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TRANSPORT FINDINGS

Role of Innovativeness in US Electric Air Taxi Adoption Dynamics

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Findings

Based on surveys of 910 long-distance airport access travelers in the United States, we observed early adopters with higher intentions to adopt Electric Air Taxis (EAT) and laggards with lower intentions and notable resistance toward acceptance, compared to majority, thus validating Rogers' innovativeness-based categorization. The intention to adopt EAT was motivated by perceived ease of use, social validation, and the utility offered by EAT during airport access trips. Performance expectancy emerged as a key predictor of intention to use EAT among the majority and laggards, while social influence had a stronger impact on intention to use EAT among early adopters.

1. Questions

The aim of this study is to examine how people form behavioral intentions to use Electric Air Taxis (EAT) in the United States (US) for long-distance airport access trips, by integrating two theoretical frameworks: the Unified Theory of Acceptance and Use of Technology (UTAUT) by Venkatesh et al. (2003) and Diffusion of Innovation (DOI) by Rogers (1962). UTAUT provides a structured model for understanding the key determinants of technology acceptance, while Rogers' DOI theory explains how people adopt innovations at different times based on their level of innovativeness.

From Rogers' theory, individuals can be categorized based on their level of innovativeness, e.g.: early adopters (those who quickly adopt new technologies as soon as they are introduced), the majority (a larger segment of people who adopt new technologies after seeing their success demonstrated by early adopters), and laggards (traditionalists and the last to adopt an innovation). According to Venkatesh et al. (2003), behavioral intention is influenced by four key factors: performance expectancy (the belief that the innovation will improve task performance), effort expectancy (the perceived ease of using the innovation), social influence (the impact of important others' beliefs that they should use the innovation), and facilitating conditions (the availability of support for using the innovation).

Building on these two theories, the key questions we examined are:

1. *How does intention to use EAT differ among adopters classified based on their level of innovativeness (Rogers 1962)?*

2. *How do determinants of technology acceptance by Venkatesh et al. (2003) differ and shape EAT usage intention among early adopters, the majority, and laggards?*

2. Methods

To investigate these questions, we administered an online Qualtrics panel survey (n=910) about long-distance airport access travel between May and June 2024. The population involved US adults who made at least one trip (of 75 – 200 miles (120 – 320 km)) to/from an airport in the prior six months. This distance range was chosen to represent intercity airport trips, with a focus on understanding Regional Air Mobility (RAM). While much attention has been given to understanding how individuals form intentions and make decisions regarding the acceptance of Urban Air Mobility (UAM) (Al Haddad et al. 2020; Karami et al. 2024; Kim, Lim, and Ji 2023; Lee et al. 2023), the application of EAT for RAM remains relatively underexplored. This is especially true for airport travel which represents a promising early use case with the potential to offer meaningful time savings and improved airport accessibility, particularly in areas with limited ground transportation options.

The survey included questions about attitudes and perceptions toward EAT (from UTAUT), intention to use EAT, and individuals' innovativeness (from DOI). (See Supplemental Information, Figure SI-1 for question wording and responses, and Table SI-1 for sample descriptive statistics). To measure individuals' innovativeness, we first conducted a confirmatory factor analysis (CFA) to validate the measurement structure of the innovativeness latent variable (Table SI-2), and subsequently computed individual innovativeness factor scores. Second, we applied k-means clustering to the innovativeness factor scores to group respondents into three innovativeness groups: early adoptors, the majority, and laggards (Figure SI-2). Third, to ensure that later comparisons using these innovativeness groups were not influenced by measurement differences, we tested for factorial invariance of the innovativeness latent variable. This involved assessing configural invariance (factor structure same across groups), metric invariance (factor loadings same across groups), and scalar invariance (factor loadings and intercepts same across groups), which confirmed invariance (Table SI-4).

