BIOMETRIC SECURITY ADOPTION IN KOREAN AVIATION: INSIGHTS FROM INNOVATION DIFFUSION THEORY

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Abstract

Purpose – This study investigates the decision-making process behind the adoption of biometric security technology (BST) in Korea's aviation sector. By extending innovation diffusion theory (IDT) with perceived security, the study examines how innovation attributes and security perceptions influence experiential value, trust, and reuse intention.
Methodology/Design/Approach – An online survey was conducted with 338 BST users at Korean airports. Using SmartPLS 4.0, the study tested the structural relationships among relative advantage, compatibility, trialability, perceived security, experiential value, trust, and reuse intention.
Findings – Relative advantage, compatibility, trialability, and perceived security positively affected experiential value, while relative advantage, compatibility, and perceived security positively influenced trust. Trialability did not significantly affect trust. Experiential value and trust both enhanced reuse intention. Mediation analysis revealed that experiential value fully mediated the effect of relative advantage and partially mediated the effects of compatibility, trialability, and perceived security on reuse intention.
Originality of the research – This study expands IDT by integrating perceived security to better explain BST adoption in aviation. It contributes theoretically by clarifying how innovation attributes and security shape user value, trust, and reuse intention, and provides practical insights for enhancing biometric-based airport services.
Keywords airport, Korea, biometrics security technology, innovation diffusion theory, perceived security

Original research paper
Received December 2025
Revised 2 December 2025
31 March 2026
30 May 2026
25 August 2026
Accepted 30 August 2026
https://doi.org/10.20867/thm.33.2.3

INTRODUCTION

Biometric Security Technology (BST) is utilized across various sectors, including finance, information and communication, healthcare, social welfare, administration, access control, and immigration inspection (Minaee et al., 2023). BST is a type of automation that identifies individual differences using digital computers (Wayman et al., 2005). Recent advances in biometric technologies have expanded their role beyond conventional authentication systems to digital identity management and seamless passenger processing in smart airports. As airports increasingly adopt biometric systems to enhance operational efficiency and passenger convenience, trust in information protection and privacy has emerged as a critical determinant of technology acceptance (Kim et al., 2023). Furthermore, although biometric technologies such as fingerprints, iris recognition, facial recognition, retina scans, palm prints, finger veins, DNA, and voice recognition offer increased security and convenience, recent studies emphasize that challenges related to privacy protection, biometric template safeguarding, data governance, and digital trust continue to be significant barriers to their widespread implementation. (Jain et al., 2022; Melzi et al., 2024).

In 2018, Korean airports implemented and utilized BST to enhance immigration services (Korea Airports Corporation, 2018). Their objective was to address challenges such as prolonged wait times and service quality issues resulting from the substantial increase in air passenger volume. Airport biometric technologies enhance passengers' behavioral intentions by improving perceived security, convenience, and functional value, while also enabling more efficient passenger processing (Untaru et al., 2025).

Studies on BST are being conducted in both the industrial sector and academic institutions. Recent studies have focused on understanding travelers' acceptance of airport biometric systems by incorporating factors such as trust in information protection, technology familiarity, social influence, perceived security, perceived convenience, and functional value (Kim et al., 2023; Untaru et al., 2025). In addition, researchers have increasingly emphasized privacy-preserving biometric technologies and digital identity governance as essential prerequisites for sustainable deployment of biometric systems (Melzi et al., 2024).

However, most existing studies have focused primarily on technology acceptance, operational efficiency, privacy protection, and security enhancement in biometric systems, while paying relatively little attention to passengers' experiential value, trust formation, and post-adoption behavioral responses in airport environments. Including these dimensions in BST research is crucial, as they highlight the significant role of experiential value and trust in assessing factors such as continued usage and

satisfaction with emerging technologies, such as autonomous driving. (Yuen et al., 2020).

Innovation Diffusion Theory (IDT) can validate the process of adopting new products or utilizing emerging technologies. IDT is widely acknowledged as a practical framework for explaining how new products or concepts are adopted and disseminated throughout society, based on human beliefs and acceptance of innovative technologies. Consequently, IDT has been validated through its application to various cutting-edge technologies of the twenty-first century, such as autonomous driving, e-learning, and artificial intelligence, particularly in decisions about adopting innovative technologies. IDT posits that among its five variables, relative advantage, compatibility, and observability significantly influence the decision-making process for adopting new technologies, thereby underscoring their importance. Furthermore, because BST requires individuals to register their biometric information at airport immigration, users may develop either positive or negative perceptions of BST's security. Accordingly, IDT needs to be integrated to evaluate the substantial role of perceived security in BST adoption.

This study addresses a significant gap in existing research by comprehensively examining the user-centered decision-making process. This study's uniqueness lies in combining IDT with perceived security, conceptualizing innovation attributes → experiential value → trust → reuse intention, and applying this framework specifically to the Korean aviation context. Specifically, it aims to validate the structural relationships among security, experiential value, trust, and intention to reuse, while incorporating perceived security as an additional variable alongside the core IDT variables (relative advantage, compatibility, and observability). This study is expected to yield substantial academic and practical implications for BST by providing foundational insights that enhance user convenience and contribute effectively to aviation security.

