Heliyon 6 (2020) e05581

Contents lists available at ScienceDirect

Heliyon

journal homepage: www.cell.com/heliyon

Research article

Recommendations for emerging air taxi network operations based on online review analysis of helicopter services

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ARTICLE INFO

Keywords:
Air taxi
Helicopter services
Text analytics
Online customer reviews
Urban air mobility (UAM)
Vertical takeoff and landing (VTOL)
Industrial engineering
Systems engineering
Environmental assessment
Information science
Psychology

ABSTRACT

The effects of traffic congestion are adverse, primarily including air pollution, commuter stress, an increase in vehicle operating costs, and accidents on road. In efforts to alleviate these problems in metropolitan cities, logistics companies plan to introduce a new Urban Air Mobility (UAM) service called air taxis. These are electric-powered vehicles that would be tested and operated in the forthcoming years by international transportation companies like Airbus, Uber, and Kitty Hawk. Since these flying taxis are an emerging mode of transportation, it is necessary to provide recommendations for initial design, implementation, and operation. This study proposes managerial insights for these upcoming UAM services by analyzing online customer reviews and conducting an internal assessment of helicopter operations. Helicopters are similar to air taxis in regards to their vertical takeoff and landing (VTOL) operations, and therefore, customer reviews pertaining to the former can enable us to obtain insights into the strengths and weaknesses of the short-distance aviation service, in general. A four-stage sequential approach is used in this research, wherein online reviews are mined in *Stage 1*, analyzed using bigram and trigram models in *Stage 2*, 7S internal assessment is conducted for helicopter services in *Stage 3*, and managerial recommendations for air taxis are proposed in *Stage 4*. The insights obtained in this paper could assist any air taxi company in providing better customer service when they venture into the market.

1. Introduction

With the continuous growth of the population in large cities, traffic congestion has become an unavoidable issue that increases stress, accidents, and air pollution. Traffic gridlocks are not only detrimental to those who reside in large cities, but also contribute to the economic loss (Rajendran and Srinivas, 2020). According to Inrix (2019), an average commuter spends about an additional 90 min in traffic. The prolonged time spent in motor vehicles might limit the working hours and family time, which in turn causes a decrease in revenue, economic output, thus leading to a poor lifestyle. In order to resolve this ongoing issue, subways and alternative forms of motor transportation (such as busses, ridesharing car services) have been implemented but do not entirely solve this problem. Thus, in addition to utilizing roadways, air space also has to be leveraged, and therefore, air taxis will be implemented in the following years (Holden and Goel, 2016).

Air taxi is an upcoming ridesharing service that is expected to combat ground traffic through aviation. These are small electric aircraft that will provide passengers a faster and more convenient mode of transportation compared to current public transportation systems that are already in place (Rajendran and Shulman, 2020). These air taxis would significantly alleviate traffic congestion in large metropolitan cities, such as New York City (NYC), Los Angeles, and Bangalore, and could become a viable alternative to regular ground taxis (Holden and Goel, 2016). For instance, NYC estimates that nearly four million citizens are traveling each day to Manhattan, resulting in traffic gridlock (Partnership for New York City, 2019). These adverse effects exist in other large cities across the globe, such as Tokyo and London.

Even though there are many benefits as outcomes of the implementation of this aviation service, several challenges and constraints must be addressed. For example, station location decisions must be made considering variables such as space, customer demand, and infrastructure design in neighborhoods within suburban areas (Antcliff et al., 2016; Hawkins, 2018). Additionally, routing and coordination of multiple air taxis through a private network must be efficiently monitored and synchronized. A reliable control system is essential due to the existence of considerable risk associated with aviation services when compared to traveling by road (Rajendran and Zack, 2019).

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https://doi.org/10.1016/j.heliyon.2020.e05581
Received 19 June 2020; Received in revised form 6 August 2020; Accepted 19 November 2020

Although helicopters and air taxis are quite different with regards to the travel speed and flight range, they are very similar in terms of their vertical takeoff and landing (VTOL) operations, scheduling and infrastructure requirements, such as the presence of helipads for VTOL procedures (Datta et al., 2018). Due to the similarities of business operations, in this study, customer reviews of helicopter services are examined and used to create recommendations for air taxis. By analyzing online customer reviews and conducting an internal assessment of similar services, such as helicopters, we believe that we can obtain insights into the strengths and weaknesses of the short-distance aviation service, in general. Even though air taxis are targeted towards everyday commutes, customers would receive similar experiences to helicopters and, therefore, may have similar preferences and dislikes. By assessing the current customer-perceived positives and negatives of helicopters, air taxi services could implement proper strategies to appease their passengers.

