ISSN 3032-3533
Vol 1, No.1 (2024)

Factors Influencing Airport Technology Development: Customer Convenience, Aviation Security, and Environmental Issues

1st Musri Kona
Teknik Listrik Bandara
Politeknik Penerbangan Jayapura
Jayapura, Indonesia
musrikona78@gmail.com

2nd Rifqi Raza Bunahri
Teknik Listrik Bandara
Politeknik Penerbangan Jayapura
Jayapura, Indonesia
rifqiraza@gmail.com

***Abstract*— Technology development had introduced automation techniques in the airport operation and service system. Passengers also feel more comfortable choosing an airport which has equipped with technology. Therefore, many airports are becoming more enthusiastic about implementing new technologies because they can increase efficiency, reliability, and sustainability within their operations. This article then tried to explain several factors which are significantly influencing airport technology development. The method used by the authors was a qualitative method focusing on the literature review. The research result showed that there are three prominent factors influencing airport technology development. First, the customer convenience factor encourages airports to apply self-service technologies that are more flexible and efficient. Second, the aviation security factor creates body scanner technology to automatically scan the passengers and the liquid explosives detection system. Third, environmental issues can be looked at from the airport's efforts to implement various energy-saving behaviors and utilize renewable energy sources. Moreover, there are also other factors influencing the airport technology development, namely price, rapidness, customer experience, customer value, risk minimization, and communication enhance.**

Keywords*— *airport technology, customer convenience, aviation security, environmental issues

I. INTRODUCTION

Airport is a critical component of the international air transportation system that supports and facilitates the movement of passengers, air cargo and tourism. Nowadays, international airports don't just facilitate planes taking off and landing. However, there are more than 40,000 airports worldwide offering a complex travel experience and serving billions of passengers each year [1]. This causes airports to have a major impact on a country's economic development due to their ability to provide a faster and more effective mode of transportation [2]. The era of globalization and Industrial Revolution 4.0 then requires airports to adapt by implementing new and innovative technologies. These technological advances, when complemented by airport communications and information *platforms*, will provide a unique opportunity to develop the 'smart airport' concept in the future [3].

The development of communication and information technology then changed the way airports operate by introducing automation techniques in customer or passenger service. Quoting from [4], Adapting to technological advances is very important because airports can also modernize their aging facilities. Technology can help airports periodically forecast passenger numbers and accurately plan passenger flows to create memorable moments. When viewed from a demand perspective, passengers tend to feel more comfortable choosing airports that are well equipped with technology [5].

Many airports are increasingly enthusiastic about implementing new technologies because they are able to increase the efficiency, reliability and sustainability of airport operations. Technology also has the ability to increase customer satisfaction levels, increase revenue, and increase efficiency in airport operations to achieve predetermined targets and goals. [5]. Therefore, this article aims to explain a number of factors that influence the development of airport technology.

Based on the background that has been explained, the problem can be formulated:

1. Does customer comfort influence the development of airport technology?
2. Does aviation security influence the development of airport technology?
3. Do environmental issues influence the development of airport technology?

II. LITERATURE REVIEW

After reviewing a number of literature, the author succeeded in obtaining findings which can be seen in table 1 below.

TABLE 1. LITERATURE REVIEW FINDINGS

No	Author (year)	Research Result	Equation with This article	Difference with This article
1.	Bogicevic	Speed, customer	Customer comfort has a	Speed and customer