1. LITERATURE REVIEW AND HYPOTHESIS DEVELOPMENT

1.1 Biometric security technology

BST uses human characteristics, including physiological and behavioral traits, to identify individuals. (Down & Sands, 2004). BST can be categorized into two types. The first type utilizes physical characteristics, including facial features, veins, fingerprints, iris patterns, DNA, and retinal patterns (Buciu & Gacsadi, 2016). The second type employs behavioral characteristics, such as signatures, voice, gait, and keystroke patterns (Buciu & Gacsadi, 2016). Jain et al. (2004) argue that the physiological or behavioral characteristics of the BST can be employed when the seven specific criteria, namely, universality, distinctiveness, permanence, collectability, performance, acceptability, and circumvention, are satisfied. Biometric technologies have expanded beyond conventional authentication systems and are increasingly applied to digital identity verification and AI-enabled facial recognition services. At the same time, their use has raised important concerns regarding trust, security, privacy, and fairness (Choung et al., 2024; Jain et al., 2022). As global air passenger traffic continues to increase, airports are increasingly adopting biometric technologies as part of self-service systems to improve operational efficiency, strengthen airport security, and enhance the passenger experience throughout the travel journey (Untaru et al., 2025).

In particular, following the terrorist attacks of September 11, efforts have concentrated on establishing pertinent institutions and emphasizing BST to enhance safety and personal identification. (Haas, 2019). BST is also employed at domestic airports in Korea, where it is expected to enhance operational efficiency and accuracy by enabling travelers to pass through a dedicated gate after their biometric data, such as palm or fingerprint, is authenticated. Currently, BST serves only domestic flights; however, its deployment is expected to expand to international flights in the future (Korea Airports Corporation, 2018). Hence, this research seeks to examine users' decision-making processes via BST, given its prominent role in airport immigration procedures.

1.2 Innovation diffusion theory

Innovation Diffusion Theory (IDT) has been extensively utilized to elucidate the adoption of innovative technologies across diverse contexts, including autonomous driving, artificial intelligence, and digital technologies (Yuen et al., 2020; Xu et al., 2024).

The IDT, developed by Rogers (2010), aims to elucidate how new behaviors or products disseminate throughout society through specific channels. Additionally, it explains individuals' decisions to accept or reject innovations based on their beliefs (Pinho et al., 2021; Yuen et al., 2021). IDT categorizes individuals into five groups based on their timing of adoption: innovators, early adopters, early majority, late majority, and laggards (Ho, 2022).

Rogers (2010) outlined the characteristics of innovation as relative advantage, compatibility, complexity, trialability, and observability (Poong et al., 2009). Relative advantage is defined as the extent to which an innovation is perceived as superior to what was previously available, and it is the most influential antecedent variable in innovation adoption (Lee et al., 2011). Compatibility refers to an individual's belief that an innovation aligns with their values, prior experiences, and current needs (Waheed et al., 2015). Complexity is the degree of difficulty users experience in comprehending and using technology or innovation. Trialability pertains to the extent to which it can be tested within a limited scope (Lee et al., 2011). Observability is the extent to which an innovation's outcomes are observable by others (Inman, 2000).

In prior IDT research, Yuen et al. (2021) used IDT to investigate the decision-making processes influencing public acceptance of autonomous driving. The study demonstrated that relative advantage, compatibility, trialability, and observability positively influence perceived value, whereas complexity negatively influences it. Furthermore, perceived value positively affects trust in autonomous driving and public acceptance. Shin et al. (2022) conducted a study grounded in trust transfer theory to examine the impact of relative advantage, compatibility, and trialability on attitudes, trust, and willingness to adopt self-bag drop kiosk services. Using IDT, the study found that relative advantage and trialability positively influence attitudes, trust in the service provider, and trust in the kiosk. Meanwhile, compatibility positively influenced attitudes and trust in the kiosk. Relative advantage, compatibility, and trialability were recognized as primary factors that significantly impact individuals' intentions to adopt the latest technology (Moore & Benbasat, 1991; Shin et al., 2022).

Based on the extant literature, this study excluded the constructs of complexity and observability given the specific operational context of airports. Complexity, defined as the perceived difficulty of use (Rogers, 2010), was deemed less relevant because BST is designed as a highly intuitive, guided process aimed at seamless passenger flow, thereby minimizing variance in users' perceived difficulty. Similarly, observability, the degree to which the results of an innovation (Rogers, 2010) are visible to others, was excluded because the biometric verification process occurs privately and instantaneously at specific touchpoints, making the direct observation of its functional benefits by other passengers limited during the immediate travel stages.

1.3 Perceived security

Perceived security is defined as the user's subjective feeling that their personal information will not be unlawfully tampered with (Flavián & Guinalíu, 2006). Peikari (2010) characterized perceived security within a technical context as the extent to which users believe that a particular technology or service is secure. Hartono et al. (2014) emphasized that robust security systems can enhance protection against the exposure of personal information.

In studies concerning perceived security, Kim et al. (2023) showed that trust in information protection was a major determinant of travelers' intention to use BST, suggesting that users' perceptions of security play a crucial role in BST acceptance. According to Sarkar and Singh (2020), BST is not easily vulnerable to theft or hacking because it relies on distinctive individual characteristics. To examine users' perceived security aspects related to BST, this study incorporates the additional variable of IDT. Therefore, this study examines perceived security alongside the three core variables (relative advantage, compatibility, and trialability) among the five IDT variables that significantly influence the adoption of new technologies. The study also investigates their impact on experiential value and trust.