The importance of analyzing customer reviews (OCRs) has risen dramatically with the expansion of social media websites, and has allowed consumers to assess the quality of a product or service through other people's opinions (Srinivas and Rajendran, 2019). With the increasing accessibility of the Internet, online customer interactions and postings are viewed by thousands of potential purchasers every day, so the distribution of positive reviews is crucial. Since OCRs are considered the second most trustworthy source for product information (next to recommendations of friends and family), satisfied customers who share their experience will encourage other buyers, and therefore, increase product sales (Iduozee, 2015; Balaji et al., 2016). The analysis of OCRs also supplements companies' knowledge of customers' perception of their products/services. Utilizing the information provided through OCRs, the perceived quality of a product/service, or its features, can be determined, and recommendations to improve (or sustain) can then be made (Wang et al., 2016).

This study uses a four-stage sequential approach, wherein online helicopter reviews are mined in *Stage 1*, analyzed using bigram and trigram models in *Stage 2*, 7S internal assessment is conducted for helicopter services in *Stage 3*, and managerial recommendations for emerging air taxi services are proposed in *Stage 4*. The managerial insights could assist air taxi companies in providing better customer service when they venture into the market.

The remaining paper is organized as follows. Section 2 reviews the literature pertaining to air taxi and online customer reviews. Section 3 details the four-stage sequential approach, including text analytics methodology, as well as the organizational effectiveness tool used in this study. Section 4 discusses the results of an internal assessment of helicopter services. Section 5 presents the managerial recommendations for air taxis, while Section 6 gives the discussion questions from an implementation standpoint. Finally, conclusions and future works are given in Section 7.

2. Literature review

2.1. Review of air taxi literature

Since air taxis are expected to become a viable alternative to ground transportation for millions of commuters traveling long distances every day, a reliable and safe vehicle that can withstand a large demand is crucial. Falck et al. (2018) discussed the essential aircraft features, including battery life and passenger capacity. Further addressing the flying taxi design, Shamiyeh et al. (2017) evaluated different models, especially during takeoff and landing. Compared to the lift + cruise configuration, it was determined that 18-rotor multicopter design had an advantage with respect to noise levels, but higher travel speed was achieved during the testing of fixed-wing cruise flights. Propulsion methods in aircraft, such as battery-electric, hybrid, and electric/hydrogen, are also studied to evaluate their efficiency, capacity, and noise levels (Anderson et al., 2015; Antcliff et al., 2016; Datta et al., 2018).

Another air taxi design that is widely considered is the ducted design. In this type, the propellers are contained within a cylindrical duct that significantly reduces the noise produced from the tips of the rotors (Kim et al., 2018). Rotor ducts significantly mitigate the effects of blade slap and allow for higher rotor velocity without additional production of vortex noise (Rajendran and Srinivas (2020)). Steeper ascent and descent angles will also limit the exposure area of the rotor vortex noise - with that factor into consideration, takeoff and landing will likely be the loudest portion of the operation (Basset et al., 2018; Rajendran, 2020b). Subsequently, location selection for vertiports will also play a vital role in noise and disturbance.

The ideal vehicle candidates for air taxis have a carrying capacity of approximately four passengers, capable of reaching speeds of 160 miles/hour on average, and with a range of 100 miles on a full charge (Holden and Goel, 2016; Duffy et al., 2017; Finger et al., 2018; Rajendran and Zack, 2019). While numerous companies are in the process of developing air taxi designs, the city infrastructure needed to support this sort of operation is regarded as a significant barrier to the entry of this emerging technology (Reiche et al., 2019; Tarafdar et al., 2019). Studies, such as Rajendran (2020b), Rajendran and Shulman (2020), and Hasan (2019), have named two types of infrastructures when considering the station locations, vertistop and vertiport. While vertistops are smaller facilities having infrastructures only for customer pickup and dropoff, vertiports are larger sites with air taxi maintenance, charging, and docking stations (Vascik and Hansman, 2019).

In addition to the above-mentioned articles that have investigated the air taxi design, prior works have also focused on operational aspects of this aviation service. The weekly flow of passengers for a single provider was evaluated through a network formulation created by Lee et al. (2008). Two models were developed within this study: discrete-event and aggregate flow, and their performances were compared to identify the better performing model under different settings. The authors concluded that the aggregate flow model obtained more accurate outputs and is valid for pricing decisions. To further understand strategic operations, Sun et al. (2018) estimated the total travel time for passengers using different methods of commutes. The competitiveness of the upcoming market versus ground transportation was analyzed for several populated cities in Europe. The authors suggested that short and very lengthy travel distances are most quickly completed by car and aircraft, respectively. They also concluded that air taxi gains time advantage primarily in three European countries: Belgium, Netherlands, and Germany.

