission rate at Imam Khomeini International Airport was accepted as 4259,12 tons/year. In 2016, it showed that the highest total emission rate was accepted as 2718,47 tons/year at Mehrabad Airport. The results showed that Mehrabad Airport, which has more flights than Imam Khomeini International Airport, produces lower emissions. In addition, due to the wind direction blowing from west to east at these airports, the east side of these airports has been exposed to more pollution.

The aim of the study by Harley et al. (2020) is to explore the range of environmental practices used at small European airports and identify the factors affecting their adoption. Findings from online surveys of 413 small airports reveal that the most widely adopted environmental practices relate to noise reduction and waste management. Privately owned airports have generally engaged in more environmental practices than publicly owned ones. In the study, consumer pressure, regulatory interventions, and airport size positively affect the adoption of environmental practices; Technological complexity, perceived relative advantage and human resource constraints have been found to negatively affect the adoption of environmental practices. In the article, it is stated that in order to reduce the environmental impact of the growing airport operations, it would be beneficial to make suggestions to encourage greater participation in environmental practices and to adopt environmental practices to policy makers.

The study by Sebastian and Louis (2021), which conducted an overall review of airport waste management systems, observed that although some airports generate as much waste as a small city, there is limited literature on waste management at airports. In the study, which took into account many small, medium, and large airports, it was observed that despite the increase in passenger volume, many large airports successfully transitioned to zero waste projects and there are airports that dispose of 75% of their waste in landfills. It has been observed that a significant part of the wastes generated at the airports discussed in the study is composed of general mixed wastes, paper wastes, and organic wastes. This study identified several challenges related to sustainable waste management, such as the role of stakeholders, regional policy, the impact of regulations, and the challenges of using the circular economy. The article identified the need to re-evaluate existing waste management systems in terms of the quantity and characteristics of the waste stream. Most systems do not have intermediate storage facilities to cope with a sudden increase in waste quantities (Sebastian and Louis, 2021).

Development of Airports in the World and in Turkiye

An airport is a place consisting of one or more runways for passenger and freight transport activities by aircraft, facilities, and technical support needed to provide services related to ground operations (Güner and Gülay, 2018).

The term airport is defined in the Turkish Civil Aviation Law No. 2920 as “Places with facilities specially prepared for the take-off and landing of aircraft on land and on water, suitable for meeting the maintenance and other needs of aircraft, and taking and delivering passengers and cargo.” It is defined as Among the airports open to civil traffic in our country, operated by DHMI, the squares open to domestic and international traffic are “airports”; Domestic and non-scheduled international flights and squares open only to domestic flights were defined as “airports”. However, in 2012, it was decided to change the name of all squares in our country to the airport. The term "airport" used in the international community includes the concepts of airport and aerodrome (Auzef, 2021).

Airports are one of the basic elements of the process defined as air transportation. Air transportation is a system consisting of aircraft operators, airports, and units that provide all kinds of infrastructure, support, and complementary services related to air navigation for the safe and effective air transport of people, other living things, and goods. The role of airports in the operation of this system is to physically bring all system elements together and to ensure the uninterrupted flow of the process. In other words, airports are the heart of air transport (Kuyucak Şengür, 2017).

In the USA, which is the leader in the birth and development of the air transportation sector, the concept of an airport could not be mentioned during the first flight trials in the early 1900s. Wide and flat areas were used for aircraft landing and take-off. In 1918, the first scheduled airmail service was started and the construction of the passenger terminals began in the 1920s; The construction of the landing strip with compressed filling material coincides with the 1930s. In real terms, airports were planned and built during the air transport industry's infancy, from the mid-1920s to the end of the 1930s. Over time, these airports have turned into more complex structures. With the increase in demand, the introduction of new technologies for capacity has also changed and improved airport structures and functions (Auzef, 2021).

With the development of international air transport, after the 1960s, new airports began to be established instead of facilities with insufficient capacity, most of which were built for military purposes or too old to be used. These newly established airports are mostly located outside the cities (Zamanov, 2017).

Airports are structures that constantly evolve and change over time. This change and development are mostly related to political and economic developments as

well as being related to technology. Especially after the liberalization and privatization of the aviation sector, major changes have occurred in airports. Among the important factors affecting airport development between 1975-1992 are possible terrorism and risk of illegal acts, privatization of airports, increased liberalization of air transport and environmental problems other than airport developments (Kazda and Caves, 2007).

In parallel with the start of aviation activities in Turkiye, the construction of airports came to the fore, and the first airports were shaped to serve this purpose, within the framework of aviation activities planned for military purposes. From the date the first airport was built in our country to the present day, many airports have been built in a period of close to a century. In this context, Turkiye's first airport is Yeşilköy Airport, which was opened in Istanbul Yeşilköy in 1912 and forms the basis of today's Atatürk Airport (Bakırcı, 2012).

