

Contribution Autogate System and Customer Convenience to Ease of Using Technology: Implications for Passenger Satisfaction

Hanifah Aizah Andhini^a, Untsa Zhafira Chistarlanda^b, Prasadja Ricardianto^c, Haryono^d

^{a,c,d} Faculty of Management and Business, Institut Transportasi dan Logistik Trisakti,
Jakarta, Indonesia

^c Directorate of Postgraduate, Institut Transportasi dan Logistik Trisakti, Jakarta,
Indonesia

Corresponding author: hanifahaizahandhini@gmail.com

Abstract: Leveraging technology is crucial for businesses to enhance their processes, particularly in airport services. Soekarno-Hatta International Airport, Indonesia's main entry and departure point, has implemented an Autogate System to boost efficiency and security. This system processes biometric data swiftly, reducing passenger queues and manual errors, thereby increasing passenger satisfaction. However, the Autogate system at Soekarno-Hatta faces challenges such as low public interest and usability issues. This research aims to analyze the direct and indirect effects of the Autogate system and customer Convenience on passenger satisfaction, mediated by the ease of use of technology at Terminal 3 immigration checks. Using a quantitative approach, the study surveyed 70 Garuda Indonesia passengers who used the Autogate system. Data was analyzed using Structural Equation Modeling (SEM) with SmartPLS 4 software. These findings are expected to provide insights into optimizing the Autogate system to better meet passenger needs and enhance satisfaction at Soekarno-Hatta International Airport.

Keywords: *Autogate system, customer convenience, passenger satisfaction, ease of use of technology, Soekarno-Hatta Airport.*

1. INTRODUCTION

Leveraging technology and digitalization effectively is essential for businesses to improve their business processes. Business actors operating in the field of airport services and air traffic services are likely to further improve the services they provide to airport service users.

Soekarno-Hatta international airport is the main entry and departure point for both foreign and Indonesian citizens. Hanantyo and Susanto (2022) stated that the facilities provided are divided into three parts, including departure, arrival and other checks such as roadside, baggage claim, check-in area, the immigration Checkpoint (TPI), and waiting room. Therefore, strict control of immigration crossings is required. The Directorate General of Immigration under Soekarno Hatta put in place an automated gate system. That provides several gates which must be adjusted to the concentration of passengers to provide Convenience in carrying out activities at Soekarno Hatta Airport.

The implementation of Autogate system is the main focus in increasing efficiency and security at airports. This system can process biometric data such as facial recognition and fingerprints quickly and accurately, thereby speeding up the immigration inspection process and reducing passenger queues. Study by Alam, Kabir, and Sumi (2023) showed that implementing AI-based systems in immigration checks can increase processing and reduce manual errors. Other research by Zhang (2020) also found that implementing this technology increases passenger satisfaction through a faster and more efficient experience.

Customer convenience at the airport is a critical factor that influences overall satisfaction. This Convenience includes physical aspects such as Convenienceable chairs, a clean and quiet environment, and easy access to facilities. According to

research by Li et al. (2022) environmental Convenience at the airport has a positive correlation with the level of passenger satisfaction, where a Convenienceable environment can reduce stress and increase positive perceptions of airport services

On the other hand, ease of use of the technology plays an important role in the passenger experience with an autogate system. Park (2020) found that ease of use of technology significantly influences passenger satisfaction, especially in complex airport contexts where users may be unfamiliar with existing procedures. This research also highlighted the importance of additional facilities such as free Wi-Fi and rest rooms in enhancing passenger Convenience and satisfaction

Understanding the interaction between customer convenience and ease of use of the technology is pivotal in shaping passenger satisfaction and loyalty. According to research by Yang, Bilgihan, and Bujisic (2013) passenger satisfaction is the main indicator of the success of service at the airport. Passenger satisfaction is influenced by various factors including speed of service, Convenience, and interaction with technology.

The TPI Soekarno-Hatta Special Class I Immigration Office implements an automatic scanning system (Autogate) to speed up immigration services and inspections. This system allows for automatic crossings for Indonesian citizens entering and leaving Indonesian territory. Santoso (2020) emphasize despite its efficiency, autogate machines are still of little interest to the public, especially the Indonesian people. Autogate does not yet answer the function of the Directorate General of Immigration as providing technology-based services, because in reality many people still choose manual counters as an option for completing immigration checks, autogate still needs to be evaluated to optimize its role at TPI Soekarno Hatta International Airport.

There are issues with the biometric system at Soekarno-Hatta International Airport's Terminal 3. Operators can fix fingerprint unidentifiability caused by imperfect conditions, such as dry fingertips, by applying hand sanitizer to wet fingers. Because of their routines, passengers can potentially find the system confusing. To prevent this, it's critical to let travelers understand exactly how effortless and time-saving the biometric technology system is to us, as outlined by Denita et al. (2018)

This paper aims to determine and analyze Autogate system (X1) and Customer Convenience (X2) direct and indirect on Passenger Satisfaction (Y) mediated by Ease of use of technology (Z) at Immigration Checks at Terminal 3 Soekarno Hatta Airport.

2. LITERATURE REVIEW

2.1 Autogate System

AI-based autogate systems use biometric verification technologies, such as facial recognition, to automate and expedite the immigration process. In the context of immigration services Autogate is an automatic access system that can be utilized in various applications, including immigration services (Yaacob et al. 2021).

These systems are designed to enhance security while reducing wait times and streamlining passenger flow. Antonovica (2022) noted that AI technologies significantly improve processing efficiency at airports, leading to reduced queues and faster passenger throughput. Another study by Hasni, Farah, and Adeel (2021) confirmed that the implementation of AI in autogate systems enhances operational efficiency and passenger experience by minimizing human errors and increasing accuracy.

