

Impact of Innovation & Infrastructure of Green Airports Toward Airlines and Passengers

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Abstract

In this paper, we have analyzed the response of airlines and passengers by changing airport infrastructure and providing innovations. However, by doing a thorough empirical analysis of different Green International airports, we learned that passengers and airlines could differentiate between eco-friendly and regular airports. Different technologies are being used in these green airports; for instance, they utilize and convert natural resources like sun and rainwater in a helpful manner for additional facilitation. Furthermore, our targeted samples airlines and passengers are willing to work for a sustainable, eco-friendly environment to breathe in. Therefore, airports are a great place to promote green living and reduce carbon emissions. In addition to the survey, web-based research was undertaken to evaluate the present state of sustainability efforts at various airports and passenger and airline attitudes regarding them.

1- Introduction:

Everyone is concerned about rising pollution levels worldwide, which are causing drastic changes in the global environment. People are worried about how we will leave contaminated earth for succeeding generations. So, for the past few years, people have been attempting to raise awareness about global pollution and how to counteract it. As a result, a new environmentally-friendly trend has emerged worldwide, with individuals emphasizing the consumption of eco-friendly goods and services. Because they are aware of how this dreadful pollution is getting the earth closer towards becoming uninhabitable for humans. Rapid industrialization productivity is blamed for a variety of severe environmental effects, such as the depletion of environmental assets, water, and air pollution, rising temperatures, deadly diseases, and wildlife endangerment. (Amit, Arunesh., 2020). However, as more people become sensitive to the environment, industries are attempting to develop green products and services (environmentally friendly) that will attract potential people. Imagine when people are planning trips and attempting to decide which hotel to stay in, and they have a variety of hotel options to select from, each having its image. They will prefer a hotel with a lot of greens and other eco-friendly characteristics over one with less green and less eco-friendly elements because their primary concern for a trip is to spend some time relaxing in a location that can calm their nerves and soothe their inner spirit.

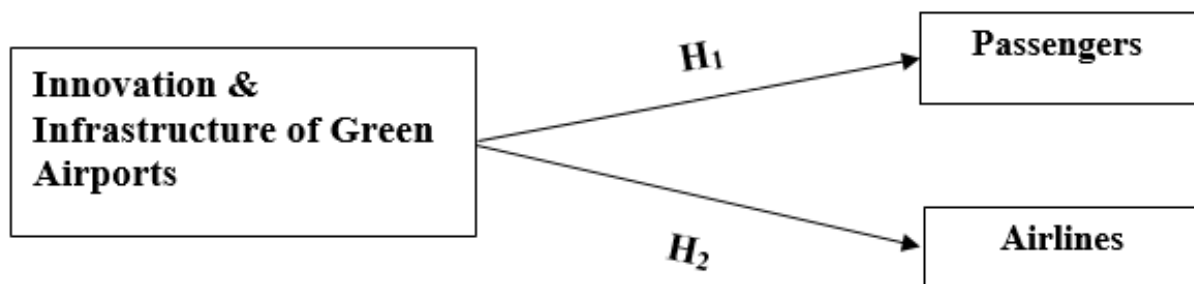
According to the United Nations Environment Programme (UNEP), the building industry is the world's greatest consumer of energy, accounting for 30-40% of global energy consumption. (Yingling and Xinping., 2019). Many studies have recently been conducted on how the aviation industry harms the environment. Many technological advancements made in the aviation industry over time for the convenience of humans are the primary source of greenhouse gas emissions in the environment. The pollution of the atmosphere caused by these greenhouse gases makes it harder for humans to breathe in a healthy environment. As a result of this pollution, the world is increasingly confronted with severe environmental difficulties, such as global warming, droughts, floods, barren soil, ozone layer depletion, and plenty of other problems. The aviation sector is the world's fastest-growing industry, and as a result, it is one of the most polluting industries on the earth. In 2006, the FAA and NASA released a paper detailing the impact of aircraft pollutants on the climate and how it could be the most important environmental concern the aviation industry confronts. This study also showed how it would affect the aviation industry's predicted increasing demand (Airports Council International, 2006).