1.4 Experiential value

Values influence human consumption behavior and significantly impact the use of functional, social, emotional, and cognitive knowledge (Mathwick et al., 2001). Values have long attracted significant attention across disciplines for their important role in human life and behavior (Sweeney & Soutar, 2001). Zeithaml (1988) defined value as an evaluation of a product's or service's utility, encompassing elements such as cost, satisfaction, usability, and comparability. Mathwick et al. (2001) argued that value is perceived exclusively through the relationship between quality and price; consequently, they emphasized experiential value and developed the experiential value scale. Experiential value has garnered increasing scholarly interest in tourism and digital service research because it plays a significant role in assessing users' experiences across online and offline service contexts. (Maubisson & Rivière, 2023). Numerous studies emphasize the significance of experiential value in the adoption and dissemination of new technologies (Kim et al., 2021; Mathwick et al., 2001; Park et al., 2013). Park et al. (2013) examined the correlation between consumer experiential value and brand loyalty, including repurchase and word-of-mouth intentions, in the context of consuming innovative technology products. As a result, consumer experiential value (encompassing aesthetics, fun, usefulness, and economic value) positively impacts brand loyalty. In light of the current discussion, this study examines the relationship between BST's experiential value and the intention to reuse it, drawing on prior research on experiential value in the adoption of new technologies (Kim et al., 2021; Park et al., 2013).

1.5 Trust

Cook and Wall (1980) characterized trust as the extent to which an individual accepts the veracity of statements and assertions. Trust is the confidence many individuals place in others' actions, grounded in prior interactions and the expectation that the other party will behave as anticipated (Gefen, 2000). A biometric system, in particular, must be highly accurate and robust to ensure reliability; efforts should establish strong trust in the system by demonstrating its dependability (Jain et al., 2022). Users will reuse the BST if they believe the provider's performance is high quality. If users have confidence in the BST's performance quality, they are likely to reuse the system. Trust is associated with customers' evaluations of a company's ability to manage and safeguard personal information in accordance with their expectations in uncertain contexts (Li, 2016). Trust in mobile payment systems positively influences reuse intentions. Therefore, this study will examine the relationship between users' trust in BST and their intentions to reuse (Narahdita et al., 2020).

1.5.1 Relationships among relative advantage, compatibility, trialability, and experiential value

Wang (2022) investigated the relationship between the innovation attributes of mobile payment and its value, based on Rogers' diffusion of innovation theory and customer value theory. They confirmed that relative advantage, compatibility, and trialability positively affect pragmatic value. Nel and Heyns (2017) verified that mobile payment offers a greater relative advantage by being faster than alternative payment methods. Customers want to complete tasks quickly (Hansen, 2005), and positive emotions, such as pleasure, may increase when customers save time and effort (Li et al., 2020). Building on previous research, this study seeks to confirm that the relative advantage, compatibility, and trialability of BST positively impact experiential value. Consequently, the following hypotheses were formulated.

H1a: *Relative advantage positively influences experiential value in BST.*
H1b: *Compatibility positively influences experiential value in BST.*
H1c: *Trialability positively influences experiential value in BST.*

1.5.2 Relationships among relative advantage, compatibility, trialability, and trust

Research regarding the association between IDT and trust remains limited. Most studies have used constructs such as perceived ease of use, perceived usefulness, and attitudes, derived from the Technology Acceptance Model, to examine customers' intentions to adopt new technologies (Davis et al., 1989). Agag and El-Masry (2016) confirmed that perceived usefulness in online travel communities positively influences trust. Perceived usefulness is conceptually akin to relative advantage and contextual relevance (Wang et al., 2011). Thus, the relative advantage of BST is expected to positively affect trust. El Naggar and Bendary (2017) affirmed that a perceived high degree of trialability in mobile services significantly impacts individuals' trust in service providers. Shin et al. (2022) confirmed that relative advantage, compatibility, and trialability positively influence passengers' perceived trust in airport self-bag drop kiosks. Hence, the following hypotheses were developed:

H2a: *Relative advantage positively influences trust in BST.*
H2b: *Compatibility positively influences trust in BST.*
H2c: *Trialability positively influences trust in BST.*

1.5.3 Relationship among perceived security, experiential value, and trust

Alalwan et al. (2019) demonstrated that consumers' perceived security in e-commerce positively affects their perceived value and trust. Trust helps consumers navigate the perceived risks of conducting online financial transactions, sharing sensitive information, and adopting new technologies for transactional purposes (Martin, 2018). Malhotra et al. (2004) argued that consumer confidence in safeguarding personal information is crucial to the development of future e-commerce initiatives. Furthermore, Ponte et al. (2015) confirmed that perceived security on online travel product buyers' websites positively impacts website trust. Hence, the following hypotheses were developed:

H3a: *Perceived security positively influences experiential value in BST.*
H3b: *Perceived security positively influences trust in BST.*

