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Exploring the User Acceptance of Urban Air Mobility: Extending the Technology Acceptance Model with Trust and Service Quality Factors

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ABSTRACT
The purpose of this study is to explore how trust in and the service quality of urban air mobility (UAM) relate to the user acceptance of UAM. We hypothesized that trust directly influences the attitude and intention to use UAM, while service quality factors affect its perceived usefulness and ease of use. A survey data of 450 respondents were analysed by using a partial least squares structural equation model. The results show that trust positively influences the intention to use UAM, and safety perception contributes the most to UAM's trustworthiness. In addition, transport service quality factors (i.e., time-saving, availability, flight comfort, and perceived cost) significantly explained the perceived usefulness and/or ease of use. Path coefficients of the structural model indicate that trust has a greater impact on the user's attitude toward UAM than perceived usefulness. The results of this study contribute to increasing the early user adoption of UAM.

1. Introduction

Urban air mobility (UAM) is an emerging form of transportation supporting air travel within or between urban areas. Rapid population growth in large cities has imposed strains on their transport system, and the mobility needs are increasing in those areas (Fu et al., 2019). Comparing to the surface transportation, UAM will have significant cost advantages over heavy-infrastructures such as roads, rail, and bridges (Holden & Goel, 2016). In addition, UAM is less affected by the event of interruptions as it does not need to follow designated routes (Holden & Goel, 2016). These benefits make the UAM expected as a solution to the urban transport problems. UAM is currently receiving increasing attention from both industry and academia, envisioning a market value of up to $500 billion by 2030 (Reiche et al., 2018).

UAM vehicle, also known as a vertical takeoff and landing (VTOL) aircraft, is a key technology that enables air travel within the urban areas (Straubinger et al., 2021). UAM vehicles will be capable of carrying out vertical takeoff and landing but are distinguishable from existing urban aerial vehicles such as helicopters by their technical structures. VTOL aircrafts adopt an electrical distributed propulsion system that can improve the stability of aircraft through independent control of several motors (Holden & Goel, 2016). Porsche Consulting proposed three vertical mobility concepts that employ either a multirotor system, a lift-and-cruise combination, and a tilt-X system, each with a travel speed ranging between 70 and 300 km/h (Grandl et al., 2018). The EHang 216 is composed of multiple motors and coaxial propellers and can travel a short-to-medium ranged distance (3–100 km) at a flight elevation of under 800 m (Xu, 2020).

Despite significant developments in vehicle design and VTOL technology, UAM could face several barriers to growth, such as takeoff and landing infrastructures, regulation, weather, societal and user acceptance, and concerns about safety, noise, and privacy (Cohen et al., 2021; Reiche et al., 2021; Straubinger, Rothfeld, et al., 2020). In particular, the acceptance of UAM by the public and potential users remains unclear. A market study conducted jointly by NASA and Mckinsey & Company found that 25% of consumers surveyed were comfortable with unmanned aerial technology, while another 25% did not intend to use unmanned aerial systems even when such transportation becomes widely available and the intention of the remaining 50% appears to be ambiguous (Cureton, 2020). The results from the Global Automotive Consumer Survey conducted by Deloitte suggest that safety concerns have led to negative consumer perceptions of UAM (Deloitte, 2020). Specifically, although there has been an increase in the percentage of consumers who agree that air taxis would be a viable solution to roadway congestion, the proportion of consumers doubtful about the safety of UAM is nevertheless high (Deloitte, 2020). Thus, anxiety over this new mode of transportation is expected to continue until a sufficient timeframe of safe operational performance has been demonstrated.

Along with the market studies, a few researchers conducted empirical studies to investigate the user acceptance drivers of UAM. Al Haddad et al. (2020) conducted a survey to identify what factors influences the user adoption of

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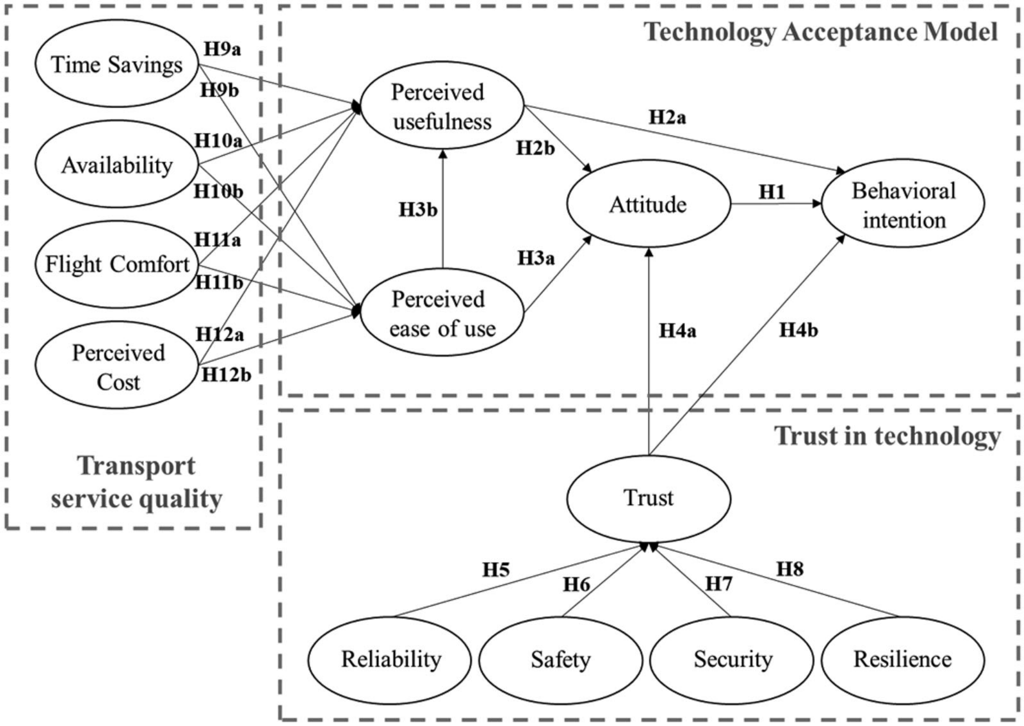

Figure 1. The conceptual research model.

UAM. They showed that safety and trust, user's affinity to automation, data concerns, and socio-demographics are important factors for potential users' UAM adoption. Fu et al. (2019) modeled the preference for four transportation alternatives including private cars, public transportation, autonomous taxis, and autonomous flying taxis, targeting respondents in Munich. It was revealed that the total travel time, travel cost and safety are critical determinants in autonomous transportation mode adoption. A recent demand analysis for advanced air mobility conducted by Goyal et al. (2021) found that the airport shuttles and air taxis could capture 0.5% of total mode share and would replace mandatory trips greater than 45 min.

Previous studies suggest that there are two main types of contributors in the user acceptance of UAM. First, like other new technologies, trust in UAM is crucial because people lack confidence in UAM technology. Second, transport service quality factors such as travel time and cost play an important role in the UAM adoption since the UAM is a type of urban transport. Therefore, the present study aimed to provide an understanding of the key determinants that motivate users' intention to use the UAM by extending the technology acceptance model (TAM) with trust and transport service quality factors. In addition, the relative importance of technology trustworthiness dimension was investigated when the user perceives the trustworthiness of UAM.

The remainder of this paper is organized as follows. Section 2 provides a literature review on studies relating to UAM adoption factors with the research hypotheses of the present study. The research method is covered in Section 3. In Section 4, we present the results from measurements and the structural model. Finally, a discussion and limitations of the study are presented in Section 5. The last section concludes our research.