In recent years, the aviation industry has introduced Green Airports, which are more eco-friendly and preferred by many people concerned about rising environmental threats. Different elements at airports tend to increase pollution in the natural atmosphere, such as the number of vehicles used at airports for various tasks that consume a lot of fuel; aircrafts landing on airports with high carbon emission rates; and the cutting of greens for the construction of new buildings, all of these elements combined with increasing the pollution in the environment. We will briefly address the notion of innovation and infrastructure of green airports in this study, including how they will be more environmentally sustainable and what influence they will have on airlines. Is it necessary for airlines to optimize their fleet to work with green airports? What will passengers' attitudes toward green airports be like? Researches have been done for years to understand travelers' mindset on a sustainable environment. The majority of the public is ready to spend surcharges if the money is used to support environmental practices. (Kelly et al., 2007)

Pakistan faces a particular challenge regarding pollution, making it extremely difficult for living beings to live and breathe in such an environment. In 2021, Pakistan's second largest city, Lahore, was declared the world's most polluted city. Several measures should be taken to deal with and reduce pollution, such as transforming the present Lahore International Airport into a Green Airport. Pakistan has a large number of natural resources that can be used as power sources and are also environmentally safe; thus, it has a lot of potential for creating sustainable green airports. (Zeeshan Asghar, 2013). Allama Iqbal International Airport is Pakistan's second busiest airport, with four million passengers traveling through each year. The innovation and infrastructure of a green airport will assist in minimizing pollution on the land, in the water, and in the air across the city. This will be a major project that will encourage other industries in the city to modify their facilities to be more eco-friendly. This measure must be performed in Lahore, or the city would become unfit for living beings in a few years, and such a magnificent metropolis with a rich cultural legacy will be destroyed.

2- Literature Review

Many initiatives and studies have been undertaken to establish a sustainable environment surrounding and within airports. This article's primary goal is to focus on various aspects of green airport innovation and infrastructure to maintain an eco-sustainable atmosphere. Many infrastructure modifications must be made to reduce space usage, prevent natural resource damage, and foster innovation to benefit both passengers and airlines in order to increase interest in the notion of green airports. We do not need to build new airports; instead, we may innovate current infrastructures to create a more sustainable environment.



The past two decades have played a major role in taking different industries' attention toward environmental stability and improvement. However, the aviation industry is one of the major industries that play a large part in changing environment.

The world is now moving toward the idea of an eco-friendly environment to live in, and for this, in most parts of the world, airports have started moving towards the concept of green airports. People often use different slogans like "Go Green" and "don't be mean, just go Green," etc. (59 Go Green Slogans, By Cheryl Cirelli). They use these phrases, which mean energy-saving, environmentally friendly. They also use them for spreading awareness. Being environment friendly means using organic products that can be reused in the future instead of using non-renewable products. For example, companies are now trying to use recyclable products instead of plastic because plastic takes ages to decay. Green airports try to reduce and mitigate the effect of airport activities and operations on the environment and climate. Nowadays, airports are operating a large amount of the world's traffic which means they play a wide role in anthropogenic climate change (Zanin, 2007). However, airports are the main source of getting people from one part of the world to the other there are no alternates. The Green Airport International Flight Academy

(GAIFA) in the Dominican Republic (DR), has introduced a model that can be applied to a variety of locations, they illustrated the benefits of utilizing biofuels and renewable energy at airports (Zanin, 2007). Furthermore, Airports like Chicago O'Hare International Airport, Amsterdam Schiphol Airport, Munich Airport, Germany, are considered the world's top ten

green airports. These airports are creating new ideas to sustain an eco-friendly environment and air travel. To sustain means mitigating the carbon footprints and using natural resources so that their decreasing speed can be slowed down.

