Exploring the Determinants of Travelers’ Intention to Use the Airport Biometric System: A Korean Case Study

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Abstract: After the pandemic, there has been an increasing emphasis on customer convenience, with biometrics emerging as a key solution. This study empirically investigates the intention of Korean travelers to use airport biometric systems. The technology acceptance model (TAM) was employed to explore users’ perceptions of the system’s functional aspects, while technology familiarity, social influence, and trust in information protection were integrated into the model to understand users’ psychological aspects. The results reveal that perceived usefulness and ease of use have a positive relationship with the intention to use the biometric system and that perceived ease of use positively influences perceived usefulness. The impact of social influence and technology familiarity was not statistically significant but trust emerged as the most influential factor determining the intention to use the system. Furthermore, the study identified that gender moderates the effect of trust on the intention to use. This study contributes by identifying key determinants for airport biometric system adoption and by investigating the moderating influence of gender. As a primary result, airport biometric systems must have effective functionality and a user-friendly passenger environment while ensuring confidence in system security. These findings have significant implications for the sustainable implementation of airport biometric systems.

Keywords: airport; airport biometric system; social influence; sustainable implementation; technology acceptance model; technology familiarity; trust in information protection

1. Introduction

Travelers who encountered notable complexity and inconvenience at airports during COVID-19 are now seeking swift and seamless travel experiences [1]. Airports must implement suitable measures to ensure the sustainability and safety of their operations in response to this [2]. Even prior to the pandemic, airports had been striving to develop more efficient technology-based service processes to cope with the explosive growth in air travel demand [3,4]. Innovative concepts like kiosks [5], artificial intelligence, and robot technology [6], have been introduced to enhance airport facilities and operations, aiming to offer improved services [7]. The adoption of a new passenger-handling system, based on biometric information, has emerged as a crucial remedy to streamline service processes and enhance the travel experience [1]. This implementation is expected to significantly reduce the overall service process time at airports [8–10]. Related reports suggest that the airport’s biometric system can cut the passenger-handling process time by approximately half [11]. Additionally, the biometric system is seen as a measure to bolster airport security [7,12]. Given the dynamic nature of the global air transport industry, airports must prioritize the security of their service systems for travelers’ safety, with the biometric system enhancing airport security during passenger handling [13–15]. The advantages of the biometric system have garnered strong support from travelers [1,16,17]. According to the International Air Transport Association (IATA)’s 2022 global passenger survey, three quarters of passengers...
prefer biometric data over passports and boarding passes. Moreover, more than 33% have already had the experience of utilizing biometric identification during their travels and 88% of them reported satisfaction with the process [1]. With such resounding support, biometrics is currently being implemented by airlines and airports in various countries, including the United States, China, and Korea.

Despite the airport’s biometric system showing high growth potential and efficiency, the passengers’ concerns regarding the information security capability of the system can hinder its widespread adoption [1,18]. Users of the system may hesitate to use the biometric system due to concerns about potential privacy breaches and the exposure of private information [19]. For example, approximately half of the travelers are still worried about data protection in the results of IATA’s 2022 global passenger survey. This negative perception of users can increase the risk of rejection, leading to potential failure in the sustainable implementation of biometric technology [18,19]. Therefore, it is crucial to prioritize the identification of critical determinants that positively or negatively influence passengers’ intention to accept biometric technology [20].

The lack of conclusive findings in related academic fields can be attributed to the scarcity of studies exploring the factors that significantly influence the acceptance intention of airport biometric systems although a few exist (e.g., [10,13,21,22]). Also, travel behaviors have undergone significant changes in response to COVID-19 [23–25]. As we prepare for the post-pandemic era, it is important to establish precise strategies by identifying the factors that influence the adoption of airport biometric systems. Thus, this study aims to identify the key drivers behind travelers’ intention to use airport biometric systems and suggests practical implications for the sustainable deployment of the system. We examine the intention of travelers using the technology acceptance model (TAM) to consider the traveler’s perception of the functional aspect of the biometric system. We also delve into the roles of individual psychological factors by incorporating external variables such as trust in the airport’s information protection capability, social influence, and technology familiarity. The uniqueness of biometric information raises privacy concerns, leading us to propose that trust in the airport’s information security significantly impacts the intention to use the system. Due to the growing accessibility of biometric technology, users are more inclined to adopt it, which justifies the consideration of technology familiarity [26]. Thus, technology familiarity is expected to significantly affect the intention to use and the ease of using the airport biometric system. Social influence plays a role as potential adopters seek opinions from familiar groups when faced with new technology, impacting travelers’ technology acceptance intention [27,28]. While these three constructs are valid in explaining technology acceptance (e.g., [26,29–32]), there have been limited studies that have concurrently investigated their effects when examining the intention to use the airport biometric system. To address this research gap and better understand the factors influencing biometric technology acceptance, we propose an extended TAM. Moreover, we are evaluating the moderating effect of gender given its significance in the technology acceptance literature [32–38]. The current literature lacks academic insight into the effect of gender differences. In essence, the primary aim of this study is to answer the following research questions (RQ).

**RQ 1:** What are the key drivers that affect the intention to accept an airport biometric system?

**RQ 2:** Does gender difference moderate the effect of drivers on airport biometric acceptance intention?

This study contributes two aspects to the literature: First, it identifies the crucial determinants for the intention to use the airport biometric systems using the extended TAM, introducing the relatively undere xplored aspects of technology familiarity and trust in information protection within this research topic. Second, it represents the initial endeavor to validate how gender moderates the use of airport biometric systems as far as the authors are aware. As a result, this study reveals that for airport biometric systems to be sustainable, they must establish effective functionality and a user-friendly customer environment based on trust in information protection. At the same time, it is evident that women are more
inclined to adopt airport biometric recognition systems than men when there is a sufficient
sense of security in information handling.

2. Literature Review
2.1. Airport Biometric Technology

A biometric system is an automated pattern-recognition system that identifies a person
based on single or multiple individual characteristics that the person possesses [8]. With the
recent pandemic driving an increase in non-face-to-face services, the utilization of biometric-
based services is naturally on the rise [39]. As the technical maturity of biometric technology
has increased, this technology has been widely utilized in many settings because of its
advantages in offering improved convenience and security [40,41]. Specifically, biometrics
in airport operations can serve as a safe and efficient means to handle the rising passenger
demand in the post-pandemic era [42,43].