In addition, the four main dimensions of service quality are defined (Jamil, Wahyono, and Kusuma 2023) a service system, input optimization, processing time, monitoring system.

2.2 Customer Convenience

Seiders et al., (2007) defined "service convenience" as consumers' perceptions of the time and effort involved in purchasing or using a service after conducting a thorough examination of the literature on consumer convenience in a service economy. Khairunnisa and Mursito (2021) stated that since convenience is an intangible kind of service that cannot be seen, smelled, or touched, the physical component of service becomes significant. If the facilities that customers use are made to be Convenienceable and attractive those who are looking for convenience while they wait for the service to be performed will feel more at ease.

In the aviation industry, the influence of customer convenience on airport technology is affected by elements related to customer satisfaction. According to Keskin and Salman (2020) this element is strongly tied to confidence benefits, which can create sentiments of security, Convenience, and clarity about expectations for the services offered by the airport

Development Customer convenience is a central theme in discussions about technological implementations in airports. Bacinskas, Kempers, and Lenka (2020) indicates that the ease of using technology directly influences customer satisfaction. When technologies are user-friendly, passengers are more likely to perceive the immigration process as smooth and hassle-free. The user interface design, accessibility features, and intuitive operation of autogate systems are crucial factors that to this ease of use (Hendarto and Werdiningsih 2024)

2.3 Passenger Satisfaction

Satisfaction plays a crucial role in evaluating both the loyalty of existing customers and the attractiveness to potential ones. Xie et al. (2020) states one of the most important considerations when creating a transportation planning strategy in metropolitan regions is passenger satisfaction. According to Chahal and Bala (2012) passenger satisfaction is defined as the contentment experienced by customers when a product aligns with their expectations.

Oktarini (2019) presents an alternative viewpoint, defining customer satisfaction as a post-purchase assessment based on whether the performance of the chosen product or service meets or exceeds the customer's pre-purchase expectations. If the perceived performance falls short of expectations, it results in dissatisfaction. Key metrics for assessing customer satisfaction include repeat purchases, positive word-of-mouth recommendations, reduced consideration of competitors' products, additional purchases from the same company, and the provision of product or service recommendations to companies (Kotler, P., & Keller, K 2016)

2.4 Ease of Use of Technology as a Mediating Variable

The Technology Acceptance Model (TAM) elucidates and forecasts user behavior concerning IT adoption, as defined by Rosli et al. (2022). Since its introduction in 1990, TAM has been a focal point in numerous IT research studies. Within TAM, perceived enjoyment and perceived ease of use are deemed crucial and practically significant parameters (Iancu et al., 2023). Perceived usefulness is defined as the degree to which an individual believes that using a specific system will enhance job performance (Davis et al., 1989).

According to previous studies on TAM, The concept of technology ease acting as a mediator between system implementation and passenger satisfaction has been explored in various contexts. The ease of use of autogate systems ensures that passengers, regardless of their technological proficiency, can navigate the immigration

process smoothly. Studies by Mariani (2022) user-friendly interfaces and clear instructions are essential for passenger satisfaction. Passengers prefer systems that minimize effort and stress, contributing to a more pleasant travel experience.

In the case of AI-based autogate systems, the ease of use can significantly mediate the relationship between the technology's implementation and passenger satisfaction (Miskolczi, Jászberényi, and Tóth 2021). If passengers find the autogate system easy to use, their satisfaction with the overall immigration process increases, reinforcing the importance of user-centered design in technological deployments.

Tables and Figures

Tables are presented in the following:

Table 1

Measurement of variables

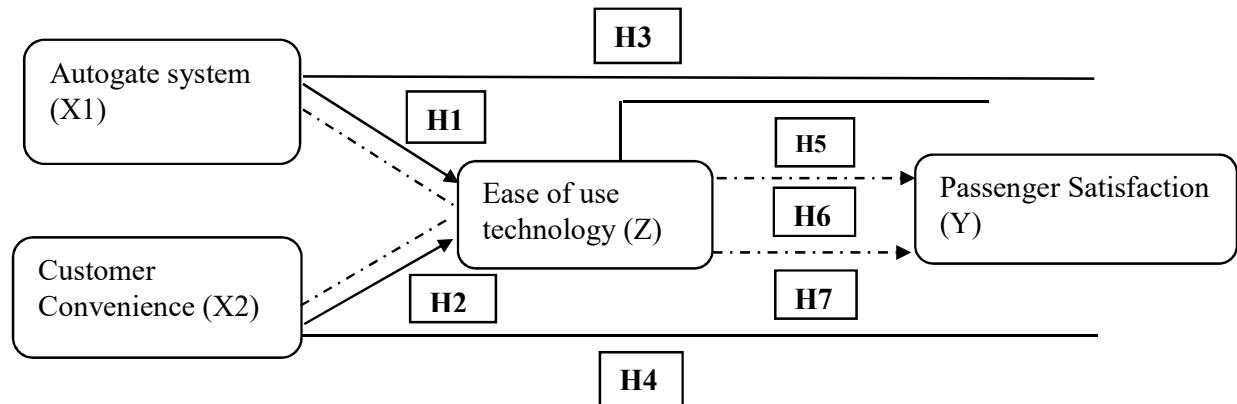
Variable	Operational definition	Operational Dimension	Source
AI based Autogate system	The system automatically identifies and verifies passengers' identities using facial recognition technology, fingerprints and other biometric data.	1. Service system 2. Input optimization 3. Processing time 4. Monitoring system	Hakim (2019), Jamil, Wahyono, and Kusuma (2023)
Customer Convenience	The ease, simplicity, and efficiency with which customers can access products, services, or information to fulfill their needs or preferences.	1. Decision 2. Access 3. Benefit	Ameen et al. (2021), Berry, Seiders, and Grewal (2002)
Passenger Satisfaction	The results felt by passenger expectations for the product match reality, including quality of service, overall travel experience, and meeting or exceeding expectations.	1. Customer experience 2. Customer Expectations 3. Fulfill Customer Needs 4. Satisfy Customers	Shah et al. (2020), Isa, Lubis, and Chaniago (2019)

Ease of Use of Technology

The extent to which a particular technology or system is considered easy to use, intuitive, and easy to operate by its users.