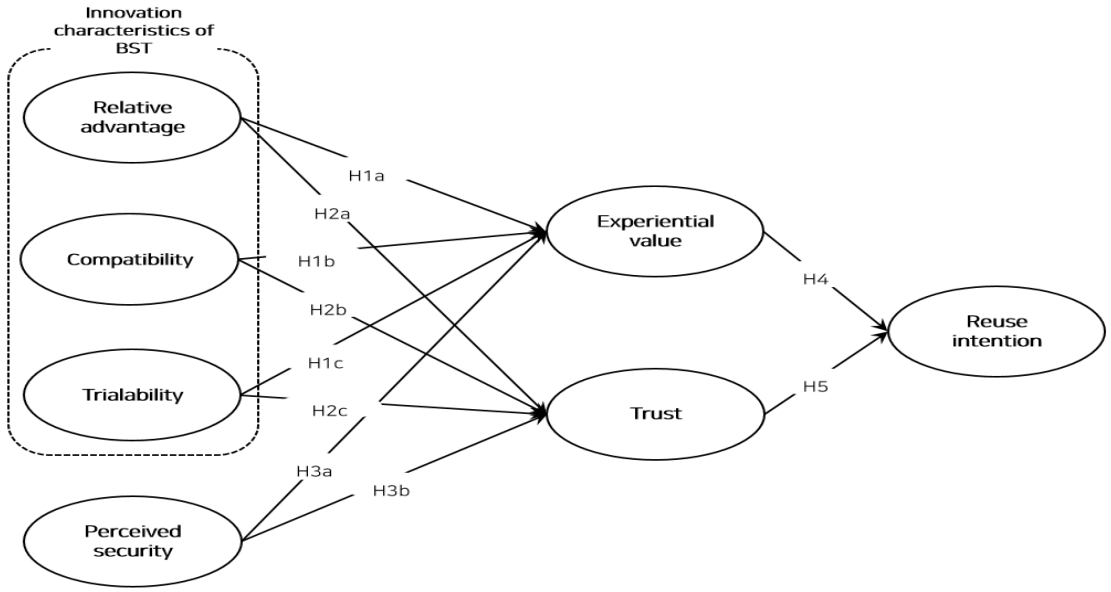
1.5.4 Relationship among experiential value, trust, and reuse intention

According to Zauner et al. (2015), consumers exhibit rational behavior in product or service selection, favoring options that provide the most value. These rational choices are associated with commendable behaviors such as loyalty and a sustained intention to make future purchases. In this context, if passengers perceive that using BST saves time, provides economic benefits, and offers convenience and a sense of accomplishment, they are inclined to revisit the system. Customer value plays a key role in shaping behavioral intention (Parasuraman & Grewal, 2000). Yang et al. (2016) and Vishwakarma et al. (2020) confirmed that customers' perceived value of virtual reality technology positively influences their intention to use it. Hence, the following hypotheses were developed:

H4: *Experiential value positively influences reuse intention in BST.*
H5: *Trust positively influences reuse intention in BST.*

Based on the preceding discussion and logic, we developed a conceptual model (Figure 1).

Figure 1: **Research model**



2. METHODS

2.1 Measurement

The three primary innovation attributes of BST, specifically, relative advantage (comprising five items), compatibility (comprising four items), and trialability (comprising three items), were adopted by Rogers (2003), Yuen et al. (2020), and Shin et al. (2022). Perceived security (comprising four items) was utilized by Damghanian et al. (2016) and Morosan (2018). The scale items adapted by Mathwick et al. (2001) were used to evaluate experiential value, assessed using 7 items. The scale items adapted by Ko and Kim (2012) were used to measure trust and consisted of three items. Reuse intention, consisting of four items, was adopted from Bhattacherjee (2001).

The validity of all measurement items was confirmed through consultations with five university professors and airline managers, ensuring that respondents' use of BTS in the aviation industry was appropriate for measurement purposes. A pre-test was subsequently conducted with a sample of 15 graduate students specializing in tourism, all of whom had practical experience using BTS. This procedure was essential to evaluate their comprehension of the test and measurement items. During this phase, the researchers made minor revisions to improve the clarity and comprehensibility of the items. All items within the constructs were measured using a five-point Likert scale, ranging from "strongly disagree" (1) to "strongly agree" (5).

2.2 Data collection and analysis

The online survey was conducted from January 20 to 31, 2023. This study involved administering an online survey via Embrain, which has the largest survey panel in Korea, comprising 1.6 million respondents. Embrain's rigorous respondent management significantly enhances the reliability and validity of research, establishing it as a widely used, preferred platform among researchers (Embrain, 2023). Furthermore, in recent years, online surveys have gained increased popularity among researchers relative to offline paper surveys, owing to advantages such as expedited response times, simplified analysis, and cost efficiency (Saleh & Bista, 2017).

The survey was divided into four stages. In the first stage, respondents were informed of the survey's purpose and background and that it would be used solely for academic research. In the second stage, a BST registration checkbox was placed as the first question to filter for BST registrants only. In the third stage, demographic questions were added to analyze factors such as gender, age, education level, and income. In the fourth stage, measurement items were presented to gather responses. The online survey was conducted from January 20 to 31, 2023. Embrain disseminated it via email to 16,303 individuals. Of the 345 responses received, 6 were excluded for invalid or insincere answers, leaving 338 valid responses.

The collected data were analyzed for demographic purposes using SPSS Statistics 23.0. The causal relationships between constructs were estimated, and hypotheses were tested using the measurement and structural models in SmartPLS 4.0. In the measurement model, reliability, including outer loadings (λ), Cronbach's alpha, and composite reliability (CR), as well as validity, including Average Variance Extracted (AVE) and discriminant validity of the latent variables, were assessed, which substantiate the constructs' reliability and validity. Subsequently, the structural model was tested using structural equation modeling, evaluating

model fit with the Variance Inflation Factor (VIF), R-squared (R^2), and Q-squared (Q^2), and confirming the significance of the path coefficients via p-values and t-statistics. SmartPLS 4.0 offers an intuitive user interface and demonstrates high reliability and excellent explanatory and predictive capabilities, making it a widely used tool in the social sciences (Cheah et al., 2024).