From the passenger’s perspective, biometric systems can replace all the existing
document-based boarding procedures (like boarding passes and passports) with a single
registration of biometric information. This means passengers no longer need to worry about
losing or damaging these documents. Additionally, given the ongoing risk of pandemics
negatively impacting travel intentions [44], the non-face-to-face services offered by airport
biometric systems can provide passengers with a sense of psychological reassurance. One
of the most significant advantages appreciated by passengers is the reduction in overall
service process time, sparing them from long waits at the airport. Excessive waiting
times are directly associated with negative perceptions such as neglect, time wastage, and
boredom, ultimately leading to negative feelings and impressions [45]. In this regard,
airport biometric systems can be a potent solution to this problem. For instance, the
U.S. Customs and Border Protection (CBP) has implemented biometric facial comparison
technology in various air transport environments, including 14 pre-clearance locations and
44 air exit locations. This innovative technology enables travelers to experience quicker
and safer journeys [46].

From the perspective of airport operators, the biometric system can be utilized to
automatically verify and recognize that the document owner and traveler are the same
person through pre-registered biometric information [13]. According to Kalakou et al. [7],
the biometric system is particularly expected to play a key role in the short-term devel-
opment of airports because it can improve the end-to-end experience of travelers and
overall security of the passenger-handling system. This enhancement is directly linked
to increasing terminal capacity [47]. For instance, Istanbul Airport, in collaboration with
Turkish Airlines, has implemented a new boarding gate based on biometric technology,
resulting in a 30% reduction in processing time [43]. Miami Airport, which introduced
biometric technology for screening international arrivals in 2018, reported an 80% decrease
in passenger processing time [48]. Similarly, Los Angeles International Airport confirmed
that the entire passenger processing procedure can be completed in just 20 min via the
biometric system, representing a significant time reduction compared to conventional
document-based processes [49]. Since biometric information is hard to be mimicked [50], it
enables the airport to prevent identity fraud and minimize errors in the passenger-handling
process [51]. The U.S. National Institute of Standards and Technology (NIST) reported an
impressive accuracy rate of approximately 99.5% after evaluating the performance of seven
algorithms implemented in the airport biometric system [52].

While it is evident that airport biometric systems offer faster and more efficient au-
thentication and identification processes, they also raise concerns, particularly related
to cybersecurity. Despite their ability to enhance security, these systems inevitably face
cybersecurity risks due to the storage of numerous passengers’ biometric data in a single
database or platform. Rajapaksha and Jayasuriya [53] emphasized that cybersecurity is
a crucial risk factor in airport operations relying on biometric systems, highlighting the
importance of airports having policies and technologies that passengers can trust. Ad-
ditionally, the reliance on electronic systems for recognition introduces the possibility
of errors. Prabhaker, Pankanti, and Jain [20] have pointed out that variations in users’ physiological characteristics, ambient conditions, or potential systemic errors can lead to misinterpretations in the sensor–user interaction. Such issues could potentially result in more inconveniences compared to the existing document-based processing procedures.

2.2. Further Related Research

It is crucial to consider factors influencing user technology acceptance to ensure the sustainable and successful implementation of the biometric system [18,54]. In the tourism and hospitality industry, various studies have been made to understand the tourist’s intention to accept biometric technology and TAM has been considered as a reliable model to examine the behavioral intention to use biometric technology. For example, Morosan [55] confirmed the predictive power of the TAM to explain intention to adopt biometric technology in restaurants by conducting an empirical study. Kim, Brewer, and Bernhard [56] used the TAM to investigate the hotel guests’ intention to use a fingerprint door lock and found that the two variables in the TAM (perceived usefulness and perceived ease of use) well explained the intention to use the biometric system. Morosan [57] also conducted empirical research on the intention to use the biometric system in hotels using TAM and suggested that TAM is an appropriate framework for the study of biometric system adoption.

In the air transport literature, a few researchers have tried to explore the biometric system field to increase the service quality and operational efficiency of airports. Farrell [51] reviewed the latest trends and related information to provide useful implications for airport operators to introduce biometric systems more effectively. Negri, Borille, and Falcão [47] studied the passengers’ possibility to use the biometric system of a Brazilian airport using the discrete choice model and found that 83% of passengers were expected to use the biometric service of the airport. Recent empirical studies were conducted to explore factors that affect the individual’s intention to use and accept it. Kim, Lee, and Costello [22] examined the relationship between perceived risk, perceived benefit, initial intention to use, and repeat intention to use and confirmed that there was a significant relationship in all links. Park and Park [10] developed a model incorporating variables from the innovation diffusion theory and the unified theory of acceptance and use of technology. This framework aimed to identify the factors that drive the adoption of airport biometric systems. Their study revealed significant connections between performance expectancy, effort expectancy, and the intention to accept the technology. Morosan [13] empirically investigated the U.S. travelers’ intention to use airport biometric systems using the research model based on a unified theory of adoption and use of technology model and showed that performance and effort expectancy, low privacy concern, and compatibility have a positive impact on the U.S. travelers’ intention. Kasim et al. [21] used the extended theory of planned behavior, incorporating perceived usefulness, perceived ease of use, and privacy concern into the basic model, to investigate the intention to use airport biometric systems. They discovered that attitude, subjective norm, and privacy concern had a positive impact on usage intention. However, the finding that the two core variables (perceived usefulness and perceived ease of use) did not significantly influence behavioral intention stood out when compared to other related literature, suggesting the need for further examination of these variables’ impact. Also, exploring potential cultural differences using Asian samples could yield valuable insights and implications.

2.3. Theoretical Backgrounds and Hypotheses Developments

2.3.1. Technology Acceptance Model

The TAM is a customized version of the theory of reasoned action designed to understand users’ technology adoption intentions and behavior. Since its inception by Davis [58], the TAM has become widely accepted as one of the leading models for explaining individual intentions to adopt technology. It revolves around two cognitive factors: perceived usefulness and perceived ease of use [59]. Perceived usefulness refers to the extent to which
an individual believes that a particular information system or technology will enhance their task performance [60]. When technology is perceived as highly useful, individuals are more likely to recognize its positive impact on performance [60]. Moreover, people tend to view a system as more useful when it is user-friendly [61,62]. On the other hand, perceived ease of use relates to an individual’s perception of the cognitive effort required to learn and utilize a system or technology [26]. Based on these theoretical frameworks, it is generally believed that when a person perceives minimal effort in using a system or technology, they are more likely to adopt it [59,60].