2.2. Review of OCR analysis

With the expansion of the Internet, online reviews allow existing clients to interest potential customers and other readers around the world (Duan et al., 2008; Hu et al., 2008, 2014; Zhu and Zhang, 2010). It was found in a study conducted by Cheung and Lee (2012), that over 61% of the people review customer feedback posted online before purchasing a product or utilizing a service. Additionally, customers are willing to pay at least 20% more for services that receive an “excellent” rating (i.e., 5-star rating) than those that obtain a “good” rating (i.e., 4-star rating).

To further analyze online customer reviews, Erkan and Evans (2016) studied the influence of eWOM in social media on the purchasing intention of customers. The authors developed a model integrating the Information Adoption Model (IAM) and Theory of Reasoned Action (TRA) to identify the motivators of eWOM in efforts to gain a better understanding of the purchasers' decisions. Likewise, other papers have attempted to analyze the correlation between eWOM and sales, as well

(Amblee and Bui, 2011; Lin et al., 2013; Hyrynsalmi et al., 2015; Babić Rosario et al., 2016).

2.3. Contributions to the literature

To the best of our knowledge, this research is the first to propose managerial recommendations for air taxi emerging technology based on the online review analysis of helicopter services. Through the analysis of customer feedback, the current weaknesses and strengths of helicopters are established. These insights provide a greater understanding of customer's satisfaction levels and can be utilized to develop efficient business operations for air taxi services. Moreover, this research is one of the pioneers in integrating internal assessment tools, such as 7S, with text analytics. The developed four-stage sequential approach enables us to assess the current customer-perceived positives and negatives of short-distance aviation service, in general. Even though air taxis are targeted towards everyday commutes, customers would receive similar experiences to helicopters and, therefore, may have similar preferences and dislikes.

3. Methodology

This section overviews the developed four-stage sequential framework used in this study. Stage 1 pertains to the extraction of online reviews (detailed in Section 3.1) that have been posted on several social networking sites, such as yelp, trustpilot, and birdeye. Following the review extraction, Stage 2 involves (i) categorization of reviews based on their star ratings (Section 3.2), and (ii) identification of positive and negative feedback using bigram and trigram analysis (Section 3.3). Step 3 focuses on the internal assessment of helicopter reviews using 7S (Section 3.4). Based on the internal assessment, recommendations for air taxi services are proposed in Stage 4.

3.1. Extraction of online customer reviews and data preprocessing

The proposed approach begins with the extraction of publicly available OCRs from numerous online sites. For this study, records extracted include service ratings (ranging from one to five stars) and contextual customer reviews. This data is mined to determine the most commonly discussed topics using text analytics. Individual reviews may not be centralized around a single feature of helicopter service. Thus, contextual feedback is separated into sentences and treated independently. After data extraction, a Python® code is utilized to summarize reviews through the removal of duplicate or missing statements. Furthermore, every sentence is prepared for text analytics through tokenizing, removing unnecessary words, stemming words, and conversion of all characters to lowercase. These steps are completed through packages available in the Python natural language toolkit (NLTK).

3.2. Separation of reviews based on star rating

Upon completion of the review extraction and preprocessing, reviews are separated by the rating score. These ratings range between one and five stars, and are dependent on a customer's perception of quality. Negative reviews consist of star ratings of 1 and 2, neutral reviews are ratings of 3, and 4–5 ratings are considered positive reviews. The separation of these reviews based on star ratings enable us to identify the topics that are positively and negatively perceived by passengers.

3.3. Bigram and trigram analysis

As mentioned earlier, the bigram and trigram analyses are used in this study for investigating the OCR to capture the outlook of customers towards aviation services. This section discusses the bigram and trigram models detailed in Jurafsky and Martin (2014) that has been widely adopted by prior studies in both manufacturing and service sectors (e.g., Rajendran, 2020a; Rajendran and Pagel, 2020; Sinha et al., 2020).