2. Literature review and research hypotheses

Understanding the determinants in the adoption of innovative technologies is important when predicting their market demand and success. However, as UAM is a relatively new form of transport, research on it is still limited (Straubinger, Kluge, et al., 2020). Previously, researchers have found it useful to utilize factors influencing autonomous vehicle adoption and transportation mode choices for eliciting the determinants of UAM acceptance (Al Haddad et al., 2020; Fu et al., 2019; Straubinger, Kluge, et al., 2020). Through investigation of the current literature, we developed a research model based on TAM, trust, and transportation service quality factors (Figure 1). In the rest of this section, we present the constructs and their relationships.

2.1. Technology acceptance model (TAM)

TAM is one of the most widely used frameworks used to explain the adoption of novel technology systems (Lai, 2017). While TAM was developed to explore the acceptance of information technology by Davis (1989), the outcomes of later studies have shown that the model is useful in other domains such as autonomous vehicles (Choi & Ji, 2015; Herrenkind et al., 2019).

In the original TAM, the actual use of information technology can be explained with the following four constructs: behavioral intention, attitude toward using, perceived usefulness, and perceived ease of use (Davis et al., 1989). Behavioral intention refers to the degree of the psychological state of the individual toward using specific services and systems. In the TAM, behavioral intention is influenced by one's attitude toward system use and perceived usefulness. Attitude is defined as an individual's positive or negative feelings about performing the target behavior and is directly affected by two constructs: perceived usefulness and ease of use. Perceived usefulness refers to "the degree to which a person believes that using a particular system would enhance his or her job performance" (Davis et al., 1989). Perceived ease of use is defined as "the degree to which a person believes that using a particular system would be free of effort" (Davis et al., 1989). From the TAM, we proposed the following hypotheses:

H1. Behavioral intention to use UAM is positively affected by attitude.

H2a. Perceived usefulness has a positive influence on attitude toward using UAM.

H2b. Perceived usefulness has a positive influence on behavioral intention to use UAM.

H3a. Perceived ease of use has a positive influence on attitude toward using UAM.

H3b. Perceived ease of use has a positive influence on the perceived usefulness of UAM.

2.2. Trust in technology

Trust is a critical factor in user's acceptance of new technologies, especially in technologies that include automated features (Hoff & Bashir, 2015). Although the trust concept was not originally considered in the TAM (Davis, 1989) or its successors (Venkatesh & Davis, 2000), the outcomes of several later studies suggest that incorporating trust into TAM is necessary, especially in conditions where high risk and uncertainty exist (Gefen et al., 2003). Within the information system domain (as in other fields), trust is usually examined and defined in terms of trust in people without regard for trust in technology (Mcknight et al., 2011). However, researchers have claimed that trust in technology should be differentiated from interpersonal trust (Lankton et al., 2015; Mcknight et al., 2011). Trust in technology is mostly determined by system features such as reliability rather than social attributes (Hoff & Bashir, 2015; Truong et al., 2017).

Trust in technology is defined as the belief that the specific technology has the attributes necessary to perform as expected in a given situation where there are potential negative outcomes (Mcknight et al., 2011). It has been revealed that trust is a key factor in adopting innovative transportation modes such as autonomous vehicles (Chen, 2019; Choi & Ji, 2015; Dai et al., 2021; Liu et al., 2019; Rahman et al., 2018; Zhang et al., 2019, 2020). Dai et al. (2021) identified that trust in autonomous vehicles positively affects the attitude and behavioral intention to use them. The results of another study conducted by Zhang et al. (2019) also reveal that initial trust regarding automated vehicles is the most critical factor in promoting a positive attitude and the intention to use them.

Trust has also been proposed as a crucial factor for UAM adoption (Al Haddad et al., 2020; Chancey & Politowicz, 2020). Al Haddad et al. (2020) conducted a stated-preference survey to assess the perception of UAM by users, the findings from which reveal the importance of trust in automation to the acceptance of UAM. Chancey and Politowicz (2020) tested the effect of five different types of UAM operation and the mediating role of trust on the public acceptance of UAM, the results from which suggest that trust in UAM will most likely affect its public acceptance. The findings from previous studies have shown that trust has a positive relationship with attitude and the intention to use. Therefore, we hypothesize the following:

H4a. Trust in UAM technology has a positive influence on attitude.

H4b. Trust in UAM technology has a positive influence on behavioral intention.

Several researchers have identified the aspects of trustworthiness in a specific technology. In the present study, we propose four trustworthiness attributes in UAM technology based on the existing literature: reliability, safety, security, and resilience.

2.2.1. Reliability

Reliability suggests one expects a technology to work consistently and predictably (Mcknight et al., 2011). The importance of system reliability in human-machine trust has been revealed, especially in future mobility such as autonomous driving environments. Beller et al. (2013) conducted a driving simulator study to compare the driver's trust in automation system with two levels of reliability. They showed the unreliable system which made mistakes during a drive trusted less by the drivers than a reliable system. A survey study conducted by Kaur and Rampersad (2018) also found that the reliability of driverless cars is an important determinant of trust in autonomous vehicles. Mcknight et al. (2011) confirmed that reliability is a valid component in evaluating one's trust in a specific technology. Madsen and Gregor (2000) also found that the perceived reliability of a computer system should be considered as a component of human-computer trust. Therefore, we put forward the following hypothesis:

H5. The reliability of UAM technology has a positive influence on trust.

2.2.2. Safety

People have consistently expressed safety concerns when they consider using UAM (Al Haddad et al., 2020; Edwards & Price, 2020; Planing & Pinar, 2019; Straubinger, Kluge, et al., 2020). This is not surprising, considering that users' perceived safety is strongly correlated with trust in autonomous driving or physical human-robot interaction (Nordhoff et al., 2021; Rubagotti et al., 2022). In the survey study of Zhang et al. (2019), it was found that perceived safety is a determinant of the initial trust in autonomous vehicles. Xu et al. (2018) also revealed that perceived safety is a direct predictor of the acceptance of automated vehicles, and it also has a positive relationship with trust. Thus, we propose the following hypothesis:

H6. The safety of UAM technology has a positive influence on trust.

2.2.3. Security

In the present study, the security construct is related to the cybersecurity concept rather than physical security such as protecting passengers from robberies. Generally, security is defined as the property of being protected from unauthorized access, change, or destruction. Security was modelled as a predictor of trust and behavioural intention in the autonomous vehicle domain, where the potential risk of cyberattack exists (Kaur & Rampersad, 2018; Waung et al., 2021). As UAM relies on digital technology and telecommunication for its traffic management (Straubinger, Rothfeld, et al., 2020), it could be assumed that security is influential to the trust in UAM. People have expressed concerns about cybersecurity and cyberterrorism when using UAM, and those concerns have increased as the automation level of UAM has advanced (Shaheen et al., 2018). Likewise, Al Haddad et al. (2020) stressed the importance of data concerns in UAM adoption and noted that they can exhibit a negative influence on trust. Therefore, we developed the following hypothesis:

H7. The security of UAM technology has a positive influence on trust.