3. RESULTS

3.1 Profile of the sample

As detailed in Table 1, the proportion of male respondents (53.3%) exceeded that of female respondents (46.7%). The sample was categorized into age groups: individuals aged 21 to 30 years (24.6%), 31 to 40 years (21%), 41 to 50 years (24.6%), under 20 years (17.2%), and 51 years or older (12.7%). In terms of educational attainment, those holding a bachelor's degree constituted the largest segment at 60.1%, followed by those with a graduate degree or higher (26.6%) and those with a high school diploma (13.3%). The monthly income distribution of respondents ranged from more than 3million to less than 3.99 million won (21.6%), more than 4 million to less than 4.99 million won (21.3%), exceeding 5 million won (17.2%), more than 2 million to less than 2.99 million won (16.3%), from 1 million to less than 1.99 million won (14.8%), and less than 1 million won (8.9%).

Table 1: **Demographics of the respondent**

Characteristics		**N (338)**	**% (100)**
Gender	Male	180	53.3
	Female	158	46.7
Age (years)	Less than 20	58	17.2
	21–30	83	24.6
	31–40	71	21.0
	41–50	83	24.6
	Over 50	43	12.7
Education	High school or below	45	13.3
	University graduate	203	60.1
	Graduate school or higher	90	26.6
Monthly income (million KRW)	Less than 1	30	8.9
	1–1.99	50	14.8
	2–2.99	55	16.3
	3–3.99	73	21.6
	4–4.99	72	21.3

3.2 Measurement model

As illustrated in Table 2, the normality of the data was assessed by examining the skewness and kurtosis of the measurement items. According to Kline (2023), data can be considered normally distributed when the absolute value of skewness is less than 3, and the absolute value of kurtosis is less than 10. In this study, the skewness values ranged from −1.087 to .037, and the kurtosis values ranged from −.797 to 1.657. Since all values fell within the recommended thresholds, the data were considered to satisfy the assumption of normality, thereby supporting construct validity. The standardized factor loadings ranged from .635 to .901, whereas the average variance extracted (AVE) spanned from .501 to .802. These values exceed the respective thresholds of .7 and .5, as delineated by Hair et al. (2011), thereby confirming satisfactory convergent validity. The composite reliability (CR) ranged from .792 to .877, and Cronbach's alpha (α) ranged from .766 to .876. These metrics indicate that internal consistency was achieved within the study (Henseler et al., 2009).

Table 2: **Results of confirmatory factor analysis**

Items	Mean	SD	λ	Skew.	Kurt.
Relative advantage: α(.815), AVE(.634), CR(.896)					
Using BST is faster than the conventional check-in system.	3.618	.777	.830	-.552	.898
Using BST is more convenient than the conventional check-in system.	3.683	.712	.781	-1.087	1.657
Using BST is easier than the conventional check-in system.	3.677	.796	.842	-.347	-.236
Using BST is simpler than the conventional check-in system.	3.766	.837	.810	-.329	-.404
Using BST is more efficient than the conventional check-in system.	3.523	.844	.710	-.372	-.547
Compatibility : α(.853), AVE(.692),CR(.900)					
Using BST is completely compatible with my current situation.	3.810	.785	.819	-.577	.751
Using BST is compatible for check-in procedures.	3.751	.945	.846	-.312	-.797
Using BST fits me overall.	3.819	.854	.835	-.420	-.367
BST is suitable for use without check-in staff.	3.630	.852	.828	-.252	-.104
Trialability : α(.876), AVE(.801),CR(.924)					
I would like a demonstration before using BST.	3.588	.832	.893	-.408	-.404
Sufficient guidance on how to use BST is available.	3.704	.858	.891	-.409	.010
I can easily find BST locations and user guides.	3.618	.874	.901	-.487	-.218
Perceived security : α(.826), AVE(.660),CR(.885)					
I think BST is safe.	3.695	.742	.843	-.626	.261
I think BST can protect privacy.	3.662	.807	.879	-.913	1.035
Generally, BST ensures a safe environment for check-in procedures at the airport.	3.547	.746	.819	-.335	.238
I feel confident that technological advances of BST make them safe for me to use at airports.	3.653	.663	.697	-.457	.199
Experiential value : α(.815), AVE(.632),CR(.923)					
Using BST allows for time savings.	3.792	.725	.735	-.037	-.438
BST has economic value.	3.934	.650	.856	-.131	-.103
The use of BST provides convenience in daily life.	3.683	.745	.805	-.581	.177
The use of BST brings a sense of accomplishment in life.	3.855	.718	.812	-.309	.021
The use of BST is efficient.	4.082	.670	.788	-.394	.268
The use of BST is adapting to future life.	3.541	.710	.803	-.572	.463
The use of BST is creative.	3.417	.710	.759	-.354	.148
Trust : α(.809), AVE(.724),CR(.887)					
BST is faster and more reliable than the conventional check-in system.	3.979	.845	.844	-.553	-.241
BST has few errors.	3.872	.818	.848	-.645	.162
I trust BST overall.	4.056	.730	.861	-.868	1.287
Reuse intention : α(.766), AVE(.604),CR(.819)					
I will continue to use BST at the airport in the future.	4.127	.615	.880	-.082	-.416
I will continue to use BST regardless of check-in staff.	4.082	.670	.731	-.394	.268
I will consistently use BST at the airport.	3.541	.710	.710	-.572	.463