If $\alpha_1, \alpha_2, \ldots, \alpha_n$ are a set of words, then the probability of occurrence of α_1 followed by α_2 and α_3 (i.e., $P(\alpha_1, \alpha_2, \alpha_3)$) is given by Eqs. (1) and (2).

$$P(\alpha_1, \alpha_2, \alpha_3) = \mathrm{P}(\alpha_3|\alpha_1, \alpha_2) \times P(\alpha_1, \alpha_2) \tag{1}$$

$$P(\alpha_1, \alpha_2, \alpha_3) = P(\alpha_1) \times \mathrm{P}(\alpha_2|\alpha_1) \times \mathrm{P}(\alpha_3|\alpha_1, \alpha_2) \tag{2}$$

Extending Eq. (2) to a set of N words, Eqs. (3) and (4) give the probability that N words occur in a sequence $(P(\alpha_1 \ldots \alpha_N))$.

$$P(\alpha_1 \ldots \alpha_N) = P(\alpha_1) \times P(\alpha_2|\alpha_1) \times P(\alpha_3|\alpha_1, \alpha_2) \ldots P(\alpha_N|\alpha_1, \alpha_2 \ldots \alpha_{N-1}) \tag{3}$$

$$\mathrm{P}(\alpha_1 \ldots \alpha_N) = \prod_{n=1}^{\mathrm{N}} \mathrm{Pr}(\alpha_n|\alpha_1 \ldots \alpha_{n-1}) \tag{4}$$

Through the application of chain rule of conditional probability to the word series under study, Eqs. (5) and (6) give the probability that N words occur in a sequence.

$$\mathrm{P}(\alpha_1 \ldots \alpha_N) = P(\alpha_1) \times \mathrm{P}(\alpha_2|\alpha_1) \times \mathrm{P}\left(\alpha_3|\alpha_1^2\right) \ldots \mathrm{P}\left(\alpha_N|\alpha_1^{n-1}\right) \tag{5}$$

$$\mathrm{P}(\alpha_1 \ldots \alpha_N) = \prod_{i=1}^{N} P\left(\alpha_i|\alpha_1^{i-1}\right) \tag{6}$$

The Markovian assumption that $P(\alpha_N|\alpha_1^{N-1}) = P(\alpha_N|\alpha_{N-1})$ is applied to the current study, and $P(\alpha_N|\alpha_{N-1})$ bigram can be obtained as the proportion of words containing α_{N-1} and α_N in a sequence (represented by $f(\alpha_{N-1}\alpha_N)$) to the total number of words containing α_{N-1} (i.e., $\sum_{\alpha} f(\alpha_{N-1}\alpha)$), as given in Eq. (7).

$$P(\alpha_N|\alpha_{N-1}) = \frac{f((\alpha_{N-1}\alpha_N))}{\sum_{\alpha} f(\alpha_{N-1}\alpha)} \tag{7}$$

Likewise, $P(\alpha_N|\alpha_{N-1}, \alpha_{N-2})$ trigram is obtained similar to the bigram model, as shown in Eq. (8).

$$P(\alpha_N|\alpha_{N-1}, \alpha_{N-2}) = \frac{f((\alpha_{N-2}\alpha_{N-1}\alpha_N))}{\sum_{\alpha} f(\alpha_{N-2}\alpha_{N-1}\alpha)} \tag{8}$$

3.4. Introduction to McKinsey 7S framework

In this study, we used the McKinsey's 7S internal assessment tool for evaluating the helicopter services from a customer standpoint. The reason for particularly using this framework is because it has been widely adopted and proven to be successful in several sectors, such as education, banking, and commercial businesses, to identify elements within a business model that must be realigned to improve performance and sustainability (e.g., Chen and Liu, 2010; Alshaher, 2013; Naipinit et al., 2014). This realignment could include restructuring professional strategies, introducing new processes, and changing staff or leadership Bastian et al. (2015) and Kambli et al. (2020). The 7S framework begins with ensuring that shared values are consistent across both hard and soft elements, consisting of structure, strategy, systems, style, staff, and skills (Channon and Caldart, 2015). After establishing these persistent values, both “hard” and “soft” components are cross-referenced to guarantee their support to one another to reach a common objective. If a “soft” metric (shared values, skills, style, and staff) does not reinforce a “hard” component (strategy, structure, and systems), then it must be reconfigured (Hanafizadeh and Ravasan, 2011).

