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Master's Dissertation 2020

Potential of Flying Cars in the Southeast Asian Market through Demand Estimation and Evaluation of Stakeholder Perceptions

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ABSTRACT

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Title

Potential of Flying Cars in the Southeast Asian Market through Demand Estimation and Evaluation of Stakeholder Perceptions

Abstract

Despite flying car development activity being focused on developed countries around the world, countries within the emerging market of the ASEAN region have started diving into developing and testing flying cars as well. The purpose of the study is to understand the potential that flying cars have within the ASEAN market by evaluating the estimated market demand, as well as evaluating stakeholder perceptions from government bodies and potential operators for flying car operations. This study explores how stakeholders within government, aviation, and tourism are responding these developments within the context of Thailand and the Philippines, how these may affect them, and which use cases may be appropriate for launch. Semi-structured interviews of multiple helicopter operators, resorts, and government authorities were conducted in the Philippines and Thailand to assess their perceptions on the market for flying cars within their respective countries. This study finds that the Philippines and Thailand have greater market potential for eVTOL compared to their neighbors. It also finds that, upon weighing stakeholder's opinions from both countries, launching leisure/sightseeing services in Cebu may be most optimal, given regulatory issues impacting most of these opinions. Lastly, the study also finds that Thailand has higher potential market demand compared to the Philippines based on market demand estimates, and that different pricing strategies may need to be considered. Information from the perceptions displayed here will be used for future work on estimating market demand.

Keywords: eVTOL, flying car, Thailand, Phillippines, tourism

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CHAPTER 1: Introduction

1.1 Locations of flying car development and its limitations

Flying cars have made leaps in its development over the past few years, with startups and companies taking on this initiative all around the world. With the Uber Elevate project [1] being one of the more ambitious initiative currently being developed, already determining three cities to be part of the first international markets for Uber Air's demonstrator flights in 2020 and commercial launch in 2023: Dallas, Los Angeles, and Melbourne— the pressure in the race for developers to create their own flying car and have it released on the market growth.

However, these developments for flying cars have been limited to developed countries. Deloitte released a whitepaper [2] about flying cars that included a timeline of major flying cars under development, noting that most of the major flying cars under development are from Europe (e.g. or the United States. Asian countries have also gotten involved in the race for flying car development with EHang, whose developments are centered in China, being one of the more prominent makers within the scene. Recent developments have also notices that companies from Japan and South Korea have come into the race with their own prototypes and concepts. NEC has released its prototype and has launched a test flight [3]. Meanwhile, Hyundai is currently teaming with Uber to create its own flying car concept [4].

Majority of development and respective use case studies have focused on locations within the developed Western world and, though this has expanded to consider the Asian market, this reveals a gap with the existing knowledge on coverage of the applicability of the technology. There is still a lack in consideration regarding the rest of the world and their needs, most

especially within the majority if Asia, as well as developing countries with growing markets and possible needs that can be addressed using eVTOL. This current limitation leaves a sizable portion of the project global eVTOL market untouched and unexplored in the viability of possible use cases that can be implemented within the region as well as their corresponding market demand. In their study regarding the global market for eVTOL 2035, Porsche Consulting has noted that majority of the world distribution for intra-city eVTOL usage will be in the Asia Pacific region in 2035 (see Fig.1).

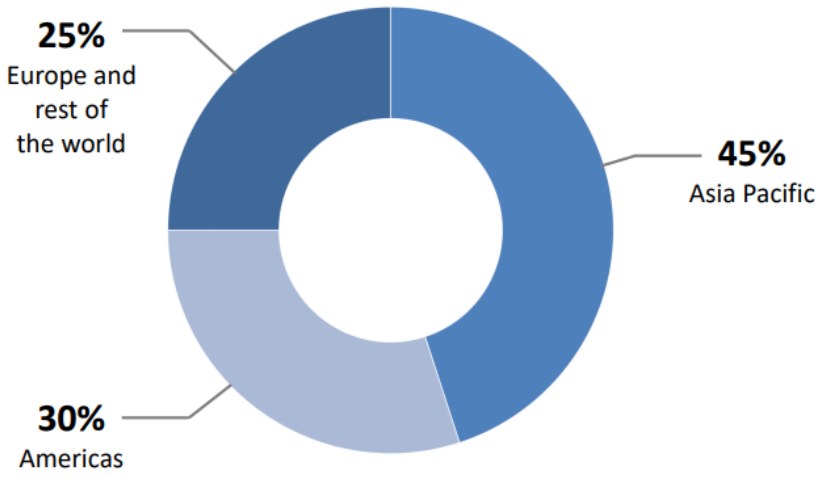


Figure 1: Regional split of the eVTOL market in 2035 [40]

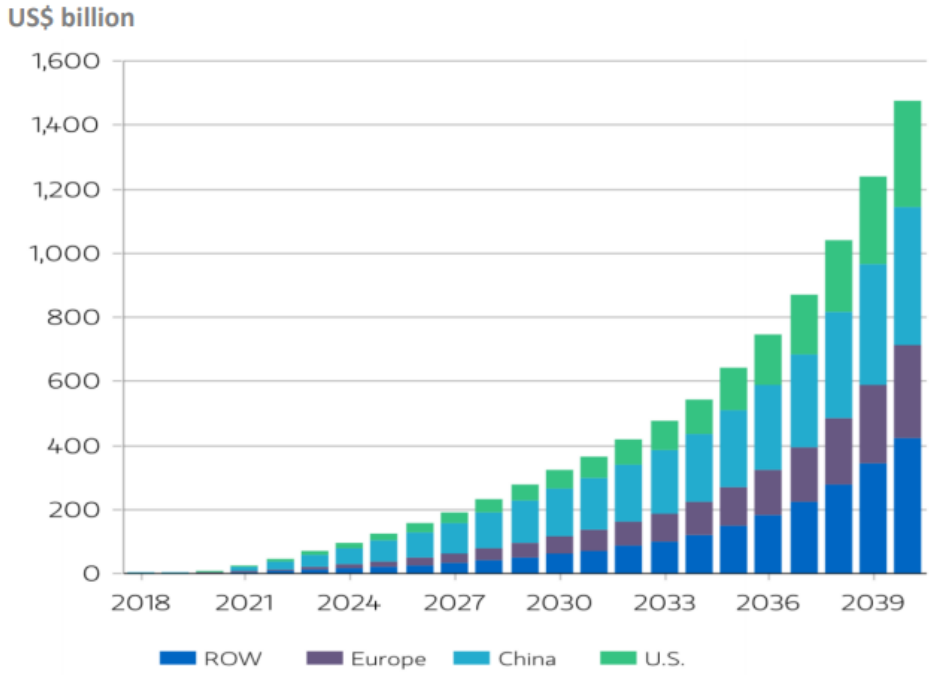


Figure 2: Urban Air Mobility global total addressable market, based on Morgan Stanley Research data [41]

Although, based on data from Morgan Stanley Research, it could be speculated that majority of the market share around this time will come from China (see Fig. 2), there is still sizable market share within the rest of the world that includes other countries in Asia that, despite their status as developing countries, have growing markets that should not be ignored for possible eVTOL launch and implementation.

1.2 Southeast Asian market's potential for flying cars

One of the portions within Asia that can serve as a potential market within the region is the ASEAN region. The region comprises of 10 countries, namely Brunei, Cambodia, Indonesia, Laos, Malaysia, Myanmar, the Philippines, Singapore, Thailand, and Vietnam. All countries are at different stages of development, but the region as a whole show that they have potential for immense market growth.

The region as a whole has encountered average GDP growth of 5.5% between the years of 2010 up until 2016[42], making them one of the rapidly growing economic zones in the world with relatively stable growth. However, it should be noted that the region is diverse in its economic output, GDP per capita, and distribution of wealth among its people[43].

Thailand's market is representative of the countries that are more affluent within the ASEAN region, as Thailand has an income categorization as an upper-income country by the World Bank[5], along with Malaysia [44]. 17 million people in Thailand (25 percent of the total Thai population) were estimated by Boston Consulting Group in 2015 to be classified as part of the upper middle class within the country[6]. The Philippine market, along with Indonesia, is more representative of the countries within the ASEAN region that may not be as affluent but have large potential for economic growth. Albert, Gaspar, and Raymundo [7] estimated that only 790,000 households within the Philippines (3.6% of the total) in 2015 are classified as upper middle class or higher, but the World Bank has reported that the country has sustained average annual economic growth of 6.3% between 2010-2018 and has reduced poverty from 26.6% in 2006 to 21.6% in 2015[8]. Meanwhile, the World Bank has noted that although Indonesia has made considerable strides in poverty reduction and has kept itself as a member of the G-20, 20.6% of the population still reminds vulnerable to falling into poverty based on March 2019 World Bank data [45].

The region has emerging needs for tourism and everyday travel that where eVTOL could be utilized for implementing relevant services, such as aerial sightseeing, inter-island travel, and traffic mitigation. Though helicopters are already in use in these countries for these use cases, eVTOL can stand in as a novel, affordable, and compact alternative for use by operators, especially when the technology has developed to match appropriate specifications for their

needs. Additionally, these services may be made available in the region sooner compared to their developed Asian counterparts as these countries may be able to overcome difficulties that makers are facing in getting the technology implemented, such as difficulty in attaining certification, negotiating regulation, gaining public acceptance, and finding a large market size for these services.

Given the dynamic nature of the region's market, it gives way to explore different environments for eVTOL to operate in, each with its own set of opportunities that may prove favorable to that technology's launch. These have to be explored.

1.3 Objective of this study

The main objective of this study is to understand the potential that flying cars have within the ASEAN market through evaluating the estimated market demand, as well as evaluating stakeholder perceptions from government bodies and potential operators for flying car operations. This study examines this within the context of the Thai and Philippine markets, as these two countries are representative of dynamic market environment within the ASEAN region.

1.4 Literature review

Previous studies exploring stakeholder perceptions have mainly evaluated the perceptions of potential passengers or end users and determined factors that can affect technological acceptance for this group of stakeholders, with respondents for their corresponding surveys coming from more developed countries either located in Europe or in North America. Rohlik and Stasch[9] in 2015 developed an extension of the Technology Acceptance Model and adapted it for flying cars, and have determined that the global key determinants that strongly

influence the behavioral intention of potential users to utilize air taxis are perceived usefulness affecting attitude towards air taxis, subjective norm, travel cost, and personal innovativeness with age and occupation having a possible effect on the relationships between users' behavioral intent and time saving as well as behavioral intention and travel cost. Eker, Ahmed, Fountas, and Anastasopulos [10] in 2019 determined that, in the context of the United States, perception of flying cars, especially in light of safety- and security-related concerns is dependent on a mix of demographic characteristics, including, but not limited to, the following: Age, race, income level, location of residence, driving exposure, and educational background (technical or non-technical), as certain demographics lean more towards certain beliefs regarding the technology compared to others. Planing and Pinar[11] in 2019 conducted a survey following a Volocopter unmanned air taxi demo flight in Stuttgart, Germany in September of that year, and found that a majority noted that they are likely or most likely to use the vehicle and are willing to support an offering of a Volocopter Service in Stuttgart. However, the same group of respondents are not sure whether it'll play a part in their daily life, with only less than half (45%) agreeing that it may play a part in their daily life.

Other previous studies estimating market demand for flying cars have fallen into the same geographical and use case limitations that the aforementioned studies on stakeholder perceptions have, with their scopes forming in developed countries. Aside from this, previous studies mainly base their estimations for operations in urban settings, where the cars will be most likely used for air taxi related use cases. Balac, Schmid, Vertrella, and Rothfeld [12] in 2019 estimated market demand for passenger aerial vehicles using a multi-agent transport simulation carried out using a reduced population 50 km radius Zurich scenario with allowance for agents to perform mode and

route choice, allotted for the cost comparisons depending on transportations mode, and proposed that the vehicle's capacities and accessibility will affect the demand. Garrow, Moktharian, German, et al. [13] in 2019 conducted a commercial opinion survey of 2,500 commuters in urban areas in the US (Atlanta, Boston, Dallas-Ft. Worth, San Francisco, and Los Angeles areas) to model competition between electric air taxi service, autonomous ground vehicles, and traditional ground vehicles that will be used for forecast commuting demand for eVTOL flights. Boddupalli [14] in 2019 generated a multinomial logit model and a latent class model to explain the varying tastes of the market segments identified based on the 2019 survey conducted by Garrow, Moktharian, German, et al.

1.5 Purpose and originality

In comparison to previous works, this study aims to evaluate perceptions from a business and government perspective rather than end user perceptions, and determine the factors that may affect public acceptance by this separate group of stakeholders. In contrast to previous studies, the geographical scope of this study explores these factors in the context of developing countries. Previous papers have not explored other potential use cases aside from UAM that could be made available for flying cars, which stifles the creativity of the way this technology could be used and limits the discussion of opportunities and problems for flying cars that arise from the discussion of other use cases. This study, in comparison, will be covering new ground that the geographical and use case scope of previous studies have not addressed by estimating demand and assessing issues for leisure/sightseeing and air taxi use cases for the ASEAN region.

1.7 Structure of this paper

This paper consists of five chapters. The first chapter involves the introduction and background for this study. The second chapter describes the methods used in detail, along with their purposes and modifications necessary for this study. The third chapter details the results, along with their respective summaries. The fourth chapter synthesizes the results and discusses recommendations for the implementation of eVTOL in both countries that could be drawn from these results, as well as the limitations of this study. The fifth chapter gives the conclusion for the study.

CHAPTER 2: Methods

2.1 Overview

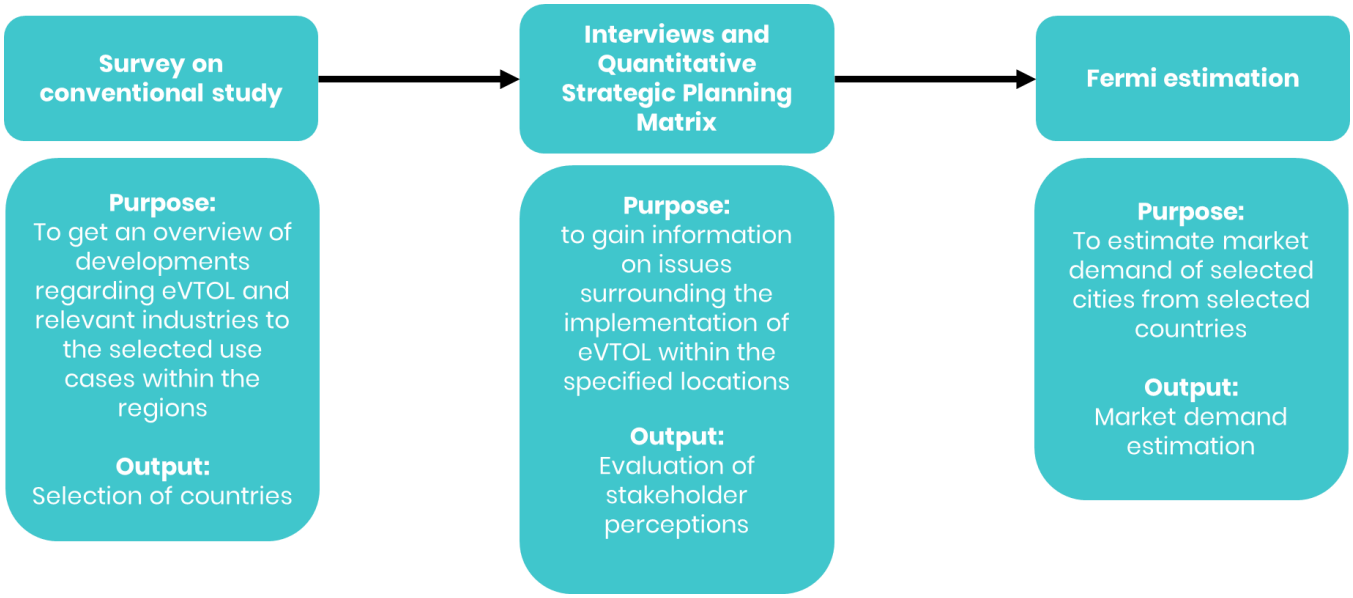


Figure 3: Flow of method with corresponding purposes and outputs

This study is done in three steps. Firstly, a survey on conventional study was done to gain insight into the current situation in the ASEAN region with regards to eVTOL developments in the region, whether technological or regulatory, as well as insights on the market situation in industries that can open up possibilities to consider different use cases within the region and select locations where implementation can be considered. Secondly, interviews were conducted with multiple stakeholders within the selected locations to gain information on their perceptions on issues surrounding the implementation of eVTOL within the specified locations. These are then evaluated through a quantitative strategic planning matrix. Finally, market demand is then estimated for all selected locations through Fermi estimation[47]. Thereafter, comparisons between all two countries are then discussed to assess which use cases may be more feasible for launch within the region.

2.2 Survey on conventional study

Conventional research was done to gather information about potential market for eVTOL services and flying car developments from five countries in ASEAN, namely Malaysia, Thailand, Philippines, Indonesia, and Singapore. These countries were selected for their economic significance within the ASEAN region when ranked according to their nominal GDP, as estimated by the IMF in 2019.

Table 1: Ranking of ASEAN countries according to nominal GDP [46]

Rank	Country	Population in million	GDP Nominal (millions of USD)
1	Indonesia	266.998	1,111,713
2	Thailand	67.913	529,177
3	Malaysia	32.801	365,303
4	Singapore	5.670	362,818
5	Philippines	108.307	356,814
6	Vietnam	95.494	261,637
7	Myanmar	53.019	65,994
8	Cambodia	16.494	26,730
9	Laos	7.163	19,127
10	Brunei	0.447	12,455

News reports, market research reports, and other relevant studies with information on the developments regarding tourism, traffic, emergency medical services, and flying car-related issues (development or regulatory) were compiled and reviewed to give insight on the situation within these countries and the advantages the situations in each country may have on different

potential use cases. These were then used as basis to choose our locations for interviews with relevant stakeholders.