After the 1930s, the number of airports started to increase gradually, after Istanbul and Ankara, Izmir and Adana (1937), Afyon, Elazig, Van (1943), then Sivas, Erzurum, Diyarbakir, Konya, Kayseri, Malatya Antalya, Gaziantep, İskenderun, Urfa (1944), Samsun (1945) and Bursa (1946) airports were built, and the number of airports increased to 19 in 1947 (Taşlıgil, 1997).

International flights are carried out at 37 of the 58 civil airports operating in the country. 18 of them are also used for military purposes. There are also 18 airports in the country that are only used for military purposes(https://tr.wikipedia.org/).

Factors such as the increasing population and the development of air transport have increased the number of airports and caused the capacity of existing airports in big cities to grow. Istanbul Airport, one of the largest airports in the world, started to serve in 2018.

Airport Sections

Airports are large and complex structures that carry out different activities together. There are many departments at airports to carry out these activities. These sections are divided into two as air side and the land side.

Air Side

They are the areas used by planes to land, take off and make their movements on the ground. Areas where access is controlled, including runways, aprons, taxiways, adjacent areas and, in certain cases, buildings used for direct flight activity (Dhmi Havacılık Terimleri Sözlüğü, 2021).

Runway; These are the areas prepared for the landing and take-off of aircraft and determined in the form of a rectangle (Dhmi Havacılık Terimleri Sözlüğü, 2021). An airport may have more than one runway so that flight activities are not disrupted in all weather and traffic conditions.

Apron; They are defined areas for passenger, mail, and cargo loading-unloading, refueling, maintenance, and parking purposes of aircraft (Dhmi Havacılık Terimleri Sözlüğü, 2021).

Taxiway; They are the roads created to ensure the movement of aircraft on the ground and used to connect one point of the airport to another yollardır (Dhmi Havacılık Terimleri Sözlüğü, 2021).

Aircraft Parking; Specific areas on an apron intended to be used for parking an aircraft (Dhmi Havacılık Terimleri Sözlüğü, 2021).

Hangar; They are generally large buildings used for the maintenance and repair of aircraft or for their preservation (Dhmi Havacılık Terimleri Sözlüğü, 2021).

Air Navigation Units; Used for air navigation; landing site, lights, meteorological equipment, communication devices, and all electrical/electronic equipment (Dhmi Havacılık Terimleri Sözlüğü, 2021).

On the airside, apart from the units listed above, there are fuel oil facilities, rescue and first aid facilities, meteorology stations, special facilities belonging to enterprises, and electricity and heating buildings.

Land Side

It is the part of the airport outside the air side, starting from the main entrance roads control point, which includes terminal buildings, all other structures, and usable or vacant areas that are not directly involved in flight operations at an airport. The primary purpose of the land side is to ensure the passage of passengers and luggage to the aircraft (Dhmi Havacılık Terimleri Sözlüğü, 2021).

Environmental Impacts of Airports

Although airports make great social and economic contributions to the region they are located, they also have negative effects on the environment. As in every sector, sensitivity towards the environment has started to increase in the aviation sector and studies on its environmental effects have begun to emerge.

Although land transportation has the greatest impact on environmental pollution, it is stated that air transportation will play an important role in environmental management in the future. Especially, with the enlightenment of people living in settlements close to airports about the negative effects of airport activities on the environment, airports compare with pressures to reduce their environmental impacts. Legislation as a result of pressure tries to impose various environmental taxes and operational restrictions and raise standards. Environmental management models should be developed that will increase the quality of life of people on a regional and global scale and minimize the environmental impacts of airports (Korul, 2003).

Noise Pollution

Noise is one of the most important factors that reduce people's quality of life. Airports also negatively affect the environment due to noise, and there are various noise factors in airports. These are:

*Aircraft Noise: The noise caused by airplane landings and take-offs is the most important environmental impact of airports, as it is easily perceived and has the fastest effect on people. Aircraft noise is most likely to occur during take-off, where the most power is expended. Aircraft noise causes effects such as sleep disorders, loss

of concentration, and deterioration of mental health (Türkoğlu, 2014).

*Noise Caused by Airport Ground Activities: Ground services are services such as unloading and loading of passengers, cargo and mail, fuel and oil supply, air conditioning, aircraft line maintenance, catering service, pushback services, and the vehicles used in these services during the process from the arrival of the aircraft to the departure from the airport also cause noise. In addition, vehicles used for aircraft maintenance cause water and air pollution as well as noise pollution (Korul, 2003).