1. Speed
2. Useful
3. Effective
4. Improve performance

Chairina
(2021), Davis
(1989)



Conceptual Framework

Hypothesis

1. Hypothesis 1 (H1): The autogate system has a direct effect on the ease of use of technology

H1: Nursanto et al. (2024) showed in their research that Autogate's user-friendly design and accessibility features allow passengers to use the system independently and inclusively. Hua et al. (2015) determine that through the seamless and efficient functioning of autogate systems, passengers can move quickly and minimize the difficulties caused by completing the immigration clearance process. This positive user experience may help increase the adoption of technology and usage.

2. Hypothesis 2 (H2): Customer convenience has a direct influence on the ease of use of technology

H2: Putra and Arifin (2020) demonstrate that enhancing customer convenience improves the ease of use of border technology, highlighted by the intuitive design and suggestions for better system integration and accessibility in Indonesia's immigration control. Similarly Collier and Kimes (2013) noted that the convenience is highlighted as a key factor that influences various aspects of using self-service technologies, such as speed of transaction, accuracy of orders, exploration intentions, and making the technology more user-friendly.

3. Hypothesis 3 (H3): The use of autogate system has a direct effect on passenger satisfaction

H4: Bakır et al. (2022) said there systems streamline the boarding process, reduce waiting times, enhance security, and improve overall efficiency at airports. By

automating the boarding process, passengers can experience quicker and smoother transitions, leading to increased satisfaction levels. Halpern (2021) shown these systems not only improve operational efficiency but also contribute to a more seamless and convenient travel experience for passengers.

4. Hypothesis 4 (H4): Customer convenience has a direct effect on passenger satisfaction.

H5: Usman et al. (2023) states that in the context of airport services, factors such as Convenience, processing time, convenience, and overall ease of use contribute significantly to passenger satisfaction. Research by Saut (2022) shown that passenger satisfaction is closely linked to the convenience and efficiency of services provided at airports . Therefore, ensuring customer convenience can enhance passenger satisfaction levels, leading to a more positive overall experience for travelers.

5. Hypothesis 5 (H5): Ease of use of technology has a direct impact on passenger satisfaction.

H3: Nursanto et al. (2024) concludes that the user-friendliness of Autogate technology greatly improves passenger satisfaction by streamlining the immigration process, minimizing stress, and providing strong security measures. Studies by Shiwakoti et al. (2022) indicated a significant connection between passengers' points of view on technology used in the aviation sector and their level of satisfaction overall. When passengers find digital technologies easy to use, convenient, and efficient, it enhances their overall experience and satisfaction with the airline services

6. Hypothesis 6 (H6): The AI autogate system and ease of use technology have an indirect effect on passenger satisfaction.

H6: Chen and Liu (2021) emphasizes that use of AI Autogate systems and the ease of technology in immigration checks have been shown to have a positive impact on passenger satisfaction. Research has indicated that perceived ease of use and perceived usefulness of technology play a significant role in passengers' decision to continue using automated border control systems like E-Gates. Furthermore, as defined by Chang et al. (2013) the importance of emphasizing the benefits that passengers can obtain from using such systems, such as convenience and efficiency in immigration clearance services, to increase passenger satisfaction and encourage continued use .

7. Hypothesis 7 (H7): The interaction between customer convenience and ease of use of technology has an indirect effect on passenger satisfaction.

H4: Denita et al., n.d. (2018) indicates that passenger satisfaction is positively impacted by the connection between biometric technology's simplicity of use and consumer convenience during immigration inspections, as long as these technologies are installed strategically and made readily visible. Chunchang Xie, Jin, and Guo (2022) demonstrated that the usage of self-service technologies, like luggage drop and check-in kiosks, greatly improves passenger happiness by offering more practicality and usability. These innovations make travel more enjoyable by reducing wait times and streamlining procedures. Passengers are more likely to employ these technologies because they are easy to use, which indirectly increases their level of satisfaction with the service overall.

3. RESEARCH METHODS

3.1 Research Design

In this study, researchers used a quantitative approach strategy. By using quantitative methods, researchers can answer research problems in measuring passenger satisfaction with the implementation of Autogate System at Terminal 3 of Soekarno Hatta airport.

3.2 Population and Sample

The data collection technique that the author uses is a population of 215 people based on economy seat data on Garuda Indonesia's Airbus 1330-300 aircraft and a sample of 70 people (using the Slovin formula) Garuda Indonesia passengers who have used the AI-based autogate system at Terminal 3 of Soekarno Hatta Airport.