2.3 Interviews and stakeholder evaluation

2.3.1 List of interviewees and stakeholder analysis

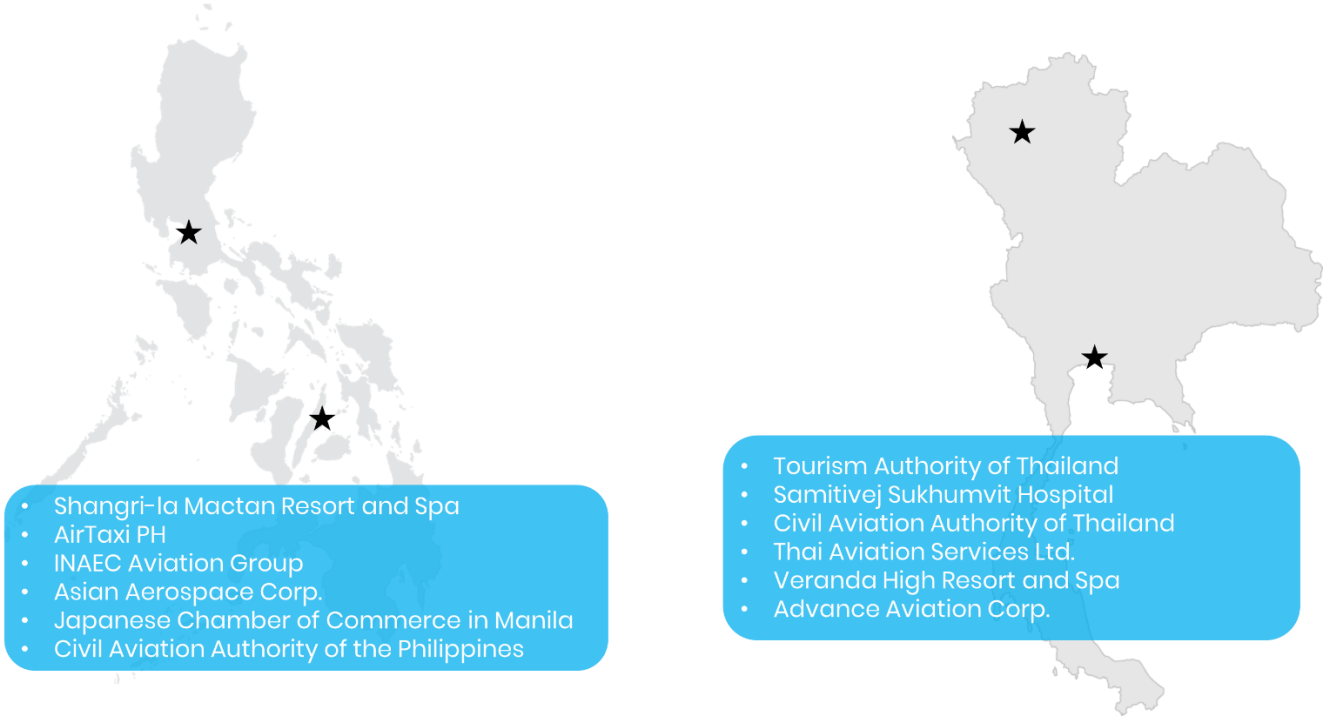


Figure 4: Stakeholder List of Interviewees in the Philippines and Thailand

Interviews were conducted among different stakeholders within the Philippines and Thailand for the purpose of assessing the existing market for helicopter-based transportation within both countries, as well as to assess stakeholder perceptions for the market demand, tourism impact, and business concerns regarding the entry of flying cars within the region. These interviews were semi-structured, as discussions were based on different sets of questions regarding the possibility of implementation of the UAM use case, the possibility of implementation of the sightseeing/leisure use case, other possible use cases, and regulatory problems, but the

interviewees were allowed to speak freely regarding these issues. Figure 2 below summarizes the list of stakeholders interviewed in both countries.

Business-related Stakeholders

Table 2: Stakeholder analysis for business-related stakeholders

Stakeholder Name	Location	Merit of eVTOL for the stakeholder	Demerit of eVTOL for the stakeholder
AirTaxi PH (Cebu Hangar)	Cebu, Philippines	Novelty for sightseeing experiences	Limitation of range for inter-island travel packages
INAEC Aviation Group	Manila, Philippines	More affordable alternative vehicle for point-to-point urban travel	Limitation of range for inter-city travel
Asian Aerospace Group	Manila, Philippines	More affordable alternative vehicle for point-to-point urban travel	Limitation of range for inter-city or inter-province travel
Japanese Chamber of Commerce in Manila	Manila, Philippines	Possibility of recommending Japanese-made eVTOL to Philippine operators	Lack of involvement with the aviation industry
Advance Aviation Corp. (Chiang Mai Hangar)	Chiang Mai, Thailand	Novelty for sightseeing experiences	Limitation of range for inter-city travel packages
Thai Aviation Services	Bangkok, Thailand	More affordable alternative for point-to-point urban travel	Limitation of range for inter-city travel
Samitivej Sukhumvit Hospital	Bangkok, Thailand	Alternative transportation option for emergency medical services	Specifications may not cater to hospital needs

Stakeholders contacted and interviewed in the Philippines for market insight include Air Taxi PH, INAEC Aviation Corp., Asian Aerospace Corp., and the Japanese Chamber of Commerce (JCC) in Manila. In Thailand, aviation-related businesses mainly involve Advance Aviation

Corp., Thai Aviation Services Ltd. These companies are helicopter operators that offer a wide variety of services which include, but are not limited to, the following: offshore and gas operations, charter services, sightseeing, and medical evacuation. Aside from the aforementioned businesses, Samitivej Sukhumvit Hospital (SSH) in Thailand was also contacted and interviewed, as they operate helicopters for medical use. These businesses were interviewed to gain understanding on the market for helicopter operations in the aforementioned countries, as well as insights regarding any issues affecting operations within these countries.

Figure 5: AirTaxi PH Cebu hangar in Mactan Island [Photo from author]

Figure 6: AirTaxi PH helicopter in Cebu used for sightseeing flights [Photo from author]

Figure 7: Advance Aviation helicopter in Chiang Mai used for sightseeing flights [Photo from author]

Regulation-related stakeholders

Table 3: Stakeholder analysis for regulation-related stakeholders

Stakeholder Name	Location	Merit of eVTOL for the stakeholder	Demerit of eVTOL for the stakeholder
Civil Aviation Authority of the Philippines (CAAP)	Manila, Philippines	Early adoption of innovative technology, especially if regulation were set in place	Difficulty in creating regulations for the new technology
Civil Aviation Authority of Thailand (CAAT)	Bangkok, Thailand		

Aviation-related government bodies contacted and interviewed include the Civil Aviation Authority of the Philippines (CAAP) and the Civil Aviation Authority of Thailand (CAAT). These parties were interviewed to have an understanding of existing regulations for air mobility in these countries, as well as to determine the possible framework the authorities of these countries are currently using. Moreover, they were interview to gain an understanding of the issues surrounding the creation of regulatory framework for eVTOL if the technology were to enter these countries.

Tourism-related stakeholders

Table 4: Stakeholder analysis for tourism-related stakeholders

Stakeholder Name	Location	Merit of eVTOL for the stakeholder	Demerit of eVTOL for the stakeholder
Shangri-la Mactan Resort and Spa	Cebu, Philippines	Novelty for sightseeing experiences, easier connection between airport and resort	Lack of infrastructure and interest in current market
Veranda High Resort and Spa	Chiang Mai, Thailand		
Tourism Authority of Thailand	Bangkok, Thailand	Creation of marketable services that can generate more tourism appeal within the country	Conflict of interest between supporting existing sightseeing businesses and eVTOL-related leisure businesses

Tourism-related parties contacted and interviewed include Shangri-La Mactan Hotel and Resort in the Philippines, as well as Veranda High Resort and the Tourism Authority of Thailand (TAT). These parties were interviewed to gain understanding of the tourism market in each country. They were also interview to have an understanding of the possible customer profile that are likely to avail of helicopter-related services and, in turn, eVTOL-related services, as well as gain insight on the possible impact that utilizing flying cars may have in the tourism industry.

Figure 8: Coastal view of Shangri-la Mactan Island Resort and Spa [Photo from author]

Figure 9: Shangri-la Mactan Resort and Spa's in-resort helipad [Photo from author]

Figure 10: Veranda High Resort and Spa [Photo from author]

2.3.2 Interview questions

The interview questions are divided into three main sets: Possibility of air taxi use case, possibility of leisure use case, and other promising use cases. The air taxi and leisure use cases are chosen as both had significant potential for the flying car, based on the overview. Each of these sets include questions that lead to insights regarding the current situation for aerial transportation surrounding these use cases, which then lead on into how issues within the current environment will affect the possible usage of flying cars in the locations interviewed. Figures 11-14 lists the interview questions according to its sets.

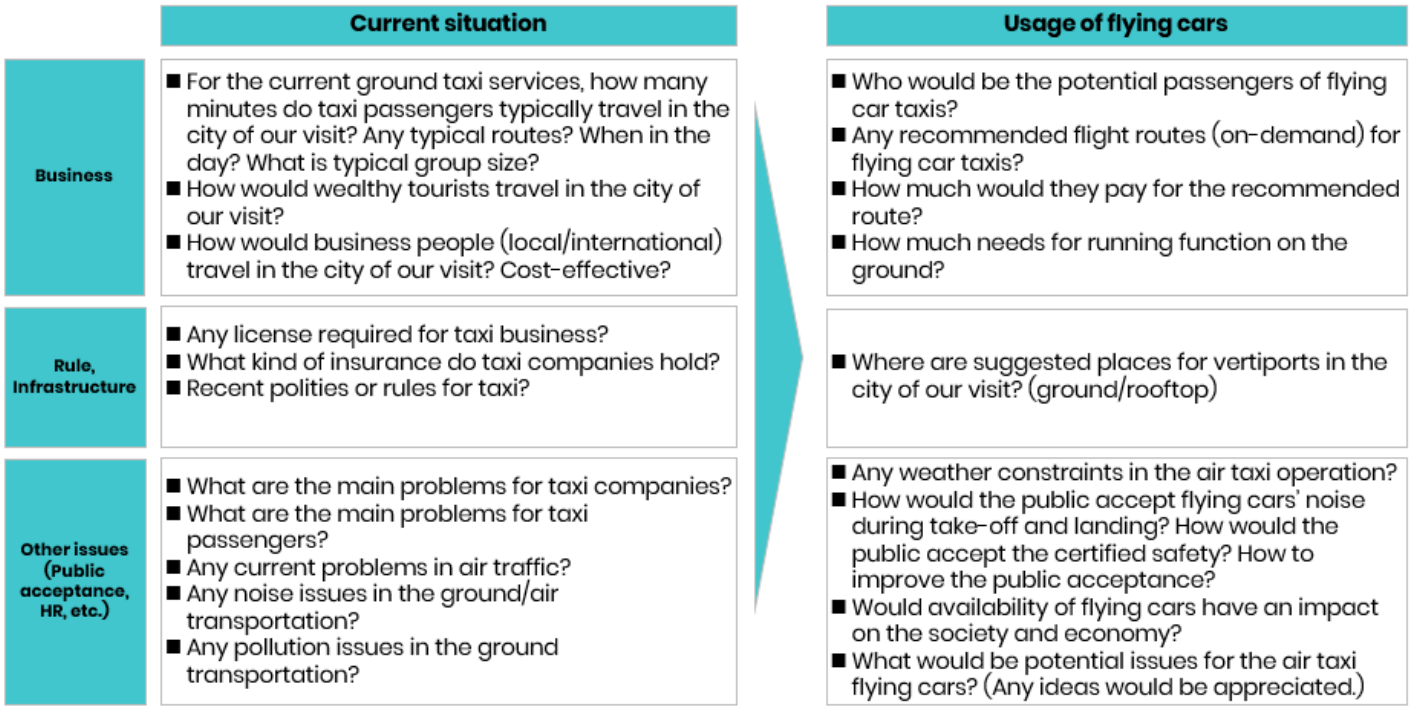


Figure 11: List of questions for the possibility of the air taxi/UAM use case

The questions regarding the air taxi/UAM use case discuss three different issues surrounding the implementation of eVTOL for the use case: business, rules and infrastructure, and other issues regarding public acceptance (e.g. noise, air traffic, environmental impact, weather etc.) and human resources. Moreover, these questions divided into two scenarios to give points of comparison between the issues that the current industry of our stakeholders (aviation or tourism)

are currently facing with existing technology, and issues that may have to be faced in the future when flying cars are launched for the specific use case. The questions surrounding the air taxi use case focus mainly on issues regarding target market and public acceptance issues within the capitals of the countries visited.

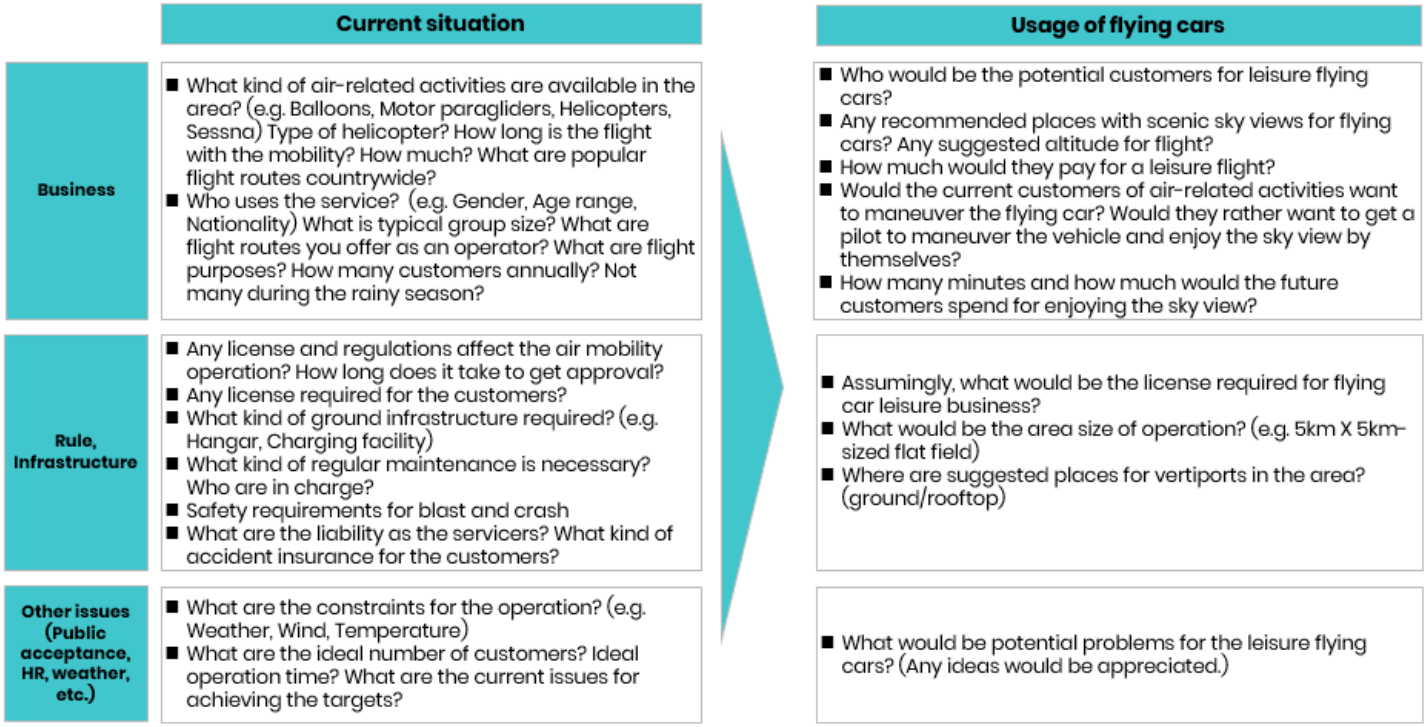


Figure 12: List of questions for the possibility of the leisure use case

The questions regarding the leisure use case are divided similarly among the same three issues (business, rules and infrastructure, and other issues regarding public acceptance and human resources) and two scenarios (current and future usage of flying cars). However, compared to the UAM use case, the questions expand on the scenario of the aircraft and activities that fall under aerial leisure and recreation, as well as the regulations surrounding the aerial recreation.

	Usage of flying cars
Business	■ What usecases have potentials other than Leisure/Air taxi usecases, from the perspective of local residents? What is the underlying transportation issue to solve? What would be the benefits? ■ Any promising business models?
Rule, Infrastructure	■ Where are suggested places for vertiports for the suggested usecases? (ground/rooftop)
Other issues (Public acceptance, HR, etc.)	■ Any potential problems for the suggested usecases?

Figure 13: List of questions for other promising use cases

The questions regarding the other use cases are divided similarly among the same three issues (business, rules and infrastructure, and other issues regarding public acceptance and human resources), but only focus on the scenario of the future usage of flying cars. These questions look into use cases (e.g. emergency medical services, medical tourism, cargo, etc.) that may be explored within the scope of the countries visited, as well as to explore any other issues that may arise within these use cases that may affect UAM and sightseeing/leisure use cases as well.