Notes: λ= factor loadings; *α*= Cronbach's *α*; AVE= Average variance extracted; CR= Composite reliability

Fornell-Larcker, Cross-loading, and HTMT values are commonly used to evaluate discriminant validity in SmartPLS 4.0 (Henseler et al., 2015). In this study, the Fornell-Larcker criterion was used to assess discriminant validity, as it has been the most frequently employed by previous researchers (Hair et al., 2011). According to this criterion, discriminant validity is confirmed when the square root of a latent variable's AVE exceeds its correlations with other latent variables (Henseler et al., 2015). As shown in Table 3, the square root of AVE for all latent variables was higher than their correlations with other variables, indicating that discriminant validity was established (Henseler et al., 2015).

Table 3: **Correlations and discriminant validity**

	Correlation of the Constructs						
Construct	(1)	(2)	(3)	(4)	(5)	(6)	(7)
(1) ***Relative advantage***	**.796**						
(2) ***Compatibility***	.702	**.832**					
(3) ***Trialability***	.551	.565	**.895**				
(4) ***Perceived security***	.653	.597	.632	**.812**			
(5) ***Experiential value***	.526	.599	.623	.737	**.795**		
(6) ***Trust***	.304	.410	.417	.590	.714	**.851**	
(7) ***Reuse intention***	.452	.396	.346	.596	.788	.503	**.777**

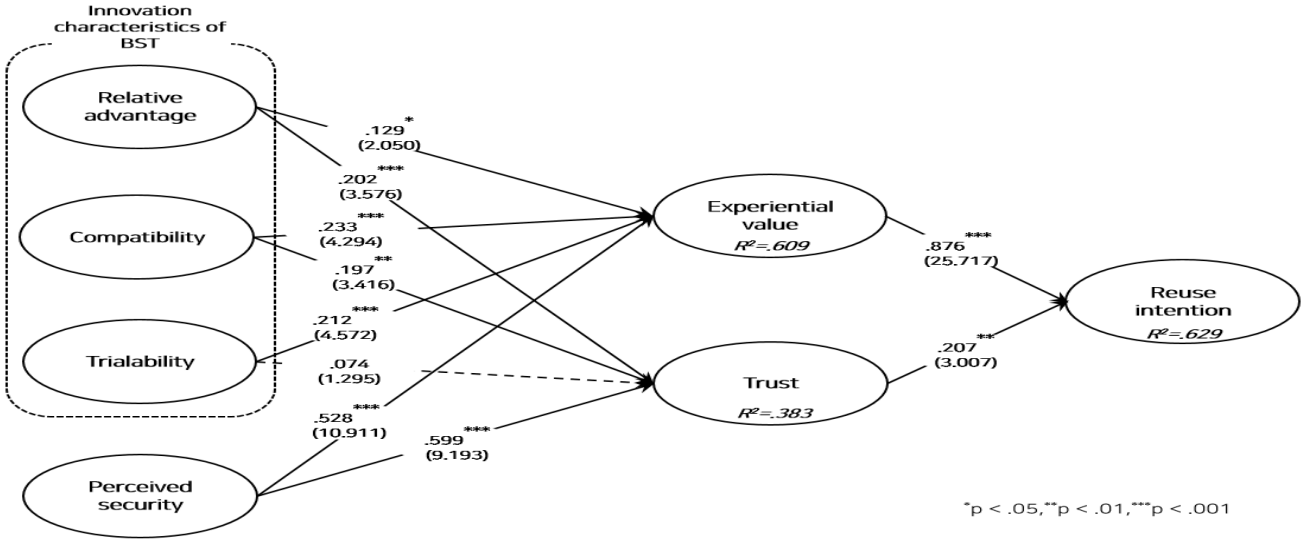
Note: Bold figures are the square root of AVE.

3.3 Structural model

In PLS-SEM, the predictive capacity of the structural model is evaluated using the Variance Inflation Factor (VIF), R-squared (R^2), and predictive relevance (Q^2) (Hair et al., 2022). VIF values ranged from 1.849 to 2.392 (all < 5), indicating no multicollinearity concerns (Henseler et al., 2015). R^2 values of .25, .5, and .75 represent weak, moderate, and substantial explanatory power, respectively (Hair et al., 2022). Furthermore, the model's predictive relevance was corroborated by Q^2 values exceeding zero, ranging from .180 to .374. Accordingly, all prerequisites for establishing the predictive validity of the structural model were fulfilled (Hair et al., 2022).