*Noise Caused by Airport Construction Works: Construction vehicles and vehicles used in the construction work for the construction of a new airport or the expansion of the existing airport are also among the main sources of noise.

*Noise of Vehicles Used for Transportation to the Airport: Another source of noise at airports is the transportation vehicles that provide transportation to the airport. The fact that the residential areas where traffic flows in the access to the airport are dense residential areas increases the rate of being affected by this noise (Gökdalay, 2008).

Air Pollution

Factors that cause air pollution at airports are aircraft take-offs and movements on the ground, aircraft refueling systems, power generation, office buildings, ground handling vehicles, and road traffic in and around the airport. Generators, paving operations, fuel distribution operations, and construction activities also contribute to increased air quality-related emissions. Aircraft emissions in the form of nitrous oxide and carbon monoxide in the immediate vicinity of airports contribute to local air quality problems. Despite relatively low levels, airport emissions are increasingly causing respiratory health problems among the local population (Shgm,2010).

Water Pollution

Activities at the airport can affect surface and groundwater quality. For example, chemicals discharged from airports can contaminate water sources and reduce water quality. Substances such as jet fuel can be lethal to plants and fish, albeit at levels as low as one part per million. In addition, chemicals used in the maintenance of aircraft and vehicles, as well as fire training activities, can cause water pollution (ICAO,2021).

Waste Products

The volume of waste in many industrialized countries has increased significantly in recent years, accompanied by an increase in the amount of environmentally harmful substances. In the light of these developments, airline companies and airports see better waste management as an important problem.

**Category I (Toxins)*

Toxins cannot be naturally degraded by the environment and must be treated before disposal. Handling of toxins must comply with national regulations. The main sources of airline companies and airport waste in category 1 at airports are (Shgm,2010):

- Fuels and oils consumed by airplanes.
- Apron fuel delivery equipment.
- Maintenance hangars and workshops.
- Apron vehicles.
- Air bridge lubricants.
- Refrigeration plants.
- Airport power stations.
- Aircraft oil delivery vehicles.

**Category II (Biodegradables)*

Biodegradable chemicals can be naturally degraded by the environment, and do not pose a hazard to the environment if they are disposed of in a controlled manner. In addition, the legislation regarding the volume and rate discarded should be taken into account. The main sources of airline companies and airport waste in category 2 at airports are:

- Waste water and sewage.
- Food waste.

Impact on Natural Life

Operational activities at the airport harm both the animals living in that area and the vegetation. Airports cause frighten and migration of animals with many effects such as noise and air pollution. The area used in the construction of the airport causes changes in the vegetation, migration of animals, and deterioration of the ecological balance. The airport may also have an impact on nearby coastal resources, rivers, wetlands, floodplains and farmland (Dursun and Aksoy, 2017).

Impact on Public Health

In recent years, results have been obtained that exposure to aircraft noise can pose a danger to human health. Accordingly, exposure to airplane or road traffic noise triggers diseases such as high blood pressure, heart attack, atherosclerosis, and stroke. Increased stress with exposure to noise can cause physiological stress reactions in the individual. Figure 1 shows cardiovascular diseases caused by exposure to environmental noise (Babisch, 2014).

Carbon-Free Project

The Carbon-Free Airport Project aims to provide sustainable airport management by applying the conditions determined by the national legislation and airport authority on the use of natural resources, air pollution control, noise, waste, wastewater, and chemical use in order to control the environmental effects of the activities carried out at the airports. This project covers the environmental aspects and management processes that arise as a result of the activities of the airport operators, ground handling, maintenance, fuel, and catering establishments that have facilities on the air side

of the airport and the facilities deemed necessary by the airport operatör (DHMİ, 2021).

It provides guidance on carrying out the carbon management process at the airport and achieving accreditation at different project levels through the Airport Carbon Accreditation Program prepared by the Airports Council International (ACI). Thus, the airport gains public acceptance and recognition. The overall aim of the program is to provide validation of the improved performance of carbon and energy management and to encourage the development of management practices that support the principles of carbon neutralization (Dube, 2021).

ACI Europe supports member airports to reduce their carbon footprints for solutions to climate change. This program has been designed in partnership between ACI Europe and WSP. It enables the carbon management process to be carried out at the airport, and by achieving accreditation at different project levels, public acceptance and recognition will be gained. As the first step, the carbon footprint is calculated. In the next stages, it continues until carbon balancing. The airport that succeeds in carbon offsetting is rewarded with the highest level of participation (Nam, 2019).