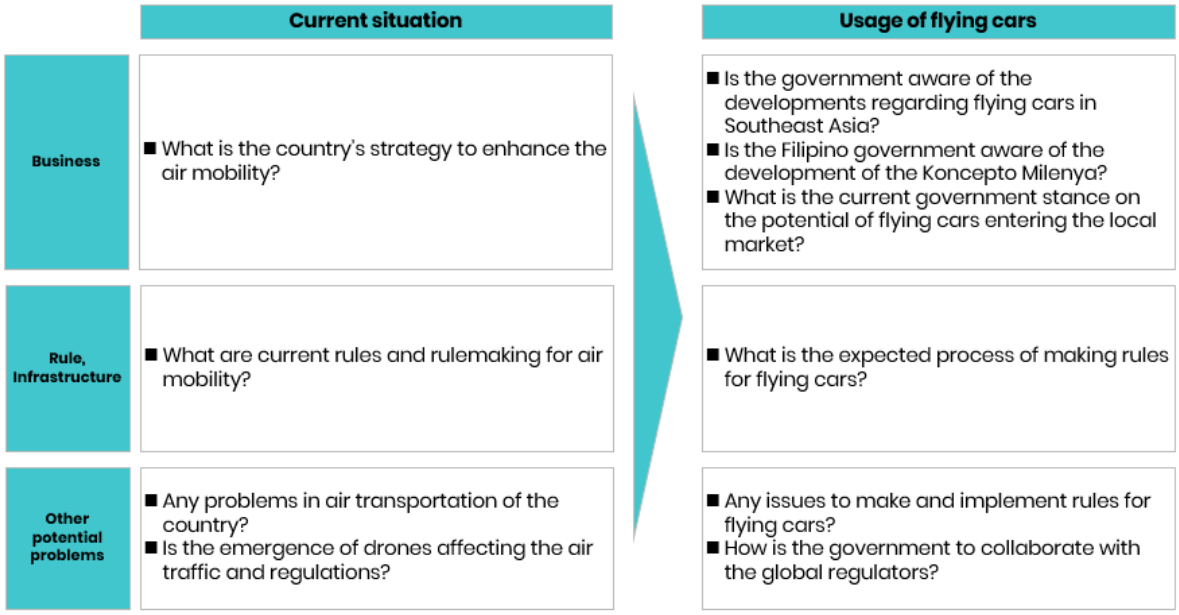


Figure 14: List of questions for air transportation regulations

The questions regarding regulations focus on what are the problems that may have to be considered by regulators, operators, and tourism-related parties when it comes to current operations for aerial transportation for commuting purposes or for aerial recreation and sightseeing purposes. Furthermore, these questions also explore the issues that may arise upon implementing flying cars for the aforementioned use cases.

2.3.3 Evaluation method: Quantitative Strategic Planning Matrix

The results from the interviews are then evaluated through the Quantitative Strategic Planning Matrix (QSPM). This matrix, developed by F.R. David, helps organizations give an objective approach in evaluating and choosing alternative strategies[33]. This is done by first listing and assigning weights to the organization's internal strengths and weaknesses, as well as their external opportunities and threats. These factors will be used for the vertical axis. After, alternative strategies are listed as the horizontal axis. Each strategy and factor is then given an "attractiveness score" according to how attractive the strategy is in addressing the factor.

Finally, the scores are then multiplied by their weights and then summed up. The total attractiveness scores can then be compared to one another to determine which strategy is best for implementation.

For this study, the matrix had to be modified due to the different context that this matrix is applied to. As this method is mainly used in the context of an organization or company evaluating its own alternative strategies considering internal and external factors affecting the organization, this has been modified to assess alternative use cases in the context of an eVTOL service provider evaluating use cases in Southeast Asia given a speculated vehicle. The modifications to the steps of the QSPM done for this research are listed in Fig. 7 below.

Original steps for QSPM	Modified
1. Make a list of an *organization's internal strengths/weaknesses and external opportunities and threats* 2. *Assign ratings* to each internal and external factor (1 – 4, 1 as major weakness and 4 as major strength) 3. *Determine alternative strategies* that the organization is considering on implementing 4. Determine *attractiveness scores* (AS) for each factor and strategy. *(1, the strategy is not acceptable; 2, the strategy is possibly acceptable; 3, the strategy is probably acceptable and 4, the strategy is most acceptable.)* 5. Compute the total attractiveness scores (AS * factor rating), and compute the sum total attractiveness score for the strategy.	1. List down external factors and the eVTOL specification that are to be considered. 2. *Assign ratings* to each factor and specification in accordance to how much influence it may have. 3. *Determine the use cases and their respective locations* that will be considered for implementation. 4. Determine *applicability scores* (AS) from a scale of 0 to 7 for each factor and strategy. 5. Compute the total applicability scores (AS * factor rating), and compute the sum total applicability score for the strategy

Figure 15: Comparison of original QSPM procedure to the modified procedure in this study

Regarding step four in the modified QSPM, applicability scores were utilized rather than attractiveness scores, as this matrix is going to be used to evaluate how freely can eVTOL be used for this use case and location given the limitation of the factor being considered. The descriptions of the scale being used to evaluate the applicability can be seen in Figure 8 below.

Score	Description
0	Not applicable at all. eVTOL **cannot be used at all** given this factor.
1	eVTOL can be used given this factor, but it is **near impossible**.
2	eVTOL can be used **with great difficulty or restrictions** given this factor.
3	eVTOL can be used **with moderate difficulty** given this factor.
4	eVTOL can be used **with heavy reservations or concerns** given this factor.
5	eVTOL can be used with **slight reservations or concerns** given this factor.
6	eVTOL can **almost be used freely** without restrictions given this factor.
7	eVTOL can be **used freely without restrictions** given this factor.

Figure 16: Descriptions for each applicability score

2.4 Demand estimation

2.4.1 Base demand

Fermi estimation was done to compute the estimated demand. Below is the mathematical notation or nomenclature for this section.

D_{Sight}	Base demand for sightseeing/leisure use case
D_{UAM}	Base demand for UAM
$D_{SightWeather}$	Demand with weather constraints (Sightseeing/Leisure)
$D_{UAMWeather}$	Demand with weather constraints (UAM)
$D_{SightPubAcc}$	Demand with weather, public acceptance, and regulatory constraints (Sightseeing/Leisure)
$D_{UAMPubAcc}$	Demand with weather, public acceptance, and regulatory constraints (UAM)
$D_{SightFare}$	Demand with weather, public acceptance, regulatory, and fare constraints (Sightseeing/Leisure)
$D_{UAMFare}$	Demand with weather, public acceptance, regulatory, and fare constraints (UAM)
$Sales_{Sight}$	Amount of sales (Sightseeing/Leisure)
$Sales_{UAM}$	Amount of sales (UAM)
$n_{households}$	Number of households
w_R	Percentage of population classified under the wealthiest socioeconomic status
w_E	Percentage of population classified under the wealthiest, upper income, and upper middle income socioeconomic statuses

s	Percentage of people that may avail eVTOL services (5%)
d	Number of rainy days
r	Percentage affected by regulation constraints
n_{hotel}	Number of 5-star hotel rooms
$OccuRate$	Occupancy rate (80%)
u	Utilization rate
ur	Utilization ratio
f	Fare

The base demand for both use cases involved calculating the number of wealthy people that are likely to use eVTOL services within a year using formulas 1 and 2:

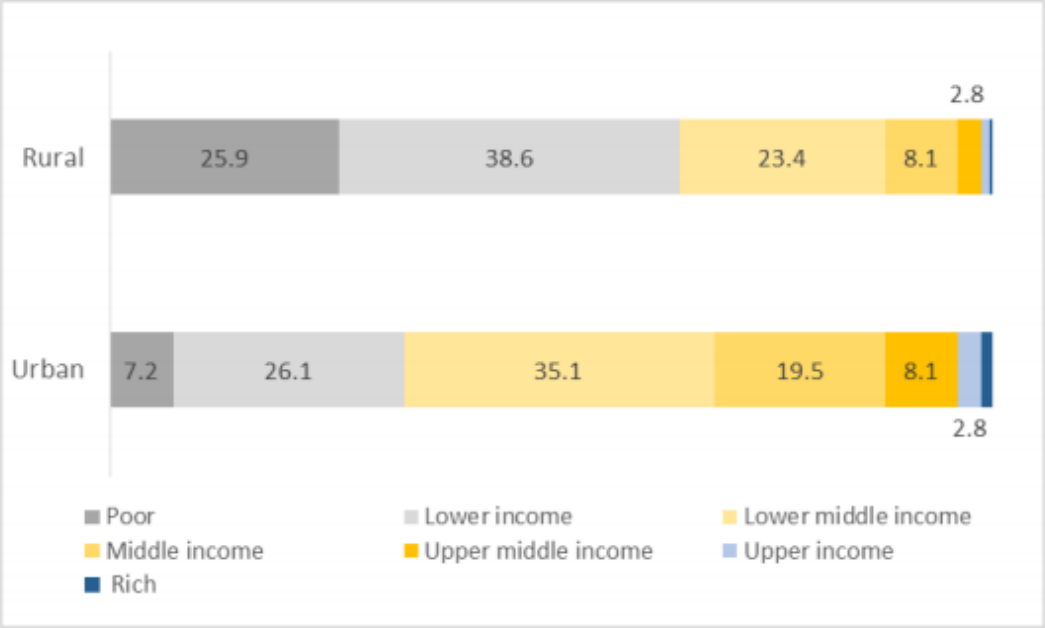
$$D_{UAM} = n_{households} \times w_R \times s \times 365 \quad (1)$$

$$D_{Sight} = n_{hotel} \times OccuRate \times s \times 365 \quad (2)$$

For the UAM use case, the number of households that would be classified as wealthy within the capital were computed. In the Philippines, the Philippine Institute of Development Studies compiled the distribution of residents by income clusters, showing the percentages of people who would be considered rich, upper income, and upper middle class within urban areas based on data from the national Family and Income Expenditure Survey (FIES) done by the Philippine National Statistics Office in 2015. (See Fig.8) In Thailand, the Thai Marketing Research Society (TMRS) has also compiled the percentage of those within similar classes in their Standardization

of Socioeconomic Status (SES). For the purpose of this study, only the percentages of those under the A+, A, and B classes will be used.

Figure 4: Distribution of urban/rural residents by income clusters



Source: FIES 2015

Figure 17: Distribution of urban/rural residents by income clusters [34]

TMRS SES classification		
Class	**Bangkok**	**Distribution**
E	0 – 7,500 THB	6%
D	7,501 – 18,000 THB	32%
C-	18,001 – 24,000 THB	14%
C	24,001 – 35,000 THB	16%
C+	35,001 – 50,000 THB	12%
B	50,001 – 85,000 THB	12%
A	85,001 – 160,000 THB	6%
A+	160,000+ THB	2%

Figure 18: TMRS SES Classification [35] [36]

Two scenarios were computed for the UAM use case. The first scenario involves computing demand only with the wealthiest population within the cities, using only the percentage of those under the “Rich” class in the Philippines and those under the A+ classification in Thailand. The second scenario expands the demand to include upper income and upper middle socioeconomic classes, assuming expanded accessibility of eVTOL services in the long term as prices go down. This would include the percentages of those under the “Upper income” and “Upper middle income” classes in the Philippines, and the percentages of those under the A and B classification in Thailand.

For the sightseeing use case, the sum of the number of five-star hotel rooms were computed in four tourist destinations in both countries. In the Philippines, Cebu, Palawan, Boracay, and Bohol were chosen. In Thailand, Chiang Mai, Phuket, Pattaya and Koh Samui were chosen. For all locations in the Philippines, as well as Chiang Mai in Thailand, the number of the 5-star hotel rooms in listed and totaled. An annual occupancy rate of 80% was assumed for all locations.

However, for Phuket, Pattaya, and Koh Samui, a different method was used to get the total number of hotels. First, the top 25 hotels with the best Google Maps rating were listed with the number of rooms. Second, the average number of rooms and standard deviation were calculated. Third, the standard deviation was added to the average before multiplication to compute upper and lower ranges. Lastly, the average number of rooms, as well as the upper and lower ranges of the rooms, was multiplied by number of 5-star listings in each location.

2.4.2 With weather constraint

$$D_{UAMWeather} = n_{households} \times w_R \times s \times (365 - d) \quad (3)$$

$$D_{SightWeather} = n_{hotel} \times OccuRate \times s \times (365 - d) \quad (4)$$

The demand for weather constraint is then subtracted by subtracting the number of rainy days (see formulas 3 and 4), as it is assumed that the eVTOL may not be able to operate during rainy days. The following information was taken for the number of rainy days in each location:

- Philippines (nationwide): 143 days [37]
- Thailand:
    - Bangkok (Central region): 128 days [39]
    - Chiang Mai (Northern region): 121 days [38]
    - Phuket and Koh Samui (Southeastern region): 145 days [38]
    - Pattaya (East): 130 days [38]

$$D_{UAMPubAcc} = n_{households} \times w_R \times s \times (365 - d) \times (1\text{-}r) \quad (5)$$

$$D_{SightPubAcc} = n_{hotel} \times OccuRate \times s \times (365 - d) \times (1\text{-}r) \quad (6)$$

2.4.3 With public acceptance constraint

The demand with public constraints is then multiplied (see formulas 5 and 6). The following assumptions for the percentages and their breakdowns for each use case are determined based on interview information (see Fig. 10).

Philippines – UAM: 30%

- *5% inconvenience from 1-week period for attaining flight permit*

Thailand – UAM: 99%

- *99% government restriction of airspace*

- *5% noise and visual disturbance*
- *10% inconvenience from dealing with Air Transportation Office (ATO) red tape*
- *10% building/property landing approval*

Philippines – Sightseeing: 27%

- *7% inconvenience from 10-day period for attaining flight permit*
- *5% noise and visual disturbance*
- *10% landing approval*
- *5% airport no-fly zone restriction*

Thailand – Sightseeing: 25%

- *5% inconvenience from 1-week period for attaining flight permit*
- *5% noise and visual disturbance*
- *10% landing approval*
- *5% risk of strictly controlled airspace (Koh Samui and Phuket only)*

Fig. 10: Percentage assumptions for public constraints

2.4.4 With fare constraint

.

$$D_{UAMFare} = n_{households} \times w_R \times s \times (365 - d) \times (1\text{-}r) \times u \times ur \quad (7)$$

$$D_{SightFare} = n_{hotel} \times OccuRate \times s \times (365 - d) \times (1\text{-}r) \times u \times ur \quad (8)$$

$$Sales_{UAM} = n_{households} \times w_R \times s \times (365 - d) \times (1\text{-}r) \times u \times ur \times f \quad (9)$$

$$Sales_{Sight} = n_{hotel} \times OccuRate \times s \times (365 - d) \times (1\text{-}r) \times u \times ur \times f \quad (10)$$

The demand with fare constraints (see formulas 7 and 8) as well as the estimated number of sales (see formulas 9 and 10) is then applied with the following assumptions for possible fares, utilization rates, and utilization ratios shown in the matrices below (see Fig. 11).

Fare (PHP)	Utilization rate	60%	80%	95%
30,000		1%	5%	7%
15,000		5%	10%	25%
5,000		10%	25%	45%

Philippines

Fare (THB)	Utilization rate	60%	80%	95%
30,000		1%	10%	20%
15,000		5%	20%	30%
5,000		15%	30%	60%

Thailand

Figure 19: Utilization ratio assumption matrices

The utilization rate assumes the annual percentage of eVTOL flights booked that have flown successfully without cancellations (especially those caused by inclement weather), and aids in telling the reliability of the service's availability. Three assumptions were made for the utilization rate: 60%, which is the current utilization rate for helicopter operations as noted by our interviewees (Advanced Aviation Corp. and AirTaxi PH), a midway point of 80%, and an assumed optimum of 95%. These three percentages, along with the three assumed fares for each country, aid in painting nine separate scenarios of service availability depicted as utilization ratios.

The utilization ratios assume the percentages of people within the country that will avail the service given the utilization rate and fare. The estimated percentages are more conservative for the Philippines compared to Thailand due to the following considerable factors:

- Percentage of wealthy population: As described previously, the Philippines has a smaller percentage of people that are classified under socioeconomic classes considered upper middle class and higher (12% in the Philippines compared to 20% in Thailand).

- Impact of safety: According to interview data, more interviewees from the Philippines, especially non-regulation related interviewees, have stressed that safety is of utmost concern for consumers.

Chapter 3: Findings

3.1 Findings from survey on conventional study

3.1.1 Recent developments regarding flying cars within the Southeast Asian region

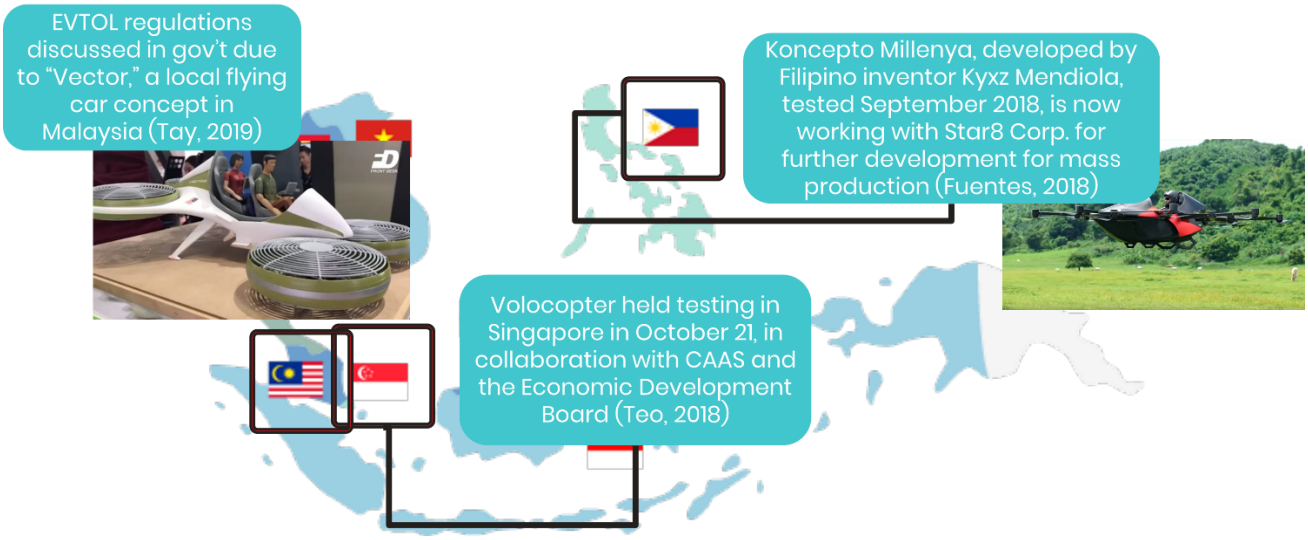


Figure 20: News developments regarding eVTOL within the ASEAN region

Different parties from specific countries in the ASEAN region are getting involved in the race for the flying car's technological development and release in their countries, with each country having its own unique take on the stakeholders involved and the kinds of activities that they are taking in for its development.