Through a wide range of empirical studies, numerous researchers have validated the TAM as a robust model for predicting technology acceptance intentions (e.g., [63–67]). In various information technology industries, such as online shopping [27,68], mobile technology [69], online banking [70], social media [71], and kiosks [72,73], the TAM has demonstrated its suitability in explaining technology acceptance intentions effectively. It is noteworthy that TAM remains effective in studying the intention to use contemporary innovative technologies like metaverse, AI, connected vehicles, and service robots [74–77]. Researchers in the air transport field have also extensively used the TAM to comprehend air travelers’ intentions to use technology. For instance, Ruiz-Mafe et al. [78] applied TAM to study online ticket purchasing behavior, while Lu, Chou, and Ling [79] employed TAM to explain the intention to use self-check-in services provided by airlines. Assaker [33] employed TAM to explore the intention to adopt online travel reviews and user-generated content. Li and Jiang [80] and Min, So, and Jeong [81] similarly demonstrated the effectiveness of TAM in explaining the intention to use new technologies in tourism, AR-based tourism, and the Uber mobile application, respectively. These previous studies justify that TAM can be an appropriate model for explaining travelers’ intentions to use the airport biometric system. Based on the theoretical background presented earlier, we propose the following three hypotheses:

**H1:** Perceived ease of use will significantly influence the perceived usefulness.

**H2:** Perceived ease of use will significantly influence the intention to use the biometric system of an airport.

**H3:** Perceived usefulness will significantly influence the intention to use the biometric system of an airport.

### 2.3.2. External Variables

As the original TAM primarily addressed technology use in unavoidable everyday situations, such as the workplace, it may not fully capture users’ intention to use technology in voluntary scenarios [82], prompting researchers to question its adequacy (e.g., [82,83]). TAM has also been criticized for its limitation in capturing psychological factors arising from the technology-using process [84]. To enhance the model’s predictive power, additional variables have been proposed [62]. Thus, to better understand airport users’ intention to use the biometric system and increase the model’s explanatory power, this study incorporated three external variables, namely technology familiarity, social influence, and trust in the information protection capability of airports, based on the related literature, which is particularly relevant to the context of the biometric recognition system [54,85,86].

Familiarity refers to specific activity-based cognition resulting from past experiences and interactions with a particular target [26,27]. In this study, technology familiarity is defined as a user’s perception formed by experience with biometric technology. It involves the user’s understanding of how the biometric system functions and how to use it. Familiarity reduces uncertainty and simplifies the task process by establishing the structure of the task [26]. That is, familiarity with a specific task situation causes the development of rules that simplify the decision-making process [31] and thus a person with familiarity with performing a given task feels it is easy to do so and makes fewer errors [87]. Previous studies have shown that there is a positive relationship between technology familiarity
based on experience and perceived ease of use [88,89]. Numerous information system studies have also found a positive relationship between technology familiarity and the intention to use the technology (e.g., [26,90,91]). At the same time, there were aspects where familiarity lacked statistical significance in studies explaining acceptance intention [28]. For instance, Kim and Kwon [92] concluded that familiarity’s influence on travelers’ behavioral intentions was not substantiated when considering airport biometric systems as part of their travel experience. Based on this, we hypothesize that technology familiarity significantly influences the intention to use and the perceived ease of use of the airport biometric system.

Social influence refers to the degree to which alterations in an individual’s feelings, motivations, or behaviors are caused by the influence of others [32]. In this study, social influence is specifically defined as the extent to which individuals believe that significant referents endorsed the use of the technology [93]. While the original TAM did not incorporate social influence in examining technology usage intention, models for explaining an individual’s behavioral intention such as the theory of reasoned action and theory of planned behavior considered social influence as one of the key constructs. Many studies have demonstrated social influence’s validity as an appropriate additional variable for predicting intention to accept new technology (e.g., [28,30,94]). This variable has consistently proven to be a significant motivator of behavioral intention within the tourism and air transport sectors until now (e.g., [95–97]). In biometrics-related research, a significant connection between social influence and acceptance intention has been observed [54,56,98]. Despite the abundance of empirical evidence supporting the positive effects of social influence on travel-related behavior and technology acceptance, it is worth mentioning that instances of negative influence have also been documented (e.g., [99,100]). According to Miltgen, Popović, and Oliveira [18], social influence can either encourage or discourage technology usage intention. Thus, we hypothesize that social influence significantly impacts the intention to use the airport biometric system.

Trust in the capability of safeguarding information is a subjective belief that the party that owns the personal information will voluntarily implement appropriate and dependable protection commitments against potential threats and vulnerabilities of exposure [27]. This variable represents the opposite concept of privacy concern, signifying the apprehension arising from individuals’ unease regarding the provision of their unique personal information [101]. In other words, privacy concerns stem from individual psychological factors, while trust is based on evaluations and faith in the information recipient [102]. These two variables have been considered crucial in understanding the intention to adopt technology. In certain instances, privacy concerns have been deemed insignificant in airport biometric system studies ([12,103]). However, research on the influence of trust has been overlooked in this topic and exploring this aspect could reveal fresh perspectives. In numerous studies, trust has been verified as one of the factors that have a strong influence on an individual’s willingness to accept a technology [104–108]. In particular, trust has been considered essential for information systems dealing with personal information such as mobile payment and e-commerce [109,110]. Also, studies on biometric systems have highlighted the strong impact of trust on users’ decisions to adopt this technology [111]. Based on the evidence of previous studies, we established hypotheses as follows. The theoretical research model of the current study is illustrated in Figure 1.

H4: Technology familiarity will significantly influence perceived ease of use.

H5: Technology familiarity will significantly influence the intention to use the biometric system of an airport.

H6: Social influence will significantly influence the intention to use the biometric system of an airport.

H7: Trust in information protection will significantly influence the intention to use the biometric system of an airport.
2.3.3. Moderating Effect of Gender

Previous studies have suggested that gender is a critical demographic variable as a moderator in understanding technology acceptance intention \[34,37,112\]. For example, Venkatesh and Morris \[32\] found that gender-moderated relationships involving perceived ease of use, perceived usefulness, and behavioral intention also moderated the effect of social influence on behavioral intention. Their research revealed that males were more influenced by perceived usefulness in accepting technology, while females were more influenced by perceived ease of use. Furthermore, the impact of social influence on behavioral intention was greater for females compared to males \[32\]. Borrero et al. \[112\] also found that gender moderated the effect of perceived usefulness, perceived ease of use, and social influence on acceptance intention. Additionally, some prior studies have highlighted gender-specific perspectives regarding trust in technology \[113,114\]. Shao et al. \[114\] suggested that females displayed more concerns about privacy infringement and were more sensitive to an organization’s security-related policy. Despite these insights into gender’s role in moderating the relationship between user perception and behavioral intention, there is no academic insight into what causes the difference in the level of intention to use the airport biometric system between males and females. To address this research question, we established hypotheses to examine the moderating effect of gender as follows:

**H8a**: Gender has a significant moderating effect on the relationship between perceived ease of use and perceived usefulness.

**H8b**: Gender has a significant moderating effect on the relationship between perceived ease of use and behavioral intention.