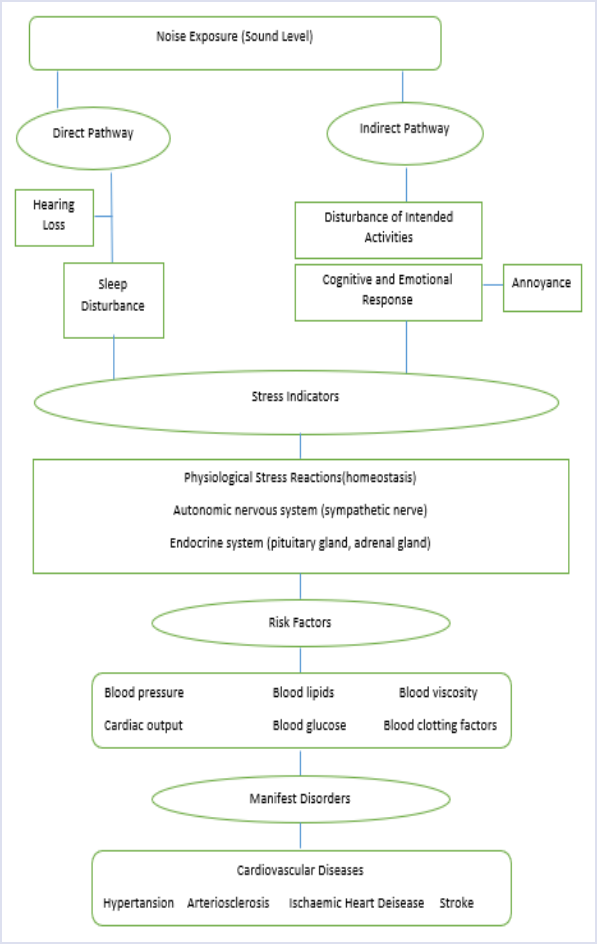

Figure 1. Pathways from environmental noise exposure to cardiovascular disease Babisch, W. (2014).
Şekil 1. Çevresel gürültüye maruz kalmaktan kardiyovasküler hastalığa giden yollar Babisch, W. (2014).

Carbon Free Airport Project Implementation Principles

Carbon Management

Carbon management refers to the determination of the carbon emissions that are or may arise as a result of the activities of the businesses within the scope, the creation of the carbon inventory report, and the creation of plans and targets for the reduction or even neutralization of carbon emissions, and the implementation of practices in this direction.

Creating the Carbon Emissions Report

At this stage, the emission sources of Scope 1 (carbon emission from sources directly controlled by the enterprise) and Scope 2 (carbon emission generated during the production of electricity, heat, or steam consumed by the enterprise outsourced) within the boundaries of the enterprise are determined. For these sources, annual carbon emissions are calculated by collecting data from the previous year and a carbon inventory report is created (DHMİ,2022).

Carbon Reduction

- A policy for carbon reduction should be determined,
- Appropriate procedures should be established,
- To implement these procedures, a Carbon Management Committee should be established,
- A plan for carbon reduction should be established,
- Targets should be determined within this plan,
- Efforts should be made to achieve these goals.

The Carbon Management Committee, which is formed with the participation of stakeholders under the coordination of the airport operator, should meet at least once a year, report on the above issues, and follow up (DHMİ,2022).

Optimization

Scope 3 emissions (carbon emissions from GHG sources owned or controlled by other entities as a result of the operations' activities) should also be considered at this stage. In addition, the carbon emissions of the stakeholders should be added to the calculations within Scope 1 and Scope 2.

Neutralization

For Scope 1 and Scope 2, carbon emissions should be neutralized after the conditions in the first 3 phases are met.

Application

In all airports whose terminals are operated within the scope of public-private cooperation, an application should be made to the Airport Carbon Accreditation (ACA) program carried out by Airport Council International (ACI) by including the project scope under the coordination of the terminal operator, and the requirements of the above 4 stages must be fulfilled.

At airports where DHMI is the terminal operator, carbon inventory report creation and carbon reduction stages are carried out. Airports that will apply to ACA by fulfilling the optimization and neutralization stages are determined by DHMI. The fees to be paid during the application and certification process are paid by the

relevant airport/terminal operator and then distributed to the companies or organizations included in the scope in proportion to the emission amount (DHMİ,2022).

Waste Management

Waste management is one of the most important environmental issues in that it includes issues such as reducing waste in the environment where it is generated, separating it according to its characteristics, collecting and transporting it to temporary storage areas, and bringing it into the recycling process and ensuring its control.