2.2.4. Resilience

Resilience refers to the ability of a system withstand a major disruption within acceptable degradation parameters and to recover with a suitable time and reasonable costs and risks (Haimes, 2009). The usage of the term resilience has increased in the literature due to its role in reducing the risk associated with the inevitable disruption on systems (Hosseini et al., 2016). In the software engineering domain, resilience is regarded as a principal property of trustworthiness that reflects the user's degree of trust in the trustee (Avižienis et al., 2004; Cho et al., 2019). UAM operates in higher risk environments compared to surface transportation, and the consequences of disruption are more lethal. Therefore, UAM vehicles have been designed with resilient features, including driving redundancy provided by multiple motors and propellers to prevent passengers from fatal accidents (Edwards & Price, 2020; Xu, 2020). Given the relationship between trust and resilience, we produced the following hypothesis:

H8. The resilience of UAM technology has a positive influence on trust.

2.3. Transport service quality

Even if potential users trust UAM, there is no guarantee that UAM will be adopted in the marketplace. Hence, it is necessary to identify what will facilitate user's mode change behavior from conventional transport to UAM (Fu et al., 2019), which can affect the perceived usefulness and ease of use of UAM services. The outcomes from previous studies have shown that the perceived service quality of a transit system is important for consumer satisfaction and behavioral intention in the public transportation and airline domains (De Oña et al., 2013; W. T. Lai & Chen, 2011). Therefore, we identified the transport service quality factors that may influence the satisfaction and adoption of UAM as a transport mode to evaluate the external factors of the UAM acceptance model.

2.3.1. Time-saving

One of the characteristics of UAM is that it is less affected by traffic congestion and can reach its destination without relying on roads. These features offer the advantage of saving travel time over surface transportation. From the definition of Sepasgozar et al. (2019), we defined time savings as the perception of time-saving through using UAM. Time-saving has been considered one of the key factors in transportation mode choice (Tyrinopoulos & Antoniou, 2019), and it is also considered an influential factor in adopting UAM (Al Haddad et al., 2020; Straubinger, Kluge, et al., 2020). Fu et al. (2019) revealed that total travel time plays an important role in autonomous transportation mode choice.

H9a. Time-saving has a positive influence on the perceived usefulness of UAM.

H9b. Time-saving has a positive influence on the perceived ease of use of UAM.

2.3.2. Availability

In the transportation service context, availability of service is described as the extent of the provided services in terms of geography, time, and frequency. Providing customers with high frequency, generous operating hours and a wide network coverage is essential for improving the service quality of transportation (Ibrahim et al., 2020). For example, Trompet et al. (2013) conducted a series of surveys on the service quality of bus operators in different regions over time; their data reveal that the availability of service was the main priority for customers. De Oña et al. (2013) also discovered that the frequency of a bus transit service was related to service quality. In this vein, constraints on UAM operations, such as weather, capacity of infrastructure, and time of day, may affect its availability, and eventually relate to user demand (Reiche et al., 2018). Thus, the following hypotheses were constructed:

H10a. Availability has a positive influence on the perceived usefulness of UAM.

H10b. Availability has a positive influence on the perceived ease of use of UAM.

2.3.3. Flight comfort

Comfort is a key factor associated with passenger experience in both airline travel and surface transportation (De Oña et al., 2013; Vink et al., 2012). When UAM acceptance was being assessed, people expressed concerns about their comfort during flight, such as noise and vibration (Edwards & Price, 2020). Clemes et al. (2008) reported that comfort is positively related to customer satisfaction during international air travel. De Oña et al. (2013) demonstrated that comfort is a latent variable of overall service quality in bus transit services. Therefore, we defined flight comfort of UAM as "the overall comfort and well-being of the occupants during the flight" and formulated hypothesis 11 as follows:

H11a. Flight comfort has a positive influence on the perceived usefulness of UAM.

H11b. Flight comfort has a positive influence on the perceived ease of use of UAM.

2.3.4. Perceived cost

The cost aspect is one of the largest barriers to acceptance in both new technologies and transportation services. The results of previous studies have shown that the perceived cost negatively affects the intention to use UAM as well as other transport services. It has been shown that cost is the primary limiting reason for consumer frequency of air travel (Shaheen et al., 2018). It has also been indicated that perceived travel cost is highly influential for late UAM adoption (Al Haddad et al., 2020). Fu et al. (2019) found that travel cost is negatively related to the intention to use UAM. We defined the perceived cost of the UAM service in terms of the estimated cost and formulated the following hypotheses:

H12a. The perceived cost has a negative influence on the perceived usefulness of UAM.

H12b. The perceived cost has a negative influence on the perceived ease of use of UAM.

3. Methods

3.1. Measurement

A total of 13 constructs were obtained based on the literature review, with each one being measured with multiple items adopted from previous studies to improve the content validity; superficial modification was conducted to comply with the UAM context. Hence, a total of 39 items are provided in Table 1. All of the items were translated from English into Korean and measured by applying a 7-point Likert scale from 1 (highly disagree) to 7 (highly agree).

3.2. Participants and data collection

The data for the present research was collected through an online survey conducted using Google Forms. The online survey was conducted with respondents living in South Korea. The online survey was distributed in May 2021, and responses collected during the period of May to June 2021 were used for the data analysis. Convenience sampling technique, which is a type of non-probability sampling methods, was used for the data collection. Only participants aged 18 or older were allowed to respond to the survey.

At the beginning of the survey, respondents were asked to read a description of UAM. The description included four images of different types of UAM vehicles which were Volocopter 2X, Joby S4, Lillium Jet, and Hyundai S-A1. Also, the description explained the definition of UAM, its technical features, its potential benefits such as mitigating traffic congestions, and expected journey of UAM including the stations (known as vertiports). Subsequently, respondents assessed their beliefs about UAM. On the last page of the questionnaire, participants were requested to indicate their gender and age information. In this survey, respondents answered their age in one of the following three ranges: 18–39, 40–59, 60 and over.

After obtaining the survey responses, we first removed data that contained missing values or inattentive responses. As a result, a total of 450 completed questionnaires were used in the analysis: 52.4% of the respondents were between 18–39, 45.6% were between 40–59, and 2% were over the age of 60, with 79.1% male and 20.9% female (Table 2).

3.3 Data analysis

The hypotheses of the proposed model were analyzed by using SmartPLS 3.0 software. Partial least squares (PLS) analysis is a consistent tool for examining the validity of constructs and evaluating the structural relationship among the constructs via a latent variable analysis (Chin, 1998; Gefen et al., 2000).

The efficacy of the overall study model was investigated in two steps. First, we tested the reliability and validity of the measurement model. Cronbach's alpha, composite reliability, and standardized item loadings were used to assess the reliability of the measurement model. According to literature, a Cronbach's alpha value of 0.7 or higher reveals good internal consistency reliability while above 0.6 is acceptable (Barclay et al., 1995). It is recommended that composite reliability of each latent variable exceed 0.6 (Nunnally & Bernstein, 1994) and standardized item loadings exceed 0.6 (Hair, 2009).

The convergent and discriminant validity of the measurement model were analyzed by average variance extracted (AVE) value. It is suggested that 0.5 or higher AVE value for each latent variable reflects favorable convergent validity and the square root of the AVE should be greater than the inter-construct correlations to ensure discriminant validity (Barclay et al., 1995; Chin, 1998).

After measurement model testing, we investigated the validity of the PLS structural equation model to test the

Table 1. Construct and measurement items.