**H8c**: Gender has a significant moderating effect on the relationship between perceived usefulness and behavioral intention.

**H8d**: Gender has a significant moderating effect on the relationship between technology familiarity and perceived ease of use.

**H8e**: Gender has a significant moderating effect on the relationship between technology familiarity and behavioral intention.

**H8f**: Gender has a significant moderating effect on the relationship between social influence and behavioral intention.

**H8g**: Gender has a significant moderating effect on the relationship between trust in information protection and behavioral intention.
3. Methodology

Data Collection and Analytical Method

The questions in the questionnaires were formulated using information from the pertinent literature [13,18,30,31,55,59,104,115,116]. Before actual data collection, we conducted a pre-test on 30 people comprising air practitioners and frequent flyers to ensure content validity. That is, the pre-test was conducted to evaluate whether each question effectively measured the intended aspects and to estimate the required time and resources before conducting the large-scale study [117,118]. The Cronbach’s alpha values of the 30 samples fell within the range of 0.754 to 0.877, exceeding the threshold of 0.7 recommended by Gefen, Straub, and Boudreau [119]. Also, the questions were properly revised based on respondents’ feedback. The final set of questionnaires consisted of 8 questions pertaining to demographic and travel-related information, alongside 18 questions targeting 6 constructs within the research model. All participants’ responses were evaluated utilizing a 5-point Likert scale (1 = strongly disagree; 2 = disagree; 3 = neutral; 4 = agree; 5 = strongly agree). The survey data for the current research was collected at Gimpo international airport in Korea from May 22 to June 12 in 2023. The survey was administered in person through face-to-face interactions with the respondents. Well-trained investigators explained the research purposes and contents of the questionnaires to the respondents to reduce response errors. The survey was conducted when the respondents fully understood the questionnaires and agreed to the data collection. The investigators maintained a certain distance during the response for free expression from respondents. After excluding inappropriate responses and non-responses (41 in total), we collected 581 usable data out of the initial 622. We aimed to collect as much data as possible within the time frame permitted by the airport to ensure the quality of the analysis. Table 1 provides a summary of the respondents’ demographic and travel-related information. We employed structural equation modeling using AMOS 27 and SPSS 27. We developed a research model using thoroughly validated relationships between variables and we employed the AMOS program, which is recognized for its effectiveness in confirmatory structural equation modeling (SEM) [120]. We also employed Cronbach’s alpha to evaluate reliability through internal consistency.

Table 1. Demographic and travel-related information of the collected sample.

<table>
<thead>
<tr>
<th>Attribute</th>
<th>Subgroup Categories</th>
<th>Sample Size</th>
<th>Proportion (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td>Male</td>
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<td>50</td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>290</td>
<td>50</td>
</tr>
<tr>
<td>Age *</td>
<td>20–29</td>
<td>147</td>
<td>25</td>
</tr>
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<td></td>
<td>30–39</td>
<td>162</td>
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<td></td>
<td>40–49</td>
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<td>24</td>
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<td></td>
<td>≥50</td>
<td>135</td>
<td>23</td>
</tr>
<tr>
<td>Purpose of travel</td>
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<td>68</td>
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<tr>
<td></td>
<td>Business</td>
<td>50</td>
<td>9</td>
</tr>
<tr>
<td></td>
<td>Visit friends and relatives</td>
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</tr>
<tr>
<td></td>
<td>Others</td>
<td>113</td>
<td>19</td>
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<tr>
<td>Education level</td>
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<td></td>
<td>Associate degree</td>
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<td></td>
<td>Graduate degree</td>
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<td>Government employee</td>
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<td>12</td>
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<td></td>
<td>Others</td>
<td>82</td>
<td>14</td>
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Table 1. Cont.

<table>
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<th>Attribute</th>
<th>Subgroup Categories</th>
<th>Sample Size</th>
<th>Proportion (%)</th>
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<td>Monthly income</td>
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<tr>
<td></td>
<td>$1000–2000</td>
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<td></td>
<td>$2001–3000</td>
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<td></td>
<td>$3001–4000</td>
<td>121</td>
<td>21</td>
</tr>
<tr>
<td></td>
<td>More than $4000</td>
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<td>17</td>
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<td>Mainly used seat class</td>
<td>Economy class</td>
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<td>96</td>
</tr>
<tr>
<td></td>
<td>Business</td>
<td>18</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>First</td>
<td>8</td>
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<tr>
<td>Flying frequency/Year</td>
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<td>32</td>
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<td></td>
<td>Two or three times</td>
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<td></td>
<td>Four or five times</td>
<td>117</td>
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<tr>
<td></td>
<td>Over six times</td>
<td>62</td>
<td>11</td>
</tr>
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</table>

* Due to the age restrictions that prohibit individuals under the age of 14 from registering biometric information, this specific age group, with individuals aged 14 to 19, was excluded from the survey.

4. Results
4.1. Measurement Model

To assess the measurement model’s validity and reliability, confirmatory factor analysis (CFA) was performed. Before a CFA was carried out, we tested the normality assumption using skewness and kurtosis criteria. The absolute values of skewness ranged from 0.032 to 0.687 and kurtosis ranged from 0.239 to 1.304, indicating that the normality of measurement scales were satisfied [121]. The mean, standard deviation, skewness, and kurtosis of each construct were summarized in Appendix A. The goodness of fit of CFA is $\chi^2 = 397.244$ (df = 120, $p = 0.000$); GFI = 0.929 (recommended >0.900); $\chi^2$/df = 3.310 (recommended <3); CFI = 0.969 (recommended >0.950); NFI = 0.957 (recommended >0.900); and RMSEA = 0.063 (recommended <0.080); RMR = 0.039 (recommended <0.080) [122]. We evaluated the convergent validity by using standardized factor loading and the average variance extracted (AVE) of each latent construct. When all the factor loading values exceed 0.7 and the AVE value exceeds 0.5, convergent validity is confirmed [123]. In this study, the factor loading of items was greater than the recommended value, ranging between 0.791 and 0.919. AVE values were also higher than the threshold value, showing the range from 0.723 to 0.820. This outcome suggested good convergent validity. The reliability of the construct was examined by calculating composite reliability and Cronbach’s alpha score. To establish reliability, all composite reliability and Cronbach’s alpha scores should be over 0.7 [119]. The results showed that all composite reliability and Cronbach’s alpha values were more than 0.7, which indicated the appropriate reliability. The composite reliability ranged from 0.886 to 0.932 and Cronbach’s alpha coefficient ranged from 0.878 to 0.930. These results are summarized in Table 2. The discriminant validity was evaluated from a comparison between AVEs and the square value of inter-construct correlations. In order to verify a discriminant validity, AVE values should be greater than all square values of inter-construct correlation [123]. Table 3 shows that the lowest value of the AVE is 0.723 and the highest square value of inter-construct correlation is 0.539, indicating that the proper discriminant validity is achieved.