	(2017) [3]	comfort and customer experience have a positive and significant influence on the development of airport technology	positive and significant influence on the development of airport technology	experience have a positive and significant influence on the development of airport technology
2.	Chen et al. (2015) [6]	Customer comfort, increased communication and customer value have a positive and significant influence on the development of airport technology	Customer comfort has a positive and significant influence on the development of airport technology	Customer value and increased communication have a positive and significant influence on the development of airport technology
3.	De Neufville (2008) [7]	Flight safety, price and risk minimization have a positive and significant influence on the development of airport technology	Aviation security has a positive and significant influence on the development of airport technology	Price and risk minimization have a positive and significant influence on the development of airport technology
4.	Drennen (2011) [8]	Price, speed and customer convenience have a positive and significant influence on the development of airport technology	Customer comfort has a positive and significant influence on the development of airport technology	Price and speed have a positive and significant influence on the development of airport technology
5.	Feng (2007) [9]	Flight safety, price and risk minimization have a positive and significant influence on the development of airport technology	Aviation security has a positive and significant influence on the development of airport technology	Price and risk minimization have a positive and significant influence on the development of airport technology
6.	Gocmen (2021) [10]	Environmental issues and customer experience have a positive and	Environmental issues have a positive and significant influence on the development of	Customer experience has a positive and significant influence on the development of airport technology
		significant influence on the development of airport technology	airport technology	
7.	Lee Anant & Monpanthong (2021) [5]	Environmental issues, price and speed have a positive and significant influence on the development of airport technology	Environmental issues have a positive and significant influence on the development of airport technology	Price and speed have a positive and significant influence on the development of airport technology
8.	Miskolczi et al. (2021) [1]	Environmental issues and improved communication have a positive and significant influence on the development of airport technology	Environmental issues have a positive and significant influence on the development of airport technology	Improved communication has a positive and significant influence on the development of airport technology

III. METHODOLOGY

The method used in compiling this article is a qualitative method with a literature review design. Therefore, instead of focusing on primary data, this paper focuses more on secondary data, which includes journal articles and organizational research. However, the data is credible and relevant to the topic discussed. This is because the author uses trusted sources obtained from various international journal sites, such as JSTOR, Taylor & Francis, and Sage Publication.

IV. RESULT AND DISCUSSION

A. The Influence of Customer Convenience on Airport Technology Development

The development of airport technology is influenced by customer comfort factors. This factor is closely related to *confidence benefits* which can form feelings of comfort, security and certainty of expectations regarding the airport services provided [3]. Airports usually choose *self-service* technology so that customers can have more control over their wishes. In addition, *self-service* technology can also save time and costs; reducing waiting times; more efficient, flexible, and comfortable to use; and make it easier for consumers to design what they want. This technology has been applied to *check-in kiosks* which are an integral part of airport facilities and the development of e-tickets also allows the use of the internet for check-in [11].

By considering customer comfort factors, airports can implement *common-use self-service* (CUSS) technology which provides services to customers in purchasing tickets,

progressing seating order, printing boarding passes, baggage tags, and viewing various other types of information [8]. The airport will also consider the use of technology that allows customers to change flight schedules, change personal information, check flight status, and other services that can increase their convenience. Apart from that, CUSS technology can also increase effectiveness during the boarding process. In the development of airport technology, there are at least three main factors to pay attention to, namely the ability of technology to reduce space, increase effectiveness in the *check-in* process, and reduce transaction time [12].

The argument that customer comfort influences the development of airport technology is in accordance with the arguments of Drennen [8], Abdelaziz et al. [11], Gualandi et al. [12], Ku & Chen [13], Chen et al. [6], and Bogicevic et al. [3].

B. *The Influence of Aviation Security on the Development of Airport Technology*

Airlines usually also consider security aspects in choosing the technology used at airports. This is because this technology will become a vital component in the airport security system which is used to prevent threats from terrorists or other irresponsible parties [9]. Therefore, several airports have begun to develop the latest technologies, which include body scanners to carry out automatic checks on passengers and liquid explosive detection systems (LEDS). Body scanners have been used by a number of airports around the world to check whether passengers are carrying prohibited non-metallic items on their bodies. Meanwhile, the distribution of LEDs still tends to be lower compared to body scanners. [14].

