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# Electrifying the Skies: Battery Electric Aircraft and Their Role in Advancing Regional Integration

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## Abstract

The aviation sector is transforming as electrification emerges as a promising technology. Adopting battery-electric aircraft (BEA) - aircraft that solely rely on rechargeable onboard batteries - is a sustainable alternative to conventional aviation that could change short-haul regional travel habits for business and leisure travellers. This study examines the factors influencing individuals' public acceptance in China's Greater Bay Area (GBA) context. Given the limited research, a qualitative methodology grounded in the Theory of Planned Behaviour (TPB) examines the underlying factors influencing behavioural intentions (attitudes, subjective norms, perceived behavioural control, and perceived risks). The findings indicate that participants recognise the technology's environmental benefits and potential to enhance regional connectivity; however, they still have concerns about safety, infrastructure, and operations. The respondents' perceived ease of access, information available, and endorsements from reputable sources also have essential roles in influencing broader acceptance. Addressing these factors with appropriate communication efforts is vital for promoting trust and accelerating technology acceptance and use. Although exploratory, this study offers insights to develop strategies for infrastructure readiness, build public confidence, and endorse sustainable aviation. The research is conducted within the GBA context. Still, the findings also apply to regions with fragmented geographies or developing transportation networks, thus contributing to global environmental sustainability and advancing regional integration goals.

## Keywords

Battery Electric Aircraft (BEA), Electric Aviation, Sustainable Development, Sustainable Transportation, Greater Bay Area (GBA)

## Introduction

Regional integration drives economic growth and social cohesion by enabling the movement of goods, services, and people. In this context, after the automotive sector (Lampo & Silva, 2024), the electrification of aviation presents a novel opportunity to bolster regional connectivity (Veisten, Wangsness, & Farstad, 2024). As a sustainable alternative to conventional aircraft

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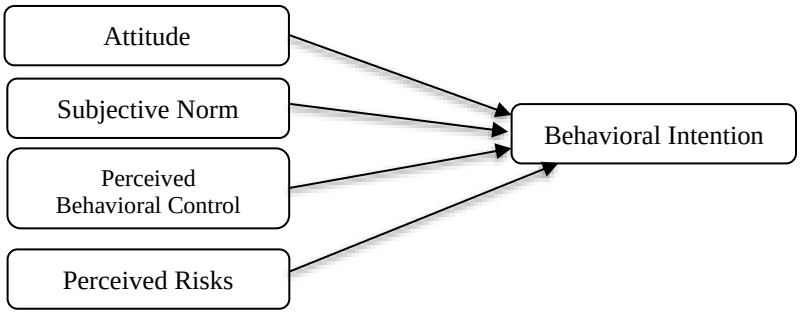
(Deloitte, 2021), battery-electric aircraft (BEA) - vehicles capable of atmospheric flight using electric motors powered by electricity - could facilitate short-haul flights between regional airports (Moeckel & Fu, 2023) while alleviating climate change (Secretariat, ICAO, 2019). This is especially true in the case of regions with fragmented geographies or developing transportation networks (Lampo et al, 2023). Such aircraft are currently under development and are expected to enter commercial operations soon. If the right conditions are met (e.g., infrastructure readiness and technological reliability), electric, hybrid-electric, and hydrogen-powered planes could be operational by the 2030s to gradually transition to full electric power by the 2040s (Transport & Environment, 2024). Given the relatively short range, however, BEA technology is initially positioned as a sustainable solution for regional air travel needs.

The widespread adoption brings serious challenges as travellers and industry stakeholders remain sceptical. Battery limitations restrict flight ranges to short-haul routes, making electric aircraft suitable for regional connections (Secretariat, ICAO, 2019). Given the limited research on traveller preferences, this study explores the determinants of public acceptance within the context of regional integration in China's Greater Bay Area (GBA), an economic region in southern China that connects nine cities (among which Guangzhou and Shenzhen) and two Special Administrative Regions (Hong Kong and Macao) to promote growth and integration (Lampo, Diakite, & Ip, 2024). Understanding acceptance factors is essential, as the success of any technological innovation depends on behavioural intention and adoption (Lampo, 2023).