Philippines:

In the Philippines, a flying car concept called the Koncepto Milenya conducted its first test flight in September 2018, which went viral on social media [15]. Kxyz Mendiola, the inventor of the vehicle, developed the aircraft with the intention for it to be used as alternative means of transport to beat the traffic in Metro Manila. The original prototype has the following specifications: 100 kg payload, under 10-15 minutes of flight time at 6.1m above ground level at speeds of 50-60 kph [15][16]. Currently, Mendiola has since partnered with Star8 Corporation,

an Australian company to refine the vehicle design for mass production with intentions for the company to market the vehicle in Australia, Hong Kong, and Europe[15].

Malaysia:

In Malaysia, flying car regulations were reportedly being discussed within the Civil Authority of Malaysia in light of the development of Vector, a flying car concept being developed within the country[17]. Considered as more of a drone car concept [18], Vector was expected to have its prototype launched towards the end of 2019, even as early as October 2019 as claimed by Entrepreneur Development Minister Redzuan [17], with the following specifications:150-200 kg payload, 30-90 minutes of flying time at 50m above ground level at speeds of 60 kph[18]. The claim was met with skepticism by various parties within the Malaysian government[18].

Singapore:

In Singapore, Volocopter cooperated with the Civil Aviation Authority of Singapore, the Ministry of Transport, and the Economic Development Board to launch a test flight within the country in late October 2019[19][20]. The trials are meant to test the performace of Volocopter's flying car in the country's humid weather and to demonstrate the aircraft's safety and feasibility to local authorities[20][21].

3.1.2 Potential use case: Air taxi/Urban air mobility (UAM) — Traffic as an emerging problem

Traffic has been proven to be a major problem in the metropolitan areas of the ASEAN region. Boston Consulting Group (BCG) conducted a study in 2017 in collaboration with Uber assessing the public transport landscape in Southeast Asia, and assessing the benefits that the

adoption of ridesharing to the problems surrounding it. BCG noted that, in the classifications of major cities in Southeast Asia, that Bangkok and Kuala Lumpur are classified as “Tier 2” cities, meaning that overall adoption of public transport is still low, with commuters travelling less than 25km, despite gains in developing infrastructure[22]. Meanwhile, Manila and Jakarta are classified as “Tier 3” cities, with less developed traffic infrastructure and commuters driven by more “informal, road-based” public transport networks. Tier 3 cities are also at risk of reaching high levels of congestion by 2022[22]. Flying cars can be utilized in this case to mitigate traffic within urban areas in the region.

3.1.3 Potential use case: Sightseeing/Leisure — Tourism to boost economy

In Southeast Asia, tourism plays a large role in contributing to the GDP of each country. Travel activities help boost local economy, as seen in Table 1 listing the values for the top travel activities within the region as well as non-casino attractions (e.g. cultural attractions, museums, national theme parks, etc.) as of 2018. This makes way for the flying car’s potential in sightseeing.

Table 5: Ranking of tourism activity values according to top travel activities and non-casino attractions in ASEAN, based on Euromonitor data [23] [24] [25] [26][27]

Top Travel Activities in the ASEAN Region	Non-Casino Attractions
Shopping (by International Tourists) 1. Thailand: ¥1,736,337,556,800 2. Malaysia: ¥700,157,946,400 Casino	ingapore (¥114,879,813,491 as of 2018) 1. Thailand: ¥56,832,137,436

3. Philippines: ¥395,920,206,651 Spa 4. Thailand: ¥251,665,320,100	

However, aside from typical tourism activity, Thailand, Malaysia, and Singapore have another tourism advantage that helps boost its local economy: Medical tourism. Euromonitor noted that Thailand has the biggest market for medical tourism in the ASEAN region, with ¥171,066,573,310 in activity value[26]. Noree, Hanefeld, and Smith [28] in 2015 noted that medical tourism has an additional effect on the economy through non-medical spending, which includes, but is not limited to accommodation, food, drinks, and shopping. Asians are likely to spend 3,031 USD for themselves and 2,800 USD for their companions, while Americans, Europeans, and Australasians: 2,142 USD and 2,387 USD respectively[28]. Meanwhile, Malaysia has outpaced Singapore in 2018, with the latter projected to decline due to cheaper medical services in the country compared to Singapore[24]. Aside from sightseeing, the flying car may be used in medical services especially for luxury patients.

3.1.4 Potential use case: Emergency and medical services — Lack of services despite disaster risks

Southeast Asia is vulnerable to natural disasters due to the circumstances of its geographical location resulting in high risk of seasonal typhoons and high risk of earthquakes, volcanic eruptions, and tsunamis[29]. In particular, the Philippines, Indonesia, and Thailand were noted to have the respective top 3 risk rankings in the region according to United Nations Office for Disaster Risk Reduction in 2010[29].

However, despite these risks, it is estimated by FlightGlobal Fleets Analyzer in 2017 that only 24 helicopters are available for emergency medical use for the entire ASEAN region[30], as listed with their corresponding operators and ages as recorded on Flight Fleets Analyzer data in Figure 12 below.

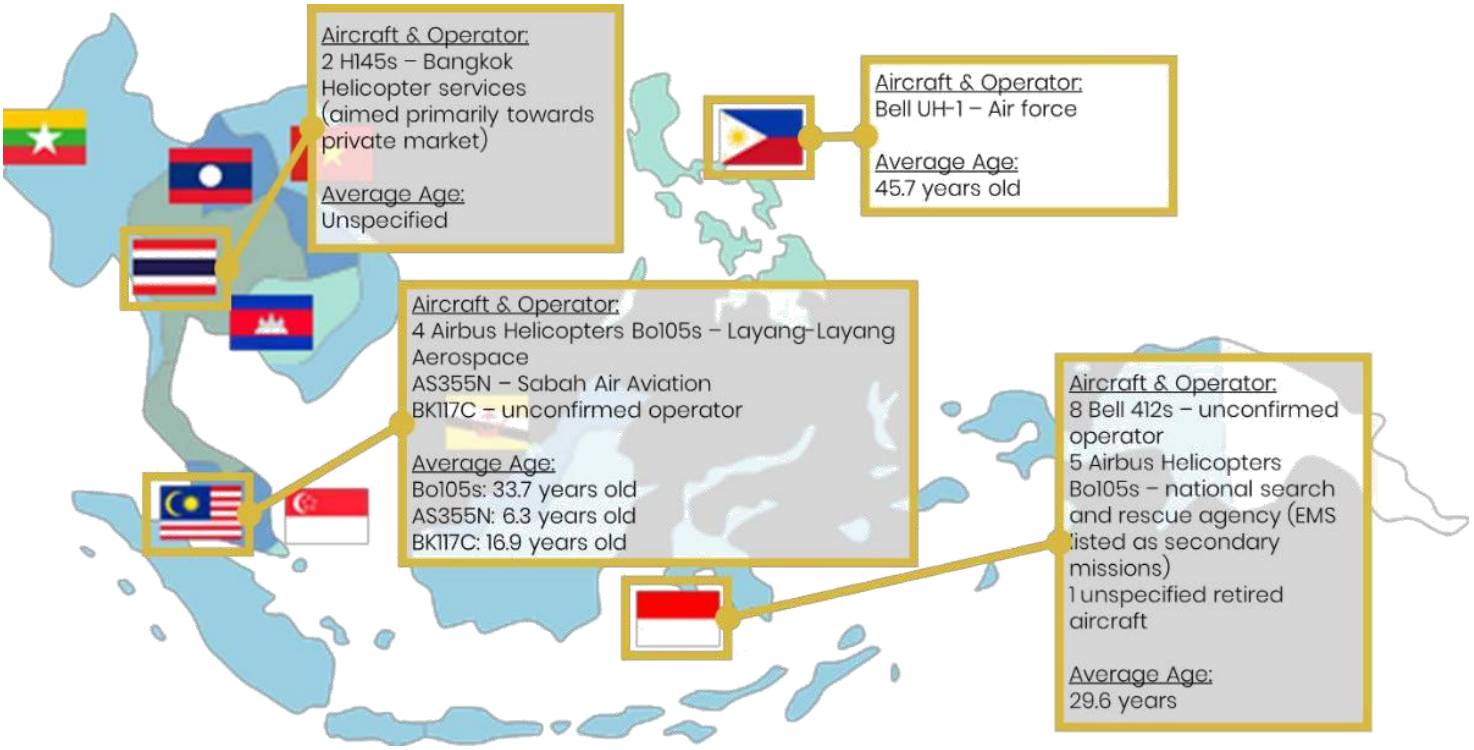


Figure 21: EMS Helicopters reportedly available in the ASEAN region, based on Flight Fleets Analyzer data [19]

3.1.4 Summary

Given the information above, it can be said that, though there are multiple possibilities within each country, the Philippines and Thailand are optimal locations to look at within the region. Differing factors make for this conclusion, as both countries differ in their environments.

The Philippines already has considerable strides of eVTOL development happening in their area. The country already has a functional prototype that's being further developed for market release, despite the country not being as prosperous as its neighbors. It would be beneficial to understand how this may apply within the context of the Philippine market, and what factors allow for testing within the country.

Thailand has the second most prosperous population among the five countries, with Singapore being the wealthiest. Moreover, the country has to biggest potential for tourism, being the market leader for the industry within the region. As Singapore can be classified as a fully developed country, it would be better to have Thailand serve as basis for the wealthier end of the region's representation while remaining in the scope of the developing world.

3.2 Findings from interviews

3.2.1 Interview summary

Table 6: Comparison of Philippine and Thai environments for the possibility of the air taxi use case

	Philippines		Thailand	
	Current Situation	***Usage of Flying Cars***	***Current Situation***	***Usage of Flying Cars***
Business	+ Steady usage of helicopter services by wealthy businessmen for inner city travel and politicians for inter-island travel (JCC, AirTaxi PH) - Existing transportation options are cheap, with the cheapest option being 0.32 USD (JCC)	- Businessmen only account for approx. 2% of national population (JCC) - Operational costs need to be lower compared to helicopters, currently at approx.. 500-800 USD for only direct operations costs (INAEC)	+ Wealthy tourists use helicopters to go from 5-star hotels to luxury department stores for reserved shopping (TAT)	+ 10km range would be sufficient for inner-city travel in Bangkok to beat traffic jams (TAT) - Subway lines may be doubled in Bangkok in the next 5 years, mitigating the traffic jam (TAT)
Rules/ Infrastruct-ure	- Need for 5-10 days approval for flying from non-CAAP authorized helipads (AirTaxi PH, Shangri-La Resort) + Businessmen utilize existing rooftop helipads located in most buildings in the business areas (JCC)	- Cautionary attitudes for regulations towards innovation due to former FAA and EASA blacklisting (INAEC)	- Thailand is more conservative when it comes to experimentation due to spatial issues, risk cannot be minimized to the pilot as it is in the US (CAAT) - Determining regulations for EVTOL is still a bit far for CAAT, with drones already posing a challenge for the authority (CAAT)	- Need to take into account Bangkok's no-fly zones (TAT)

Issues	+ High skills and English abilities of Filipino crew members in the country: Airframe maintenance for Lufthansa; Forklift personnel for Toyota, Isuzu and Komatsu (JCC)	+ Noise is not a big issue for operations (CAAP, JCC)	+ Possibility of strong opposition from competing industries – i.e. taxis, island-hopping businesses (TAT)

Current users and use case of aerial travel within the city: Philippines

Helicopter charter services in the Philippines are frequently used by wealthy businessmen look to avoid the traffic, as well as government officials who are going from island to island. Charter services are particularly useful in urban areas, as 7 km is sufficient to beat the traffic in the area. However, the population that has the same income bracket as these group of customers make up for only 2% of the population, as estimated by the Japanese Chamber of Commerce. This number may be even lower as noted in the estimate by Albert, Gaspar, and Raymundo mentioned earlier[7].

Current users and use case of aerial travel within the city: Thailand

In the case of tourism and medical use cases in Bangkok, interviewees noted how flying cars can still be useful for sightseeing, medical evacuation, doctor helicopter, and tourist charter use cases even with the limitations of the early and mid-term specifications. This is due to the short distances required, where only 10 km is needed to beat traffic jams within the city. Adding to this is the wealthy clientele of some of the operators providing charter services specifically for those going to shopping malls with requests to shop by themselves in the mall after hours.

Regulatory issues

However, there is hesitation on the regulatory end when it comes to implementing flying cars for the air taxi use case. In the Philippines, this is due to operators taking on a more

cautionary approach in operations to ensure aviation safety affecting the permissiveness of implementing new aviation technology within the country. This is due to the Philippine aviation blacklisting, which began already in 2008-2010 and was strengthened even further in 2012, with it only lifting in 2015[31][32]. Airlines based in the Philippines held Category 2 status by the FAA imposed in 2008, which meant that airlines servicing PH-North America routes cannot expand to different routes or services. Meanwhile, in Europe, airlines based in the Philippines were placed on the blacklist in 2010, barring any airline to operate within European airspace[31]. In Thailand, operators have noted that working around to CAAT's regulations is a major problem that restricts operations. This is emphasized with CAAT's current stance on holding off considerations for flying car regulations while they're still figuring drone regulations.

Table 7: Comparison of Philippine and Thai environments for the possibility of the leisure use case

	Philippines		**Thailand**	
	Current Situation	***Usage of Flying Cars***	***Current Situation***	***Usage of Flying Cars***
Business	+ In-island travel through destination packages and inter-island aerial tours/charters commonly availed in Cebu (AirTaxi PH)	- Flight distances would need to exceed 100km range, especially for the availed packages (AirTaxi PH)	+ Phuket is popular for aerial sightseeing due to its island geography, flight ranges are also shorter in Phuket (Veranda High Resort, Advance Aviation) - 70% of flight missions in Chiang Mai are charter, 1 flight per week estimate in Chiang	

			Mai (Advance Aviation)	
Rules/ Infrastruc-ture	- Flight route for an aerial tour affected by turnover of management at Mactan-Cebu International Airport (AirTaxi PH) + Flight altitude is up to the discretion of the pilot but can fly as low as 150m-300m for aerial views (AirTaxi PH)	+ Starting negotiations for eVTOL regulations can be made easier by discussing with hobbyist groups for aerial recreation (CAAP)	+ Pictures for the angle of approach used for flight permit inspection	+ 4x4m lot could be allotted for flying cars in resorts (Veranda High Resort)
Issues	+ Despite typhoon season, flights are mainly availed during October for passengers who are stranded due to inclement weather. (AirTaxi PH) + High skills and English abilities of Filipino crew members in the country: Airframe maintenance for Lufthansa; Forklift personnel for Toyota, Isuzu and Komatsu (JCC)	+ Noise is not a big issue for operations (CAAP, JCC) + However, audiovisual perceptions may affect local people's associations of noise with aircraft depending where the aircraft has been situated (Asian Aerospace)	- Noise is starting to become an issue on beaches as helicopter services are transitioning into giving tours, as it may ruin atmosphere (Thai Aviation Services, Veranda High Resort)	+ Possibility of strong opposition from competing industries – i.e. taxis, island-hopping businesses (TAT)

Services availed and covered within the use case: Philippines

In the Philippines, sightseeing, destination packages, and inter-island travel services make up a portion of helicopter operations for operations in Cebu. Aside from the usual travel services, tourists within the area have also been availing of other services being offered due to travel-related emergencies. One of our interviewees mentioned that they handle emergency charter transfers for tourists stranded due to inclement weather stranding them on islands, as the ferries are not operational during storms. Another one of interviewees mentioned that they handle medical evacuation services for tourists who have availed travel insurance premiums from the

companies that the operator is working with. Considering that these concerns are year wide, they make as a good boost to stabilize year-round operations. It should be noted though that, due to the nature of required long-distance travel, short-term specifications may not work for this use case.

Services availed and covered within the use case: Thailand

Outside of Thailand, helicopter services are availed of throughout the country, with popular services varying per location. In Chiang Mai, according to the operator we interviewed, charter/transfer services are the most popular service being availed in that city. Medical transfers are also popular within the region. Travel agents can arrange helicopter transfers mainly to high end resorts. However, aerial tourism isn't popular as a sightseeing option despite the area being mountainous.

This is where Phuket excels, as the area allows for sightseeing to be the most popular service as one can go short-distance island-viewing within the area. However, it should be noted that concerns will still be raised for tourism as visual and noise pollution may prove to be a problem for the industry if flying cars were to be implemented.