Businesses should determine the waste types and waste codes of all wastes generated as a result of their activities and collect their wastes separately at the source in a way that will not pose a risk to air, soil, plants, animals, people, and will not cause discomfort through the noise, vibration, and odor. In addition, the following issues specific to waste types should also be taken into account when they are related to the operations of the enterprise (SHGM,2019):

- Collecting waste oils separately according to their categories in tanks/containers with the phrase "Waste Oil",
- For the accumulation of vegetable waste oils, the use of watertight, corrosion-resistant inner and outer surfaces and collection containers with the phrase "vegetable waste oil" on them,
- In the collection of medical wastes; Resistant to tearing, puncture, explosion, and transportation, large enough to be seen on it, with the black "International Biohazard" emblem on both sides and "Attention! Use of red plastic bags bearing the phrase "Medical Waste",
- It is the temporary storage of hazardous wastes (waste oils, electrical and electronic wastes, waste batteries, etc. other types of waste) for a maximum of 6 months, and non-hazardous wastes (packaging wastes classified as non-hazardous, etc.) for a maximum of 12 months.

Wastewater Management

Wastewater generated as a result of the activities of the enterprises should be managed in accordance with the environmental legislation. Enterprises that deliver their wastewater to a wastewater infrastructure facility belonging to the relevant municipality must have a connection permit. Enterprises that purify their wastewater and discharge it to the receiving environment must have a valid environmental permit or temporary activity certificate covering the issue of wastewater. Accordingly, the necessary wastewater analysis should be done within the legal period. For waste oils and wastewater mixed with vegetable waste oils, oil trap systems should be used before they are discharged to the sewer. The maintenance of these systems should be carried out at least every 3 months and recorded in the Waste Oil Trap Control Form (DHMİ, 2022).

Management of De-icing / Preventive Activities

An area where de-icing/preventive activities are carried out should be created in order to meet the following requirements;

- To ensure the drainage or collection of liquids/substances resulting from activities,
- It will prevent the collected liquids/materials from mixing with the waste water drainage and treatment system, the soil, or the rainwater collection system and will allow the separation of rainwater, sand, oil, and similar materials by physical methods as much as possible,
- In the areas where deicing/preventive activities will be carried out, there will be instructions explaining the application, the areas where liquids collect will be clearly visible and marked in a way that cannot be erased (SHGM,2019).

Chemical Management

Businesses should prepare a Chemical Inventory List for all the chemicals they use. Safety Data Sheets for the chemicals used in the business should be kept in the storage areas and the chemicals should be stored under appropriate conditions.

Air Pollution Management

By the environmental legislation, flue gas analyses should be performed by accredited institutions and the analysis results should provide limited value. In case of exceeding the limit values, necessary measures should be taken. According to the regulation, how long it takes for those who use liquid, solid, and gaseous fuels to have an analysis can be specified here. Exhaust emission measurements of vehicles traveling outside the airport borders should be done and a certificate of conformity should be obtained. Vehicles operating with environmentally friendly technology (electrical energy) should be used instead of fossil fuel-powered vehicles in all indoor environments.

The Regulation on Control of Industrial Air Pollution for enterprises that have emergency power systems (not operated continuously, put into operation due to any malfunction or a power cut and taken out of operation after the disappearance of these situations and used for a minimum of 500 hours a year) that are used entirely in emergencies. must comply with emissions standards (DHMİ,2022).

Noise Management

Noise measurements should be made by airport operators within the framework of the provisions of the Regulation on the Evaluation and Management of Environmental Noise, and noise maps should be prepared. If noise action plans have been prepared by the relevant municipality for the airports for which the noise map has been prepared and the obligations to be fulfilled by the airport operator are defined in the action plan, these obligations should be fulfilled. Other obligations specified in the Regulation on the Evaluation and Management of Environmental Noise must be fulfilled by airport operators. For example, A noise monitoring and measurement system should be established at airports

with more than 50000 flights per year, and necessary measures should be taken for activities/regions where noise emissions exceed the limit values. Environmental noise levels should be determined for noise emissions from activities carried out by maintenance organizations (SHGM,2019).

Education

Environmental awareness and awareness training should be given to the personnel working at the airport and it should be recorded. This training covers energy efficiency, carbon management, natural resource use, zero waste management, etc. should contain titles.

Social Responsibility

Organizations operating at airports should be encouraged to participate in social responsibility projects aimed at raising public awareness of the environment, within their means.

Audit

The stakeholders determined by the airport operator should be audited at least once a year within the scope of the Carbon-Free Airport Project and should be recorded with the Audit Questionnaire. The airport operator should also perform its inspection once a year with the internal inspection mechanism it will establish (DHMİ,2022).