Construct		Item
Behavioral intention	BI1	I intend to use UAM in the future.
	BI2	I expect to use UAM in the future.
	BI3	I plan to use UAM in the future.
Attitude toward using	AT1	Using UAM is a positive idea.
	AT2	Using UAM is a good idea.
	AT3	Using UAM is a pleasant idea.
Perceived usefulness	PU1	Using UAM will improve my travel performance.
	PU2	I find UAM a useful means of transport.
	PU3	I believe that using UAM will be an effective way to travel.
Perceived ease of use	PEOU1	Using UAM will be convenient.
	PEOU2	Learning to use UAM will be easy for me.
	PEOU3	If I use UAM, it would be simple for me.
Trust	TRU1	UAM is a dependable technology.
	TRU2	UAM is a reliable technology.
	TRU3	Overall, I trust UAM.
Reliability	REL1	I believe that UAM is free from errors.
	REL2	I believe that UAM will operate consistently under a variety of circumstances.
	REL3	I believe that UAM will carry out its essential functions.
Safety	SF1	I believe that it will be safe to travel using UAM.
	SF2	I believe that UAM guarantees the safety of passengers.
	SF3	I believe that UAM can prevent accidents.
Security	SEC1	I believe that UAM will not share its data (e.g., GPS data) to unauthorized parties.
	SEC2	I believe that UAM is secure against hackers.
	SEC3	I believe that UAM will protect information from external access.
Resilience	RES1	I believe that UAM will be resistant to failures that occur during flight.
	RES2	I believe that UAM will recover from degradation that occurs during a flight.
	RES3	I believe that UAM will adapt to changes in the system status that occur during a flight.
Time saving	TS1	I believe that using UAM will reduce travel time.
	TS2	I believe that using UAM will avoid time spent in traffic congestion.
	TS3	I believe that using UAM will help me reach my destination more quickly.
Availability	AVA1	I believe that UAM will provide convenient operating hours.
	AVA2	I believe that UAM will operate at a high frequency.
	AVA3	I believe that UAM will offer wide network coverage.
Flight comfort	FC1	I believe that the level of noise in the UAM will be low.
	FC2	I believe that the level of vibration in the UAM will be low.
	FC3	I believe that UAM will provide enough space for passengers. (e.g., legroom, ceiling height, etc.)
Perceived cost	PC1	The cost of using UAM will be expensive.
	PC2	The price of UAM services could be a financial burden for me.
	PC3	I think that I will not be able to easily afford the UAM services.

Table 2. Description on demographic information of respondents.

Demographics	Category	*N* (Total = 450)	Proportion (%)
Age	18–39	236	52.40
	40–59	205	45.60
	60 or more	9	2.00
Gender	Male	356	79.10
	Female	94	20.90

proposed research hypotheses. A bootstrapping method with 1000 subsampling was used to estimate the path coefficients of our research model. The significance of the path coefficients was analyzed by Student *t*-test based on a significance level of 0.05.

4. Results

4.1. Descriptive statistics

Table 3 reports the descriptive statistics including the mean and standard deviation for the measurement items of each construct. The results suggest that respondents generally had a positive attitude (M = 5.00) and behavioral intention (M = 5.13) toward UAM usage. Further, respondents perceived that UAM is a useful mode of transportation (M = 5.73), but their trust was found to be below the moderate level (M = 3.82).

Table 3. Descriptive statistics of the constructs.

Construct	Mean (SD)
Behavioral Intention	5.13 (1.58)
Attitude toward using	5.00 (1.47)
Perceived usefulness	5.73 (1.19)
Perceived ease of use	4.61 (1.59)
Trust	3.82 (1.53)
Reliability	3.98 (1.67)
Safety	3.66 (1.55)
Security	3.65 (1.71)
Resilience	3.98 (1.50)
Time-saving	6.14 (1.04)
Availability	5.20 (1.51)
Flight comfort	3.79 (1.66)
Perceived cost	5.58 (1.30)

4.2. Analysis of the measurement model

The assessment results of the measurement model are provided in Table 4, in which it can be seen that all item loadings exceeded 0.6. All constructs showed a Cronbach's alpha value of 0.7 or higher except for security ($\alpha = 0.690$). Overall, the constructs showed composite reliability larger than 0.7, and all of the AVEs were larger than 0.5. These results show the good reliability and convergent validity of the measurement model.

To assess the discriminant validity of each construct, the square root of the AVE for each factor was compared to its correlation coefficient with other factors. As shown in

Table 5, the square root value of the AVE for each latent variable (the values on the diagonal lines) is obviously larger than its correlation coefficient with other factors.

4.3. Analysis of the structural model

Figure 2 shows the correlation coefficient (R^2) values of the endogenous constructs and path coefficient. The R^2 values for behavioral intention, attitude, perceived usefulness, ease of use, and trust were 0.618, 0.586, 0.490, 0.494, and 0.759, respectively. Falk and Miller (1992) suggested that the R^2 values of the latent constructs should be at least 0.10 to be judged as adequate.

Table 4. Reliability and convergent validity measurements.

Construct	Item	Loading	α	CR	AVE
Behavioral intention	BI1	0.950	0.956	0.972	0.920
	BI2	0.961			
	BI3	0.966			
Attitude toward using	AT1	0.939	0.935	0.959	0.885
	AT2	0.942			
	AT3	0.942			
Perceived usefulness	PU1	0.898	0.889	0.931	0.818
	PU2	0.917			
	PU3	0.898			
Perceived ease of use	PEOU1	0.913	0.929	0.955	0.876
	PEOU2	0.956			
	PEOU3	0.938			
Trust	TRU1	0.963	0.962	0.975	0.929
	TRU2	0.954			
	TRU3	0.975			
Reliability	REL1	0.924	0.872	0.921	0.796
	REL2	0.883			
	REL3	0.869			
Safety	SF1	0.941	0.852	0.910	0.773
	SF2	0.940			
	SF3	0.740			
Security	SEC1	0.891	0.690	0.791	0.562
	SEC2	0.699			
	SEC3	0.636			
Resilience	RES1	0.910	0.914	0.946	0.854
	RES2	0.936			
	RES3	0.926			
Time-saving	TS1	0.906	0.913	0.945	0.852
	TS2	0.938			
	TS3	0.925			
Availability	AVA1	0.860	0.818	0.891	0.732
	AVA2	0.847			
	AVA3	0.860			
Flight comfort	FC1	0.919	0.863	0.917	0.786
	FC2	0.908			
	FC3	0.830			
Perceived cost	PC1	0.810	0.850	0.909	0.769
	PC2	0.935			
	PC3	0.881			

Note: α: Cronbach's alpha; CR: composite reliability; AVE: average variance extracted.

Table 6 lists the path coefficients and significance for each hypothesis. All hypotheses were supported except for H9b, H11a, and H12a. Behavioral intention is determined as perceived usefulness, attitude, and trust. Attitude (H1 : $\beta = 0.529$; $p < 0.001$) was the most influential factor for behavioral intention, followed by trust (H4b: $\beta = 0.241$; $p < 0.001$) and perceived usefulness (H2b: $\beta = 0.130$; $p < 0.01$). Attitude can be explained by perceived usefulness (H2a: $\beta = 0.347$; $p < 0.001$), ease of use (H3a : $\beta = 0.220$; $p < 0.001$), and trust (H4a: $\beta = 0.404$; $p < 0.001$). Trust explains the largest part of attitude compared to perceived usefulness and ease of use.

All trustworthiness factors had a significant relationship with trust. Safety showed the largest path coefficient compared with the others (H6: $\beta = 0.413$; $p < 0.001$). Resilience (H8: $\beta = 0.287$; $p < 0.001$) and reliability (H5 : $\beta = 0.224$; $p < .001$) were also associated with trust, while security (H7: $\beta = 0.093$; $p < 0.01$) had the least impact.