4.3. Other promising use cases

Table 8: Comparison of Philippine and Thai environments for other use cases

	Philippines	Thailand
	Usage of Flying Cars	Usage of Flying Cars
Business		+ Flying cars can be used for EMS and police transportation to rush to sites (TAT) + EMS: Growing number of cases in the northern portions of Thailand (SSH)

Rules/Infrastructure	- Limited number of hospitals with helipads in Manila, only 4 hospitals (JCC)	+ CAAT is planning to reorganize regulation to make it easier for medical operations (SSH) - EMS: One cannot land anywhere in Bangkok. This restriction only allows medical helicopters to fly 2-3 times per month in the city (SSH)

Emergency medical services are considered use cases within the Philippines and Thailand, but both face different hurdles for flying cars to be considered for the use case. In the Philippines, increasing infrastructure would need to be a priority, as only four hospitals in Metro Manila can accommodate helicopters. In Thailand, private EMS operators are disadvantaged in operations compared to the public sector. One major problem noted by the hospital interviewed in Bangkok is that one cannot land anywhere in the city at any time. This restriction only allows to fly 2-3 times per month in the city. However, public-private partnerships can help grow this number, and further democratize air travel. CAAT is planning to reorganize regulation to make it easier for medical operations.

3.2.2 Evaluation of interviews through qualitative strategic planning matrix

Market- and operations-related factors

Table 9: Quantitative Strategic Planning Matrix – Market- and operations-related factors

		Philippines				Thailand				Highest Score	
		Manila: UAM		*Cebu: Sightseeing/Leisure*		*Bangkok: UAM*		*Chiang Mai: Sightseeing/Leisure*			
Market- and Operations-related factors		**AS**	**TAS**	**AS**	**TAS**	**AS**	**TAS**	**AS**	**TAS**	**AS**	**TAS**
Perception of market size	0.3	3	0.9	5	1.5	5	1.5	3	0.9	7	2.1
Ease of acquiring skilled HR	0.1	5	0.5	5	0.5	4	0.4	4	0.4	7	0.7
Public acceptance factors: Noise and visual disturbance	0.3	6	1.8	5	1.5	5	1.5	4	1.2	7	2.1
Availability of Infrastructure (e.g. presences of existing helipads)	0.1	6	0.6	4	0.4	5	0.5	4	0.4	7	0.7
Operations cost	0.2	3	0.6	4	0.8	5	1	4	0.8	7	1.4
Sum weight	1	**4.4**		**4.7**		**4.9**		**3.7**		**7**	

As seen in the table above, the UAM use case in Bangkok is the most optimal application of eVTOL from a market and operations perspective as their perceived market size, compared to the other locations and their respective use cases, raises the score.

The following considerations were made when it came to assuming the scores for the locations:

- Perception of market size
    - Manila (3): Our interviewees from the Japanese Chamber of Commerce in Manila and the Civil Aviation Authority of the Philippines, current helicopter travel is reserved for the wealthy, counting for approximately only 2 percent of the total population in the country.

    - Cebu (5): Our interviewees from AirTaxi PH's Cebu hangar have noted consistent seasonal acquisition of destination packages and inter-island travel packages. Moreover, charter flights are also in steady stream.
    - Bangkok (5): Our interviewees from the Tourism Authority of Thailand sees major potential in flying car services being availed through tourism and increased aerial sightseeing activity. Moreover, further promotional activities in exhibitions through the TAT can aid in bolstering further demand for tourism-related eVTOL services in the country.
    - Chiang Mai (3): Both interviewees from Advance Aviation and Veranda High Resort have noted limited number of flights being booked or spotted within the area. Furthermore, our interviewee from Veranda High Resort has mentioned that the clientele that would acquire such helicopter services would be guests from more premium hotels in the area (e.g. Four Seasons Resort).
- Ease of acquiring skilled HR
    - Manila (5) and Cebu (5): Our interviewees from the JCC have noted that training mechanics and pilots for eVTOL may be suitable in the Philippines as trained workers have been sent to the Middle East especially for their high skill level and English language abilities.
    - Bangkok (4) and Chiang Mai (4): Our interviewee from Thai Aviation Services Ltd. has noted that, though there is a current sufficient number of workers for maintenance services in the country in recent years, skilled workers still have to be acquired from overseas.
- Noise and visual disturbance:

    - Manila (6): Our interviewee from the Civil Aviation Authority in the Philippines has noted that noise is not a major problem when it comes to aerial transportation and that there are not many concerns regarding the issue, especially within Metro Manila.
    - Cebu (5): The general consensus of the Civil Aviation Authority still stands that noise is not an issue. However, our interviewee from Asian Aerospace has noted that they may have to be considerate of landing locations in island destinations as helicopter-associated noise is noticed by the locals.
    - Bangkok (5): Noise has not been touted as an issue by our interviewees in Thailand.
    - Chiang Mai (4): Our interviewee in Veranda High Resort has noted that there is a possible risk of visual and auditory noise that may disturb the peaceful ambience that comes with the resort experience if prevalent use of eVTOL were to happen within the area.
- Availability of infrastructure
    - Manila (6): Our interviewees in in the JCC has noted that there are numerous helipads located within major financial districts (e.g. Makati City, Bonifacio Global City).
    - Cebu (4): AirTaxi PH has noted that, though there are some helipads within the city, resort-based helipads like the one in Shangri-La Resort may not be CAAP certified and would have to take additional steps for gaining take off and landing approval.

    - Bangkok (5): Our interviewees in TAT have noted that there are helipads shopping mall rooftops in Bangkok.
    - Chiang Mai (4): Our interviewees in TAT have noted that there is sufficient infrastructure for take-off and landing within the countryside in Thailand, though interviewees from Advance Aviation has noted limitation in landing spots.
- Operations cost:
    - Manila (3): Our interviewee from INAEC Aviation Corp., a Manila-based operator, stressed that helicopter operators around the country would need to ensure that the estimated operations cost of utilizing eVTOL is lesser compared to current operations cost for helicopter operations if they are going consider using eVTOL as an alternative vehicle for their businesses.
    - Cebu (4): INAEC Aviation Corp. interviewee's concerns regarding operations cost and their claims being felt by other operators around the country may be felt by operators in Cebu, but the higher number of use case and flights in the area, as noted by interviewees, may move them to be more lenient in looking for cost effective options.
    - Bangkok (5): Our interviewees handling helicopter operations at Samitivej Sukhumvit Hospital in Bangkok have noted that cost isn't an issue for them, as the further democratization of airspace is the bigger issue.
    - Chiang Mai (4): It is possible that, similar to Samitivej Sukhumvit Hospital, operators within the Chiang Mai don't have cost as a major problem, but the limited flights in the area, as noted by interviewees in the area, may move them to consider more cost effective options.

Regulation-related factors

Table 10: Quantitative Strategic Planning Matrix – Regulation-related factors

		Philippines				Thailand				Highest Score	
Regulation-related factors		***Manila: UAM***		***Cebu: Sightseeing/Leisure***		***Bangkok: UAM***		***Chiang Mai: Sightseeing/Leisure***			
Ease in gaining flight/landing approval	0.15	6	0.9	5	0.75	1	0.15	6	0.9	7	1.05
Attitude of relevant government bodies (e.g. civil aviation authorities) towards novel technology	0.4	3	1.2	4	1.6	2	0.8	2	0.8	7	2.8
Attitude/ease of relevant government bodies (e.g. civil aviation authorities) towards negotiating new regulations for EVTOL	0.25	2	0.5	6	1.5	3	0.75	3	0.75	7	1.75
Ease of gaining political backing for eVTOL regulation discussion	0.2	4	0.8	5	1	3	0.6	3	0.6	7	1.4
Sum weight	1	**3.4**		**4.85**		**2.3**		**3.05**		**7**	

The sightseeing/leisure use case in Cebu is considered to be the most optimal application of eVTOL given regulatory limitations and concerns, as the civil aviation authorities in the country have recognized that the environment within provincial areas in the Philippines is forgiving regarding testing and experimentation.

The following considerations were made when it came to assuming the scores for the locations:

- Gaining flight/landing approval:

    - Manila (6) and Chiang Mai (6): According to our interviewees (Advance Aviation and INAEC Aviation), processes generally take over a week for most locations and paperwork is easily coordinated.
    - Cebu (5): Similar to the aforementioned locations above, processes do take a week, but may be hindered with difficulty with certain resort locations as noted with the helipad situation in Shangri-La Mactan Resort as noted by our interviewee in AirTaxi PH.
    - Bangkok (1): According to our interviewee from Samitivej Sukhumvit Hospital, Bangkok's military-controlled airspace makes it difficult to gain landing approval.
- Attitudes of government bodies towards novel technology
    - Manila (3) & Cebu (4): Our interviewees from CAAP are generally open towards novel technology, but have reservations preferring human-piloted systems.
    - Bangkok (2) & Chiang Mai (2): Our interviewees from CAAT have noted hesitation towards novel technology and negotiation for novel technology, already expressing difficulty in negotiating regulation for drones.
- Attitudes of government bodies towards eVTOL: Philippines civil aviation authorities generally more open towards negotiating eVTOL regulations and testing in provincial areas, using current regulation for aerial recreation aircraft as basis.
    - Manila (2) & Cebu (6): As mentioned above, CAAP is generally open towards negotiation. However, given the use case associated in each location, they noted that negotiation would be easier if aerial recreation and hobbyist groups (mainly operating in provinces like Cebu and Pampanga) were to negotiate for eVTOL's

use for recreational use cases compared to UAM use case (especially if implemented in Manila).

- Bangkok (3) & Chiang Mai (3): As mentioned above, CAAT already has hesitant attitudes towards novel technology. However, they are willing to talk and negotiate regulations once risk assessment and safety case for eVTOL has been made.

- Gaining political backing:
  - Manila (4) & Cebu (5): Our interviewees from CAAP have noted that, aside from negotiating though hobbyist groups from provincial locations, negotiation would be made easier if the presence of a "champion politician," or a high ranking politician in considerable political influence within the affected industry (in this case, transportation), could make lobbying for eVTOL regulations easier within the upper legislative branches of Philippine government.
  - Bangkok (3) & Chiang Mai (3): Our interviewees from Samitivej Sukhumvit Hospital have noted that there are initiatives to democratize air travel especially for medical services, but other interviewees (Thai Aviation Services Ltd., CAAT) have really driven the point that the regulation authorities are difficult to deal with overall.

Short-term specifications

Table 11: Quantitative Strategic Planning Matrix – Short-term specifications

	Philippines		Thailand		
Specifications-related factors (Short-term)	***Manila: UAM***	***Cebu: Sightseeing/Leisure***	***Bangkok: UAM***	***Chiang Mai: Sightseeing/Leisure***	**Highest Score**

Flight distance (<10 km)	0.5	4	2	1	0.5	5	2.5	0	0	7	3.5
Flight time (20 min)	0.4	3	1.2	4	1.6	4	1.6	1	0.4	7	2.8
Size (4.3 x 3 x 2 m)	0.1	7	0.7	7	0.7	6	0.6	6	0.6	7	0.7
Sum weight	1	**3.9**		**2.8**		**4.7**		**1**		**7**	

The UAM use case in Bangkok is considered to be the most optimal application of eVTOL given the chosen short-term specifications, as the environment within the city allows the eVTOL to work within limitations of these specifications.

The following considerations were made when it came to assuming the scores for the locations:

- Flight distance
    - Manila (4) & Bangkok (5): Shorter flight distances are more easily applicable for city-based locations, as seen in the case maps. Our interviewees in TAT have noted that flights of only 10 km are already useful in Bangkok. However, certain locations within Southern Metro Manila may require more than 10 km.
    - Cebu (1): Most of the locations acquired in AirTaxi PH's tours and destination packages go over 10 km. The only viable routes for this specification involve airport to resort charter flights or air taxi/charter flights in the city, which are rarer in acquisition compared to their sightseeing/leisure-related flights.
    - Chiang Mai (0): Advance Aviation has noted that they may need to take further flights especially for their sightseeing package, and 10 km is less than what is necessary to reach sightseeing lcoations.
- Flight time:
    - Manila (3): Some of INAEC Aviation's routes for ASCENT's air taxi service within the city goes for only 10 minutes.

- Cebu (4): AirTaxi PH offers a city tour of Cebu City that goes for a duration of only 10 minutes.
- Bangkok (4): Given that our interviewees in TAT have noted that flights of only 10 km are already useful in Bangkok, it can be said that short flight times are already sufficient within the city.
- Chiang Mai (1): According to Advance Aviation, sightseeing in Chiang Mai requires the vehicle to fly for at least 20 minutes to be able to access major sightseeing spots.

- Size:
  - Manila (7) & Cebu (7): AirTaxi PH has noted that the size dimensions listed are sufficient for the landing areas that are frequented.
  - Bangkok (6) & Chiang Mai (6): Though our interviewee at Veranda High Resort has noted that a 4m by 4m sized lot would be sufficient for allotment for eVTOL landing, and 7m by 7m lot would be tricky. The eVTOL may need to be smaller to allow for landing at a lot of such size.

Long-term specifications

Table 12: Quantitative Strategic Planning Matrix – Long-term specifications

		Philippines				Thailand				Highest Score	
Specifications-related factors (Long-term)		***Manila: UAM***		***Cebu: Sightseeing/Leisure***		***Bangkok: UAM***		***Chiang Mai: Sightseeing/Leisure***			
Flight distance (30-100 km)	0.5	7	3.5	7	3.5	7	3.5	7	3.5	7	3.5
Flight Altitude (150-500 m)	0.4	5	2	5	2	5	2	7	2.8	7	2.8

Noise (1/2 compared to heli)	0.1	7	0.7	5	0.5	7	0.7	5	0.5	7	0.7
Sum weight	1	**6.2**		**6**		**6.2**		**6.8**		**7**	

The sightseeing/leisure use case in Chiang Mai is considered to be the most optimal application of eVTOL given the chosen long-term specifications.

The following considerations were made when it came to assuming the scores for the locations:

- Flight distance: A flight distance of under 30 kilometers would work well with all possible flight use cases for each location, as determined by the sample use case maps (see Appendix).
- Flight altitude:
    - Manila (5) & Cebu (5): Our interviewees from AirTaxi PH have noted that they would normally fly at an altitude of 300-500m. However, they can go as low as 150m in Cebu when they are away from Mactan island as the airport is located there.
    - Bangkok (5): According to Advance Aviation, generally helicopters go at an altitude of 500m.
    - Chiang Mai (7): According to Advance Aviation: Chiang Mai is forgiving with how low pilots can fly in the area. Helicopters can go as low as 150 m for sightseeing flights.
- Noise
    - Manila (7) & Bangkok (7): As mentioned previous, noise is not an issue for civil aviation authorities within the country.
    - Cebu (5) & Chiang Mai (5): However, as also previously mentioned above, noise is increasingly becoming an issues in island sightseeing locations due to

disruption of ambience, which may pose a general concern for operation in those locations.

3.3 Findings from demand estimation

3.3.1 UAM in Manila

Rich households only	
Base Demand	
Number of households in Metro Manila	3,318,000
% that may avail eVTOL services	5%
% of "Rich" households	0.012
Number of people	1991
Total	47,784
Weather constraints	
% of non-rainy days	0.608219178
Total	29,064
Public acceptance constraints	
Total	20,345
Number of flights per day	56

Rich + Upper Income households	
Base Demand	
Number of households in Metro Manila	3,318,000
% that may avail eVTOL services	5%
% of "Rich," "Upper income," and "Upper Middle" households	0.121
Number of people	20074
Total	481,776
Weather constraints	
% of non-rainy days	0.608219178
Total	293,026
Public acceptance constraints	
Total	205,119
Number of flights per day	563

Figure 22: Estimated demand for UAM in the Philippines without cost constraint

When considering only the wealthiest households in Metro Manila classified under the "Rich" socioeconomic class according to PIDS classification, as well as weather constraints and public acceptance constraints for the city, the number of flights per day within the capitol can reach up to 56 flights per day. This number can reach up to 563 flights per day upon expanding the socio-economic demographic of the target market to include those classified under the "Upper income" and "Upper middle" households within the city.

Rich households only

Number of flights	Number of flights per day	Sales (PHP)	Sales (JPY)	Utilization ratio	Utilization rate	Fare (PHP)
123	1	3,662,100	7,910,136	1%	60%	30,000
814	4	24,414,000	52,734,240	5%	80%	30,000
1353	7	40,588,275	87,670,674	7%	95%	30,000
611	3	9,155,250	19,775,340	5%	60%	15,000
1628	8	24,414,000	52,734,240	10%	80%	15,000
4832	22	72,479,063	156,554,777	25%	95%	15,000
1221	6	6,103,500	13,183,560	10%	60%	5,000
4069	19	20,345,000	43,945,200	25%	80%	5,000
8698	40	43,487,438	93,932,867	45%	95%	5,000

Rich + Upper Income households

Number of flights	Number of flights per day	Sales (PHP)	Sales (JPY)	Utilization ratio	Utilization rate	Fare (PHP)
1231	6	36,921,420	79,750,268	1%	60%	30,000
8205	37	246,142,800	531,668,448	5%	80%	30,000
13641	62	409,212,405	883,898,795	7%	95%	30,000
6154	28	92,303,550	199,375,668	5%	60%	15,000
16410	74	246,142,800	531,668,448	10%	80%	15,000
48716	220	730,736,438	1,578,390,707	25%	95%	15,000
12308	56	61,535,700	132,917,112	10%	60%	5,000
41024	185	205,119,000	443,057,040	25%	80%	5,000
87689	395	438,441,863	947,034,425	45%	95%	5,000

Figure 23: Estimated demand for UAM in the Philippines with cost constraint

With the assumptions for cost constraints applied, the number of flights per day ranges from 1 flight per day to 40 flights per day when only the wealthiest households are considered. This range can go from 6 flights per day up to 395 flights per day when the scope of households is expanded. Out of the utilization rates and fare combinations for this use case, the combination that generates the most sales involves utilization rate of 95% at a fare of 15,000 PHP (approx. 30,000 JPY).