4. Results

4.1. Case study

To accommodate customers' preferences almost entirely and propose reputable recommendations for air taxis, customer reviews of helicopter services are analyzed due to their similar business operations. For

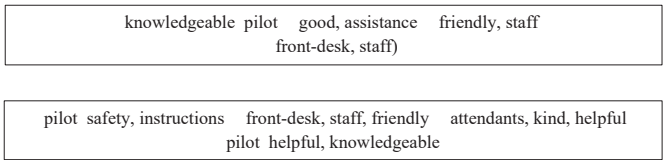

Figure 1. Sample bigrams and trigrams generated for topic "staff" from analyzing helicopter reviews.

example, both these transportation methods utilize aircraft to provide passengers rides for short-distance commutes. Their services also face similar obstacles, such as high operating costs and ride scheduling. By considering the current drawback and well-perceived helicopter service features established through online reviews, air taxi services could obtain further insight into aviation customer's likes and dislikes. We mined over 5000 online reviews of helicopter services from several social networking sites, such as yelp, trustpilot, and birdeye, that have been posted from January 2011–February 2020. The total number of sentences was approximately 25,000. On average, there were 4.71 sentences per review (with a standard deviation of 2.15) and 6.59 words per sentence (with a standard deviation of 1.12).

4.2. Model summary

Table 1 highlights the critical topics obtained from bigram and trigram models. While most of the topics, such as promotion, features, staff, reservation, safety, and guided tours, are viewed positively by customers, negative reviews are obtained for certain topics - e.g., waiting area and site visibility.

Figure 1 portrays sample bigrams and trigrams for the topic "staff" that are generated from analyzing the helicopter reviews.

4.3. Analysis of helicopter reviews based on 7S framework

Based on the topics identified, 7S internal assessment is conducted to understand the "hard" and "soft" components. These elements are then utilized to create recommendations for air taxi services due to operation similarities. Hard features, discussed in Section 3.4, are analyzed first due to their higher impact on businesses' success.

- To begin internal assessment, the hard element *Strategy* is first studied. Helicopter services frequently offer promotions to increase ride demand and retain returning customers. These discounted services are intended to ensure long-term success and are, therefore, strategic and tactical business decisions. The promotions may be extended to past or future customers and sometimes to large parties depending on aircraft availabilities.
- An additional crucial hard element is *Systems*. For example, helicopter services often handle reservations via online booking websites. These sites are user-friendly and straightforward, which has led to positive customer reviews and can easily be implemented in air taxi service operations. Additional features, like ride payment, are also available on these sites and are considered very convenient by clients.
- The first soft element examined is *Shared Values*. The highest priority for any aviation service is passenger safety, which is emphasized before every helicopter ride, as concluded through online reviews. This value is pertinent for the success of these services, and hence, safety training for all passengers is required before flight. Also, helicopter reviews negatively describe the refund after service cancellation (due to severe weather conditions).
- The second soft element, *Skills*, is also analyzed. Many customers spoke highly of the pilots' flying ability and also commented on captains warning passengers of upcoming turbulence, which led to an increase of comfort. Therefore, to ensure customer safety and comfort level, a high flying safety performance level for all pilots employed by the helicopter service is necessary.
- The last soft element considered in the 7S Framework is *Staff*. In many positive reviews, customers commented on the friendly, helpful staff employed by the aircraft businesses. These included safety trainers, front-desk workers, and pilots. The welcoming environment created by employees made passengers feel safe and comfortable, which was consistently expressed throughout the reviews. However, sometimes customers (who are particularly obese) feel embarrassed because workers ask for their weight in front of other passengers. Although weight is an essential factor in determining the number of allowable passengers on a helicopter flight, it could be a sensitive topic to customers.

Figure 2 summarizes the results of the internal assessment. The reviews did not provide an evaluation of the "structure" and "systems" components because they are from the management perspective.

5. Recommendations for air taxi services

Based on the internal assessment of helicopter services using online positive and negative customer reviews, the following suggestions are proposed for emerging air taxi services.

5.1. Promotions

Air taxi services can begin offering coupons and/or free rides to customers on special occasions, such as their birthdays and wedding

Table 1. Key Topics Identified using Bigram and Trigram Analyses.