Transport service quality factors were exploited to explain the variance of perceived usefulness and ease of use. 49.0% of the variance in perceived usefulness is accounted for the perceived ease of use(H3b: $\beta = 0.212$; $p < 0.001$), time-saving(H9a : $\beta = 0.444$; $p < 0.001$), availability (H10a: $\beta = 0.162,$; $p < 0.01$), and perceived costs (H12a: $\beta = 0.091$; $p < 0.05$). Contrary to the hypothesis, the perceived cost had a positive effect on perceived usefulness. There was no significant relationship between flight comfort and perceived usefulness (H11a: $\beta = 0.050$; $p = 0.173$). Availability (H10b: $\beta = 0.482$; $p < 0.001$), flight comfort (H11b: $\beta = 0.288$; $p < 0.001$), and perceived cost (H12b: $\beta = -0.077$; $p < .05$) contributed 49.4% of the variance in the perceived ease of use. Availability had the greatest impact on the perceived ease of use whereas time-saving was not associated with it (H9b: $\beta = 0.064$; $p = 0.112$).

5. Discussion

This research was conducted to uncover the acceptance factors for UAM. Based on the TAM, we investigated the

Table 5. Correlation matrix and discriminant validity of the constructs.

Construct	BI	AT	PU	PEOU	TRU	REL	SF	SEC	RES	TS	AVA	FC	PC
BI	**0.959**												
AT	0.757	**0.941**											
PU	0.520	0.587	**0.905**										
PEOU	0.528	0.585	0.484	**0.936**									
TRU	0.618	0.627	0.333	0.484	**0.964**								
REL	0.512	0.542	0.315	0.441	0.751	**0.892**							
SF	0.557	0.574	0.300	0.410	0.806	0.757	**0.879**						
SEC	0.361	0.370	0.215	0.299	0.487	0.370	0.418	**0.750**					
RES	0.548	0.536	0.276	0.423	0.740	0.631	0.644	0.489	**0.924**				
TS	0.362	0.373	0.624	0.351	0.183	0.174	0.175	0.186	0.158	**0.923**			
AVA	0.517	0.538	0.553	0.646	0.442	0.426	0.391	0.294	0.373	0.549	**0.856**		
FC	0.495	0.497	0.258	0.510	0.612	0.603	0.628	0.347	0.598	0.111	0.418	**0.887**	
PC	−0.064	−0.057	0.080	−0.173	−0.159	−0.155	−0.160	−0.123	−0.142	0.122	−0.106	−0.194	**0.877**

Note: The bold values on the diagonal provide the square root of average variance extracted for each latent constructs. BI: behavioral intention; AT: attitude toward using; PU: perceived usefulness; PEOU: perceived ease of use; TRU: trust; REL: reliability; SF: safety; SEC: security; RES: resilience; TS: time-saving; AVA: availability; FC: flight comfort; PC: perceived cost.

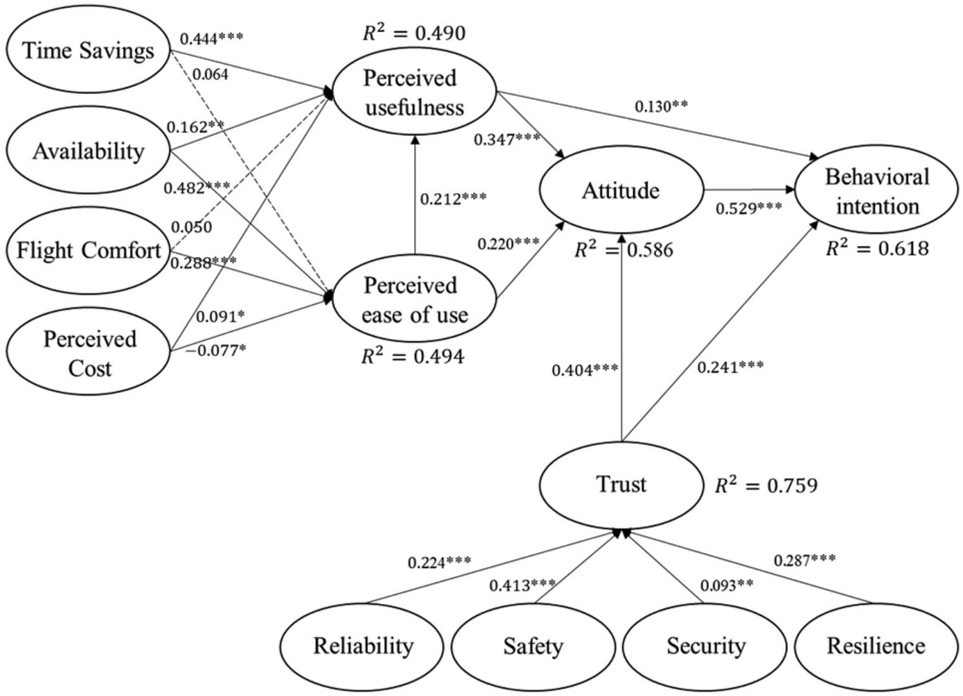

Figure 2. Assessment of the structural model. *Note:* *$p < 0.05$, **$p < 0.01$, ***$p < 0.001$.

Table 6. Results for the structural model.

Hypothesis	Path (relation)	Coefficient	*t*-Statistic	Significance	Outcome
H1	AT → BI (+)	0.529	9.026	***	Supported
H2a	PU → AT (+)	0.347	7.497	***	Supported
H2b	PU → BI (+)	0.130	2.740	**	Supported
H3a	PEOU → AT (+)	0.220	4.685	***	Supported
H3b	PEOU → PU (+)	0.212	4.426	***	Supported
H4a	TRU → AT (+)	0.404	10.023	***	Supported
H4b	TRU → BI (+)	0.241	5.125	***	Supported
H5	REL → TRU (+)	0.224	5.507	***	Supported
H6	SF → TRU (+)	0.413	10.468	***	Supported
H7	SEC → TRU (+)	0.093	2.810	**	Supported
H8	RES → TRU (+)	0.287	7.637	***	Supported
H9a	TS → PU (+)	0.444	8.116	***	Supported
H9b	TS → PEOU (+)	0.064	1.590	0.112	Not Supported
H10a	AVA → PU (+)	0.162	2.637	**	Supported
H10b	AVA → PEOU (+)	0.482	10.548	***	Supported
H11a	FC → PU (+)	0.050	1.362	0.173	Not Supported
H11b	FC → PEOU (+)	0.288	6.626	***	Supported
H12a	PC → PU (−)	0.091	2.521	*	Not Supported
H12b	PC → PEOU (−)	−0.077	2.277	*	Supported

Note: BI: behavioral intention; AT: attitude toward using; PU: perceived usefulness; PEOU: perceived ease of use; TRU: trust; REL: reliability; SF: safety; SEC: security; RES: resilience; TS: time-saving; AVA: availability; FC: flight comfort; PC: perceived cost.

impact of trust in technology and its antecedents on the intention to use UAM. In addition, our structural model was extended by applying transportation service quality factors. An online survey was conducted to gather user opinions. The research model was statistically tested by using a PLS structural equation model. The results show that all of the hypotheses were supported except for three.