Table 2. The test results of reliability and validity.

<table>
<thead>
<tr>
<th>Construct</th>
<th>Item</th>
<th>Factor Loading</th>
<th>AVE</th>
<th>Composite Reliability</th>
<th>Cronbach’s Alpha</th>
</tr>
</thead>
<tbody>
<tr>
<td>Perceived Usefulness [18,55,59]</td>
<td>1. Utilizing airport biometric technology will expedite my boarding process.</td>
<td>0.916</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>2. I think that utilizing airport biometric technology improves the overall quality of the airport service process.</td>
<td>0.912</td>
<td>0.820</td>
<td>0.932</td>
<td>0.930</td>
</tr>
<tr>
<td></td>
<td>3. Overall, I think that utilizing airport biometric technology is useful</td>
<td>0.889</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Table 2. Cont.

<table>
<thead>
<tr>
<th>Construct</th>
<th>Item</th>
<th>Factor Loading</th>
<th>AVE</th>
<th>Composite Reliability</th>
<th>Cronbach's Alpha</th>
</tr>
</thead>
<tbody>
<tr>
<td>Perceived Ease of Use [18,55,59]</td>
<td>1. I would find it easy to learn how to use the airport biometric technology.</td>
<td>0.856</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>2. The airport biometric technology is user-friendly, especially during initial use.</td>
<td>0.864</td>
<td>0.749</td>
<td>0.899</td>
<td>0.893</td>
</tr>
<tr>
<td></td>
<td>3. Utilizing airport biometric technology does not demand significant effort.</td>
<td>0.876</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Technology Familiarity [51,116]</td>
<td>1. I am familiar with using airport biometric technology.</td>
<td>0.903</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>2. I have the knowledge to use airport biometric technology.</td>
<td>0.861</td>
<td>0.778</td>
<td>0.913</td>
<td>0.878</td>
</tr>
<tr>
<td></td>
<td>3. I experienced with airport biometric technology.</td>
<td>0.882</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Social Influence [30,115]</td>
<td>1. My friends or relatives would support my use of airport biometric technology.</td>
<td>0.791</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>2. Those who matter to me would prefer my use of airport biometric technology.</td>
<td>0.887</td>
<td>0.723</td>
<td>0.886</td>
<td>0.888</td>
</tr>
<tr>
<td></td>
<td>3. Those who influence my actions motivate me to utilize airport biometric technology.</td>
<td>0.869</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Trust in Information Protection [13,18,104]</td>
<td>1. I trust that the airport will take measures to safeguard personal biometric information.</td>
<td>0.841</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>2. I trust that the airport will not share any of my personal biometric information without obtaining my consent.</td>
<td>0.869</td>
<td>0.754</td>
<td>0.902</td>
<td>0.901</td>
</tr>
<tr>
<td></td>
<td>3. I trust that the airport biometric technology offers a high level of security.</td>
<td>0.894</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Behavioral Intention [13,55,59]</td>
<td>1. I plan to utilize the airport biometric technology in the future.</td>
<td>0.919</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>2. I will suggest others to utilize the airport biometric technology.</td>
<td>0.887</td>
<td>0.819</td>
<td>0.931</td>
<td>0.928</td>
</tr>
<tr>
<td></td>
<td>3. I intend to use the airport biometric technology.</td>
<td>0.908</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 3. The test results of discriminant validity.

<table>
<thead>
<tr>
<th></th>
<th>PU</th>
<th>PEOU</th>
<th>TF</th>
<th>SI</th>
<th>TIP</th>
<th>BI</th>
</tr>
</thead>
<tbody>
<tr>
<td>PU *</td>
<td>0.820**</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PEOU</td>
<td>0.402</td>
<td>0.749</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TF</td>
<td>0.267</td>
<td>0.471</td>
<td>0.778</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SI</td>
<td>0.245</td>
<td>0.212</td>
<td>0.175</td>
<td>0.723</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TIP</td>
<td>0.171</td>
<td>0.233</td>
<td>0.257</td>
<td>0.366</td>
<td>0.754</td>
<td></td>
</tr>
<tr>
<td>BI</td>
<td>0.419</td>
<td>0.457</td>
<td>0.358</td>
<td>0.387</td>
<td>0.539</td>
<td>0.819</td>
</tr>
</tbody>
</table>

* PU = Perceived Usefulness, PEOU = Perceived Ease of Use, TF = Technology Familiarity, SI = Social Influence, TIP = Trust in Information Protection, BI = Behavioral Intention. ** The values in bold indicate the AVE for each construct while the plain values indicate the squared inter-construct correlations.

4.2. Structural Model

The structural equation model analysis was performed to test the hypotheses. The model demonstrated goodness of fit statistics in their acceptable ranges [122]: $\chi^2 = 273.968$ (df = 97, $p = 0.000$); GFI = 0.954 (recommended >0.900); $\chi^2 / df = 2.946$ (recommended <3); CFI = 0.980 (recommended >0.950); NFI = 0.970 (recommended >0.900); RMSEA = 0.058 (recommended <0.080); RMR = 0.067 (recommended <0.080). These model fit indicators demonstrated a good fit for the research model. The path analysis results are summarized in Table 4. The result showed that H1 is supported ($\beta = 0.645$, $p < 0.01$) and it means that if travelers feel free to use the biometric system at an airport, they are more likely to perceive the usefulness of the system. Perceived ease of use positively affected usage intention ($\beta = 0.281$, $p < 0.01$) and perceived usefulness also had a positive relationship
with usage intention ($\beta = 0.249, p < 0.01$), supporting the H2 and H3. These results suggest that travelers are more likely to accept the airport biometric system when they recognize that the system can efficiently support their airport task and is not difficult to use. In terms of external variables, technology familiarity had a positive effect on perceived ease of use ($\beta = 0.758, p < 0.01$) but it did not have a statistically significant impact on acceptance intention ($\beta = 0.015$, $p = 0.775$). Therefore, H4 was supported while H5 was not supported. In addition, the impact of social influence on intention to use was not statistically verified in this study ($\beta = 0.070$, $p = 0.065$) and it rejected H6. This result revealed that social influence is not a consideration when a traveler determines whether they use the airport biometric system. Finally, trust was confirmed as the greatest motivator to accelerate the traveler’s intention to use the biometric system ($\beta = 0.472, p < 0.01$) and it supported H7. This result indicated that the trust of tourists must be considered to increase the intention to use the biometric system. The finalized research model is depicted in Figure 2.