3.3 Data Analysis Tools

In this study, the authors analyzed the data using Structural Equation Modelling (SEM) – SmartPLS 4 software in managing the results of the survey to conclude the results of the study

4. RESULT AND DISCUSSION

4.1 Validity Test Result

Table 1 Validitas Konvergen

	Code	Outer Loading	VIF
Autogate System	AS1	0.867	3.067
	AS2	0.879	3.360
	AS3	0.797	2.236
	AS4	0.864	3.255
	AS5	0.866	3.179
Customer Convenience	CC1	0.856	2.318
	CC2	0.903	3.319
	CC3	0.842	2.543
	CC4	0.777	1.544
Ease Of Use	EOU1	0.873	2.631
	EOU2	0.890	2.890
	EOU3	0.894	2.797
	EOU4	0.836	2.204
Passenger Satisfaction	PS1	0.862	2.760
	PS2	0.856	2.954
	PS3	0.858	2.702
	PS4	0.880	3.495
	PS5	0.903	4.058

Source : Sem PLS (v.4.1.0.6)

The assessment of the outer model involves examining convergent validity, Average Variance Extracted (AVE), discriminant validity, composite reliability (CR), and collinearity (Hair and Alamer 2022). Consequently, all indicators demonstrate outer loading values greater than 0.70 and VIF values below 5. Convergent validity is tested

by examining the loading factor of each indicator. This suggests that the indicator effectively measures the relevant latent variables. In this study, all indicators have met this criterion, signifying good convergent validity.

Table 2 Discriminant Validity- Heterotrait- Monotrait Ratio of Correlations (HTMT)

	AS	CC	EOU	PS
Autogate System				
Customer Convenience	0.507			
Ease Of Use	0.778	0.587		
Passenger Satisfaction	0.680	0.581	0.726	

Source : Sem PLS (v.4.1.0.6)

Meanwhile, the reflective construct has the strongest link with its own indicators, with a correlation value of less than 0.9, according to discriminant validity results using the Heterotrait- Monotrait Ratio of Correlations (HTMT) (Henseler et al., 2015).

Table 3 Cross Loading

	AS	CC	EOU	PS
AS1	0.867	0.402	0.537	0.544
AS2	0.879	0.386	0.587	0.556
AS3	0.797	0.354	0.537	0.435
AS4	0.864	0.438	0.654	0.588
AS5	0.866	0.343	0.695	0.539
CC1	0.451	0.856	0.409	0.429
CC2	0.372	0.903	0.479	0.447
CC3	0.327	0.842	0.395	0.403
CC4	0.369	0.777	0.483	0.475
EOU1	0.656	0.397	0.873	0.514
EOU2	0.641	0.513	0.890	0.601
EOU3	0.646	0.551	0.894	0.621
EOU4	0.526	0.360	0.836	0.569
PS1	0.464	0.509	0.612	0.862
PS2	0.502	0.492	0.545	0.856
PS3	0.562	0.377	0.559	0.858
PS4	0.602	0.426	0.581	0.880
PS5	0.597	0.471	0.584	0.903

Source : Sem PLS (v.4.1.0.6)

Based on table 3, it can be seen that the cross loading value for each indicator already has a value that is greater than the other construct variable indicators. An indicator exhibits satisfactory discriminant validity when its cross-loading value exceeds 0.7 and is the highest among latent variables it measures, as compared to others. This research indicates that each observable variable demonstrates robust discriminant validity

4.2 Realibility Test Result

Table 4 Realibility Result

	Cronbach's alpha	Composite reliability (rho_a)	Composite reliability (rho_c)	Average variance extracted (AVE)
AS	0.908	0.913	0.931	0.731
CC	0.866	0.869	0.909	0.715
EOU	0.896	0.901	0.928	0.763
PS	0.921	0.922	0.941	0.760

Source : Sem PLS (v.4)

To assess reliability, values for Cronbach's alpha and Composite reliability are employed. Reliability is deemed satisfactory when the Composite reliability value exceeds 0.7 and the Cronbach alpha value is greater than 0.6 (Ursachi et al., 2015). The findings revealed that all variables in the research met these criteria, indicating a high level of reliability.

4.3 Inner Model Result

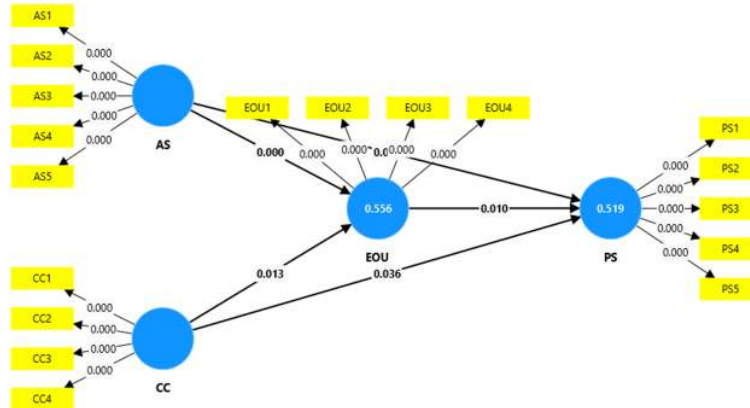


Figure 1 Model Structural

Source : Sem PLS (v.4.1.0.6)

Table 5 R-square table

	R-square
Ease Of Use	0.556
Passenger Satisfication	0.519

Source : Sem PLS (v.4.1.0.6)

In this study, after the outer model test, an inner model or structural model test was carried out using SmartPLS to assess the relationship between constructs, significance, and R-square values. Table 5 shows the magnitude of the influence of the Autogate System and Customer Convenience on Ease of Use of 0.556 (55.6%) according to Hair and Alamer (2022) included in moderate, while 44.4% is explained by another variable, namely Passenger Satisfaction. Then the magnitude of the influence of the Autogate System, Customer Convenience, Ease of Use on Passenger Satisfaction is 0.519 (51.9%) according to Hair and Alamer (2022) which is included in moderate.

Table 6 F-square table

	EOU	PS
Autogate System	0.629	0.082
Customer Convenience	0.122	0.065
Ease Of Use		0.112
Passenger Satisfaction		

Source : Sem PLS (v.4.1.0.6)

The F-Square (F^2) value expresses each relationship's effect size between the constructs. The criteria for the F^2 assessment are as follows: weak (0.02-0.14), moderate (0.15-0.34), and strong (> 0.35) (Hair et al., 2022). As a result, Autogate System has a strong influence on Ease Of Use (0.629) and has a weak influence on Passenger Satisfaction (0.082). Meanwhile, Customer Convenience has a moderate influence on Ease Of Use (0.122) and has a weak influence on Passenger Satisfaction (0.065). Finally, Ease Of Use has an influence on the structural level Passenger Satisfaction is towards moderate (0.112).