Key Topic	Description
Positive Topics	
Promotion	Exclusive offers, discounts, or coupons given to customers for future services
Features	Specific attribute of the aviation service
Staff	Individuals employed to serve customers (e.g., pilots, attendants, front-desk staff)
Reservation	Booking a future helicopter ride via phone call, online website, or smartphone application
Safety	Unlikelihood of passenger injury, danger, or risk
Guided Tour	Aviation ride over historic/well-known area or monument with announcements of specific details
Negative Topics	
Waiting Area	Room/suite designated for customers who are waiting for their helicopter rides
Refund and Cancellations	Ability to obtain easy refund and notification of service cancellations due to weather conditions
Site Visibility	Customers' ability to view through the vehicle windows during their ride
Schedule	List of intended future ride details
Vehicle Maintenance	Service procedure to ensure safe and long-term use of vehicles

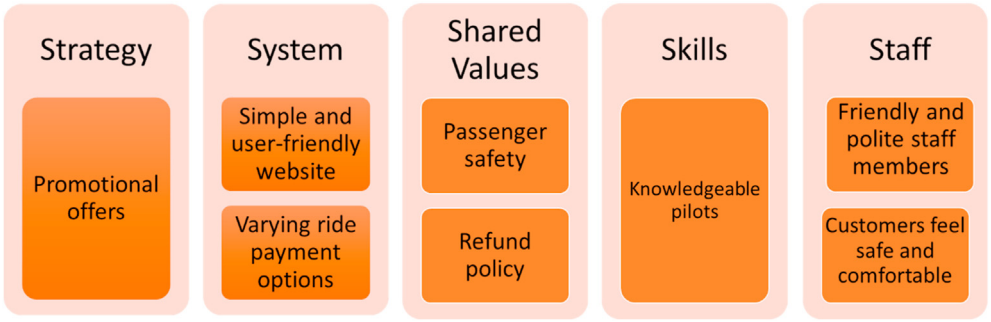

Figure 2. Summary of the internal assessment of helicopter reviews.

anniversaries. This incentivizes customers to return annually and may also result in additional marketing for the business. Birthday celebrations are often shared on social media, so customers utilizing their yearly coupons may persuade their followers to avail of these soaring services as well.

Discounts should be offered throughout the year to combat typically high prices per ride. These discounts should be strategically placed during holidays or seasons with preferable weather conditions. Customers are more likely to purchase a trip during these times, and hence, offering a discount is recommended.

To attract larger parties or corporate events, air taxi services should consider establishing discount rates for passengers paying as a group. Corporations should be offered these discounts at a relatively higher rate, due to their size, to build loyalty. These discounted rates will increase the likelihood of high customer traffic and word-of-mouth marketing.

Establishing a loyalty rewards program encourages customers to return and pay for multiple aviation services. If individuals are incentivized with discounts or free rides for their next visit, they are more likely to return to reap the benefits. Loyalty reward programs can also access personal information, such as birthdays, and track them yearly. The businesses can send coupons via email or creative paper advertisements.

By offering gift cards for air taxis, recipients are more likely to become first-time customers. These gift cards could be sold alongside other transportation services, like Uber or Lyft, at convenience stores, gas stations, grocery stores, or even be purchased online.

To accommodate customers wishing to travel at night, discount fares could be offered after 9 or 10 PM, depending on the marketing strategy. Late-night ride discounts may also attract customers looking to celebrate any occasion at midnight.

For passengers reserving “longer” rides, as determined by the air taxi service, a discount can be applied. This encourages customers to utilize the service for long distances and recommend it to others. Price does not need to be linearly increasing with distance.

5.2. Built-in camera

Customers paying for helicopter transportation are often doing so for special occasions, like an anniversary or birthday. Based on this observation from helicopter reviews, we recommend installing and standardizing a high-definition camera in flying taxis so that customers can take photos during their ride. For additional revenue, businesses can sell these photographs as souvenirs (i.e., keychain, photo album, picture frames) to customers after landing.

5.3. Staff

The helicopter transportation business standardizes basic aviation training for all employees. If all employees are highly knowledgeable, customers will feel more comfortable and safer before their ride. During the initial stages of operation, any hesitant passengers can choose to be partnered with a highly trained assistant throughout their trip at an additional cost.

5.4. Reservations

Air taxi services should offer passengers the ability to reserve specific seats within vehicles to accommodate preferences. Preferred seats, like seats near the window, could be booked at a higher price. Their preference may depend on the type of travel, whether for everyday commuting or special occasions.

Helicopter reviews negatively describe the refund after service cancellation (due to severe weather conditions). Therefore, for air taxi services, we recommend to

(a) establish a policy granting a free/discounted rescheduled ride,
(b) give complete or partial refund immediately, or
(c) offer alternative transportation if customers utilizing the air taxi for daily commuting, which can consist of train tickets or regular taxis.

These scheme(s) should be clearly displayed on the business' website or shown to customers before a reservation is made to gain their trust.

5.5. Waiting area

To combat longer waiting times for air taxis, a waiting area should be created at certain stations with high demand. These areas could have children's activities, televisions, and, if possible, some refreshments to maximize customer comfort. Standardizing waiting areas will improve a passenger's overall experience and decrease the likelihood of spreading negative eWOM regarding long wait times.