Furthermore, some airports are using recycled materials for construction. Some are using renewable energy resources, developing green parking lots, using the auxiliary power supply to provide airplanes to reduce fuel consumption and emissions. Some airports have installed LED lights on runways, guard lights, and airfield signs. Changi Airport, Singapore, has started a project to convert waste food into the water. They came up with a plan to reduce food waste by investing in digesters, which break down food waste into water utilizing bacteria. The lower the amount of food waste delivered to incinerators, the lower the total carbon emissions. Last year, these eco-friendly machines processed almost 250 tons of food waste, the equivalent of nearly seven A320 flights. Changi Airport is now Singapore's biggest consumer of food waste digesters, with 11 machines placed across all four terminals (Changi airport group). Different papers have been published to show the attitude of passengers towards green airlines and how the airlines are taking initiatives to improve the environment (Mayer, Robert, Ryley, Tim, Gilling water, David, 2012). However, in Pakistan, Benazir Bhutto New Islamabad International Airport is the first Greenfield airport which is just a start for the betterment of the environment. The airport utilizes natural resources like daylight for main lightning and sun shading to reduce cooling equipment costs and provide a lot of other innovations and facilities in its infrastructure.

Following these trends, we have proposed these hypotheses for our paper.

H1: Impact of Innovation & Infrastructure of Green Airport on Passengers

The airports are playing their part to be environmentally friendly, which means they provide exceptional services to maintain a good space for people during their stay there. These services may include installing new and easy-to-use technologies and improving sitting and waiting for areas by keeping ergonomics in view. Although, for more improvement, airports need to know the passenger reaction, which is the primary resource of an airport's revenue. People traveling from a green airport can easily tell the difference of environment between the non-green airport. If not, a good strategy will be needed to make them aware of the difference. Mostly, passengers with good incomes have no issue paying extra for the betterment if asked, and sometimes if the passengers also pay if they are impressed and keep up the good work going. We have surveyed passengers of different ages and occupations to know about their views on green airports and whether they can differentiate between green airports and regulars.

H2: Impact of Innovation & Infrastructure of Green Airport on Airlines

Nowadays, airlines are much aware of the eco-friendly environment and working for its betterment; these airlines are replacing their fleet with eco-friendly aircraft that emit less CO₂. On the flip side, LCC (low-cost carriers) are not paying much attention. The airlines which are using eco-friendly aircraft with less CO₂ emission are still in denial of environmental taxation because the tax will depend on the maximum takeoff weight (MTOW) of the aircraft, and the

eco-friendly aircraft use heavier engines than the old one so ultimately, airlines with these aircraft will have to pay more tax. Therefore, if possible, airports work together with airlines on this vital issue and find a midway to process the excellent work. Airports can use different strategies to attract airlines' attention by spreading awareness and sometimes providing exceptional facilities and offers.

3- Methodology

Two different methodologies were used in order to conduct our research and achieve the objectives that we set for our study. First, as a secondary source, we conducted a literature review of various websites, gaining an in-depth overview of the actual measures being implemented at airports around the world. This literature review was extremely beneficial to us in moving our research to the next stage. Afterward, we conducted a survey in the form of a digital questionnaire, which we distributed to participants through Google Forms. In order to gather data from both frequent flyers and airline personnel, we have chosen this method of distribution because the perspectives of both are critical to the research we are conducting.

Along with the thoughts of passengers and airline employees, we also sought the opinions of several aviation specialists in Pakistan to find out what they thought about the situation. This was quite beneficial in helping us to clarify several issues. First, it was necessary to properly develop the survey with all of the central questions in mind and demographics. The final survey consisted of six questions, eliminating demographic questions, and each of these questions covered every component of the research. The research questions were graded on a Likert scale to avoid overcomplicating the process. The participants were given a brief explanation of the research's purpose and the concept of green airports to readily express their own opinions during the survey. Getting individuals interested in the awareness campaign about how rising pollution levels are a major contributor to a dysfunctional environment is another crucial goal for doing this study. People between the ages of 25 and 40 are aware of the implications of pollution, and they wish to take the initiative to safeguard the environment from further harm. As a result, this age group expressed great interest in our research, recognizing that it will serve a greater good.