The PLS structural equation model results show that perceived usefulness and attitude have a positive influence on behavioral intention, which is in line with the outcomes of several studies in other fields revealing that attitude is the most influential factor on intention. Trust also shows a positive relationship with behavioral intention, which implies that a higher level of trust in technology may lead to a higher level of technology adoption. Perceived usefulness, ease of use, and trust were shown to be positively related to the attitude toward using UAM, with surprisingly, trust having more influence on attitude than the others. This result suggests that building trust toward UAM technology should precede improving service quality during the early stages of its introduction.

Trust was positively influenced by all four technical attributes (i.e., reliability, safety, security, and resilience). Safety was revealed as the most influential factor among them, followed by resilience and reliability. Security was shown to be the least influential factor on trust. These results correspond with those from earlier studies (Kaur & Rampersad, 2018; Zhang et al., 2019). When researchers evaluated trust in driverless cars, security appears to have only a partial effect in contrast to the reliability attribute showing high significance (Kaur & Rampersad, 2018). In the same vein, perceived safety risk has a significant effect on the initial trust of autonomous vehicles whereas perceived privacy risk does not (Zhang et al., 2019).

The service quality of UAM showed significant effects on the perceived usefulness and ease of use. Meanwhile, time-saving had the most influence on the perceived usefulness, although its relationship with perceived ease of use was not supported. This finding further supports the study of Straubinger, Kluge, et al. (2020) in which travel time was found to be the most relevant factor driving the demand for UAM. Availability had a positive influence on both the perceived usefulness and ease of use, which is in line with Trompet et al. (2013) who determined that availability is the most decisive factor when assessing the service quality of a specific transit mode. Flight comfort had a positive influence on perceived ease of use, but its relationship to usefulness was not significant.

One unanticipated finding is that the perceived cost had a positive influence on the perceived usefulness. This result may be due to the effect of social influence, especially in terms of social image (Venkatesh & Davis, 2000). Social image refers to the degree by which the use of an innovation is perceived to enhance one's status in his or her social system (Venkatesh & Davis, 2000). Previously, researchers have also noted that the use of UAM may be an indicator of one's social image (Edwards & Price, 2020; Planing & Pinar, 2019). Therefore, we assume that the high cost of using UAM influences the user's image, which led to a positive relationship with perceived usefulness.

This research has some limitations. First, our research solely relies on the online survey method. Although online surveys are a great instrument to gather data safely under pandemic situation, they have inherent flaws that respondents are not able to directly experience the technology and it is hard to collect qualitative insights compared to in-person interview. Therefore, we suggest that exploiting methods such as a focus group interview or a laddering technique should be addressed in the future work to understand the process where the potential users accept UAM as an option for transportation mode among other existing urban transits. Second, the majority of respondents were male and their age was between the range of 18–60, so the results of this study may be biased toward those groups. Male respondents expressed a more positive perception of UAM than females (Reiche et al., 2018). Furthermore, their study results also implied that the younger generation is more willing to fly in a UAM aircraft than older individuals. We assume that this is why the acceptance of UAM was generally higher, and it is expected to be lowered if other demographic groups are recruited. Third, the moderating effects of individual characteristics of respondents were not considered in the present study. It is known that not only gender and age, but also other individual characteristics such as respondents' personal innovativeness and their ethnicity affect their acceptance of future mobility (Esterwood et al., 2021; Hegner et al., 2019). As Planing & Pinar (2019) suggested that a lower level of knowledge is an indicator of greater safety concerns in UAM acceptance, further research should be conducted to identify the impacts of individual characteristics on the acceptance of UAM.

Despite such limitations, this study made the following contributions. First, our work empirically identified that the TAM can be applied to understanding the intention to use UAM. Second, we identified the need for factors such as resilience and safety in the trust of UAM, which is different from their use in the software technology domain. Third, we showed that service quality is one of the factors that determine the perceived usefulness and ease of use of UAM services. To generalize and extend our findings, we will consider individual differences in our model and conduct subsequent studies by adding human-related service quality factors.

We suggest that future work is needed to extend the results of the current study. Particularly, we believe that enlightening underlying factors which contribute to the passenger trust and trustworthy factors is crucial for improving user experience of UAM. User trust can be divided into two categories depending on the time (Hoff & Bashir, 2015): the initial trust (which is established before the interaction) and dynamic learned trust (which is continuously developed during the interaction). As aforementioned, identifying the effects of individual factors that affect one's initial trust is a practical way to establish initial market strategies for different user groups. Furthermore, in order to deal with the dynamic learned trust, it is recommended to conduct user testing which provides direct or indirect experience with UAM journey. As both of the system performance and design features can affect dynamic learned trust, it is necessary to understand the impacts of the reliability of UAM and the design of human-machine interfaces on passenger trust. In particular, the interface design for a trustworthy system is worth considering because it can alter the manner users perceive the performance of the system (Hoff & Bashir, 2015). Increasing automation transparency or transforming its appearance may be an effective method to achieve passenger trust (Lee et al., 2015; Vorm & Combs, 2022). User testing also provides the researchers with the opportunity to gather behavioral and physiological measures beyond subjective trust metrics, allowing them to observe the trust fluctuation during the UAM experience.

6. Conclusion

The purpose of this study is to explore how trust in and the service quality of UAM relate to the user acceptance of UAM. Based on the TAM, we hypothesized that trust directly influences the attitude and intention to use UAM, while service quality factors affect its perceived usefulness and ease of use. An online survey was conducted to collect data for the hypothesis testing. The survey was distributed in South Korea from May to June 2021, and 450 valid responses were collected. A partial least squares structural equation model was used for the data analysis. The results show that trust and service quality factors are significantly related to the original TAM structures. Trust in UAM technology positively influences the intention to use UAM, and safety perception contributes the most to UAM's trustworthiness. In addition, transport service quality factors (i.e., time-saving, availability, flight comfort, and perceived cost) significantly explained the perceived usefulness and/or ease of use. Path coefficients of the structural model indicate that trust has a greater impact on the user's attitude toward UAM than perceived usefulness, indicating that establishing trust is crucial for the adoption of UAM. Future research is needed on the effect of individual characteristics on UAM acceptance and design solutions to increase passenger trust.

Disclosure statement

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References

Al Haddad, C., Chaniotakis, E., Straubinger, A., Plötner, K., & Antoniou, C. (2020). Factors affecting the adoption and use of urban air mobility. *Transportation Research Part A: Policy and Practice*, *132*, 696–712. https://doi.org/10.1016/j.tra.2019.12.020

Avižienis, A., Laprie, J. C., Randell, B., & Landwehr, C. (2004). Basic concepts and taxonomy of dependable and secure computing. *IEEE Transactions on Dependable and Secure Computing*, *1*(1), 11–33. https://doi.org/10.1109/TDSC.2004.2

Barclay, D., Higgins, C., & Thompson, R. (1995). The partial least squares (PLS) approach to causal modeling: Personal computer adoption and use as an illustration. *Technology Studies*, *2*(2), 285–309.

Beller, J., Heesen, M., & Vollrath, M. (2013). Improving the driver–automation interaction: An approach using automation uncertainty. *Human Factors*, *55*(6), 1130–1141. https://doi.org/10.1177/0018720813482327

Chancey, E. T., & Politowicz, M. S. (2020). Public trust and acceptance for concepts of remotely operated urban air mobility transportation. *Proceedings of the Human Factors and Ergonomics Society Annual Meeting*, *64*(1), 1044–1048. https://doi.org/10.1177/1071181320641251

Chen, C. F. (2019). Factors affecting the decision to use autonomous shuttle services: Evidence from a scooter-dominant urban context. *Transportation Research Part F: Traffic Psychology and Behaviour*, *67*, 195–204. https://doi.org/10.1016/j.trf.2019.10.016

Chin, W. W. (1998). The partial least squares approach for structural equation modeling. In G. A. Marcoulides (Ed.), *Methodology for business and management: Modern methods for business research.* (pp. 295–336). Lawrence Erlbaum Associates Publishers.