Table 4. Results of the structural model and hypothesis test.

<table>
<thead>
<tr>
<th>Hypothesis</th>
<th>Standard Error</th>
<th>Standardized Coefficient</th>
<th>t-Value</th>
<th>p-Value</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>H1: PEOU $\rightarrow$ PU</td>
<td>0.044</td>
<td>0.645</td>
<td>14.836</td>
<td>***</td>
<td>Supported</td>
</tr>
<tr>
<td>H2: PEOU $\rightarrow$ BI</td>
<td>0.083</td>
<td>0.281</td>
<td>4.902</td>
<td>***</td>
<td>Supported</td>
</tr>
<tr>
<td>H3: PU $\rightarrow$ BI</td>
<td>0.040</td>
<td>0.249</td>
<td>6.845</td>
<td>***</td>
<td>Supported</td>
</tr>
<tr>
<td>H4: TF $\rightarrow$ PEOU</td>
<td>0.030</td>
<td>0.758</td>
<td>18.124</td>
<td>***</td>
<td>Supported</td>
</tr>
<tr>
<td>H5: TF $\rightarrow$ BI</td>
<td>0.042</td>
<td>0.015</td>
<td>0.286</td>
<td>0.775</td>
<td>Not supported</td>
</tr>
<tr>
<td>H6: SI $\rightarrow$ BI</td>
<td>0.048</td>
<td>0.070</td>
<td>1.844</td>
<td>0.065</td>
<td>Not supported</td>
</tr>
<tr>
<td>H7: TIP $\rightarrow$ BI</td>
<td>0.044</td>
<td>0.472</td>
<td>11.432</td>
<td>***</td>
<td>Supported</td>
</tr>
</tbody>
</table>

*** = $p < 0.01$.

Figure 2. Research model result (*** = $p < 0.01$).

4.3. Moderating Effect Analysis

We conducted the moderation analysis to test the moderation hypotheses. The moderation analysis consisted of measurement and structural invariance tests. The total sample data was divided into male and female groups. After that, we generated an unconstrained model ($\chi^2 = 576.358, df = 240, p < 0.001$, $\chi^2/df = 2.401$, CFI = 0.963, TLI = 0.953, RMSEA = 0.049) and full-metric invariance model ($\chi^2 = 595.116, df = 252, p < 0.001$, $\chi^2/df = 2.362$, CFI = 0.962, TLI = 0.954, RMSEA = 0.048) to test the metric equivalence. The goodness-of-fit indices of the unconstrained model showed that the model had an appropriate fit to data [124]. Since all factor loadings in the full-metric invariance model are restricted to be equivalent between male and female groups, comparing the unconstrained model with the full-metric invariance model can confirm whether the male and
female groups respond to the measurement items in the same way. The result of the chi-square difference test revealed that the two models were not significantly different (Δχ²(12) = 18.758, p > 0.05), indicating that the metric invariance of the two groups was supported.

A structural invariance test was carried out. The baseline model, which is a freely estimated model, was compared to a series of nested models constraining the specific relationships (i.e., seven paths of the baseline model). The model fit of the baseline model was included in the acceptable range (χ² = 446.837, df = 194, p < 0.001, χ²/df = 2.303, CFI = 0.972, TLI = 0.956, RMSEA = 0.047). Table 5 denotes the details of the structural invariance test and hypothesis test of the moderating effect. Our findings showed that the path from trust in information protection to behavioral intention was significantly different between gender groups. Both men and women were affected by trust in the information protection capability of airports but it turned out that women were more affected than men. Except for the path from trust to behavioral intention, all the paths did not have a significant difference. Therefore, H8a, H8b, H8c, H8d, H8e, and H8f were not supported while H8g was supported.

### Table 5. Results of the structural invariance test and hypothesis test of the moderating effect.

<table>
<thead>
<tr>
<th>Path</th>
<th>Male</th>
<th>Female</th>
<th>Baseline Model</th>
<th>Nested Model</th>
<th>Chi-Square Difference</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>H8a: PEOU → PU</td>
<td>0.656 ***</td>
<td>0.586 ***</td>
<td>χ²(194) = 446.837</td>
<td>χ²(195) = 447.556</td>
<td>Δχ²(1) = 0.719 (p &gt; 0.05)</td>
<td>NS *</td>
</tr>
<tr>
<td>H8b: PEOU → BI</td>
<td>0.429 ***</td>
<td>0.241 ***</td>
<td>χ²(194) = 446.837</td>
<td>χ²(195) = 446.842</td>
<td>Δχ²(1) = 0.005 (p &gt; 0.05)</td>
<td>NS</td>
</tr>
<tr>
<td>H8c: PU → BI</td>
<td>0.338 ***</td>
<td>0.255 ***</td>
<td>χ²(194) = 446.837</td>
<td>χ²(195) = 447.851</td>
<td>Δχ²(1) = 1.014 (p &gt; 0.05)</td>
<td>NS</td>
</tr>
<tr>
<td>H8d: TF → PEOU</td>
<td>0.566 ***</td>
<td>0.503 ***</td>
<td>χ²(194) = 446.837</td>
<td>χ²(195) = 447.903</td>
<td>Δχ²(1) = 1.066 (p &gt; 0.05)</td>
<td>NS</td>
</tr>
<tr>
<td>H8e: TF → BI</td>
<td>−0.020</td>
<td>0.063</td>
<td>χ²(194) = 446.837</td>
<td>χ²(195) = 448.035</td>
<td>Δχ²(1) = 1.198 (p &gt; 0.05)</td>
<td>NS</td>
</tr>
<tr>
<td>H8f: SI → BI</td>
<td>0.170 **</td>
<td>−0.02</td>
<td>χ²(194) = 446.837</td>
<td>χ²(195) = 450.214</td>
<td>Δχ²(1) = 3.377 (p &gt; 0.05)</td>
<td>NS</td>
</tr>
<tr>
<td>H8g: TIP → BI</td>
<td>0.410 ***</td>
<td>0.643 ***</td>
<td>χ²(194) = 446.837</td>
<td>χ²(195) = 453.372</td>
<td>Δχ²(1) = 6.535 (p &lt; 0.05)</td>
<td>S **</td>
</tr>
</tbody>
</table>

* NS = Not Supported, ** S = Supported, *** = p < 0.01.