4.4 Hypothesis Result.

Table 7 Direct and Indirect Hypothesis Result

	Original sample (O)	Sample mean (M)	Standard deviation (STDEV)	T statistics (O/STDEV)	P values
Autogate System -> Ease Of Use	0.592	0.573	0.114	5.211	0.000
Autogate System -> Passenger Satisfaction	0.284	0.298	0.132	2.152	0.031
Customer Convenience -> Ease Of Use	0.260	0.269	0.105	2.487	0.013
Customer Convenience -> Passenger Satisfaction	0.210	0.223	0.100	2.102	0.036
Ease Of Use -> Passenger Satisfaction	0.349	0.356	0.135	2.592	0.010
Autogate System -> Ease Of Use -> Passenger Satisfaction	0.207	0.204	0.090	2.305	0.021
Customer Convenience -> Ease Of Use -> Passenger Satisfaction	0.091	0.098	0.058	1.559	0.119

Source : Sem PLS (v.4.1.0.6)

Based on the table, it can be determined that the Autogate system with Original Sample = 0.592, T-statistics = 5.211 and P-values = 0.000 < 0.05 , then Customer Convenience Original Sample = 0.260, T-statistics = 2.487 and P-values = 0.013 < 0.05 has a direct positive and significant effect on Ease Of Use. Furthermore, Autogate System with Original Sample = 0.284, T-statistic = 2.152 and P-values = 0.031 < 0.05 , Customer Convenience Original Sample = 0.210, T-statistic = 2.102 and P-values = 0.036 < 0.05 , and Ease of Use Original Sample = 0.349, T-statistic = 2.592 and P-values = 0.010 < 0.05 have a positive and significant direct effect on Passenger Satisfaction. While the Autogate System and Ease of Use of Technology have a significant indirect effect on Passenger Satisfaction. with Original Sample value = 0.207, T-statistic = 2.305 and P-values = 0.021 < 0.05 . Finally, the interaction between Customer Convenience and Ease of Use does not have a significant indirect

effect on Passenger Satisfaction with Original Sample value = 0.091, T-statistics = 0.091 and P-values = 0.119 < 0.05.

4.5 Discussion

H1: Autogate System and Ease of Use of Technology

The results indicate a strong positive relationship between the Autogate System and ease of use ($t = 5.211$, $p < 0.001$). This supports the hypothesis that the Autogate System significantly contributes to enhancing the ease of use for passengers. The high t-value and extremely low p-value provide robust evidence for this relationship.

H2: Autogate System and Passenger Satisfaction

The results reveals a significant positive relationship between the Autogate System and passenger satisfaction ($t = 2.152$, $p = 0.031$). While the effect size is moderate, the statistical significance suggests that the Autogate System positively impacts passenger satisfaction. This finding is crucial for understanding the overall user experience.

H3: Customer Convenience and Ease of Use of Technology

The results demonstrate a significant positive relationship between customer convenience and ease of use ($t = 2.487$, $p = 0.013$). This indicates that increasing customer convenience directly contributes to improving the ease of using the Autogate System. The moderate effect size highlights the importance of focusing on customer convenience in system design.

H4: Customer Convenience and Passenger Satisfaction

There is a significant positive relationship between customer convenience and passenger satisfaction ($t = 2.102$, $p = 0.036$). This finding supports the notion that enhancing customer convenience leads to increased passenger satisfaction. While the effect size is moderate, the statistical significance underscores the importance of considering customer convenience in improving overall passenger experience.

H5: Ease of Use of Technology and Passenger Satisfaction

The results indicate a significant positive relationship between ease of use and passenger satisfaction ($t = 2.592$, $p = 0.010$). This confirms the expectation that a user-friendly system leads to higher levels of passenger satisfaction. The moderate effect size emphasizes the importance of prioritizing ease of use in Autogate System development.

H6: Autogate System, Ease of Use of Technology, and Passenger Satisfaction

The indirect effect of the Autogate System on passenger satisfaction through ease of use is significant ($t = 2.305$, $p = 0.021$). This finding suggests that the Autogate System indirectly influences passenger satisfaction by enhancing ease of use. While the effect size is moderate, it provides additional evidence for the importance of both the Autogate System and ease of use in determining passenger satisfaction.

H7: Customer Convenience, Ease of Use of Technology, and Passenger Satisfaction

The indirect effect of customer convenience on passenger satisfaction through ease of use is not significant ($t = 1.559$, $p = 0.119$). This result indicates that while customer convenience positively influences ease of use, its indirect impact on passenger satisfaction is not as pronounced as the direct effect of customer convenience on satisfaction.

5. CONCLUSION

The findings of this study reveal that the Autogate System significantly impacts both the ease of use and passenger satisfaction. Specifically, the efficient implementation of the Autogate System enhances the overall user experience, leading to higher satisfaction levels among passengers. Similarly, customer convenience plays a critical role, directly affecting both ease of use and passenger satisfaction, underscoring the importance of user-friendly and accessible systems. Moreover, ease of use itself has a substantial positive effect on passenger satisfaction, highlighting the necessity for intuitive technology in improving the passenger experience. These direct relationships emphasize the importance of both technological efficiency and customer-centric design in enhancing passenger satisfaction.