Silent Terminal Project

With the increasing number of passengers in recent years, within the scope of the application initiated to reduce the increasing announcement pollution at the airports; In the announcements made at the airports, taking into account the ease of access of the passengers to the aircraft, unnecessary announcements are not made (DHMİ,2021).

Methodology

This research was created in a qualitative design. In qualitative research methods, events and phenomena are observed in their natural environment. Since qualitative research methods are sensitive to understanding and recognizing the natural environment in which the research takes place, and to explaining its effects on the results, it provides the opportunity to reveal educational facts in a multidimensional way. At the same time, these aspects, add richness to educational research (Creswell, 1998).

Before starting this article, detailed information about the "Green Airport" and "Carbon-Free Airport Project" was obtained from the written sources of local and international authorities in the civil aviation sector. In the light of these resources, questions were prepared to direct the authorized person or persons to learn how the project was carried out at an airport within the scope of the project, the activities implemented and the measures taken.

In this study, the work done at Sivas Nuri Demirağ Airport, which has been awarded the title of "Carbon-Free Airport Project", is evaluated. An e-mail was sent to the airport authorities in order to obtain detailed information on the subject. Authorized personnel from the airport contacted us and said that the airport environmental officer could help us. After the meetings with the environmental officer, an appointment was made with him. On 13 December 2021, he went to the airport and had a face-to-face interview. The questions prepared in advance were answered by the environmental officer. The written recording was kept and a voice recorder was used during the interview.

Findings

Question: What are the goals of Sivas Nuri Demirağ Airport as an environmentally sensitive management approach?

Answer: Sivas Nuri Demirağ Airport is one of the first airports to receive a certificate within the scope of the "Carbon-Free Airport Project" of the State Airports Authority. In order to maintain the title of "Carbon-Free Airport", the airport and the businesses operating at the airport continue to fulfill the criteria. As an environmentally sensitive airport with its practices, this airport aims to protect and increase the quality of life of its employees and passengers.

Question: Are there personnel responsible for the execution of the "Carbon-Free Airport Project"?

Answer: As the airport environmental officer, I am responsible for the execution of the project and I am in coordination with all units related to the process.

Question: What documents does this airport have within the scope of environmental legislation? Can you give information about these documents?

Answer: These certificates are ‘’Zero Waste Certificate’’, ‘’ Engine Oil Change Point Certificate’’ and ‘’ Waste Water Environmental Permit’’

**Zero Waste Certificate:* The Zero Waste Project was established in 2017 by the Ministry of Environment, Urbanization and Climate Change with the aim of preventing waste, using resources more efficiently, preventing or minimizing waste generation by reviewing the reasons for waste generation, and collecting waste separately at its source and ensuring recycling. It is a document given to airports that fulfill the requirements.

**Engine Oil Change Point Certificate:* It is the document given to fuel stations, services, public institutions and organizations, municipalities, mining businesses, and other engine oil change companies if they fulfill the necessary qualifications.

The institution or business that receives the Engine Oil Change Point Certificate must perform the following steps, respectively:

- If engine oil is changed in more than one location/branch belonging to the same institution or business, a separate document application is made for each location/branch,
- The information (stock information) of the waste motor oils in the institution/enterprise is entered,
- Notifications about vehicles with engine oil changes are made instantly and regularly,

- The document containing the engine oil change information is instantly shared with the vehicle owner, physically or digitally (such as e-mail, message applications),
- Waste motor oils are temporarily stored in the waste temporary storage area for appropriate periods and conditions,
- Waste motor oils must be delivered to the organization authorized by the Ministry of Environment, Urbanization and Climate Change or to waste oil refining facilities that have been authorized to collect from the ministry.

**Waste Water Environmental Permit:* Some airports discharge their wastewater to the wastewater infrastructure facility of the relevant municipality. Some airports treat their wastewater in the Wastewater Treatment Plant and discharge them to the receiving environment. In both cases, an environmental permit is required.

Question: What kind of work do you have on waste management?

Answer: The establishment of a waste management system is important in terms of reducing the costs necessary to eliminate environmental pollution. We determine what we will do for waste prevention and reduction, and we deliver the necessary equipment for the separate collection and transportation of wastes to the relevant points. We report our work and its results. At our airport, scrap wastes are stored in temporary storage areas created in accordance with the legislation in a way that will not harm the air, soil, and water. Waste oils are collected under appropriate conditions in the temporary waste storage area to use different tanks/containers for each category and are sent for recycling or disposal through companies licensed by the Ministry of Environment, Urbanization and Climate Change within the period specified in the legislation.

Question: What are your activities related to Air Pollution Management?