In this context, the Theory of Planned Behaviour (TPB) (Fishbein & Ajzen, 2011) provides a framework to investigate frequent travellers' intention to use electric aeroplanes for their regional mobility needs. According to the theory, attitude, subjective norms, and perceived behavioural control are postulated to influence the intention to engage or not in a particular behaviour (Lampo, 2023). According to Ajzen (2020), the relative importance of these determinants depends on specific behaviours and the population under consideration (Ajzen, 2020). In general, the stronger the factors of attitude, subjective norm, and perceived behavioural control concerning a particular behaviour, the higher the individual's intention to perform that behaviour (Lampo, 2023), which, in our case, is the intention to adopt electric technology. In addition to the key components of the theory, the analysis includes the perceived risks of safety, operational reliability, cost, and accessibility. The following figure 1 illustrates the model.

Figure 1: Research model




The next section summarises the methodology used, followed by the results and a discussion of the findings.

## Methodology

This study is exploratory in nature. The intention was to investigate the factors influencing the behavioural intention to use electric aircraft in the GBA. A qualitative methodology was deemed appropriate for this research as it allowed for an in-depth exploration of attitudes and perceptions, crucial elements for understanding the key factors driving behavioural intentions (Creswell & Poth, 2018).

Data were collected through semi-structured interviews with 16 participants selected using convenience sampling. Further, the snowball method (Flick, 2009) was used to reach the targeted sample. Adopting a qualitative methodology, the interview questions were designed based on the theory of planned behaviour (TPB). Following the approach of Xian and Lampo (2024), who effectively adapted a technology model originally developed for quantitative research, this study similarly structured its questions to align with TPB constructs (Xian & Lampo, 2024). For instance, interviewees had to answer questions related to the attitude construct, such as "*What factor would motivate or discourage you from considering using electric aircraft in the future? (for example, environmental benefits, ticket costs, convenience, etc.)"*. Thematic analysis (Braun & Clarke, 2022) was used to analyse the responses and identify the themes related to the key constructs of the TPB. Respondents were all residents of the GBA who identified themselves as frequent travellers. The interviews took approximately 30 minutes and were audio-recorded with the interviewees' consent. The results were then transcribed for further analysis. Participation was voluntary, and no remuneration was offered. In addition to being informed of the purpose of the research, all the participants were assured that their answers were anonymous and that only limited extracts or aggregate data would be published. The following section reports on the results.

## Results and Discussion

This work explores themes related to attitudes, social norms, perceived behavioural control, and perceived risks through the Theory of Planned Behaviour. The findings reflect perspectives from 16 frequent travellers in China's Greater Bay Area (GBA). Participants (68.8% male, 31.2% female) represented diverse age groups and travel frequencies, with business travellers forming the majority (68.8%). Notably, 37.5% owned electric vehicles, offering insights into crossover acceptance of electric aviation. The following table 1 summarises the demographic characteristics.

Table 1: Demographic Profile of Participants

| Category | Subgroup | Respondents (n=) | Percentage |
|---|---|---|---|
| **Gender** | Male | 11 | 68.8% |
| | Female | 5 | 31.2% |
| **Age** | Under 35 years | 10 | 62.5% |
| | Over 35 years | 6 | 37.5% |
| **EV Ownership** | EV Owners | 6 | 37.5% |
| | Non-EV Owners | 10 | 62.5% |
| **Travel Purpose** | Business | 11 | 68.80% |
| | Leisure | 5 | 31.20% |

The following sections highlight key themes that emerged from their responses.