3.3.2 UAM in Bangkok

Rich households only	
Base Demand	
Bangkok households	24658300
% of population in A+ classification	2%
% that may acquire regular eVTOL services	5%
Number of people	24659
Total	**9000535**
Weather constraints	
Number of rainy days	128
Total	**5844183**
Public acceptance constraints	
Total	**58442**
Number of flights per day	**247**

Rich + Upper Income households	
Base Demand	
Bangkok households	24658300
% of population in A+ classification	2%
% of population in A classification	6%
% of population in B+ classification	12%
% that may acquire regular eVTOL services	5%
Number of people	246583
Total	**90002795**
Weather constraints	
Number of rainy days	128
Total	**58440171**
Public acceptance constraints	
Total	**584402**
Number of flights per day	**2466**

Figure 24: Estimated demand for UAM in Thailand without cost constraint

When considering only the wealthiest households in Bangkok classified under the "A+" socioeconomic class according to TMRS classification, as well as weather constraints and public acceptance constraints for the city, the number of flights per day within the capitol can reach up to 247 flights per day. This number can reach up to 2,466 flights per day upon expanding the socio-economic demographic of the target market to include those classified under the "A" and "B" households within the city.

Rich households only

Number of flights	Number of flights per day	Sales (THB)	Sales (JPY)	utilization ratio	utilization rate	fare
351	2	10,519,560	36,397,678	1%	60%	30000
4676	20	140,260,800	485,302,368	10%	80%	30000
11104	47	333,119,400	1,152,593,124	20%	95%	30000
1754	8	26,298,900	90,994,194	5%	60%	15000
9351	40	140,260,800	485,302,368	20%	80%	15000
16656	71	249,839,550	864,444,843	30%	95%	15000
5260	23	26,298,900	90,994,194	15%	60%	5000
14027	60	70,130,400	242,651,184	30%	80%	5000
33312	141	166,559,700	576,296,562	60%	95%	5000

Rich + Upper Income households

Number of flights	Number of flights per day	Sales (THB)	Sales (JPY)	utilization ratio	utilization rate	fare
350642	1480	10,519,230,780	36,396,538,499	1%	60%	30000
4675214	19727	140,256,410,400	485,287,179,984	10%	80%	30000
11103633	46851	333,108,974,700	1,152,557,052,462	20%	95%	30000
1753206	7398	26,298,076,950	90,991,346,247	5%	60%	15000
9350428	39454	140,256,410,400	485,287,179,984	20%	80%	15000
16655449	70277	249,831,731,025	864,417,789,347	30%	95%	15000
5259616	22193	26,298,076,950	90,991,346,247	15%	60%	5000
14025642	59180	70,128,205,200	242,643,589,992	30%	80%	5000
33310898	140553	166,554,487,350	576,278,526,231	60%	95%	5000

Figure 25: Estimated demand for UAM in Thailand with cost constraint

With the assumptions for cost constraints applied, the number of flights per day ranges from 2 flights per day to 141 flights per day when only the wealthiest households are considered. This range can go from 15 flights per day up to 1,406 flights per day when the scope of households is expanded. Out of the utilization rates and fare combinations for this use case, the combination that generates the most sales involves utilization rate of 95% at a fare of 30,000 THB (approx. 100,000 JPY).

With weather constraints

3.3.3 Sightseeing/leisure in Cebu

Cebu	
Total number of rooms	2,424
Occupancy rate	0.8
Yearly guests	1,940
Base Demand	
	70,810
Weather constraints	
	43,068
Public Acceptance/Regulation Constraints	
	31,440
142	**flights/day**

Palawan	
Total number of rooms	324
Occupancy rate	0.8
Yearly guests	260
Base Demand	
	6,935
Weather constraints	
	4,218
Public Acceptance/Regulation Constraints	
	3,080
14	**flights/day**

Bohol	
Total number of rooms	632
Occupancy rate	0.8
Yearly guests	506
Base Demand	
	13,140
Weather constraints	
	7,992
Public Acceptance/Regulation Constraints	
	5,835
27	**flights/day**

Boracay	
Total number of rooms	1,563
Occupancy rate	0.8
Yearly guests	1,251
Base Demand	
	32,120
Weather constraints	
	19,536
Public Acceptance/Regulation Constraints	
	14,262
65	**flights/day**

Figure 26: Estimated demand for sightseeing in the Philippines without cost constraint

Given the number of 5-star hotel rooms within the entirety of Cebu province, as well as weather constraints and public acceptance constraints for the province, the number of flights per day within the capitol can reach up to 142 flights per day. Compared to other provinces within that have considerable numbers of 5-star hotels within the Philippines (e.g. Bohol, Palawan, and Boracay), Cebu has the most number of flights per day.

			Cebu			
Number of flights	Number of flights per day	Sales (PHP)	Sales (JPY)	Utilization ratio	Utilization rate	Fare (PHP)
189	1	5,659,200	12,223,872	1%	60%	30,000
1258	6	37,728,000	81,492,480	5%	80%	30,000
2091	10	62,722,800	135,481,248	7%	95%	30,000
944	5	14,148,000	30,559,680	5%	60%	15,000
2516	12	37,728,000	81,492,480	10%	80%	15,000
7467	34	112,005,000	241,930,800	25%	95%	15,000
1887	9	9,432,000	20,373,120	10%	60%	5,000
6288	29	31,440,000	67,910,400	25%	80%	5,000
13441	61	67,203,000	145,158,480	45%	95%	5,000

Figure 27: Estimated demand for sightseeing in the Philippines with cost constraint (Cebu only)

With the assumptions for cost constraints applied, the number of flights per day ranges from 1 flight per day to 61 flights per day when only the wealthiest households are considered. Out of the utilization rates and fare combinations for this use case, the combination that generates the most sales involves utilization rate of 95% at a fare of 15,000 PHP (approx. 30,000 JPY).

3.3.4 Sightseeing/leisure in Chiang Mai

Koh Samui	
Base Demand	
Upper range	68,255
Base average	48,910
Lower range	29,200
Weather constraints	
Upper range	43,945
Base average	31,490
Lower range	18,800
Public Acceptance/Regulation Constraints	
Upper range	28,565
Base average	20,469
Lower range	12,220
Flights per day	
122	Upper range
88	Base average
52	Base average

Phuket	
Base Demand	
Upper range	364,635
Base average	208,780
Lower range	52,560
Weather constraints	
Upper range	186,813
Base average	106,964
Lower range	26,928
Public Acceptance/Regulation Constraints	
Upper range	140,110
Base average	80,223
Lower range	20,196
Flights per day	
597	Upper range
342	Base average
86	Lower range

Pattaya	
Base Demand	
Upper range	615,390
Base average	355,875
Lower range	95,995
Weather constraints	
Upper range	396,210
Base average	229,125
Lower range	61,805
Public Acceptance/Regulation Constraints	
Upper range	316,968
Base average	183,300
Lower range	49,444
Flights per day	
1,349	Upper range
780	Base average
211	Lower range

Chiang Mai
Base Demand
6,570
Weather constraints
4,374
Public Acceptance/Regulation Constraints
3,500
Flights per day
10

Figure 28: Estimated demand for sightseeing in Thailand without cost constraint

Given the number of 5-star hotel rooms within the main vicinity of Chiang Mai, as well as weather constraints and public acceptance constraints for the province, the number of flights per day within the capitol can reach up to 10 flights per day. Compared to other locations that are major tourist destination and have larger numbers of 5-star hotels within Thailand (e.g. Phuket, Pattaya, and Koh Samui), Chiang Mai has the lowest number of flights per day.

Chiang Mai

Number of flights	Number of flights per day	Sales (THB)	Sales (JPY)	utilization ratio	utilization rate	Fare (THB)
21	1	630,000	2,179,800	1%	60%	30000
280	2	8,400,000	29,064,000	10%	80%	30000
665	3	19,950,000	69,027,000	20%	95%	30000
105	1	1,575,000	5,449,500	5%	60%	15000
560	3	8,400,000	29,064,000	20%	80%	15000
998	5	14,962,500	51,770,250	30%	95%	15000
315	2	1,575,000	5,449,500	15%	60%	5000
840	4	4,200,000	14,532,000	30%	80%	5000
1995	9	9,975,000	34,513,500	60%	95%	5000

Figure 29: Estimated demand for sightseeing in Thailand with cost constraint (Chiang Mai only)

With the assumptions for cost constraints applied, the number of flights per day ranges from 1 flight per day to 61 flights per day when only the wealthiest households are considered. Out of the utilization rates and fare combinations for this use case, the combination that generates the most sales involves utilization rate of 95% at a fare of 30,000 THB (approx. 100,000 JPY).

CHAPTER 4: Discussion

4.1 Summary of findings

Table 13: Qualitative Strategic Planning Matrix – Total sum applicability scores

	Philippines		Thailand		Highest Score
	Manila: UAM	*Cebu: Sightseeing/Leisure*	*Bangkok: UAM*	*Chiang Mai: Sightseeing/Leisure*	
Sum Total Applicability Score	**17.9**	**18.35**	**17.3**	**14.55**	**28**

Summing up the applicability scores for all four countries, it can be said that Cebu is the most optimal location for implementation of eVTOL out of the four locations based on stakeholder perceptions within their respective areas, with Bangkok coming in with a close second. This can be attributed to how it scored regarding regulation-related factors, and how it came second to Bangkok and Chiang Mai respectively when market- and operations-related factors and long-term specifications were considered for the use cases.

However, given that Bangkok comes second to Cebu and that Thai locations had the better scores for three out of four factor groups, the market potential and the possible ease of implementation within Thailand shouldn't be discredited based on stakeholder perception and opinion.

It should be considered that, while there is an optimal choice based on stakeholder perceptions, there is a considerable gap of 9.65 points between the score of the most optimal location and the highest score that could be attained within the matrix. Given this factor, Cebu may not even be the most optimal location to consider for overall implementation of eVTOL. There may be other locations that are more suitable compared to the four that have been chosen for this study.

Table 14: Comparison of sales for each use case

Utilization ratio (PH)	Utilization ratio (TH)	Utilization rate	Fare (PHP/BHT)	UAM Manila Sales (JPY)	Sightseeing/Leisure Cebu Sales (JPY)	UAM Bangkok Sales (JPY)	Sightseeing/Leisure Chiang Mai Sales (JPY)
1%	1%	60%	30000	7,910,136	12,223,872	36,397,678	2,179,800
5%	10%	80%	30000	52,734,240	81,492,480	485,302,368	29,064,000
7%	20%	95%	30000	87,670,674	135,481,248	1,152,593,124	69,027,000
5%	5%	60%	15000	19,775,340	30,559,680	90,994,194	5,449,500
10%	20%	80%	15000	52,734,240	81,492,480	485,302,368	29,064,000
25%	30%	95%	15000	156,554,777	241,930,800	864,444,843	51,770,250
10%	15%	60%	5000	13,183,560	20,373,120	90,994,194	5,449,500
25%	30%	80%	5000	43,945,200	67,910,400	242,651,184	14,532,000
45%	60%	95%	5000	93,932,867	145,158,480	576,296,562	34,513,500

Given the amount of sales generated for each location and use case as seen in Table 10, it can be said that Bangkok has the highest amount of market potential based on estimated demand out of the four locations. With all assumptions considered, it could furthermore be said that having a utilization rate of 95% at a fare of 30,000 BHT would generate the most sales out of the four locations.

Interestingly, it should be noted that, when it comes to generating sales, differing pricing strategies between both countries would have to be implemented. In Thailand, having higher utilization rates and higher prices generates more sales, especially in the UAM use case, given the assumptions used in this study. Meanwhile, in the Philippines, pricing services with lower fares, optimally at half the current existing price, generates more sales compared to keeping the price high.

4.2 Suggestions for flying car implementation in the Philippines

The Philippines' main advantage when it comes to eVTOL implementation is the open-mindedness of the country's civil aviation authorities towards novel technology, especially towards eVTOL, as well as their attitude towards possibility for regulatory negotiation for the technology. However, it should be noted that, despite these attitudes, safety is still the main concern among both regulators and operators. Proving safety is the main challenge for gaining trust towards the technology within the country, but it is possible to have testing be carried out within the country to prove this.

The country's main disadvantage is the size of its market. As not many existing residents in the Philippines are afforded the amount of wealth necessary to be able to avail eVTOL, two things would have to be considered for eVTOL's release into the market. Firstly, sightseeing and leisure is likely to generate more sales within the country compared to urban air mobility. Launching services utilizing that use case would be a good starting point to pull in more customers. Secondly, one would need to lower the fares for eVTOL services within the country to be able to pull in more people and generate more sales. Given how high fares would have to be upon initial release of eVTOL services within the Philippines to compensate for the initial investment of the car, it would be better to either release eVTOL services in the country further into the future as technological advancements can lower the price of the vehicle and subsequently lower the fare for passengers, or target the wealthy within major cities and tourist destinations, retaining an exclusive clientele.

4.3 Suggestions for flying car implementation in Thailand

As with the Philippines, safety is the paramount concern for the consideration of eVTOL within Thailand. In fact, Thai civil aviation authorities are even stricter compared to the Philippines, and have less encouraging attitudes towards possible launch of eVTOL. Moreover, current regulations within the country are restrictive and airspace within Bangkok is heavily controlled by military. This puts them at a disadvantage, especially given that the most profitable use case is located within the country's capital.

However, this is not to say that regulation cannot be negotiated. Given the efforts that helicopter operators within the medical field have been doing to democratize air space for emergency medical services, it is possible to say that this can also apply for eVTOL with other use cases, though it may take time before discussions can be opened fully.

Thailand's main advantage is its market size. Both use cases have shown to be generate a generous amount of sales. Although launching eVTOL services seems to be the most profitable option within the country, it should be considered that it is possible that the sightseeing/leisure use case may prove more profitable if different island or coastal locations (e.g. Phuket, Pattaya, Koh Samui) were considered.

4.4 Summary, limitations of this study and future works

Given the evaluation of stakeholders and the demand estimates for locations from both countries, it can be said that like the Philippines may serve as better initial testing grounds for eVTOL implementation, but Thailand may be better for implementation in the long term as it has larger

market demand and higher profitability compared to the Philippines in both use cases that were considered.

There are three factors that are large considerations when it comes to the implementation of eVTOL within the Southeast Asian region: the attitudes of regulatory bodies, fare, and percentage of wealthy population/tourists in the area. The first factor affects the availability of eVTOL services within the region. The latter two factors mainly affect existing market demand and profitability of the use cases.

In the case of the Philippines, the country has higher attractiveness scores due to its major advantage in how authorities are more open to the discussion of eVTOL, especially when it comes to the sightseeing/leisure use case. Testing out eVTOL technology can be done through entertainment/aerial recreation use cases due to the lower regulations in the use case. The attitude of regulatory bodies towards specific use cases and locations for operation affect the availability of services provided. This can be seen in the existing case for helicopters, and in other arising issues raised up for eVTOL. There has been hesitation on regulators and operators from both countries when it comes to testing out UAM due to safety concerns from the density of cities. However, this can be circumvented through the sightseeing use case.

In the case of Thailand, it has a greater advantage in its higher demand from its wealthier population. However, it should be noted that unless safety can be proven with eVTOL technology, the demand could still be undermined by the strictness of its aviation authorities.

However, these findings are still rather limited. Future work can improve on and add to these findings on the following points of limitation:

- Expansion of location scope: Stakeholders from other tourist or metropolitan areas within both countries can help give a better idea of the situation. Moreover, similar work can be done in other Southeast Asian countries.
- Comparison between developed and developing countries: Demand comparisons can be made between developed and developing countries to verify the argumentation made by this study.
- Other constraints to be considered in the estimation: The estimates can be refined and made more accurate through the inclusion of other constraints in the estimation formula, such as vertiport, other regulatory constraints, etc.
- Other methods to be considered: More quantitative methods of evaluating stakeholder perceptions can be used to provide more accurate and objective results.

CHAPTER 5: Conclusion

This study contributes in bringing three major findings regarding the market potential within the ASEAN region.

Firstly, the study found, through a general surveying of relevant updates within the ASEAN region, that eVTOL has been discussed within the region for utilization for different purposes, and that there is presence of development activity and testing in multiple countries within the region. However, the Philippines and Thailand have greater market potential for eVTOL compared to their neighbors, use cases and development considered. In the case of Thailand, it is due to its wealthier population, the need for alternative vehicles for mitigating traffic, as well as the large market size of its tourism industry that make it a considerable location for eVTOL implementation. In the case of the Philippines, it is due to more feasible eVTOL developments as well as its tourism pull that make it a considerable location for eVTOL implementation.

Furthermore, the study found that stakeholders from both countries have similar concerns regarding the safety of the vehicle, yet have expressed differing opinions regarding the plausibility of launching eVTOL services within their respective countries. In the Philippines, regulation-related stakeholders are generally open minded and more responsive towards the implementation of eVTOL and can pave the way for testing and regulation negotiation more easily compared to Thailand. However, in Thailand, there is higher potential for eVTOL usage in tourism within Bangkok or other tourist destinations, as well as in other use cases.

Lastly, the study also found that Thailand has higher potential market demand compared to the Philippines, especially when comparing the amount of sales that could be generated when targeting only wealthy tourists and locals within the country. However, it also revealed that there is a need to generate differing pricing strategies for both countries, as launching eVTOL in

Thailand can generate more sales through higher fares, whereas the Philippines would need lower fares to be able to generate more sales.