As shown in Figure 2, relative advantage (γ = .129, t-value = 2.050, p <.05), compatibility (γ = .233, t-value = 3.576, p <.001), and trialability (γ = .212, t-value = 4.572, p <.001) positively influence experiential value. Therefore, H1a, H1b, and H1c are all supported. Relative advantage (γ = .202, t-value = 3.576, p <.001) and compatibility (γ = .197, t-value = 3.416, p <.01) are also positive influences on trust. Consequently, H2a and H2b are supported. However, trialability has no significant effect on trust (γ = .074, p >.05). Thus, H2c is not supported. Perceived security has a positive impact on both experiential value (γ = .528, t-value = 10.911, p < .001) and trust (γ = .599, t-value = 9.193, p < .001), supporting H3a and H3b. Experiential value significantly influences reuse intention (γ = .876, t-value = 25.717, p <.001), confirming H4. Trust also positively affects reuse intention (γ = .207, t-value = 3.007, p <.01), supporting H5. Additionally, R2 explains 60.9% of the variance in experiential value, 38.3% in trust, and 62.9% in reuse intention.

Figure 2: **Research model**



Furthermore, as models of social science research become increasingly complex, mediation analysis has emerged as a widely adopted method for examining the mechanisms underlying observed relationships and expanding existing theoretical frameworks (Rucker et al., 2011). Consequently, this study conducted a mediation analysis to explore the mediating roles of experiential value and trust within the research model. The findings are summarized in Table 4. The results revealed that experiential value significantly mediated the relationships between relative advantage, compatibility, trialability, perceived security, and reuse intention. In addition, trust significantly mediated the relationships between relative advantage, compatibility, perceived security, and reuse intention, whereas its mediating effect on the relationship between trialability and reuse intention was not

significant. Overall, compatibility, trialability, and perceived security exhibited significant indirect effects on reuse intention through the proposed mediators, whereas the indirect effect of relative advantage was not statistically significant.

Table 4: **Mediation effect**

Path	Total effect	Direct effect	Mediating construct	Specific indirect effect	SE	95% CI	Types of mediation effect
RA → RI	.111*	.175***	RA→EV→RI	-.100*	.049	[-.162, .003]	No mediation
			RA→TRUS→RI	.037*	.017	[.008, .070]	No mediation
COMP → RI	.032 (NS)	-.174***	COMP→EV→RI	.233***	.055	[.108, .295]	Full mediation
			COMP→TRUS→RI	-.027*	.013	[-.053, -.006]	Full mediation
TRIA → RI	-.086 (NS)	-.287***	TRIA→EV→RI	.212***	.050	[.104, .258]	Full mediation
			TRIA→TRUS→RI	-.010 (NS)	.008	[-.025, .005]	No mediation
PS → RI	.558***	.116 (NS)	PS→EV→RI	.524***	.053	[.365, .562]	Full mediation
			PS→TRUS→RI	-.082**	.028	[-.128, -.027]	Full mediation

Note: $p^{*}<.05$, $p^{**}<.01$, $p^{***}<.001$ NS: insignificant, RA = relative advantage; EV = experiential value; RI= Reuse intention; TRUS= trust; COMP= compatibility; TRIA= trialability; PS= Perceived security

4. DISCUSSION

Korea Airports Corporation is making significant efforts to reduce congestion by implementing BST to streamline boarding procedures. With finger authentication, travelers can complete boarding after registering their biometric data once, improving the efficiency of domestic travel. This study's findings align with recent research on airport biometric systems, suggesting that travelers are more likely to continue using BST when they perceive the technology as secure, advantageous, and compatible with their travel experience. (Kim et al., 2023; Untaru et al., 2025). The findings also indicate that relative advantage, compatibility, trialability, and perceived security substantially impact experiential value. Moreover, relative advantage, compatibility, and perceived security strongly influence trust, whereas trialability does not significantly affect trust. Both experiential value and trust positively affect reuse intention. Furthermore, the mediation analysis identified significant indirect effects of compatibility, trialability, and perceived security on reuse intention via experiential value and/or trust, offering additional insight into the mechanisms underpinning passengers' sustained utilization of BST.

4. 1 Theoretical implications

The study's theoretical implications may elucidate new avenues for understanding the phenomenon associated with BST. Primarily, it holds academic significance by clarifying the relationships among innovations (including relative advantage, compatibility, and trialability), experiential value, and trust among BST users in the aviation industry. This discovery corresponds with prior research on how relative advantage, compatibility, and trialability influence experiential value (Yuen et al., 2020) and trust (Shin et al., 2022). Furthermore, the findings extend the application of IDT to the context of airport BST, demonstrating that core innovation attributes remain important determinants of users' evaluations in a highly regulated airport environment. Notably, the results indicate that compatibility has the greatest influence on experiential value, underscoring its importance in enhancing user experiences with BST.

Secondly, this research holds academic significance by delineating the relationships among perceived security, experiential value, and trust, and by incorporating perceived security into the IDT. This is consistent with prior studies that have enhanced the explanatory capacity of the IDT by introducing additional variables (Chen et al., 2018; Marak et al., 2019), thereby underscoring the significance of security in the utilization of BST. This finding suggests that security-related perceptions represent an important contextual factor that complements the original IDT framework when explaining the adoption and use of biometric technologies.

Thirdly, both experiential value and trust positively influence the intention to reuse, thereby corroborating previous findings (Yang et al., 2016). In the airport context, experiential value has a greater impact on reuse intention than trust does. This finding advances the literature on technology adoption by proposing that passengers' ongoing usage intentions are influenced not only by their trust in the technology but also by the quality of the experience it generates. This demonstrates that experiential value is more important than trust in the context of BST utilization.