**Behavioural Intention to Use Battery Electric Aircraft:** Defined as individuals' likelihood of engaging in a particular behaviour (Fishbein & Ajzen, 2011), behavioural intention emerged as a recurring theme. The respondents' intentions to use BEAs were influenced by a mix of positive attitudes toward the novelty of the technology, the environmental benefits and perceived barriers related to safety, cost, and operational readiness. The statements indicate that practical considerations like cost remain a significant barrier to translating intention into action, overshadowing the benefits of flying electric. A notable finding was the dichotomy between environmental enthusiasm and practical hesitation. While 75% of respondents expressed strong interest in BEAs due to their environmental benefits, nearly all (90%) cited cost and safety as critical barriers. This suggests that while the intent to adopt sustainable technologies is high, real-world adoption stumbles on practical concerns.

*"I choose environmentally friendly products and services whenever possible. I also drive an electric car. If electric planes offer conditions similar to current ones and can help the environment, I would consider them." (R16)*

Some respondents emphasised that their willingness to use BEAs depends on evidence of safety and operational reliability. They noted:

*"I'm open to trying electric planes, but only if there is a safety record because, at this moment, there is not much information available. I must trust the technology before using it for my family." (R13)*

The relative lack of trust in new technology was a recurring theme hindering adoption, with 70% of participants explicitly mentioning the need for verifiable safety records and smooth operations before considering BEAs. This highlights the importance of transparent communications from manufacturers and regulatory bodies, which is important to build confidence.

*"If delays and cancellations are common due to battery issues, such as charging or swapping, or due to infrastructure, it will be difficult to rely on these planes for frequent travel." (R7)*

Interestingly, cost sensitivity varied by demographic. Younger respondents (under 35) were more willing to pay a premium for sustainable travel (60% expressed this view), whereas older participants (over 35) were more price-sensitive (80% prioritised cost over sustainability). These demographic split highlights the need for targeted pricing strategies to cater to different age groups.

*"I am interested in using electric aeroplanes if the prices are competitive. I would carefully consider using them if prices were significantly more expensive than alternatives available." (R3)*

**Attitude Towards the Technology:** When exploring the antecedents of intention, participants shared their attitude towards BEA technology, which is defined as the positive or negative evaluation of performing a behaviour (Fishbein & Ajzen, 2011). Participants appreciated the novelty of the technology and its potential environmental benefits, though many expressed

concerns about its readiness. Interestingly, respondents who owned EVs were 50% more likely to express positive attitudes toward BEAs, suggesting that familiarity with related technologies can ease the transition to electric aviation.

*"I think this technology is interesting, I own an EV, and I would be tempted to try electric aeroplanes with the right conditions." (R6)*

*"I often travel between Hong Kong and Macau, a few times by helicopter. If there were reliable infrastructures and convenient boarding locations, it would be good for my needs." (R1)*

**Influence of Subjective Norms:** The second antecedent of behaviour - subjective norms - was examined. This concept relates to the perceived social pressure to engage or not engage in a specific behaviour (Fishbein & Ajzen, 2011). The role of norms emerged as potentially significant, with respondents noting that broader adoption could impact individual perceptions of the technology. The influence of society was particularly strong among business travellers, with 65% stating that peer endorsements would significantly increase their likelihood of adoption. This highlights the potential for early adopters to serve as ambassadors for newer technologies.

*"If my friends or colleagues started using electric planes, I would probably feel more confident about these aeroplanes; hearing their perceptions and experiences could reduce my hesitation." (R8)*

*"If famous airlines used electric aeroplanes, it would make them seem more reliable. Right now, there is not enough visibility." (R16)*

**Perceived Behavioural Control:** The availability of infrastructure and ease of adoption were concerns captured by perceived behavioural control (Fishbein & Ajzen, 2011), the third antecedent of intention in the theoretical framework. Participants highlighted how infrastructural readiness could facilitate or delay their intention to adopt the technology. Infrastructure concerns were universal, with the majority of respondents mentioning the need for seamless integration with existing transport systems. Proximity to urban centres and streamlined boarding processes were cited as critical factors for adoption, particularly for short-haul routes.