Cho, J. H., Xu, S., Hurley, P. M., Mackay, M., Benjamin, T., & Beaumont, M. (2019). StRAM: Measuring the trustworthiness of computer-based systems. *ACM Computing Surveys*, *51*(6), 1–47. https://doi.org/10.1145/3277666

Choi, J. K., & Ji, Y. G. (2015). Investigating the importance of trust on adopting an autonomous vehicle. *International Journal of Human-Computer Interaction*, *31*(10), 692–702. https://doi.org/10.1080/10447318.2015.1070549

Clemes, M. D., Gan, C., Kao, T.-H., & Choong, M. (2008). An empirical analysis of customer satisfaction in international air travel. *Innovative Marketing*, *4*(2), 49–62. https://www.proquest.com/scholarly-journals/empirical-analysis-customer-satisfaction/docview/2622618794/se-2?accountid=15179

Cohen, A. P., Shaheen, S. A., & Farrar, E. M. (2021). Urban air mobility: History, ecosystem, market potential, and challenges. *IEEE Transactions on Intelligent Transportation Systems*, *22*(9), 6074–6087. https://doi.org/10.1109/TITS.2021.3082767

Cureton, P. (2020). Urban air mobility. In *Drone futures: UAS in landscape and urban design* (pp. 108–147). Taylor & Francis. https://doi.org/10.4324/9781351212991-4

Dai, J., Li, R., & Liu, Z. (2021). Does initial experience affect consumers' intention to use autonomous vehicles? Evidence from a field experiment in Beijing. *Accident Analysis and Prevention*, *149*, 105778. https://doi.org/10.1016/j.aap.2020.105778

Davis, F. D. (1989). Perceived usefulness, perceived ease of use, and user acceptance of information technology. *MIS Quarterly*, *13*(3), 319–339. https://doi.org/10.2307/249008

Davis, F. D., Bagozzi, R. P., & Warshaw, P. R. (1989). User acceptance of computer technology: A comparison of two theoretical models. *Management Science*, *35*(8), 982–1003. https://doi.org/10.1287/mnsc.35.8.982

De Oña, J., De Oña, R., Eboli, L., & Mazzulla, G. (2013). Perceived service quality in bus transit service: A structural equation approach. *Transport Policy*, *29*, 219–226. https://doi.org/10.1016/j.tranpol.2013.07.001

Deloitte. (2020). *Urban air mobility: What will it take to elevate consumer perception?* https://www2.deloitte.com/content/dam/Deloitte/us/Documents/energy-resources/urban-air-mobility.pdf

Edwards, T., Price, G. (2020). *eVTOL passenger acceptance, NASA CR-2020-220460.* https://ntrs.nasa.gov/api/citations/20200000532/downloads/20200000532.pdf

Esterwood, C., Yang, X. J., & Robert, L. P. (2021). Barriers to AV bus acceptance: A national survey and research agenda. *International Journal of Human–Computer Interaction*, *37*(15), 1391–1403. https://doi.org/10.1080/10447318.2021.1886485

Falk, R. F., & Miller, N. B. (1992). *A primer for soft modeling*. University of Akron Press.

Fu, M., Rothfeld, R., & Antoniou, C. (2019). Exploring preferences for transportation modes in an urban air mobility environment: Munich case study. *Transportation Research Record: Journal of the Transportation Research Board*, *2673*(10), 427–442. https://doi.org/10.1177/0361198119843858

Gefen, D., Karahanna, E., & Straub, D. W. (2003). Trust and TAM in online shopping: An integrated model. *MIS Quarterly*, *27*(1), 51–90. https://doi.org/10.2307/30036519

Gefen, D., Straub, D., & Boudreau, M.-C. (2000). Structural equation modeling and regression: Guidelines for research practice. *Communications of the Association for Information Systems*, *4*(1), 7. https://doi.org/10.17705/1CAIS.00407

Goyal, R., Reiche, C., Fernando, C., & Cohen, A. (2021). Advanced air mobility: Demand analysis and market potential of the airport shuttle and air taxi markets. *Sustainability*, *13*(13), 7421. https://doi.org/10.3390/su13137421

Grandl, G., Ostgathe, M., Cachay, J., Doppler, S., Salib, J., Ross, H. (2018). *The future of vertical mobility: A Porsche consulting study*. https://www.porsche-consulting.com/fileadmin/docs/04_Medien/Publikationen/TT1371_The_Future_of_Vertical_Mobility/The_Future_of_Vertical_Mobility_A_Porsche_Consulting_study__C_2018.pdf

Haimes, Y. Y. (2009). On the definition of resilience in systems. *Risk Analysis*, *29*(4), 498–501. https://doi.org/10.1111/j.1539-6924.2009.01216.x

Hair, J. F. (2009). *Multivariate data analysis* (7th ed.). Pearson.

Hegner, S. M., Beldad, A. D., & Brunswick, G. J. (2019). In automatic we trust: Investigating the impact of trust, control, personality characteristics, and extrinsic and intrinsic motivations on the acceptance of autonomous vehicles. *International Journal of Human–Computer Interaction*, *35*(19), 1769–1780. https://doi.org/10.1080/10447318.2019.1572353

Herrenkind, B., Brendel, A. B., Nastjuk, I., Greve, M., & Kolbe, L. M. (2019). Investigating end-user acceptance of autonomous electric buses to accelerate diffusion. *Transportation Research Part D: Transport and Environment*, *74*, 255–276. https://doi.org/10.1016/j.trd.2019.08.003

Hoff, K. A., & Bashir, M. (2015). Trust in automation: Integrating empirical evidence on factors that influence trust. *Human Factors*, *57*(3), 407–434. https://doi.org/10.1177/0018720814547570

Holden, J., & Goel, N. (2016). *Fast-forwarding to a future of on-demand urban air transportation*. https://www.uber.com/elevate.pdf

Hosseini, S., Barker, K., & Ramirez-Marquez, J. E. (2016). A review of definitions and measures of system resilience. *Reliability Engineering & System Safety*, *145*, 47–61. https://doi.org/10.1016/j.ress.2015.08.006

Ibrahim, A. N. H., Borhan, M. N., Md. Yusoff, N. I., & Ismail, A. (2020). Rail-based public transport service quality and user satisfaction–A literature review. *Promet - Traffic&Transportation*, *32*(3), 423–435. https://doi.org/10.7307/ptt.v32i3.3270

Kaur, K., & Rampersad, G. (2018). Trust in driverless cars: Investigating key factors influencing the adoption of driverless cars. *Journal of Engineering and Technology Management*, *48*, 87–96. https://doi.org/10.1016/j.jengtecman.2018.04.006

Lai, P. (2017). The literature review of technology adoption models and theories for the novelty technology. *Journal of Information Systems and Technology Management*, *14*(1), 21–38. https://doi.org/10.4301/S1807-17752017000100002

Lai, W. T., & Chen, C. F. (2011). Behavioral intentions of public transit passengers-The roles of service quality, perceived value, satisfaction and involvement. *Transport Policy*, *18*(2), 318–325. https://doi.org/10.1016/j.tranpol.2010.09.003

Lankton, N. K., Mcknight, D. H., & Tripp, J. (2015). Humanness and trust: Rethinking trust in technology. *Journal of the Association for Information Systems*, *16*(10), 880–918. https://doi.org/10.17705/1jais.00411

Lee, J. G., Kim, K. J., Lee, S., & Shin, D. H. (2015). Can autonomous vehicles be safe and trustworthy? Effects of appearance and autonomy of unmanned driving systems. *International Journal of Human-Computer Interaction*, *31*(10), 682–691. https://doi.org/10.1080/10447318.2015.1070547

Liu, H., Yang, R., Wang, L., & Liu, P. (2019). Evaluating initial public acceptance of highly and fully autonomous vehicles. *International Journal of Human–Computer Interaction*, *35*(11), 919–931. https://doi.org/10.1080/10447318.2018.1561791

Madsen, M., & Gregor, S. (2000). Measuring human-computer trust. In *Proceedings of eleventh Australasian conference on information systems* (pp. 6–8). Springer-Verlag.