The survey was created using Google Forms, and the link to it was sent straight to the participants, saving a significant amount of time and resources. The responses to the survey were overwhelmingly positive from those who took part. We attempted to collect as much information as possible from frequent fliers, airline workers, and aviation specialists. The data was analyzed after it was collected, with some of the data being analyzed using Google forms' analytical tools and some of the information being analyzed manually. After the data was analyzed, it was discovered that the younger generation is more concerned about environmental issues because they are aware of the difficulties they will face due to all of these issues and the environment they will leave for their children and grandchildren to breathe in. As a result, they were willing to take the initiative and ensured that they would comply with all rules and regulations to create a better and safer future environment for everyone.

Airlines, particularly low-cost carriers, were, on the other hand, unwilling to take the lead and initiate change. Passengers who fly on low-cost airlines are reluctant to go on higher rates because the low fares are the only reason they prefer low-cost carriers to other carriers. Therefore, it's impossible for airlines to lose consumers simply because of some environmental aspects that aren't working as they should. They want the government to take the lead and assist them in maintaining the environment.

To obtain the best possible results for the secondary data gathering, we utilized a variety of search engines. These search engines include the Google search engine, Goggle Scholar, the Airports Council International, and a slew of other airport websites converted to green in recent years. All of these studies aid us in determining what initiatives have been implemented at world-class green airports and how we might adjust the infrastructure of airports in Pakistan in order to make them more eco-friendly and environmentally sustainable. Many of the world's green airports have integrated various technologies and equipment into their infrastructure to provide innovative services to passengers and airlines alike. Some of these measures can be implemented in Pakistan to help the country evolve toward a more eco-friendly and sustainable environment at and around airports.

Gender	Male	61.40%
	Female	38.60%
Age	18-25	15%
	26-35	28.60%
	36-45	15.70%
	46-55	4.30%
	Above 55	1.40%
Marital Status	Married	44.30%
	Unmarried	55.70%
Education	Matric/Intermediate	31.40%
	Bachelor's	45.70%
	Master's	15.70%
	PhD	2.90%
	Other	4.20%
Employment	Employed	40%
	Unemployed	30%
	Bussiness Man	25.70%
	Other	4.30%
Frequent Flyer	Yes	54.30%
	No	30%
	Maybe	15.70%

4- Results & Discussion

This article's primary goal is to raise public awareness about the growing environmental challenges in Pakistan and encourage people to protect the environment. In comparison to other airports throughout the world, Pakistan's airport infrastructure is poor and incompatible with the environment. (Irem et al., 2018). Islamabad International Airport, for example, saw a fake ceiling collapse in July 2021 as a result of severe rain. We acquired some data for this study and learned about the public's perspective on it. The major goal of this research paper is to start a movement in Pakistan to make airports more environmentally friendly. This paper explains how we can innovate and change the infrastructure of an airport to make it a green airport. Heathrow Terminal 5 is the best example of green airport innovation and infrastructure. The entire project team created an innovative computer model of how the roof would behave in adverse weather, which resulted in saving 800 tonnes of steel in the structure's design. They meticulously planned the entire process to minimize potential dangers and save money. Furthermore, we did a survey to learn about the perspectives of passengers and airlines, which revealed that while people are willing for someone to act, some airlines are averse to changing their fleet to be more environmentally friendly.

The research has determined that innovation and infrastructure in green airports will aid in the preservation of the natural environment in the first question of the research. The majority of replies were extremely favorable, indicating that people desire to live in a healthy and sustainable environment. As a result, most participants, especially adults, strongly agreed with this remark. The second research question asked whether respondents believe it is the government's obligation to implement green airport features in Pakistan. The answer was yes. The majority of people, including airline personnel and airport staff, strongly agreed that it was the government's obligation, although some were ambivalent.

The third research question asks if individuals believe green airports will have more practical use in Pakistan and if you would want to travel through them as a passenger. The majority of people believe that if airports provide some particular amenities for travelers, they will enjoy traveling. For example, passengers appreciate the amenities at Amsterdam Schipol Airport, which include passenger parks with distinctive features such as benches that resemble natural logs and chairs positioned beneath enormous trees for passengers to relax.