With measurement invariance of the innovativeness scale established and three innovativeness groups identified, we performed analysis to answer this study's research questions. First, we performed structural mean modeling (SMM) to compare UTAUT latent variable means across innovativeness groups (Figure SI-3). Second, we estimated a multi-group structural equation model (SEM), to observe differences in the relationships between the UTAUT attitudes and intention to use EAT across innovativeness groups.

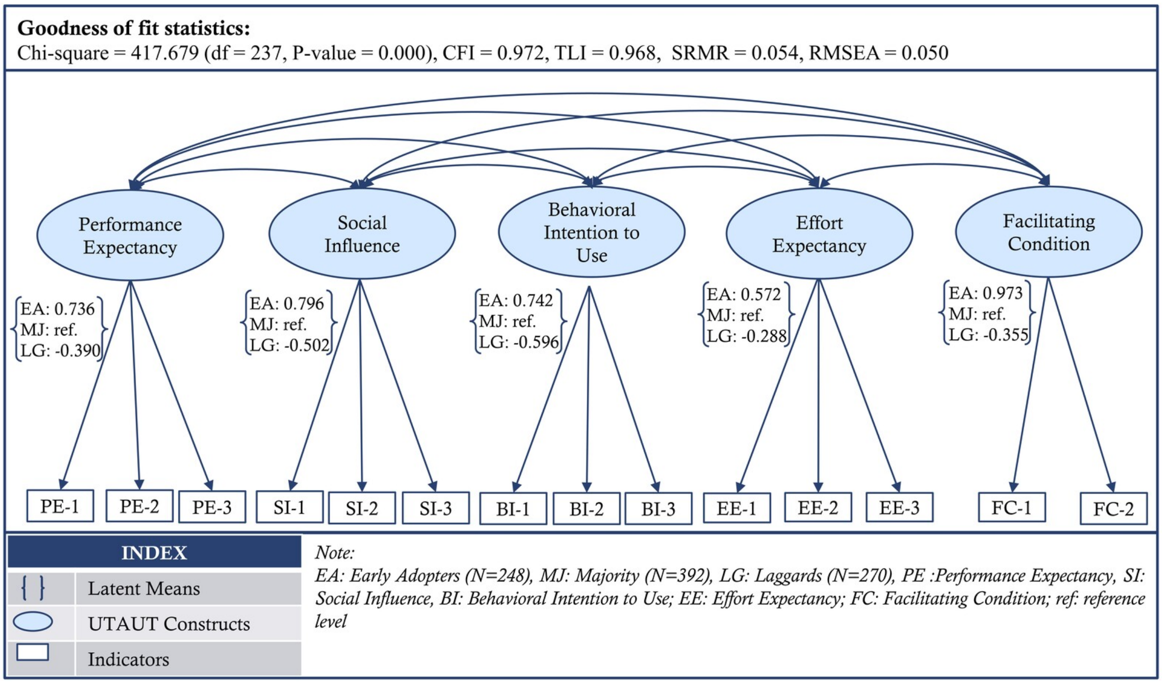

Figure 1. Latent means from the multi-group CFA with SMM

3. Findings

We answered the first research question using multi-group CFA with SSM; see means for "behavioral intention to use" in Figure 1. Early adopters (EA) exhibited the highest intention to use EAT, suggesting that individuals with greater innovativeness are more eager to try an innovation, compared to the majority (MJ). In contrast, laggards (LG) had the lowest intention to use EAT, consistent with their resistance to innovation, compared to the majority. These results support and validate Rogers' classification of adopters based on their innovativeness, demonstrating the DOI theory's relevance to understanding differences in behavioral intention to use EAT. This wave-like acceptance pattern also aligns with the theory of disruptive innovations. EAT can also be seen as a disruptive innovation with high-end destruction potential. Unlike classical disruptive innovations, EAT would start off with premium performance and high price for early adopters. Over time, as competing versions develop and business models evolve, the dominant version could facilitate broader adoption among the upper end of the majority. With technological improvements and reduced operating costs, EAT services could become more affordable and accessible to cost-sensitive travelers in the lower end of the majority (Utterback and Abernathy 1975). Eventually, this progression could lead to the displacement of conventional airport travel modes, reflecting the high-end disruption capability of EAT that initially enters the market with superior performance and higher costs, but later diffuse widely as dominant solutions reshape existing airport mobility systems (Ho 2022).