Fourthly, this study identifies the mediating roles of experiential value and trust in the relationships between innovation attributes, perceived security, and reuse intention. Experiential value significantly mediates the effects of compatibility, trialability, and perceived security on reuse intention, while trust significantly mediates the effects of compatibility and perceived security on reuse intention. These findings indicate that the effects of innovation attributes and perceived security on reuse intention can be explained through users' value evaluations and trust formation, thereby extending the application of IDT to the continued use of BST.

4.2 Practical implications

This study highlights several practical implications. Primarily, compatibility, a crucial variable within the IDT, was observed to significantly influence experiential value, thereby validating the appropriateness of employing BST in airport immigration procedures. British Airways (Thackray, 2022) exemplifies an organization that has promptly integrated BST into its operations. Passengers can now submit their biometric and passport information to the airport and undergo security screening without requiring human interaction. In light of the increased adoption of contactless services following the COVID-19 pandemic, the active utilization of contactless-optimized BST is crucial. For example, airports should integrate BST with digital identity management systems to facilitate seamless passenger journeys across check-in, baggage drop, security screening, immigration, boarding, and duty-free shopping. Such integration can diminish passenger processing times while enhancing operational efficiency and reinforcing aviation security.

Secondly, the relative advantage significantly influences trust, indicating that employing BST in immigration procedures is perceived as more reliable than current methods. User adoption is likely to increase once individuals who have used biometric technology confirm its reliability. Consequently, there may be a need to expand BST and, as necessary, gradually reduce existing facilities. Thirdly, experiential value and trust both substantially impact the intention to reuse, underscoring the importance of enhancing these factors to promote continued utilization. Proactive measures should encompass regular monitoring of the biometric immigration process at airports to identify and resolve issues, alongside investments in technical enhancements such as speed, accuracy, and efficiency to sustain trust in BST.

Third, airport operators should establish transparent governance mechanisms for collecting, storing, and using biometric information. Providing passengers with clear information regarding data protection and privacy policies is expected to strengthen digital trust and encourage the continued use of BST.

Fourthly, experiential value mediates the effects of compatibility, trialability, and perceived security on reuse intention, indicating that passengers' continued use of BST depends on whether these technological characteristics translate into positive experiential value. Therefore, airports should enhance passengers' experiential value by integrating BST seamlessly across different stages of the airport journey and providing opportunities to experience its convenience and efficiency. For example, Singapore Changi International Airport utilizes biometric technology across multiple passenger touchpoints, including immigration, baggage handling, and boarding, thereby providing a more seamless and convenient travel experience (Travelmarket Report, 2023). This integrated approach offers practical guidance for airports seeking to enhance the experiential value of BST and encourage its continued use.

4.3 Limitations and future research

This study delineates several limitations and proposes avenues for future research. Firstly, BST is currently used only on domestic flights, which limits the generalizability of the results. The deployment of BST for international flights has been postponed owing to immigration and visa verification requisites mandated by destination countries. As BST is anticipated to extend to international routes in subsequent developments, future research should examine passengers' perceptions and acceptance of BST in both domestic and international flight scenarios.

Secondly, this research omitted the constructs of complexity and observability from the IDT framework due to the operational characteristics of airport BST. Nonetheless, few preceding studies on BST or airport technology adoption have likewise excluded these constructs (Shin et al., 2022). Consequently, future investigations should reassess the significance of complexity and observability in various airport environments and technological adoption contexts.

Third, this study relied on online survey data and used a quantitative approach. Although this method enabled the collection of responses from a broad range of participants, it may not fully capture passengers' actual experiences in airport settings. Future studies should incorporate qualitative methods and include perspectives from service providers and administrators involved in BST implementation.

Finally, the operationalization of trialability constitutes another limitation. Certain measurement items indicated a preference for demonstrations rather than the conventional pre-adoption trialability concept outlined in the IDT. Considering the limited opportunities for autonomous experimentation within institutional settings, such as airports, future research should seek to refine the measurement of trialability or consider alternative conceptualizations, such as the perceived value of guided experiential support.

CONCLUSION

This study investigates decision-making processes related to the adoption of BST in the aviation sector by extending the IDT framework to include perceived security, thereby assessing its impact on experiential value, trust, and reuse intention. The results demonstrate that relative advantage, compatibility, trialability, and perceived security significantly influence experiential value, while relative advantage, compatibility, and perceived security also notably affect trust. Both experiential value and trust, in turn, positively contribute to reuse intention. Furthermore, the mediation analysis shows that experiential value significantly mediates the effects of compatibility, trialability, and perceived security on reuse intention, while trust significantly mediates the effects of compatibility and perceived security on reuse intention. These findings further demonstrate that the effects of innovation attributes and perceived security on reuse intention can be explained through users' value evaluations and trust formation. Such empirical evidence addresses a significant gap in understanding how IDT accounts for BST adoption and reuse behavior, providing valuable insights for scholars and practitioners within the aviation industry.

Declarations

The author declares that no funds, grants, or other support were received and that there are no conflicts of interest or competing interests related to this study.

Acknowledgments / Funding

This research received no external funding.

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Please cite this article as:
Kim, M. Y., Girish, V. G. & Chang, D. Y. (2027). Biometric Security Adoption in Korean Aviation: Insights from Innovation Diffusion Theory. *Tourism and Hospitality Management, 33*(2), p-pp, https://doi.org/10.20867/thm.33.2.3



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