In order to fulfill security aspects, the airport is also working to implement new technology into existing operational arrangements; interactions between human operators, technology, and infrastructure; regulatory framework; and organizational culture. In the 2010s, there were at least two types of body scanners available on the market, namely terahertz and millimeter wave nonionizing technology and backscatter x-ray ionizing technology [14]. Aviation security then received increasing attention after the events of September 11, 2001, or 9/11 in the United States. Security restructuring is starting to be carried out in Western countries, such as centralizing security in the aviation system and tightening the passenger screening process at airports. In fact, the United States Transportation Security Administration uses more sophisticated and expensive technology that can detect criminal records of passengers at airports[15].

The statement that aviation security influences the development of airport technology is in accordance with the results of research conducted by Feng [9], Leo & Lawler [15], and Hofer & Wetter [14].

C. *The Influence of Environmental Issues on Airport Technology Development*

The airport industry is facing increasing environmental pressures. There is great concern about the impact that airports have on the environment, so airports are starting to make efforts to become more responsive to existing environmental issues. One of the energy-saving measures implemented by the airport is the installation of solar photovoltaic panels on the roof of the airport building. Other energy-saving measures include building insulation and lighting renovations using light emitting diodes or LEDs [16].

The use of robots or artificial intelligence technology is then designed to react to sudden changes in the environment. Mobile boarding passes have also been widely implemented to reduce paper use, thereby avoiding deforestation [5]. Apart from that, several airports are also starting to use renewable energy sources because of the many benefits they offer, such as (1) having a lighter impact on the environment; (2) providing alternative energy sources to operate the airport; (3) produces very little waste; and (4) reducing ground emissions [16]. Thus, the development of airport technology is influenced by the challenge of reducing negative impacts on the environment.

The argument that environmental issues have an influence on the development of airport technology is in accordance with the results of research carried out by Baxter et al. [16], Gocmen [10], [5], and Miskolczi et al. [1].

D. *Conceptual Framework*

Based on the background of the problem, literature review, and discussion above, the author succeeded in obtaining the following conceptual framework.

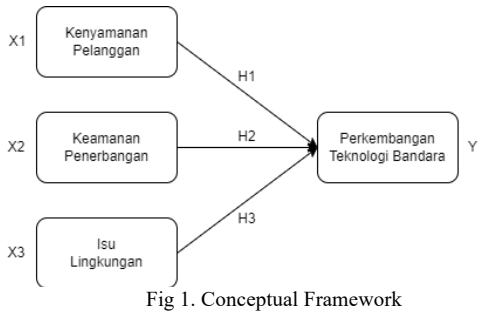

Fig 1. Conceptual Framework

From this conceptual framework, it can be seen that customer comfort, aviation security, and environmental issues have a significant influence on the development of airport technology. However, apart from these three factors, there are also other factors that have a similar influence, namely:

1. Price: Drennen [8], Feng [9], De Neufville [7], Bogicevic et al. [3], and Lee-Anant & Monpanthong [5];
2. Speed: Drennen [8], Bogicevic et al. [3], and Lee-Anant & Monpanthong [5];
3. Customer experience: Lu et al. [17], Ku & Chen [13], Bogicevic et al. [3], and Gocmen [10];
4. Customer value: Ku & Chen [13], Chen et al. [6], and Pell & Blondel [18];

5. Risk minimization: Feng [9], De Neufville [7], and Hofer & Wetter [14];
6. Improved communication: Chen et al. [6] and Miskolczi [1].

V. CONCLUSION

Based on the results of the literature review, discussion, and conceptual framework, it can be concluded that there are three hypotheses that can be used for further research related to the development of airport technology. The three hypotheses in question are as follows:

1. Customer comfort has a significant influence on the development of airport technology;
2. Aviation security has a significant influence on the development of airport technology;
3. Environmental issues have a significant influence on the development of airport technology.