In contrast, the indirect effects present a more nuanced picture. While the Autogate System indirectly influences passenger satisfaction through ease of use, thereby confirming its mediating role, the indirect effect of customer convenience on passenger satisfaction via ease of use is not significant. This indicates that, although customer convenience directly impacts ease of use and satisfaction, it does not significantly affect satisfaction when mediated through ease of use. These results suggest that ongoing improvements in the Autogate System and maintaining high levels of customer convenience are essential for directly increasing passenger satisfaction. However, enhancing ease of use alone may not be sufficient to mediate the impact of customer convenience on satisfaction. These insights provide valuable implications for airport authorities and technology providers aiming to optimize passenger experiences and satisfaction through targeted technology and service enhancements.

6. IMPLICATIONS

The implications of this study are significant for airport authorities and technology providers, emphasizing the need to prioritize technology efficiency and customer convenience to enhance passenger satisfaction. The direct effects of Autogate Systems on ease of use and passenger satisfaction suggest that investing in efficient and user-friendly technology can substantially improve the passenger experience. Likewise, ensuring high levels of customer convenience is critical, as it directly impacts satisfaction. However, the lack of significant indirect effects suggests that simply improving ease of use may not be sufficient to mediate the impact of customer convenience on passenger satisfaction. Therefore, a comprehensive approach that simultaneously addresses technological advancements and customer-centric service enhancements is critical to achieving optimal passenger satisfaction and operational efficiency at airports.

7. RESEARCH LIMITATION

This study has several limitations. The data collection technique involved a relatively small sample size of 70 Garuda Indonesia passengers, drawn from a population of 215 economy class passengers on an Airbus A330-300. This limited sample size may not fully capture the diversity of passenger experiences and preferences, potentially affecting the generalizability of the findings. Furthermore, this study only focused on passengers who had used the AI-based autogate system at Terminal 3 of Soekarno Hatta Airport, which may limit the applicability of the results to other contexts or airports with different systems and infrastructure. Future research should consider larger and more diverse samples, include longitudinal studies, and explore additional factors that may influence passenger satisfaction, such as cultural differences, individual preferences, and external environmental variables.

REFERENCES

- Alam, Kabir, and Sumi. 2023. "Artificial Intelligence (AI) and Future Immigration and Border Control." *International Journal For Multidisciplinary Research* 5 (5): 8253. <https://doi.org/10.36948/ijfmr.2023.v05i05.8253>.
- Ameen, Nisreen, Ali Tarhini, Alexander Reppel, and Amitabh Anand. 2021. "Customer Experiences in the Age of Artificial Intelligence." *Computers in Human Behavior* 114:106548. <https://doi.org/10.1016/j.chb.2020.106548>.
- Antonovica, Arta. 2022. "Application and Extension of the UTAUT2 Model for Determining Behavioral Intention Factors in Use of the Artificial Intelligence Virtual Assistants." *Frontiers in Psychology* 13:993935. <https://doi.org/10.3389/fpsyg.2022.993935>.
- Bacinskas, Justas, Viktor Kempers, and Sambit Lenka. 2020. "Effects of New Technologies on Customer Satisfaction." *Master Thesis in General Management* 6 (1): 1–65.
- Bakır, Mahmut, Şahap Akan, Emircan Özdemir, Phi-Hung Nguyen, Jung-Fa Tsai, and Hong-Anh Pham. 2022. "How to Achieve Passenger Satisfaction in the Airport? Findings from Regression Analysis and Necessary Condition Analysis Approaches through Online Airport Reviews." *Sustainability* 14 (4): 2151. <https://doi.org/10.3390/su14042151>.
- Berry, Leonard L., Kathleen Seiders, and Dhruv Grewal. 2002. "Understanding Service Convenience." *Journal of Marketing* 66 (3): 1–17. <https://doi.org/10.1509/jmkg.66.3.1.18505>.
- Chahal, Hardeep, and Madhu Bala. 2012. "Significant Components of Service Brand Equity in Healthcare Sector." *International Journal of Health Care Quality Assurance* 25 (4): 343–62. <https://doi.org/10.1108/09526861211221518>.
- Chairina, Raden Roro Lia. 2021. "The Effect of Perceived Usefulness and Perceived Ease of Use on Perceived Value and Actual Usage of Technology on the Online Service of Pt. Garuda Indonesia Tbk." *Journal of Research in Business and Management* Volume 9 (4): 59–65.
- Chang, Chi-Cheng, Kuo-Hung Tseng, Chaoyun Liang, and Fang Yan. 2013. "The Influence of Perceived Convenience and Curiosity on Continuance Intention in Mobile English