The author of this paper hopes that these findings would be beneficial for future research study as well as implementation of eVTOL services within the ASEAN region.

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APPENDIX

Contents

a.1. Interview minutes

Shangri-La Mactan Resort and Spa

Date: Sept. 6, 2019; 15:00-16:30 (GMT +8:00)

Venue: Shangri-La Mactan Resort and Spa

Punta Engaño Rd, Lapu-Lapu City, Cebu, Philippines

Web:

Attendees:

(from the Philippines)

Ms. Jacqueline Bulawan (Corporate Communications Manager at Shangri-La Mactan Resort)

Ms. Cheryl Lupiba

(Sales Supervisor, AirTaxi PH Cebu Hangar)

(from Japan)

Keio: Prof. Masaru Nakano, Patrisha Armie Bas, Aki Nakamoto

SkyDrive: X

Question (Prof. Nakano): What kind of air-related activities are available in the area? (e.g. Balloons, Motor paragliders, Helicopters, Sessna) Type of helicopter? How long is the flight with the mobility? How much?

Answer (Ms. Lupiba):

- AirTaxi PH has various tours and packages to offer

- Main convenience within Cebu, as traffic is worsening and guests within the resort are more willing to pay extra to beat the traffic
    - Comparison of travel time from Shangri-La Resort to the main city area
        - Via car: 40 min to 1 hr.
        - Via helicopter: 15-20 minutes
- The company has tours all over the Philippines. When it comes to sightseeing, customers coming in from Cebu would get tour packages that cater to these locations:
    - Cebu: Oslob, Moalboal (destination packages)
    - Other islands (within the Visayas region): Bohol, Siargao, Dumaguete (aerial tour and charters)
- Multiple stops can be accommodated, and they're flexible on missions, but one hour has to be allocated for refueling if necessary
    - Moreover, one way trips will still be charged like round trips
    - 3- & 5-seater helicopters can go for 3 hours' maximum; 4th hour will be allotted for refueling before continuing the tour

Question (Prof. Nakano): Any license and regulations affect the air mobility operation? How long does it take to get approval?

Answer (Ms. Lupiba and Ms. Bulawan):

- For any flights utilizing the resort helipad, 2 weeks to 5 days' notice is needed for AirTaxi PH to get the necessary landing permits from CAAP
    - This is mainly because the helipad on the resort isn't a CAAP-registered helipad, and has stricter regulations put on it.
        - In terms of dealing with regulations, it's much more difficult to deal with more provincial areas.

- Flight altitude is mainly at pilot's discretion.
    - However, for pictorials, weddings, and proposals, they will mainly fly at an altitude of 500-1000 feet
    - Restricted areas: Mactan tower, Mactan airport (Perimeter of Mactan island is also a restricted zone, as regulations tightened)
        - There are also strict regulations when it comes to night flights for helicopters.

Question (Ms. Nakamoto): What are the constraints for the operation? (e.g. Weather, Wind, Temperature)

Answer (Ms. Lupiba):

- Flight availability, flight time, and availed services are heavily dependent on weather
    - Head winds will cause slower speeds, requiring more refueling periods
    - Popularly availed services are also affected by weather and seasons
        - October (wet season): chartered flights are availed for passengers who are stranded or have cancelled boat trips due to inclement wether
        - January (towards end of wet season): aerial tours and Oslob flights
    - Accounting for inclement weather, 60-75% utilization rate
        - Noting flight distance is tricky (need for request of data)
        - Avg. flight time estimate is usually 10-30 mins

Question (Ms. Nakamoto): What kind of regular maintenance is necessary?

Answer (Ms. Lupiba):

- The AirTaxi PH hangar in Cebu checks their helicopters every 6 months to a year.

Question (Ms. Bas): Who uses the service? (e.g. Gender, Age range, Nationality) What is typical group size? What are flight routes you offer as an operator? What are flight purposes? How many customers annually? Not many during the rainy season?

Answer (Ms. Lupiba):

- This is the profile for local consumers
    - There is a need to note that Cebuanos are very price-sensitive, so they might not avail aerial services as easily.
    - Mainly young couples and young families will avail of aerial tours, while government officials are more likely to get the chartered flights
    - AirTaxi PH also offers emergency medical services

INAEC Aviation Group

Date: Sept. 8, 2019; 14:00-15:30 (GMT +8:00)

Venue: *Misto, Lobby Level, Seda Hotel BGC, 30th Street Corner 11th Avenue, Taguig City, Metro Manila, Philippines*

Attendees:

(from the Philippines)

Mr. Dexter Ampong

General Manager, INAEC Aviation Group

Mr. Crisostomo S. Bas Jr.

Former Security and Emergency Services Department Head, Mactan Cebu International Airport Authority

(from Japan)

Keio: Prof. Masaru Nakano, Patrisha Armie Bas, Aki Nakamoto

SkyDrive: X

Question (Ms. Bas): What are your current services?

Answer (Mr. Ampong):

- INAEC is the operator for ASCENT, with the latter acting as an platform for helicopter services
    - INAEC's main services include the following:
        - Oil and gas operators
        - Management of private individuals' aircraft
        - Charter services via ASCENT
            - 10% of their services are charter flights (4% of this is allotted for medical evacuation services from foreigners with insurance coverage)

        - Fixed based operations
    - Mainly have 6 pax helicopters (2 pilots, 4 passengers)
        - Direct operation costs: $200 fuel + $500-800 (depending on age)
            - This estimation includes reserve cost

Question (Ms. Nakamoto): What would be potential issues for the air taxi flying cars?

Answer (Mr. Ampong):

- Permissiveness within the Philippines can be pretty strict on new technology
    - This is due to the former blacklisting that occurred within the Philippines in 2015 for both commercial and general aviation.
    - In contrast, the US is more lenient as general aviation is handled differently from airlines.
        - PH: General aviation is handled similarly to airlines.
    - Entertainment use cases are not as highly regulated as there is no licensing needed.
    - Moreover, when it comes to testing as an issue, as long as it is not noted for commercial purposes and is strictly just for testing, CAAP will be more forgiving.
        - If EVTOL were to launch in the Philippines, there would be a need for a "champion politician" who can rally for regulation and acceptance of new technology within transport.
- For public acceptance, safety is the biggest issue, with pricing coming after.

Civil Aviation Authority of the Philippines

Date: Sept. 9, 2019; 18:00-21:30 (GMT +8:00)

Venue: *The Grand Kitchen Restaurant, Grand Hyatt Manila, 8th Avenue, corner, 35th St, Taguig City, Metro Manila, Philippines*

Attendees:

Capt. Jose Orlando Oliva

(Formerly under CAAP's Aviation Security & Intel Service Division, currently a CAAP consultant)

Mr. Crisostomo S. Bas Jr.

Former Security and Emergency Services Department Head, Mactan Cebu International Airport Authority

Ms. Jana Margherita Wamilda

(from Japan)

Keio: Prof. Masaru Nakano, Patrisha Armie Bas, Aki Nakamoto

SkyDrive: X

Question (Ms. Bas): What is the country's strategy to enhance the air mobility? What is the current government stance on the potential of flying cars entering the local market? Is the emergence of drones affecting the air traffic and regulations?

Answer (Capt. Oliva):

- When it comes to regulation, the Philippines is in a similar predicament with the US when looked at from the viewpoint of general aviation.
    - Drones: Progress in usage is fast and can cover various areas (land, water, etc.) but regulation can't keep up.
    - Government is at a loss despite drone boundaries getting bigger

    - MIT: Not much progress when it comes to international regulation for drones
    - In the Philippines, drones don't require a pilot's license (though one would still need certification before flying a drone)
- There is a move in the Philippines currently to revise aviation law.
    - CAAP will still handle regulation for aviation. However, the government is mainly looking into the creation of a National Transportation Safety Board that can oversee security for all kind of transportation.
    - Moreover, they are looking into a One Sky Policy.

Question (X): What is the expected process of making rules for flying cars? Any issues in making and implementing rules for flying cars? How is the government to collaborate with the global regulators?
Answer (Capt. Oliva):

- To get into the Philippine market, there is a need for negotiation for regulations
    - For drones carrying passengers, it would be best to start off by negotiating with local governments in smaller areas instead of going for testing in Metro Manila.
    - In terms of licensing, there are quite some gray areas for negotiating.
    - It is possible to get consulting companies or operators to get involved and do the negotiating.
        - It should be noted, that helicopter operators will mainly negotiate from a charter perspective, and will have a sense of apprehension due to costly nature of the venture.
        - Starting off negotiations with hobbyist groups that are interested in aerial sports and recreation could be a bit easier.
- Licensing and permits
    - Experimentation license: A special permit will have to be negotiated

    - Aircraft used for aerial recreation (e.g. kickplanes, paragliders, and hot-air balloons) will also require special permits.
        - Most of these aircraft can be found in near Clark, Pampanga as well as other parts of Central Luzon
    - When it comes to getting pilot's license for helicopters, the Philippines has a major difference compared the to the US.
        - US: One license can apply for all types of helicopters.
        - PH: The pilot is required to get a different license for each different type of helicopter that he/she wishes to fly.
- Certification and regulation bases for civil aviation authorities around southeast Asia are different in each country, and is a case to case basis.
    - Malaysia is likely to follow UK standards.
- When it comes to distribution of rich Filipinos, it should be noted there are more wealthy people (those earning 1,000,000M annually, roughly equivalent to 2,058,000 JPY) concentrated around the Metro Manila area.
    - The provinces may not have such a concentration compared to Metro Manila.

Tourism Authority of Thailand

Date: Sept. 10, 2019; 14:30-15:30 (GMT +7:00)

Venue: *Gaysorn Village, 999 Phloen Chit Rd, Khwaeng Lumphini, Khet Pathum Wan, Krung Thep Maha Nakhon, Bangkok, Thailand*

Attendees:

Dr. Yuthasak Supasorn

(総裁 Governor of Tourism Authority of Thailand)

Kentaro Shikano

(Advisor, Japanese Market for Tourism Authority of Thailand)

(from Japan)

Keio: Prof. Masaru Nakano, Patrisha Armie Bas, Aki Nakamoto

Question (Ms. Nakamoto): What are helicopters currently being used for in Bangkok?

Answer (Mr. Shikano):

- Helicopters are currently used for:
    - Emergency medical transportation to avoid traffic congestion or for wealthy people of Cambodia and Myanmar
    - International, wealthy tourists for going from the five-star hotels they stay to high-end department stores for their reserved shopping after the closing time; The building of this meeting venue also has a high-end department store and a roof-top helipad.

Question (Ms. Nakamoto): Who would be the potential customers and use cases for flying cars in Thailand? What would be potential issues for the air taxi flying cars?

Answer (Dr. Supasorn):

- Flying cars may be good for sightseeing and medical use cases in Thailand.
    - Sightseeing use case
        - Joy of seeing the view in person instead of drone videos. For example, sightseeing flight to see from the sky a bio park in Satun Province, and mountains and elephants;
    - Sightseeing flight along beaches
        - Only a flight of 10 km would be useful in Bangkok given the traffic jam.
    - Medical use case
        - Police will be able to rush to the emergency sites by flying cars.
        - Only a flight of 10 km would be useful in Bangkok, as takeoff and landing would be easy in Bangkok.
- Advantage: Reduce transportation time with a slight higher cost compared to existing helicopters
- Notes for business development
    - Subway lines may be doubled, and traffic jam may be deviated in 5 years in Bangkok.
    - Need to consider tropical climate (such as monsoons) and No-fly zones
- Governor's advice and comments:
    - Takeoff and landing would be possible, for example, at shopping mall roof-tops in Bangkok and sightseeing spots in the countryside.
    - As the organization responsible for tourism marketing and PR, TAT can appeal flying cars in the international exhibition (London and Berlin).
    - The beaches are well known in the world as an image representing Thailand, and TAT hopes to promote the beaches further.

- The choice of business site is important and requires getting the flight approval. It is easy if SkyDrive makes TAT get involved while showing the Thai government their merits. Testing and start of business would be faster at beaches.
- Consider the opposition as well, for example, people running island-hopping business. Uber also cannot run a ride sharing business because of opposition from taxis.

Samitivej Sukhumvit Hospital

Date: Sept. 11, 2019; 10:30-11:30 (GMT +7:00)

Venue: *Samitivej Sukhumvit Hospital, 133 Klang Alley, Khwaeng Khlong Tan Nuea, Khet Watthana, Krung Thep Maha Nakhon, Bangkok, Thailand*

Attendees:

Mr. Wiwis Jirasiriwatana

(Aeromedical Transport Manager, Samitivej Sukhumvit Hospital)

(from Japan)

Keio: Prof. Masaru Nakano, Patrisha Armie Bas, Aki Nakamoto

SkyDrive: X

Question (X): What EMS services are being offered within Thailand currently?

Answer (Mr. Jirasiriwatana):

- Thailand has helicopter operators in both public and private sectors handling medical services and transfers.
    - In the public sector, one can call the emergency hotline 1669, and a public ambulance will be deployed to the scene. HEMS missions mainly belong to the government, with dispatches determined through these calls.
        - Note that a doctor may or may not be provided.
        - Most of the helicopters are owned by the government, and are operated by the military.

        - A major disadvantage with relying mainly on the government for HEMS is that decisions for dispatch may take days, which undermines the purpose of the mission.
        - It should also be noted that EMS is a secondary mission for the helicopters that the government owns, and that it is dependent on the distance
        - However, the government even provides jets for missions within the nearby countries of Cambodia and Myanmar
    - Samitivej Sukhumvit Hospital has a partnership with a private operator, and doesn't have its own aircraft.

Question (X): Any potential regulation issues for the suggested use cases? Any license and regulations affect the air mobility operation?

Answer (Mr. Jirasiriwatana):

- As a private operator, the hospital is encountering issues with regulation that make operations difficult.
    - The main problem is that one cannot land anywhere, especially in Bangkok. This restriction only allows them to fly 2-3 times per month in the city.
    - Cost isn't a big issue for the hospital. However, the strictness in regulations for private operators is an issue.
        - Even for medical tourism/leisure case, the hospital would have to certify and mount equipment on their helicopters.
- CAAT is planning to reorganize regulation to make it easier for medical operations.
    - Moreover, the police will have new helicopters that have medevac capability. The National Institute for Emergency Medicine is supporting this, which can help expand HEMS operations.

        - (Side note: Funding is given to doctors in Thailand for medical education abroad.)
- Note about night flight: If they can use IFR, police can fly. However, it is preferred to fly during the day for safety.

Question (X): What is the underlying transportation issue to solve? What would be the benefits?

Answer (Mr. Jirasiriwatana):

- Concept of using a flying car for medical service comes at a good time, as it is cheaper and more compact.
    - Mainly because it's coming at a good time for emerging work with HEMS, as it can help with overcoming landing regulations and can overcome the refresher costs that come with traditional aircraft.

Question (Prof. Nakano):

Answer (Mr. Jirasiriwatana):

- Market Size
    - Much more feasible in the future, as HEMS operations in Thailand only started 5 years ago.
    - More cases are growing in the northern portions of Thailand with police HEMS missions happening there, but it's rare for them to occur in the south.
    - The hospital gets 10-12 cases per month currently. Public-private partnerships can help grow this number, and further democratize air travel.

Question (Prof. Nakano): Any noise issues in air transportation?

Answer (Mr. Jirasiriwatana):

- Noise concerns
    - Mainly need to get approval from local government.
    - Noise is mainly not a problem with high rise buildings, but it is an issue with ground landings.
        - There is need for diplomacy with local residents, given that frequency will determine the magnitude of the issue.

Civil Aviation Authority of Thailand

Date: Sept. 11, 2019; 14:00-15:00 (GMT +7:00)

Venue: *Civil Aviation Authority of Thailand, 11th Flr., 2nd Building, Lak Si Plaza, Khamphaeng Phet 6 Rd., Talat Bang Khen, Lak Si, Bangkok*

Attendees:

Dr. Chula Sukmano

(Director General of CAAT)

(from Japan)

Keio: Prof. Masaru Nakano, Patrisha Armie Bas, Aki Nakamoto

SkyDrive: X

Question (X): Is the emergence of drones affecting the air traffic and regulations? Any issues to make and implement rules for flying cars?

Answer (Dr. Sukmano):

- Determining regulations for EVTOL is still a bit far for CAAT, with drones already posing a challenge for the authority.
    - Most regulation coming from the authority focuses on manned aircraft.
    - Drones pose a challenge due to its prevalence of use in different kinds of locations. Commercialization increases the challenge for creating regulations.
- Commercial use cases for drones has more complex regulations.
    - Public acceptance will take some time

Question (X): What are current rules and rulemaking for air mobility?

Answer (Dr. Sukmano):

- The FAA Ultralight category equivalent is the Sport and Recreational Category.
    - Pilots operating aircraft over 500kg in this category will need a private pilot's license
- Thailand is more conservative when it comes to experimentation due to spatial issues.
    - This is because risk is increased in the country as it is crowded, compared to the United States where the risk can be minimized to the pilot due to the amounts of wide spaces.
- FAA and EASA have equal consideration in Thailand, but certification has more EASA influence.
    - When it comes to regulations for testing experimental aircraft, it is a case by case basis
        - There is openness for talks and negotiation upon giving safety case and risk assessment.

Thai Aviation Services Ltd.

Date: Sept. 11, 2019; 18:00-20:00 (GMT +7:00)

Venue: *Thai Aviation Services Ltd., 121/51 RS Tower Building, 12th Floor, Ratchadapisek Road, Dindeang, Bangkok, Thailand*

Attendees:

Mr. Nicolas Fragassi

(Thai Aviation Services Ltd.)

(from Japan)

Keio: Prof. Masaru Nakano, Patrisha Armie Bas, Aki Nakamoto

SkyDrive: X

Question (X): How much would they pay for the recommended route? How much needs for running function on the ground?