REFERENCES

[1] M, Miskolczi., Jasberenyi, M., & Toth, D. Technology-Enhanced Airport Services — Attractiveness from the Travelers' Perspective. *Sustainability*, *13*, 1–18. 2021

[2] H., Yang., Efficiency and productivity evidence from international airports in the Asia-Pacific region. *Journal of the Chinese Institute of Industrial Engineers*, *27*(2), 157–168. https://doi.org/10.1080/10170660903545956. 2010

[3] B., Keskin., & B., Salman., Building Information Modeling Implementation Framework for Smart Airport Life Cycle Management. *Transportation Research Record*, 1–15. https://doi.org/10.1177/0361198120917971. 2020

[4] Bogicevic, V., Bujisic, M., Bilgihan, A., Yang, W., & Cobanoglu, C. The impact of traveler-focused airport technology on traveler satisfaction. *Technological Forecasting & Social Change*, *30*(March), 1–11. https://doi.org/10.1016/j.techfore.2017.03.038. 2017.

[5] C., Lee-Anant., & P., Monpanthong. Factors Influencing Airport Technology Selections in Each Service Touchpoint of Suvarnabhumi Airport, Thailand. *Turkish Journal of Computer and Mathematics Education*, *12*(13), 3804–3816. 2021

[6] Chen, J. K. C., Batchuluun, A., & Batnasan, J. Services innovation impact to customer satisfaction and customer value enhancement in airport. *Technology in Society*, *30*(2015), 1–12. https://doi.org/10.1016/j.techsoc.2015.05.010. 2015.

[7] De Neufville, R. Low-Cost Airports for Low-Cost Airlines: Flexible Design to Manage the Risks. *Transportation Planning and Technology*, *31*(1), 35–68. https://doi.org/10.1080/03081060701835688. 2008.

[8] Drennen, H. *Self Service Technology in Airports And the Customer Experience*. Cornell University. 2004

[9] Feng, Q. On Determining Specifications and Selections of Alternative Technologies for Airport Checked-Baggage Security Screening. *Risk Analysis*, *27*(5), 1299–1310. https://doi.org/10.1111/j.1539-6924.2007.00966.x. 2007

[10] Gocmen, E. Smart Airport: Evaluation of Performance Standards and Technologies for a Smart Logistics Zone. *Transportation Research Record*, 1–11. https://doi.org/10.1177/03611981211019740. 2021.

[11] Abdelaziz, S. G., Hegazy, A. A., & Elabbassy, A. Study of Airport Self-service Technology within Experimental Research of Check-in Techniques: Case Study and Concept. *International Journal of Computer Science Issues*, *7*(3), 17–26. 2010.

[12] Gualandi, N., Mantecchini, L., & Paganelli, F. The Impact of New Technologies in Airport Passengers' Processes. *Business*, 1–9. 2011.

[13] Ku, E. C. S., & Chen, C. Fitting facilities to self-service technology usage: Evidence from kiosks in Taiwan airport. *Journal of Air Transport Management*, *32*(2013), 87–94. https://doi.org/10.1016/j.jairtraman.2013.07.001. 2013.

[14] Hofer, F., & Wetter, O. E. Operational and human factors issues of new airport security technology — two case studies. *Journal of Transportation Security*, *5*, 277–291. https://doi.org/10.1007/s12198-012-0096-5. 2012.

[15] Leo, J. G., & Lawler, J. P. A Study Of Passenger Perception And Sensitivity To Airport Backscatter X-Ray Technologies. *International Business & Economics Research Journal*, *6*(7), 11–18. 2007.

[16] Baxter, G., Srisaeng, P., & Wild, G. Environmentally Sustainable Airport Energy Management Using Solar Power Technology: The Case of Adelaide Airport, Australia. *International Journal for Traffic and Transport Engineering*, *9*(1), 81–100. https://doi.org/10.7708/ijtte.2019.9(1).07. 2019.

[17] Lu, J., Chou, H., & Ling, P. Investigating passengers' intentions to use technology-based self check-in services. *Transportation Research Part E*, *45*(2009), 345–356. https://doi.org/10.1016/j.tre.2008.09.006. 2009.

[18] Pell, R., & Blondel, M. *Airport digital transformation: From operational performance to strategic opportunity*. 2018.