Mcknight, D. H., Carter, M., Thatcher, J. B., & Clay, P. F. (2011). Trust in a specific technology: An investigation of its components and measures. *ACM Transactions on Management Information Systems*, *2*(2), 1–25. https://doi.org/10.1145/1985347.1985353

Nordhoff, S., Stapel, J., He, X., Gentner, A., & Happee, R. (2021). Perceived safety and trust in SAE Level 2 partially automated cars: Results from an online questionnaire. *PLoS One*, *16*(12), e0260953. https://doi.org/10.1371/journal.pone.0260953

Nunnally, J. C., & Bernstein, I. H. (1994). *Psychometric theory*. McGraw-Hill.

Planing, P., & Pinar, Y. (2019, December 4). Acceptance of air taxis – A field study during the first flight of an air taxi in a European city. https://doi.org/10.31219/osf.io/rqgpc

Rahman, M. M., Strawderman, L., Lesch, M. F., Horrey, W. J., Babski-Reeves, K., & Garrison, T. (2018). Modelling driver acceptance of driver support systems. *Accident Analysis and Prevention*, *121*, 134–147. https://doi.org/10.1016/j.aap.2018.08.028

Reiche, C., Cohen, A. P., & Fernando, C. (2021). An initial assessment of the potential weather barriers of urban air mobility. *IEEE Transactions on Intelligent Transportation Systems*, *22*(9), 6018–6027. https://doi.org/10.1109/TITS.2020.3048364

Reiche, C., Goyal, R., Cohen, A., Serrao, J., Kimmel, S., Fernando, C., & Shaheen, S. (2018). *Urban air mobility market study*. National Aeronautics and Space Administration (NASA). http://dx.doi.org/10.7922/G2ZS2TRG

Rubagotti, M., Tusseyeva, I., Baltabayeva, S., Summers, D., & Sandygulova, A. (2022). Perceived safety in physical human–robot interaction—A survey. *Robotics and Autonomous Systems*, *151*, 104047. https://doi.org/10.1016/j.robot.2022.104047

Sepasgozar, S. M. E., Hawken, S., Sargolzaei, S., & Foroozanfa, M. (2019). Implementing citizen centric technology in developing smart cities: A model for predicting the acceptance of urban technologies. *Technological Forecasting and Social Change*, *142*, 105–116. https://doi.org/10.1016/j.techfore.2018.09.012

Shaheen, S., Cohen, A., & Farrar, E. (2018). The potential societal barriers of urban air mobility (UAM). *National Aeronautics and Space Administration (NASA)*. https://doi.org/10.7922/G28C9TFR

Straubinger, A., Kluge, U., Fu, M., Al Haddad, C., Ploetner, K. O., & Antoniou, C. (2020). Identifying demand and acceptance drivers for user friendly urban air mobility introduction. In *Towards user-centric transport in Europe 2* (pp. 117–134). Springer.

Straubinger, A., Michelmann, J., & Biehle, T. (2021). Business model options for passenger urban air mobility. *CEAS Aeronautical Journal*, *12*(2), 361–380. https://doi.org/10.1007/s13272-021-00514-w

Straubinger, A., Rothfeld, R., Shamiyeh, M., Büchter, K. D., Kaiser, J., & Plötner, K. O. (2020). An overview of current research and developments in urban air mobility – Setting the scene for UAM introduction. *Journal of Air Transport Management*, *87*, 101852. https://doi.org/10.1016/j.jairtraman.2020.101852

Trompet, M., Parasram, R., & Anderson, R. (2013). Benchmarking disaggregate customer satisfaction scores of bus operators in different cities and countries. *Transportation Research Record: Journal of the Transportation Research Board*, *2351*(1), 14–22. https://doi.org/10.3141/2351-02

Truong, N. B., Lee, H., Askwith, B., & Lee, G. M. (2017). Toward a trust evaluation mechanism in the social internet of things. *Sensors*, *17*(6), 1346. https://doi.org/10.3390/s17061346

Tyrinopoulos, Y., & Antoniou, C. (2019). Review of factors affecting transportation systems adoption and satisfaction. In *Demand for emerging transportation systems: Modeling adoption, satisfaction, and mobility patterns*. Elsevier Inc. https://doi.org/10.1016/B978-0-12-815018-4.00002-4

Venkatesh, V., & Davis, F. D. (2000). Theoretical extension of the technology acceptance model: Four longitudinal field studies. *Management Science*, *46*(2), 186–204. https://doi.org/10.1287/mnsc.46.2.186.11926

Vink, P., Bazley, C., Kamp, I., & Blok, M. (2012). Possibilities to improve the aircraft interior comfort experience. *Applied Ergonomics*, *43*(2), 354–359. https://doi.org/10.1016/j.apergo.2011.06.011

Vorm, E. S., & Combs, D. J. (2022). Integrating transparency, trust, and acceptance: The intelligent systems technology model (ISTAM). *International Journal of Human–Computer Interaction*. Advance online publication. https://doi.org/10.1080/10447318.2022.2070107

Waung, M., McAuslan, P., & Lakshmanan, S. (2021). Trust and intention to use autonomous vehicles: Manufacturer focus and passenger control. *Transportation Research Part F: Traffic Psychology and Behaviour*, *80*, 328–340. https://doi.org/10.1016/j.trf.2021.05.004

Xu, E. (2020). *The future of transportation: White paper on urban air mobility systems*. https://www.ehang.com/app/en/EHangWhitePaperonUrbanAirMobilitySystems.pdf.

Xu, Z., Zhang, K., Min, H., Wang, Z., Zhao, X., & Liu, P. (2018). What drives people to accept automated vehicles? Findings from a field experiment. *Transportation Research Part C: Emerging Technologies*, *95*, 320–334. https://doi.org/10.1016/j.trc.2018.07.024

Zhang, T., Tao, D., Qu, X., Zhang, X., Lin, R., & Zhang, W. (2019). The roles of initial trust and perceived risk in public's acceptance of automated vehicles. *Transportation Research Part C: Emerging Technologies*, *98*, 207–220. https://doi.org/10.1016/j.trc.2018.11.018

Zhang, T., Tao, D., Qu, X., Zhang, X., Zeng, J., Zhu, H., & Zhu, H. (2020). Automated vehicle acceptance in China: Social influence and initial trust are key determinants. *Transportation Research Part C: Emerging Technologies*, *112*, 220–233. https://doi.org/10.1016/j.trc.2020.01.027

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