- Learning for High School Students Using PDAs.” *Technology, Pedagogy and Education* 22 (3): 373–86. <https://doi.org/10.1080/1475939X.2013.802991>.
- Chen, Fang Yuan, and Chang Yu Liu. 2021. “Air Passengers’ Continued Use Intention of the Airport E-Gate System: A Perspective with Perceived Benefits.” *International Journal of Business and Management* 16 (1). <https://doi.org/10.5539/ijbm.v16n1p100>.
- Collier, Joel E., and Sheryl E. Kimes. 2013. “Only If It Is Convenient: Understanding How Convenience Influences Self-Service Technology Evaluation.” *Journal of Service Research* 16 (1): 39–51. <https://doi.org/10.1177/1094670512458454>.
- Davis, Fred D. 1989. “Perceived Usefulness, Perceived Ease of Use, and User Acceptance of Information Technology.” *MIS Quarterly* 13 (3): 319. <https://doi.org/10.2307/249008>.
- Denita, Suri Dwi, Handini Salsabila, Reni Dian Octaviani, Salahudin Rafi, and Primadi Chandra. 2018. “Biometric Technology System in Autogate Soekarno-Hatta International Airport for Fast and Seamless Travel.” *Advances in Transportation and Logistics Research* 1:851–62.
- Hair, Joseph, and Abdullah Alamer. 2022. “Partial Least Squares Structural Equation Modeling (PLS-SEM) in Second Language and Education Research: Guidelines Using an Applied Example.” *Research Methods in Applied Linguistics* 1 (3): 2–16. <https://doi.org/10.1016/j.rmal.2022.100027>.
- Hakim, Ary Rezqy. 2019. “Artificial Intelligence Based Autogate System Development Concept in Immigration Examination for Indonesian Citizens at Immigration Examination in Soekarno-Hatta International Airport.” *TEMATICS: Technology Management and Informatics Research Journals* 1 (1): 69–80. <https://doi.org/10.52617/tematics.v1i1.74>.
- Halpern, Nigel. 2021. “Airport Service Quality and Passenger Satisfaction: The Impact of Service Failure on the Likelihood of Promoting an Airport Online.” *Research in Transportation Business & Management* 41 (2021) 100667 41:100667. <https://doi.org/10.1016/j.rtbm.2021.100667>.
- Hanantyo, Burhanuddin, and Tony Dwi Susanto. 2022. “Kajian Potensi Penerapan Teknologi Smart Airport di Bandara Internasional Soekarno-Hatta Jakarta Indonesia.” *Accounting Information Systems and Information Technology Business Enterprise* 7 (1): 61–75. <https://doi.org/10.34010/aisthebest.v7i1.7123>.
- Hasni, Muhammad Junaid Shahid, Maya F Farah, and Ifraaz Adeel. 2021. “The Technology Acceptance Model Revisited: Empirical Evidence from the Tourism Industry in Pakistan.” *Journal of Tourism Futures*. <https://doi.org/10.1108/JTF-09-2021-0220>.
- Hendarto, Alexander Ryan, and Indah Werdiningsih. 2024. “Evaluation and User Interface Design Improvement Recommendations of the Immigration Service Application Using Design Thinking.” *Journal of Mathematics and Its Applications* 18 (1): 0001–0018. <https://doi.org/10.30598/barekengvol18iss1pp0001-0018>.
- Henseler, Jörg, Christian M. Ringle, and Marko Sarstedt. 2015. “A New Criterion for Assessing Discriminant Validity in Variance-Based Structural Equation Modeling.” *Journal of the*

- Academy of Marketing Science* 43 (1): 115–35. <https://doi.org/10.1007/s11747-014-0403-8>.
- Hua, Yang, Lu, and Department of Air Transportation, Kainan University, Taoyuan, Taiwan. 2015. “Which Factors Affect Passengers’ Intention to Use the Automated Immigration Clearance System (e-Gate)?” *Journal of Tourism and Recreation* 2 (1): 1–22. <https://doi.org/10.12735/jotr.v2i1p01>.
- Iancu, Ioana, and Bogdan Bogdan. 2023. “Interacting with Chatbots Later in Life: A Technology Acceptance Perspective in COVID-19 Pandemic Situation.” *Frontiers in Psychology* 13 (1): 1–19. <https://doi.org/10.3389/fpsyg.2022.1111003>.
- Isa, Muhammad, H. Aswadi Lubis, and Marlina Chaniago. 2019. “Pengaruh Kualitas Pelayanan Terhadap Kepuasan Penumpang Menggunakan Jasa Angkutan Penyeberangan PT. ASDP Indonesia Ferry (Persero) Cabang Sibolga.” *Jesya (Jurnal Ekonomi & Ekonomi Syariah)* 2 (2): 164–81. <https://doi.org/10.36778/jesya.v2i2.90>.
- Jamil, M Shohibul, Dirgo Wahyono, and Rifo Desga Kusuma. 2023. “Pengaruh Penerapan Auto Gate System, Kinerja Bongkar Muat dan Lapangan Penumpukan terhadap Efektivitas Pengiriman Barang di Terminal Peti Kemas Tanjung Emas Semarang.” *E-logis: Jurnal Ekonomi Logistik* 6 (1): 119–38.
- Keskin, Basak, and Baris Salman. 2020. “Building Information Modeling Implementation Framework for Smart Airport Life Cycle Management.” *Transportation Research Record: Journal of the Transportation Research Board* 2674 (6): 98–112. <https://doi.org/10.1177/0361198120917971>.
- Khairunnisa, Lailan, and Bambang Mursito. 2021. “Kepuasan pelanggan ditinjau dari kenyamanan, keamanan dan ketepatan waktu.” *Jurnal Ekonomi, Manajemen dan Akuntansi* 23 (2): 194–98.
- Kotler, P., & Keller, K. 2016. *Marketing Management*. Harlow, England: Pearson Education.
- Li, Linbo, Tianshuang Gao, Ling Yu, and Yahua Zhang. 2022. “Applying an Integrated Approach to Metro Station Satisfaction Evaluation: A Case Study in Shanghai, China.” *International Journal of Transportation Science and Technology* 11 (4): 780–89. <https://doi.org/10.1016/j.ijtst.2021.10.004>.
- Liyana Yaacob, Nur, Ammar Ahmed Alkahtani, Fuad M. Noman, Ahmad Wafi Mahmood Zuhdi, and Dhuha Habeeb. 2021. “License Plate Recognition for Campus Auto-Gate System.” *Indonesian Journal of Electrical Engineering and Computer Science* 21 (1): 128. <https://doi.org/10.11591/ijeecs.v21.i1.pp128-136>.
- Mariani, Marcello M. 2022. “Artificial Intelligence in Innovation Research: A Systematic Review, Conceptual Framework, and Future Research Directions.” *Technovation* 122. <https://doi.org/10.1016/j.technovation.2022.102623>.
- Masudin, Ilyas, Nika Tampi Safitri, Dian Palupi Restuputri, Rahmad Wisnu Wardana, and Ikhlusal Amallynda. 2020. “The Effect of Humanitarian Logistics Service Quality to Customer Loyalty Using Kansei Engineering: Evidence from Indonesian Logistics Service Providers.”