The fourth and fifth research questions concerned people's perceptions of airlines as polluters and whether airlines would be ready to optimize their fleet in order to contribute to a more environmentally friendly environment. Most individuals agree that airlines are a source of pollution to some level, but they do not feel that airlines will be willing to optimize their fleet because it will cost them a lot of money. Finally, the sixth research question asked passengers if they would prefer to travel on airlines that operate green aircraft. However, several participants were reluctant to answer this question because most people consider the cost essential while traveling. And this is the primary reason why airlines, particularly low-cost

carriers, are hesitant to optimize their fleets: customers will not prefer to go on a more expensive airline, even if it is environmentally friendly.

Airports must consider a variety of factors in order to be environmentally friendly. For example, they can incorporate innovation into their technology to consume less energy, or they can incorporate items into their infrastructure to recycle waste material and make use of it. This will have a significant impact on pollution reduction. For example, Arlanda Airport in Stockholm, Sweden, became the world's first airport to achieve carbon neutrality, and several other airports are working to accomplish the same goal. In addition, people are more concerned about the environment, and as a result, they are increasingly looking for environmentally friendly products and services. As a result, airports must take steps to become more environmentally friendly.

Airports in Pakistan can benefit from adding various plants to their infrastructure, which will save a significant amount of resources. For example, when cooling equipment is required in the summer, the plants help to lessen the demand for such equipment by generating natural coolness in the surrounding environment. The addition of some components to the infrastructure that collect rainwater and allow it to be reused for a variety of uses after filtration is another project that airports can undertake. Another method airports could take to counteract the cold during the winter is to create a greenhouse effect, resulting in natural heating, so saving a significant amount of resources that would otherwise be used to generate artificial heat during the winter. These are the most convenient and least expensive initiatives airports may implement to initiate the change.

Future Recommendations

For future recommendations, First and foremost, airports should focus on executing the nine goals for green building certification and research to improve the overall passenger and airline experience. Airlines and airports must collaborate in the future to maintain a safe and comfortable environment; this study will assist other airports and airlines in making efforts toward a greener world. Finally, it would be helpful to choose one or two airports actively promoting sustainability at their facilities and conduct a case study to determine the cost and impact of their sustainability activities. A thorough review of these airports' financial records may provide insight into the cost and impact of sustainability initiatives.

In this sense, we should emphasize the necessity of internal communications in order to effectively portray an airport's environmental efforts to the surrounding community. It not only increases acceptance and encourages ties throughout the community, but it also draws attention to the crucial function that airports play as weather experts, which they unquestionably have. Airports and authorities should ensure that energy efficiency is included in the design of new facilities and teach employees how to reduce their energy consumption. They should develop plans to increase their renewable energy sources usage, including the aviation industry in the world carbon trading system.

Conclusion

Innovations and infrastructure are the “main course” in building green airports. By working deeply, top-notch designs for the infrastructure of airports are under development. Market mechanisms in the carbon emission reduction system should be introduced to promote the development of green airports. Environmental taxes can help businesses embrace the cost of pollution and increase their spontaneous motive for green growth.

Innovations are our current need to reduce carbon footprints. Our study has shown how the aviation industry is moving towards a sustainable, eco-friendly environment as airports play a large part in world pollution. It suggests this important matter should not be taken for granted and that every passenger and airline should contribute to this good cause.

References

Kelly, J., Haider, W., Williams, P. W., Englund, K., 2007. Stated preferences of tourists for eco-efficient destination planning options. *Tourism Management* 28, 377-390.

Amit Kumar Bhardwaj , Arunesh Garg, Shri Ram , Yuvraj Gajpal and Chengsi Zheng, Research Trends in Green Product for Environment: A Bibliometric Perspective. *International Journal of Environmental research and public health*, 2020

Yingling Shi and Xinping Liu, Research on the Literature of Green Building Based on the Web of Science: A Scientometric Analysis in CiteSpace (2002–2018). 2019

Zeeshan Asghar, The Need for Eco-Friendly Buildings in Pakistan. Amer Adnan Associates. 2013

Batool, I., Hussain, G., & Abid, M. (2018). Airport Privatization in Pakistan. *Policy Perspectives*, 15(3), 157–177.

Salil Rai (2017). Green Airports: Ways Airports can Go Green, Middle Tennessee State University Aerospace Department

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