Answer: Exhaust emission measurement is carried out for motor vehicles at the airport. In order to prove that the rules in the Air Pollution Regulation are complied with, we have our activities approved by real and legal persons with a certificate of authority. We aim to use stationary electric ground power units to reduce the emission of air pollutants and noise emissions caused by the use of ground power units at the airport.

Question: What precautions do you take against life-threatening dangers such as global warming and climate change?

Answer: We create our management system in accordance with the relevant legislation regarding the calculation of greenhouse gas emissions, we calculate greenhouse gases every year and save the data. We perform verification from an accredited company within the scope of greenhouse gas and sectoral criteria. In addition, all data is processed into the Integrated Environmental Information System, which includes the applications of chemical and environmental legislation.

Question: Do you have any studies about recycling at the airport?

Answer: Recyclable wastes such as paper and plastic are collected separately from other wastes and recycled through licensed facilities. Waste batteries are delivered to businesses or related places that distribute and sell battery products. Waste accumulators, on the other hand, are delivered to the temporary storage areas created by the operators of the vehicle maintenance-repair areas against a deposit fee. Waste accumulators can be kept on a sealed floor in the temporary waste storage for no more than 90 days.

Question: What are the procedures for end-of-life materials or spare parts?

Answer: End-of-life materials (waste tires) are collected in temporary waste storage areas and given to companies licensed by the relevant ministry free of charge.

Question: Is energy saving at the airport?

Answer: Building electricity consumption is reduced by using photocell systems and energy-efficient light bulbs in buildings. Building water consumption is reduced by using photocell armatures in sinks in buildings.

Question: What are the studies carried out to prevent leaks at the airport?

Answer: Periodic inspection activities are carried out in fuel supply companies in order to prevent leaks that may occur during fuel storage activities. The businesses within the scope take the necessary measures to minimize the negative effects that may be caused by leaks and spills that may occur during their activities. Absorbent materials and cleaning equipment are kept ready in the area where the activity is carried out, in case of leakage or spillage despite the precautions taken. In case of use of absorbent materials in leaks and spills, absorbent materials that have come into contact with leaks and spills are collected, stored, and delivered to a licensed waste carrier or disposer in accordance with the Hazardous Waste Control Regulation.

Question: What other activities do you do within the scope of this project?

Answer: We keep our environmental pollution prevention programs and programs such as zero waste management constantly updated and revise them when necessary.

Conclusion and Recommendations

The number of businesses that fulfill their duties in protecting the environment is increasing around the world. Demands from consumers about the environment also lead businesses to be more sensitive to the environment. In order not to lag behind the change, businesses also develop an environmentally sensitive management approach, taking into account the demands in this direction. In the aviation sector, airport activities that negatively affect the environment in a regional and even global sense should also be controlled.

Within the scope of the "Airport Carbon Accreditation (ACA) Program" carried out by the Airports Council International (ACI), 16 airports in Turkiye have been awarded the International Airport Carbon Accreditation Certificate. The fact that the total number of airports operated across the country is 56 shows us that the number of accredited airports is low. Sivas Nuri Demirağ Airport has become one of the exemplary airports with the work it has done within the scope of this project.

Nowadays, when environmental pollution has reached serious dimensions, airports that have not yet taken action should also fulfill the criteria as soon as possible and be included in the Carbon-Free Airport Project. It is important for airports to use energy and natural resources efficiently and sustainably, to produce products and services with low energy consumption, to minimize environmentally harmful wastes, and reduce their negative effects on the environment.

To improve, it would be beneficial for accredited airports to compare their internal performances with those of other accredited airports and act in line with the indicators. On the other hand, a more effective follow-up system can be established by working with environmental consultancy companies throughout the country within the framework of legislation. Finally, for the Carbon-Free Airport Project to be implemented at airports in the most effective and fastest way, the concept of sustainable development should be embraced by both business partners and employees, and the public.

Extended Summary

The aviation industry has been developing continuously from past to present. This development is not only limited to airplanes but is effective in all fields of aviation. In this context, the increase in the number of passengers and flight points has increased the importance of airports. These increases have led to various additional requirements at airports such as airport positioning, large grounds, large facilities, and technological systems. In addition to the fact that airports play an important role in the economic and social development of the region where they are located, the effects of environmental pollution are increasing. Due to the increasing number of settlements around airports and the increase in commercial air transport, air pollution in the environment has become an important problem for local governments. Environmental pollution is not only regional; The fact that it causes long-term global environmental effects has made it necessary to control the activities within the airport. The interest in environmental issues around the world has increased due to the increase in global warming and the widening of the opening in the ozone layer, especially after the increase in greenhouse gas emissions caused by developed countries. In this context, efforts to prevent climate change and its harms on a global scale are based on the Kyoto Protocol, which entered into force in 2005 under the leadership of the United Nations Organization and with the participation of developed countries. Turkiye, within the framework of the European Union harmonization process, makes its regulations on the environment and similar issues based on European Union norms.