### 5. Discussion

#### 5.1. Impact of Perceived Usefulness and Perceived Ease of Use on the Intention to Use the Airport Biometric System

The outcomes of this study revealed that the perceived usefulness and perceived ease of use, related to the system’s functional aspects, significantly predicted the intention to accept the airport biometric system. These findings align with earlier biometric-related research that suggested the positive impact of perceived usefulness and perceived ease of use on the intention to use biometric systems [13,55,56,125,126]. However, the results can diverge from the research conducted by Kasim et al. [21], which employed usefulness and ease of use to explore intentions towards airport biometric system usage. In their study, the impact of usefulness and ease of use on intention was not statistically significant. In response to these divergent outcomes, the researchers suggested that the influence of usefulness and ease of use might vary depending on factors such as the type of biometric information (e.g., face, eyes, vein, or fingerprints) or respondent characteristics. Additionally, it is worth noting that while their study utilized an online survey, the data for this study were gathered in person through face-to-face interactions with respondents at the airport where the biometric system is deployed. Such differences in data collection methods could potentially account for the disparities in results.

Based on these results, this study demonstrated that perceived usefulness and perceived ease of use in TAM can be used effectively in explaining traveler’s intention to use the airport biometric system. The positive impact of perceived usefulness indicates that passengers who believe the biometric system can enhance airport service efficiency are more inclined to embrace its use. Similarly, the positive connection between perceived ease of use and usage intention suggests that travelers are more likely to adopt the system when they perceive it as requiring less effort. Thus, proactively eliminating the difficulties that users may experience and making them feel free to use the system are crucial for the successful and sustainable implementation of airport biometric systems. Furthermore, the
positive correlation between perceived usefulness and perceived ease of use implies that passengers who perceive the system as uncomplicated are more likely to find it useful and consider its adoption. These encouraging effects highlight the importance of implementing the biometric system to effectively support passengers’ airport tasks and promote its widespread use.

5.2. Impact of External Variables on the Intention to Use the Airport Biometric System

One of the findings identified that trust had the strongest influence among the established constructs ($\beta = 0.572, p < 0.01$). This outcome aligns with previous research highlighting trust as the most powerful predictor of biometric system adoption [18,127]. In a similar vein, Obermeier, Kilngersberger, and Auinger [103] pointed out that while airport users might be willing to share their unique biometric data to enhance convenience, a stringent security standard would be likely to be demanded. The study by Kim, Lee, and Castello [22] also demonstrated that perceived risk, including security risk, significantly negatively impacts both initial and repeated intentions to use the airport biometric system. The apprehension surrounding potential data exposure and misuse are significant deterrents to biometric technology adoption [128] so it is reasonable that users who have confidence in the organization’s data protection capabilities are more inclined to embrace a biometric system.

Moderation analysis further unveiled that gender played a significant role in moderating trust. The impact of trust on usage intention was evidently stronger in females compared to males. This finding resonates with prior research [113,114] suggesting that females’ privacy concerns lead them to be more influenced by robust information security policies when adopting specific systems or technologies compared to males. Based on the results of the current study, it is evident that when a sense of security in information handling is established, women are more predisposed to adopting the airport biometric system than men.

While the meaning of social influence has been elucidated in various previous studies such as destination choices [129], airline preferences [130], and e-ticket purchasing [26,28], its statistical significance was established, but not in our study. This suggests that tourists using the airport’s biometric system do not heavily rely on recommendations or opinions from others. To contextualize this result, it is crucial to note that an airport biometric system is a relatively recent service, particularly limited to domestic flights in Korean airports. Regarding the intention to adopt innovation, it is often expected that the lack of a significant impact of social influence on acceptance intention can occur, as previous studies have also yielded comparable findings (e.g., [131–133]). For social influence to play a role, travelers should receive prior recommendations from experienced users [115]. However, as previously discussed, biometric system are not yet widespread compared to other airport services, making it challenging to gather relevant information from experienced peers. Moreover, modern travelers tend to seek travel-related information from online sources such as blogs, social media, online reviews, and online travel agencies [134–137] which can diminish the impact of normative pressure [106]. This scenario may well explain the lack of a significant impact of social influence on the intention to use airport biometric systems. Although its impact was not statistically significant, including this variable was necessary to comprehend the social context in the investigation of airport biometric acceptance intention [13], representing a meaningful endeavor in this regard.

Regarding technology familiarity, this variable impacted perceived ease of use ($\beta = 0.758, p < 0.01$). However, it did not have a direct influence on the intention to use the airport biometric system. This finding should be understood considering the distinctive features of airport biometric systems. Unlike biometric devices integrated into our daily routines like commuting, mobile phones, banking, and computers, it is important to acknowledge that airport biometric systems are accessible only within the confines of airport usage. In essence, individuals, even those well-versed in biometric technology, seem to perceive airport biometric systems as distinct due to their relatively limited accessibility.
5.3. Variables with Potential Negative Impact

We attempted to discover the essential determinants that impact the intention to use the airport biometric system and ascertain their statistical significance, regardless of whether they have a positive or negative effect. Our findings confirmed that perceived usefulness, ease of use, and trust in information protection significantly and positively influenced the intention to use. However, we could not identify factors negatively affecting the intent to use within our research model. Therefore, we aim to explore related studies encompassing biometric technology in general, including airport biometric systems, to pinpoint variables potentially influencing intention negatively.

In the context of airport biometrics, there are variables that have a negative influence, such as perceived risk, and privacy concern. Kim, Lee, and Castello [22] categorized perceived risk into temporary, physical, and functional risks, which were linked to a decreased intention to use the biometric system. Privacy concern has traditionally been considered a variable that can have a negative impact on the intention to use most technologies or systems involving the use of other people’s information. Similarly, the airport biometric identification system utilizes an individual’s unique biometric information for airport handling procedures, which are public services, making it susceptible to a negative impact. While Kasim’s [21] study clearly confirmed a negative influence, Morosan’s study [13] did not establish statistical significance.

There are also factors that negatively affect the intention to use biometric technology due to its inherent characteristics. For instance, James et al. [138] proposed that biometric technology involving the scanning of an individual’s eyes and face can evoke negative emotions. This characteristic is referred to as physical invasiveness. Their study empirically confirmed that physical invasiveness indeed has a negative effect on the intention to use biometric technology. In a related context, information sensitivity, defined as the degree to which an individual is sensitive to information, has been identified as a factor that negatively impacts the intention to use the biometric system. Typically, users regard an individual’s unique biometric information as highly sensitive and the act of its utilization is often perceived negatively, potentially impeding the intention to use it [54].