5.6. Schedule

To decrease customer's wait time, air taxi service should establish a time buffer in between reservation times. This allows the pilot to have sufficient time to prepare for the next flight while also compensating for any flights running behind schedule or vehicle maintenance times. If air taxi rides continue to be late after standardizing time buffer, additional measurements, such as the implementation of lean and six sigma techniques, should be taken.

Besides, to alleviate customer dissatisfaction when rides are late, coupons or future ride discounts should be made available.

5.7. Safety

Before a customer can successfully reserve a ride, online safety training should be required. By using this policy, the need for training on-

site could be eliminated, which may be time-consuming. Once an individual successfully finishes the training, he/she might not have to retake it for future rides. The safety courses can be presented as videos or text to passengers, depending on their choice. Customers may also choose to receive safety training on-site based on their preference.

Although weight is an essential factor in determining the number of allowable passengers on an aviation service, it can be a sensitive topic to obese customers. By requiring necessary personal information (e.g., height, weight, age) on phone application or website, the need to question the passenger on-site in front of other travelers is eliminated. This will be a more private and discretionary way to gather this necessary data.

If pilots are aware of upcoming turbulence, they should communicate this in detail with the passengers. When individuals are prepared for bumps along the ride, they are more likely to feel safe and comfortable on the flight. The pilots should also have an open discourse with all passengers regarding the air taxi's status during the entirety of the ride.

5.8. Guided tours

As an additional service, air taxis could offer guided tours around historical or popular areas within a city. These tours could be having discounted group rates to attract tourists, as well. Pilots should be very knowledgeable of the historical significance of all monuments, cities, and landmarks in that area.

5.9. Site visibility

To ensure that passengers can successfully locate air taxi sites, signboards should be clearly displayed around operating stations. It is also recommended that billboards be placed on major highways that contain directional information about the facilities.

5.10. Vehicle maintenance

Reviews praise helicopter service's maintenance and cleanliness. For expensive travel, like air taxis, customers would have higher expectations for ride comfortability. To meet passengers' expectations, it is recommended that air taxis are regularly cleaned and maintained. Customers should also be given a survey upon completion of the trip regarding their ride experience to gather useful data. If passengers express their concern regarding cleanliness, additional measures must be taken.

Figure 3 briefs the key recommendations for air taxi based on review analysis.

6. Discussion

Although air taxi companies attempt to provide millions of individuals with a more comfortable commute at a competitive cost, certain concerns might arise from potential customers. Numerous papers have focused on the prospective design and operations of air taxi services (e.g., Holden and Goel, 2016; Johnson et al., 2018; Sun et al., 2018; Rajendran and Zack, 2019; Rajendran and Shulman, 2020), however, the following questions need to be addressed by companies from an implementation standpoint.

The following are a couple of questions and concerns that might prevail among individuals.

- Air taxi services, in efforts to improve accessibility and increase the customer market, could serve passengers with disabilities. Given the rapid customer loading and unloading time, how can service for these customers be accommodated?
- This service may also apply to emergency situations in addition to everyday commuting. Rather than offering this to an entire population, a selected community, like a retirement complex, may be chosen. Could these services be provided to a retirement community so that they can get to the hospital faster? Or could air taxis be used to transfer organs or blood to hospitals and surgery centers?
- To improve the safety and comfort level of passengers, standardized aircraft cleaning and maintenance should be established. How can the successful implementation of cleaning services and maintenance checks be created within a busy ride schedule?
- Due to the small size and weight constraints of aircraft, would there be challenges to commute passengers who travel to and from airports who are more likely to carry heavy pieces of baggage?