For this reason, in Turkiye, the General Directorate of State Airports Authority aims to control the possible effects of ongoing activities at airports on the environment, to leave a more livable world to the next generations with the measures taken against global warming and climate change, and to provide sustainable airport management. Because of this, the carbon-free airport Project was started. Although airports make great social and economic contributions to the region they are located, they also have negative effects on the environment. As in every sector, sensitivity towards the environment has started to increase in the aviation sector and studies on its environmental effects have begun to emerge.

Although land transportation has the greatest impact on environmental pollution, it is stated that air transportation will play an important role in environmental management in the future. Especially, with the enlightenment of people living in settlements close to airports about the negative effects of airport activities on the environment, airports compare with pressures to reduce their environmental impacts. Environmental management models should be developed that will increase the quality of life of people on a regional and global scale and minimize the environmental impacts of airports. Environmental effects of airports; noise, waste, air pollution, water pollution, and its effects on public health and natural life.

Considering the implementation principles of the carbon-free airport project; there are carbon management, carbon emission report creation, neutralization, optimization and application stages. The number of airports within the scope of carbon-free airports in Turkiye is 16. These are: Sivas Nuri Demirağ Airport, Gaziantep Airport, Erzincan Yıldırım Akbulut Airport, Kahramanmaraş Airport, Bursa Yenişehir Airport, Şırnak Şerafettin Elçi Airport, Adıyaman Airport, Erzurum Airport, Çanakkale Airport, Balıkesir Koca Seyit Airport, Sinop Airport, Kapadokya Airport, İzmir Adnan Menderes Airport, Antalya Airport, Ankara Esenboğa Airport and Muğla Milas Bodrum Airport.

Sivas Nuri Demirağ Airport within the scope of this project; is one of the first airports to receive a certificate. As an environmentally sensitive airport with its practices, this airport aims to protect and increase the quality of life of its employees and passengers. A face-to-face interview was conducted with the airport environmental officer to obtain information about the works carried out within the scope of the carbon-free airport at this airport. The questions prepared in advance were answered by the environmental officer. According to the information obtained during the meeting, the waste oils at the airport are collected under appropriate conditions in a way that different tanks/containers will be used for each category in the storage area and sent for recycling or disposed of within the period specified in the legislation. Exhaust emission measurement is carried out for motor vehicles at the airport. It is aimed to use stationary electric ground

power units to reduce the emission of air pollutants and noise emissions caused by the use of ground power units at the airport. In accordance with the relevant legislation, a management system is established for the calculation of greenhouse gas emissions, and the greenhouse gas calculation is made every year and the data is recorded. All data is processed into the Integrated Environmental Information System, which includes the applications of chemical and environmental legislation. Recyclable wastes such as paper and plastic are collected separately from other wastes and recycled through licensed facilities. Waste batteries are delivered to businesses or related places that distribute and sell battery products. Waste accumulators, on the other hand, are delivered to the temporary storage areas created by the operators of the vehicle maintenance-repair areas against a deposit fee. End-of-life materials such as waste tires are collected in temporary waste storage areas and given to licensed companies free of charge. Building electricity consumption is reduced by using photocell systems and energy-efficient light bulbs in buildings. Building water consumption is reduced by using photocell armatures in sinks in buildings. Periodic inspection activities are carried out in fuel supply companies to prevent leaks that may occur during fuel storage activities. The businesses within the scope take the necessary measures to minimize the negative effects that may be caused by leaks and spills that may occur during their activities. Programs such as environmental pollution prevention programs and zero-waste management are constantly updated and revised.

As a result, the number of businesses that fulfill their responsibilities in protecting the environment are increasing around the world. Demands from consumers about the environment also lead businesses to be more sensitive to the environment. In order not to fall behind the change, businesses develop an environmentally sensitive management approach by taking into account the demands in this direction. In the aviation sector, airport activities that negatively affect the environment in a regional and even global sense should also be controlled. Nowadays, when environmental pollution has reached serious dimensions, airports that have not yet taken action should also fulfill the criteria as soon as possible and be included in the Carbon-Free Airport Project. To improve, it would be beneficial for accredited airports to compare their internal performances with those of other accredited airports and act in line with the indicators. On the other hand, a more effective follow-up system can be established by working with environmental consultancy companies throughout the country within the framework of legislation. Finally, sustainable development must be embraced by business partners, employees, and the public to implement the Carbon-Free Airport Project quickly and effectively.

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