6. Conclusions

The sustainable operation of airport biometric systems relies not only on their technological excellence but also on passenger adoption. Cutting-edge features alone do not ensure high usage rates. Hence, understanding user intentions, addressed in RQ1, is vital for sustaining these costly and time-intensive systems. The study confirmed that perceived usefulness, ease of use, and trust in information protection significantly impact intention. Notably, this research seeks to identify drivers that encourage passengers to consistently utilize the biometric system even in a post-COVID-19 environment marked by reduced risks and deregulation. Moreover, this study has confirmed the influence of gender on the intention to use airport biometric systems, especially when dealing with highly sensitive personal biometric data. This gender-related impact is particularly noteworthy in public spaces like airports [139]. We addressed this gap through RQ2 and our findings indicate that women tend to have a higher intention to use these systems, driven by greater trust in information protection compared to men.

6.1. Practical and Academic Implications

Based on the main research findings, several strategies and action plans are recommended from the perspective of airport system practitioners. Firstly, our results emphasize the need for airport managers to ensure the effective functionality of a biometric system, aligning it with passengers’ needs. Clear identification of the positive experiences passengers expect from the system and its proper implementation are crucial. To promote adoption and future use, proactive marketing efforts are essential in conveying the system’s usefulness. Additionally, practitioners should recognize the pivotal role of the ease of using the system. The simplification of processes, user-friendly interfaces, and straightforward
registration procedures for personal biometric information are vital in this regard. Secondly, trust emerges as the key driver for encouraging system use. Airport managers must establish robust policies and procedures to instill traveler confidence in the airport’s ability to safeguard personal information. Implementing marketing strategies that highlight the system’s information security capabilities and how passenger data are protected can enhance trust and subsequently influence their intention to use the biometric system.

From an academic standpoint, this study aims to address the lack of empirical research on the factors influencing travelers’ intentions to use the airport biometric system. Despite the growing global interest in airport biometric systems [1,7,13], there has been limited research focused on passenger intentions—a crucial precursor for the sustainable implementation of the system. In this regard, this study offers valuable academic insight by introducing an extended TAM framework that incorporates technology familiarity, social influence, and trust. By examining both the functional aspects of the system (perceived usefulness and perceived ease of use) and users’ socio-psychological factors (technology familiarity, social influence, and trust), the proposed research model offers a more comprehensive understanding of acceptance intentions. Moreover, gender has frequently been identified as a significant moderator in related fields [32,34,36,140] yet empirical evidence within the airport biometric system context is limited. Our study contributes to filling this research gap by exploring the moderating role of gender, providing an initial step in comprehending individual characteristics in the context of the airport biometric system.

6.2. Future Works

While the current study provides empirical insights, further research is needed for a more comprehensive understanding. Firstly, the study confirms the significance of perceived usefulness and perceived ease of use in explaining an intention to use the airport biometric system. However, these concepts encompass various attributes such as system quality, processing speed, and compatibility. Therefore, investigating the specific attributes of the biometric system that travelers find useful and easy to use is necessary for a deeper analysis. This would enable the identification of more nuanced factors influencing the intention to use the system and aid airports in formulating concrete and practical implementation strategies. Secondly, it is worth noting that individual perceptions towards a certain system or technology can evolve with usage over time [88,141]. Given that the current study adopts a cross-sectional approach, it is unable to capture these changes. To address this limitation, a recommended avenue for future research is conducting a longitudinal study that considers evolving impacts over time.


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Informed Consent Statement: Not applicable.

Data Availability Statement: The data presented in this study are available on request from the corresponding author.

Conflicts of Interest: The authors declare no conflict of interest.
Appendix A

Table A1. Mean, standard deviation, skewness, and kurtosis of measurement items.

<table>
<thead>
<tr>
<th>Construct</th>
<th>Item</th>
<th>Mean</th>
<th>Standard Deviation</th>
<th>Skewness</th>
<th>Kurtosis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Perceived Usefulness</td>
<td>PU1</td>
<td>3.859</td>
<td>1.085</td>
<td>-0.687</td>
<td>-0.326</td>
</tr>
<tr>
<td></td>
<td>PU2</td>
<td>3.816</td>
<td>1.086</td>
<td>-0.662</td>
<td>-0.308</td>
</tr>
<tr>
<td></td>
<td>PU3</td>
<td>3.874</td>
<td>1.056</td>
<td>-0.634</td>
<td>-0.427</td>
</tr>
<tr>
<td>Perceived Ease of use</td>
<td>PEOU1</td>
<td>3.439</td>
<td>1.091</td>
<td>-0.162</td>
<td>-0.698</td>
</tr>
<tr>
<td></td>
<td>PEOU2</td>
<td>3.339</td>
<td>1.082</td>
<td>-0.116</td>
<td>-0.733</td>
</tr>
<tr>
<td></td>
<td>PEOU3</td>
<td>3.318</td>
<td>1.102</td>
<td>-0.167</td>
<td>-0.642</td>
</tr>
<tr>
<td>Technology Familiarity</td>
<td>TF1</td>
<td>3.000</td>
<td>1.003</td>
<td>0.225</td>
<td>-0.239</td>
</tr>
<tr>
<td></td>
<td>TF2</td>
<td>3.033</td>
<td>1.076</td>
<td>0.068</td>
<td>-0.570</td>
</tr>
<tr>
<td></td>
<td>TF3</td>
<td>3.091</td>
<td>1.096</td>
<td>-0.032</td>
<td>-0.773</td>
</tr>
<tr>
<td>Social Influence</td>
<td>SI1</td>
<td>3.053</td>
<td>1.395</td>
<td>0.049</td>
<td>-1.305</td>
</tr>
<tr>
<td></td>
<td>SI2</td>
<td>2.733</td>
<td>1.145</td>
<td>0.403</td>
<td>-0.642</td>
</tr>
<tr>
<td></td>
<td>SI3</td>
<td>2.790</td>
<td>1.234</td>
<td>0.156</td>
<td>-0.955</td>
</tr>
<tr>
<td>Trust in Information</td>
<td>TIP1</td>
<td>2.967</td>
<td>1.126</td>
<td>0.100</td>
<td>-0.721</td>
</tr>
<tr>
<td>Protection</td>
<td>TIP2</td>
<td>3.207</td>
<td>1.052</td>
<td>-0.198</td>
<td>-0.601</td>
</tr>
<tr>
<td></td>
<td>TIP3</td>
<td>3.072</td>
<td>1.168</td>
<td>0.034</td>
<td>-0.885</td>
</tr>
<tr>
<td>Behavioral Intention</td>
<td>BI1</td>
<td>3.547</td>
<td>1.099</td>
<td>-0.334</td>
<td>-0.696</td>
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<tr>
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<td>BI2</td>
<td>3.373</td>
<td>1.110</td>
<td>-0.374</td>
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<tr>
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<td>BI3</td>
<td>3.575</td>
<td>1.079</td>
<td>-0.445</td>
<td>-0.484</td>
</tr>
</tbody>
</table>

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