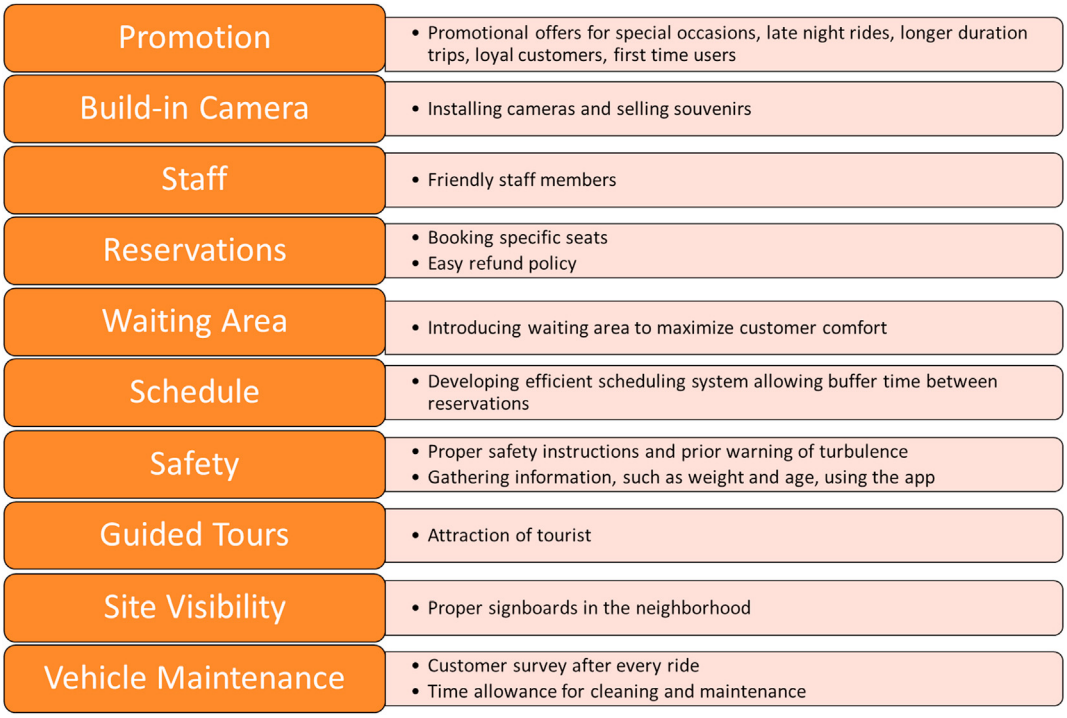

Figure 3. Summary of major air taxi recommendations.

- To ensure passenger safety, procedures and security checks are required by aviation services. However, with scheduling constraints, this expected additional time may pose many problems for air taxis. How is the air taxi service planning to handle standardized safety procedures and security check time?
- Many promotional offers available from helicopter services focus on rates for large groups or events, but do not consider discounts for young passengers. What pricing strategies for children are economically plausible?

7. Conclusion

Currently, several logistics companies are exploring the design of air taxis in large metropolitan cities. These electric-powered aircraft vehicles operate similar to helicopters, although the former are in the process of serving millions of everyday commuters in efforts to alleviate traffic congestion and reduce travel time. Due to their correlating business operations, the current strengths and weaknesses of helicopter services are assessed to determine plausible recommendations for air taxi's design, operation, and implementation. The advantages and shortcomings of aviation service are inferred after performing text analysis on helicopter services' online customer reviews (OCRs). These OCRs often contain vital information regarding the customers' perceptions of service and may impact potential customers' decision to avail of emerging methods.

This study develops a four-stage sequential approach. To determine insights that may improve the design and business operations of air taxis, OCRs are extracted from multiple social networking sites in Stage 1, and text analytics on OCRs is conducted in Stage 2. The analysis includes positive and negative review separation, bigram and trigram identification, and the recognition of critical topics based on commonly co-occurring words. Upon the completion of text analysis, a 7S internal assessment is conducted for helicopter services in Stage 3, and several managerial recommendations for air taxis are proposed in Stage 4.

The helicopter service OCRs provided many interesting findings that can be used for air taxi recommendations. For example, many customers speak highly of their ride experience, especially when accompanied by a reliable and polite staff or when additional features like a built-in vehicle camera are available. Also, discounted rates could be applicable to large groups, corporate events, or returning passengers to ensure a high customer retention rate. Safety is also a considerable concern for helicopter customers. To compensate for this, mandatory standardized safety training prior to the first air taxi ride is recommended. The proposed recommendation can assist logistics companies with efficient network operation.

One of the major limitations of this research is the lack of an adequate number of online reviews. With the availability of a large amount of data, better text analytic techniques, such as sentiment analysis and topic modeling tools, can be used for online review analysis, and more valuable recommendations could be provided.

Declarations

Author contribution statement

Suchithra Rajendran: Conceived and designed the experiments; Performed the experiments; Analyzed and interpreted the data; Contributed reagents, materials, analysis tools or data; Wrote the paper.

Emily Pagel: Analyzed and interpreted the data; Contributed reagents, materials, analysis tools or data; Wrote the paper.

Funding statement

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

Competing interest statement

The authors declare no conflict of interest.

Additional information

No additional information is available for this paper.

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