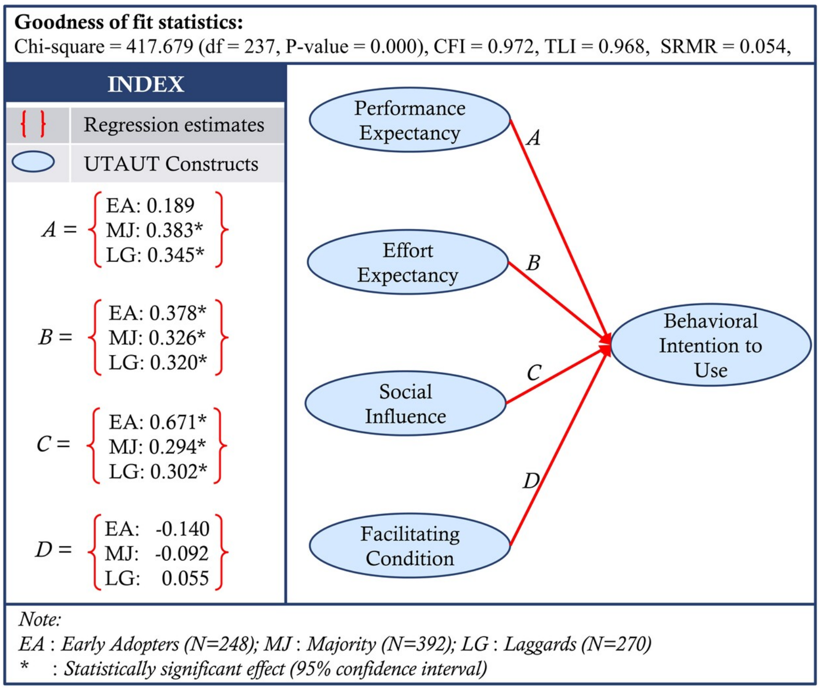

Figure 2. Results from the multi-group SEM

We addressed the second research question using both multi-group CFA with SMM and multi-group SEM (Figure 1 and Figure 2). Figure 1 indicates that early adopters reported greater levels of facilitating conditions (support availability) and strong social influence to use EAT. While early adopters recognized the benefits of performance expectancy and effort expectancy of EAT for airport trips, these perceptions were comparatively lower than their perceptions of support availability and social influence, but still higher than for the majority. Negative latent means for laggards indicate that their perceptions of key UTAUT constructs are lower than those of the majority. Laggards perceived minimal social influence, lower performance expectancy, and lower levels of facilitating conditions to use EAT; the lower level of effort expectancy to use EAT for laggards was less pronounced than for other constructs. These results address the first part of research question two: there are large differences in EAT-related UTAUT factors (perceived performance expectancy, effort expectancy, social influence, and facilitating conditions) across innovativeness-based adopter groups.

Figure 2 addresses the second research question by revealing differences in how UTAUT factors shape the intention to use EAT across adopter groups. Performance expectancy was a strong predictor of intention for the majority and laggards but was less critical for early adopters. Effort expectancy consistently predicted intention across all groups, with a slightly stronger influence for early adopters. Social influence had the most substantial impact on behavioral intention for early adopters, markedly more so than for laggards or the majority. Facilitating conditions were not significant for any group, suggesting that resource availability and support may not be primary factors influencing the intention to adopt EAT.

To summarize, perceived ease of use, social validation, and EAT's utility during long-distance airport access trips significantly motivate potential adopters across all groups, rather than resource availability and support. These results demonstrate the benefits of using UTAUT and DOI theories about technology acceptance and innovativeness to understand EAT adoption intention.

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SUPPLEMENTARY MATERIALS

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