*"If these planes are used for regional connections, it is essential to have convenient access to the boarding location. I cannot expect to go to the airport 2 hours before departure for a 30-minute flight; in this case, I may use speed trains." (R9)*

*"I'll only consider [BEA] for regional routes if boarding, scheduling and ticketing are convenient compared to current travelling options, and at this moment, I do not have information about it." (R5)*

**Perceived Risks:** This factor relates to consumers' subjective evaluation of a decision's potential dangers or disadvantages (Yao, Liu, & Zhang, 2024). Safety issues and technical reliability emerged as barriers to adoption. Risk perception was heightened among participants with limited technical knowledge. Over 80% of respondents requested clearer information about emergency protocols and battery safety, indicating a gap in public awareness that must be addressed through educational campaigns.

*"Electric batteries in cars have caught fire before. Could this happen with aeroplanes? It is difficult to be confident until electric planes have made thousands of flights and proven themselves. (R11)*

*"There is always the risk of something happening with the battery mid-air, and that is difficult to ignore." (R15)*

**Other themes**: During the interviews, a recurring theme emerged from discussing perceived risks: balancing environmental benefits and practical concerns. While participants agreed on the potential advantages of BEAs, mainly in reducing emissions, they also emphasised that practical considerations should be the priority. Hybrid solutions were favoured by 60% of respondents as a transitional step, reflecting a pragmatic approach to adoption. This suggests that a phased implementation strategy, starting with hybrid models, could ease public acceptance while full-electric technology matures.

*"I appreciate doing something good for the environment, but we also need a careful approach. Using hybrid planes, as happened in the case of cars, might be a better solution. (R1)*

Table 2 summarises the dominant themes, supporting factors, and barriers to BEA adoption, with key representative quotes.

Table 2: Key Findings on BEA Acceptance in the GBA

| Theme | Key Positive Factors | Key Barriers | Key Respondent |
|---|---|---|---|
| **Attitudes** | Environmental benefits | Safety/readiness concerns | R6 |
| **Subjective Norms** | Peer influence | Lack of visibility | R16 |
| **Perceived Control** | Urban proximity | Infrastructure gaps | R9 |
| **Perceived Risks** | Hybrid solutions favored | Battery safety fears | R1 |

## Conclusion

Inspired by the Theory of Planned Behaviour, the study qualitatively explored the perspectives of frequent flyers on BEA adoption within China's Greater Bay Area. Battery Electric Aircraft (BEA) technology has the potential to revolutionise the aviation sector and promote regional integration. While participants were optimistic about the technology's environmental benefits and the innovative nature of flying electric, they reported potential challenges in the widespread adoption. The findings showed that concerns about the safety, cost, and the lack of a full-electric ecosystem influenced individual behaviour. Further, practical factors such as pricing, convenience, and infrastructure availability emerged as determinants of actual use. Also, endorsements from trusted sources such as established industry operators influenced confidence and adoption intention.

Concerns about technical reliability and lack of knowledge about the technology and emergency responses showed the importance of manufacturers and airlines communicating information. Notably, respondents who owned an electric car tended to exhibit a greater acceptance of BEA technology, up to 50% greater than non-owners.

It is recommended that industry operators work on reducing worries and building trust with potential adopters. Striking a balance between environmental benefits and practical challenges remains a tough but essential goal for the future of electric aircraft. A solution could be found in hybrid technology to provide a phased implementation, smooth adoption, and gradually broaden consumer acceptance.

The author endorses BEA adoption as a way to enhance regional connectivity and contribute to promoting global environmental sustainability goals. With innovation, transparency, and well-planned development of an integrated and full-electric ecosystem, electric aircraft technology could make our skies cleaner and contribute to a green, regionally connected future.

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