- Miskolczi, Márk, Melinda Jászberényi, and Dávid Tóth. 2021. "Technology-Enhanced Airport Services—Attractiveness from the Travelers' Perspective." *Sustainability* 13 (2): 705. <https://doi.org/10.3390/su13020705>.
- Nursanto, Gunawan Ari, Isidorus Anung Prabadhi, Besse Hartati, Wilonotmo Wilonotmo, and Nurul Maharani Piranti. 2024. "Enhancing Public Wellbeing Through Autogate at Soekarno-Hatta International Airports." *Return : Study of Management, Economic and Bussines* 3 (2): 149–57. <https://doi.org/10.57096/return.v3i2.214>.
- Oktarini. 2019. "Pengaruh Kualitas Pelayanan dan Harga terhadap Kepuasan Pelanggan Pengguna Jasa Aplikasi Gojek di Kota Tangerang." *Jurnal Ilmiah Ilmu Sekretariat/Administrasi Perkantoran* 6 (2): 249–57.
- Park, Hye-Yoon. 2020. "A Study on the Customer Attitudes toward the Airport IT Service: Focusing on Handling Process and Acceptance Intention." *Journal of Distribution Science* 18 (1): 27–34.
- Putra, Bagas Hidayat, and Ridwan Arifin. 2020. "The Adoption of Border Technology of Immigration Control and Autogates in Indonesia." *Science and Information Technology Journal* 2 (2): 137–48. <https://doi.org/10.31598>.
- Rosli, Mohd Shafie, Nor Shela Saleh, Azlah Md. Ali, Suaibah Abu Bakar, and Lokman Mohd Tahir. 2022. "A Systematic Review of the Technology Acceptance Model for the Sustainability of Higher Education during the COVID-19 Pandemic and Identified Research Gaps." *Sustainability* 14 (18): 11389. <https://doi.org/10.3390/su141811389>.
- Santoso, Samuel Budi. 2020. "Implementasi Sistem Autogate Terhadap Jumlah Perlintasan Warga Negara Indonesia Pada TPI Soekarno Hatta." *Technology Management and Informatics Research Journals* 4 (2): 45–52. <https://doi.org/10.52617/tematics.v2i2.102>.
- Saut, Moeun. 2022. "Influences of Airport Service Quality, Satisfaction, and Image on Behavioral Intention towards Desti." *URBAN, PLANNING AND TRANSPORT RESEARCH* 10 (1): 82–109. <https://doi.org/10.1080/21650020.2022.2054857>.
- Seiders, Kathleen, Glenn B. Voss, Andrea L. Godfrey, and Dhruv Grewal. 2007. "SERVCON: Development and Validation of a Multidimensional Service Convenience Scale." *Journal of the Academy of Marketing Science* 35 (1): 144–56. <https://doi.org/10.1007/s11747-006-0001-5>.
- Shah, Faisal Tehseen, Zaineb Syed, Abeer Imam, and Aiman Raza. 2020. "The Impact of Airline Service Quality on Passengers' Behavioral Intentions Using Passenger Satisfaction as a Mediator." *Journal of Air Transport Management* 85:101815. <https://doi.org/10.1016/j.jairtraman.2020.101815>.
- Shiwakoti, Nirajan, Qiming Hu, Ming Kin Pang, Tsz Mei Cheung, Zhengkai Xu, and Hongwei Jiang. 2022. "Passengers' Perceptions and Satisfaction with Digital Technology Adopted by Airlines during COVID-19 Pandemic." *Future Transportation* 2 (4): 988–1009. <https://doi.org/10.3390/futuretransp2040055>.
- Ursachi, George, Ioana Alexandra Horodnic, and Adriana Zait. 2015. "How Reliable Are Measurement Scales? External Factors with Indirect Influence on Reliability Estimators."

Procedia Economics and Finance 20:679–86. [https://doi.org/10.1016/S2212-5671\(15\)00123-9](https://doi.org/10.1016/S2212-5671(15)00123-9).

Usman, Agus, Yudi Azis, Budi Harsanto, and Anton Mulyono Azis. 2023. “The Impact of Service Orientation and Airport Service Quality on Passenger Satisfaction and Image: Evidence from Indonesia.” *Logistics* 7 (4): 102. <https://doi.org/10.3390/logistics7040102>.

Xie, Chaowu, Jiangchi Zhang, Yanying Chen, Alastair M Morrison, and Zhibin Lin. 2020. “Measuring Hotel Employee Perceived Job Risk: Dimensions and Scale Development.” *International Journal of Contemporary Hospitality Management* 32 (2): 730–48. <http://dx.doi.org/10.1108/IJCHM-01-2019-0022>.

Xie, Chunghang, Junxi Jin, and Xiaoling Guo. 2022. “Impact of the Critical Factors of Customer Experience on Well-Being: Joy and Customer Satisfaction as Mediators.” *Frontiers in Psychology* 13:955130. <https://doi.org/10.3389/fpsyg.2022.955130>.

Yang, Wan, Anil Bilgihan, and Milos Bujisic. 2013. “Airport Service Quality Drivers of Passenger Satisfaction.” *Tourism Review* 68 (4): 3–18. [https://doi.org/DOI 10.1108/TR-09-2013-0047](https://doi.org/DOI%2010.1108/TR-09-2013-0047).

Zhang, Yahua. 2020. “A Review of Air Transport Service Quality Studies: Current Status and Future Research Agenda.” *Journal of Air Transport Research* 1 (1). <https://dx.doi.org/10.59521/EF52BB6324BD7035>.