Answer (Mr. Fragassi):

- Price point of designed operating coverage and operation cost raise big question marks.
    - There is a need to be competitive when it comes to pricing.
    - There is a need to look into reducing manufacturing costs.
- Inaccessibility of certain areas via taxi or trains make for a viable market within ASEAN.
    - This is especially true within the south of Thailand.

Question (X): Any potential issues for operations within Thailand?

Answer (Mr. Fragassi):

- The biggest challenge in this business is dealing with CAAT.

- Not many helicopters are flying within Bangkok.
- The country may be delayed by many years when it comes to getting flying cars inside Thailand and development for relevant businesses.
    - However, this is mainly for urban areas. Touching rural areas seems more viable.
- Bringing in new operations can be made easier with a reputable operator.
- Amending air operator's certificate can help with openness
- EASA special regulations can apply in Thailand.
    - This is in contrast to the Philippines, with follows FAA.

Question (Ms. Nakamoto): What are your current services?

Answer (Mr. Fragassi):

- Business operations and details
    - The company has 12 helicopters, and has 15 flights/day.
        - Medical is low-volume, as permits are required each flight and CAAT is not prepared.
        - Most of their applications are in oil and offshore gas operations.
        - Pilot supply is shifting from mostly expats to more Thai nationals, especially those that are ex-military
        - Serviceability rate is at 97%, exceeding their 95% target
        - There is a mix of expats and Thai nationals for operation and maintenance.

Question (Ms. Nakamoto): Who would be the potential passengers of flying car taxis? What use cases have potentials other than leisure/air taxi use cases, from the perspective of local residents? What is the underlying transportation issue to solve? What would be the benefits? Any promising business models?

Answer (Mr. Fragassi):

- Use case discussion

- Cargo services can make for a high value, low risk use case for entry, especially if it goes for short distances and allows for 60 kg cargo load.
    - It may not be a profitable but it is a low-risk opportunity.
    - Safety is ultimate concern for oil and gas companies
- Aerosports and recreational may be a good direction.
    - Paramotors and ultralights are popular in Thailand
    - However, having this help with customer perception is different and crucial
    - If 2 days training for license will be allotted for recreational services, it may not affect the market. (Similar to scuba diving.)
    - Races can be easier to do.
- VIP charter and EMS has very limited operations.
    - UAM is too ambitious for initial release.
- Tourism may not be a popular.
    - However, the tourist market may not be as specific about safety as compared to oil and gas companies.
    - A thing to note is that noise is starting to become an issue on beaches as helicopter services are transitioning into giving tours, as it may ruin atmosphere.

Veranda High Resort

Date: Sept. 12, 2019; 9:30-11:00 (GMT +7:00)

Venue: *Veranda High Resort, 192 Moo2 Banpong Hangdong, Chiang Mai, Thailand*

Attendees:

Mr. Christoph Leonhard

General Manager of Veranda High Resort

(from Japan)

Keio: Prof. Masaru Nakano, Patrisha Armie Bas, Aki Nakamoto

SkyDrive: X

Question (Prof. Nakano): Who would be the potential customers for leisure flying cars?

Answer (Mr. Leonhard):

- Tourist market
    - 30% Thai, 30% other Asian countries, 40% others
    - Chiang Mai mainly has a lower cost of living compared to Bangkok.
        - Due to this, Chiang Mai has become a popular spot for digital nomads
    - Travel habits
        - Middle aged and senior citizens would stay for 2 weeks, which is in contrast to younger generations which are more like to island hop or only stay for 1-2 nights before going to another place
        - Europeans are more likely to stay for 2-3 week in one place, which Asians are likely to make more sporadic travel plans spanning over 3 weeks
            - However, European travel trends may follow Asian in the coming years.

Question (Ms. Bas): Any noise issues in the ground/air transportation?

Answer (Mr. Leonhard):

- Noise will be an issue here due to disruption of ambience
    - Moreover, visual noise can also be a concern that may disrupt ambience as well.
        - There are occasional drones flying around though, which shows that regulations may not be as strict.

Question (Prof. Nakano): What would be the area size of operation? (e.g. 5km X 5km-sized flat field)

Answer (Mr. Leonhard):

- A 4x4m lot allotted for flying cars isn't an issue for the resort, but 7x7m may be a bit tricky.

Question (X): What kind of air-related activities are available in the area? (e.g. Balloons, Motor paragliders, Helicopters, Sessna) Type of helicopter? How long is the flight with the mobility? How much? What are popular flight routes countrywide?

Answer (Mr. Leonhard):

- There is plausible attraction in Chiang Mai for aerial view
- It should be noted that helicopters don't fly often within the area.
    - 1-2 flights/6 months
    - Taking a helicopter is not a popular option in this area, but travel agents can arrange helicopter transfers.
        - It should be noted that these are mainly to high end resorts, such as Four Seasons (40 mins form main city)
- Better opportunities for sightseeing lay in island areas, but there is a risk.

    - Ko Samui: Case of risk of oversaturation of tourists constricting resources if ever air travel were to be become prevalent
        - Air capacity is strongly controlled only by Bangkok Airways, as the airport can only take them
        - The island is at max capacity, which constricts hotel operations
        - However, due to tourists having a hard time accessing the island, hotels are losing.
            - Easiest way to access the island is to fly
    - EVTOL may be able to spark tourism competitiveness between islands
        - It may be better utilized for eventual island hopping and for charter.
- Ballooning is available in the region, but it is not as popular.
    - Chiang Mai has a balloon festival.
    - Ballooning is available but has limited range.
    - Moreover, visual tourism is not as popular within the area.
        - Other suggestions for point of reference: Ang Thong (southern Thailand), Raja Ampat (Indonesia, west of Papua New Guinea)

Question (Ms. Nakamoto): What would be potential issues for the leisure flying cars?

Answer (Mr. Leonhard):

- Main issues of utilizing flying cars from hotel perspective (in order)
    - Price: Guests are price sensitive, at least for the market that this resort is catering to.
    - Ecological impact: Tourists are more environmentally conscious
        - Asians are starting to hop on the trend, but it doesn't have much of an impact compared to European tourists
    - Noise and visual pollution

Advance Aviation

Date: Sept. 12, 2019; 15:00-16:30 (GMT +7:00)

Venue: *Advance Aviation Chiang Mai Base, 161 Somphot Chiang Mai 700 Pi Rd, Tambon Pa Daet, Amphoe Mueang Chiang Mai, Chang Wat, Chiang Mai, Thailand*

Attendees:

Ms. Piyamaporn "Dook" Saensiriwong

(Senior Customer Service Representative, Advance Aviation)

(from Japan)

Keio: Prof. Masaru Nakano, Patrisha Armie Bas, Aki Nakamoto

SkyDrive: X

Question (Prof. Nakano): Who would be the potential customers for leisure flying cars? Any recommended places with scenic sky views for flying cars? Any suggested altitude for flight?

Answer (Ms. Saensiriwong):

- Market size
    - Advance aviation is the only company that services helicopter flight.
    - The company has 3 bases: Bangkok, Phuket, and Chiang Mai
    - Nationalities (mainly for transfer):
        - American
        - British
        - Chinese
    - Transfer 70%, Sightseeing 20%, others 10%
    - Phuket has mainly sightseeing

        - Phuket is more optimal for sightseeing, but Chiang Mai is good for charter because the terrain is difficult to go around.
        - Ranges are shorter in Phuket because customers want to ride helicopters for the experience of it
        - Phuket base is close to the airport, so airport is also a no-fly zone
    - Medical Tourism: Bangkok Hospital has a helipad because that hospital has a helicopter with medical staff for the helicopter.

Question (Prof. Nakano): What are the constraints for the operation? (e.g. Weather, Wind, Temperature) Any license and regulations affect the air mobility operation? How long does it take to get approval?

Answer (Ms. Saensiriwong):

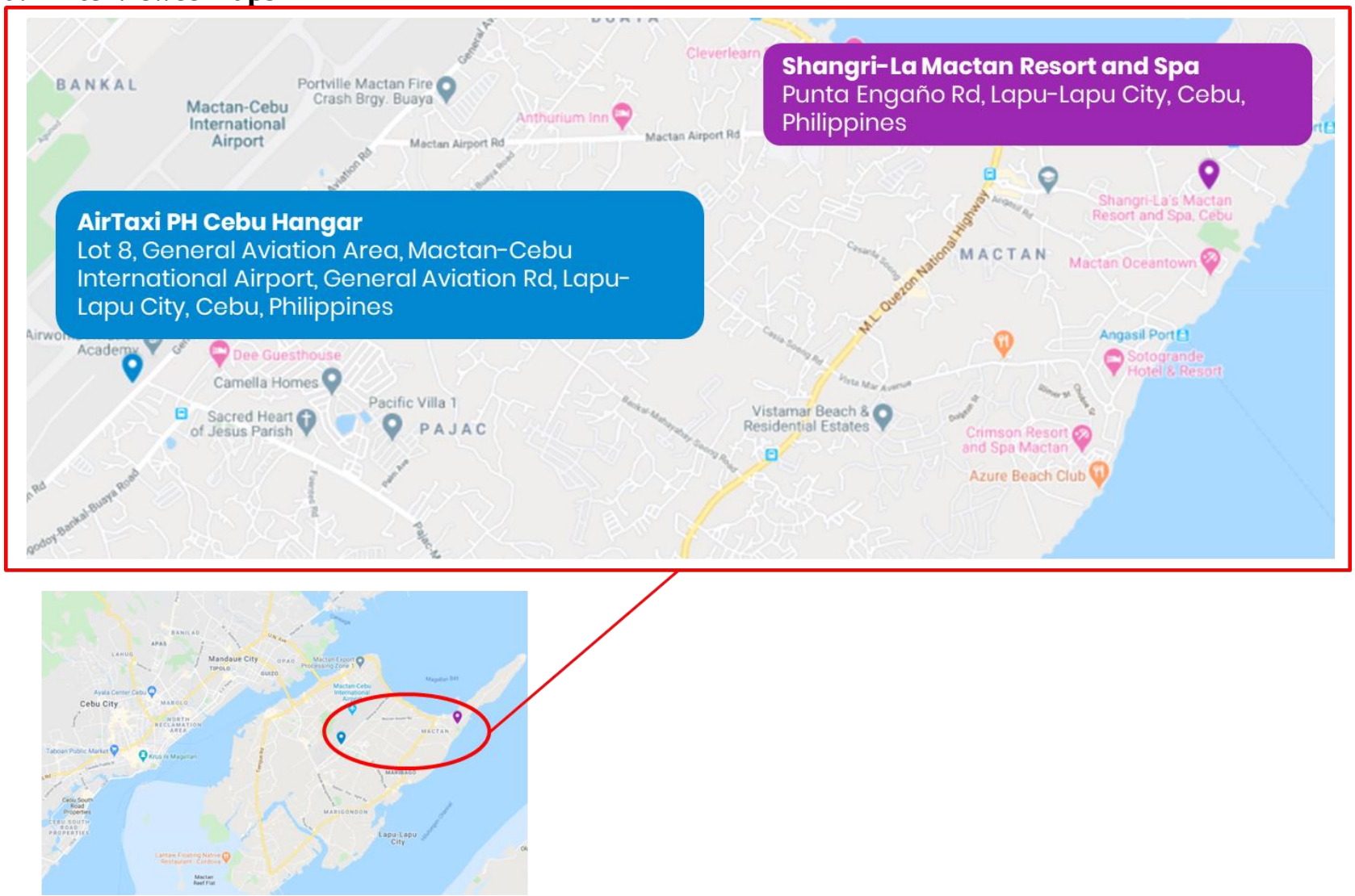
- Height for helicopters:
    - 600 m usually in PH (more like 500m for Cebu) and JP
    - Chiang Mai: 500 ft above ground for sightseeing
        - 500 ft for transfers
- Clouds
    - Japan: regulations - if there are clouds below 300m, can't fly
        - 70% clouds in the sky
    - Thai: Mainly under safety standards
        - Visibility is an issue. If pilot cannot see the ground, pilot cannot fly
        - There is no percentage for amount of clouds in the sky
        - Weather reference and ISO: Recordkeeping of weather reference from the airport is done before the flight.
        - Information needs to be sent to authority beforehand
            - If you want to fly anywhere, there needs to be 7-10 days for landing permit (TH)

- TPO: validity is for 30 days for landing permit

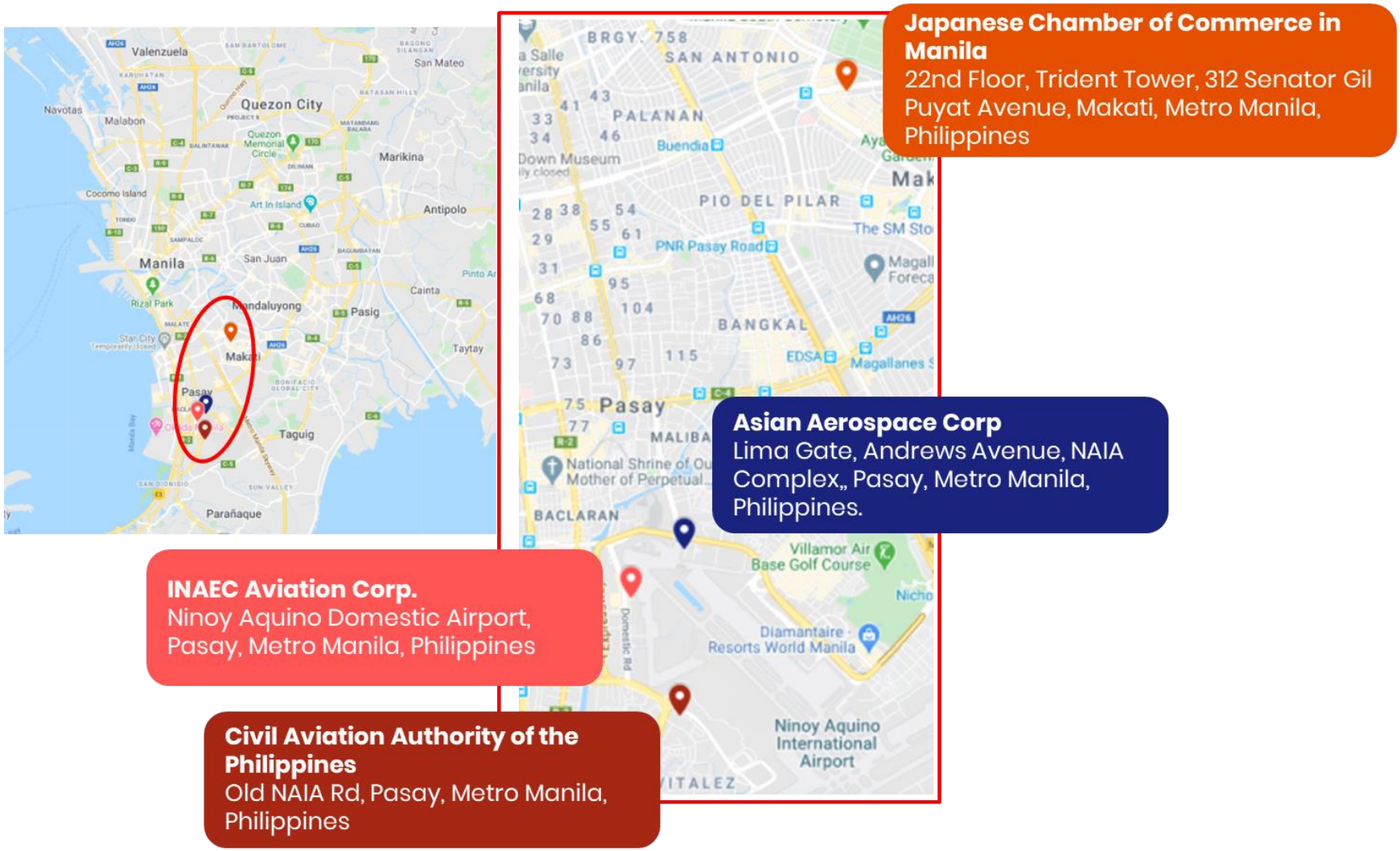
- Service Rate
    - More cancellations happen during the rainy season.
        - The company doesn't record, as they are encountering difficulty in recordkeeping due to temperamental weather,
        - They have to be very flexible due to the temperamental weather.
    - Flights don't occur everyday
        - Flights per month: 1 flight/week estimate
        - They have multiple missions
            - Max range 2 hrs. 20 mins. before refueling
            - Filming flights, sky report flights
            - Minimum is 20 minutes
        - Flight speeds: 110 knots
            - 200-220 km/h
    - Typical flight location: Manhongsorn, Chiang Rai Airport, Golden Triangle
        - Typical flight: Mainly charter
    - No fly zones (Noted by Nakamoto-san, no fly near palace in Sutlep mountain)
        - No fly zones move with the Royal family
        - Military zones also update no fly zones, causing people to reroute flights
            - 0% cancellations from this happening
            - Profit margin is smaller though
    - They can only fly during daytime
        - Limitation of pilot duty time: Pilot can only fly for 8 hours
        - If mission is too long, another pilot has to be scheduled in
    - 4 helicopters, 12 pilots

        - 4 pilots in Bangkok (1 helicopter needs 2 pilots, Bangkok has 2 helicopters)
        - Chiang Mai: 1 pilot
        - All full-time
- Difficulty of getting landing permissions
    - Documents: Permission from land owner, and picture of angle
    - Safety area for take-off and landing
    - Pictures are enough for inspection of take-off and landing sites
        - Google Earth mainly used for this
        - However, if there are qualms that it may be unsafe, physical site visit may have to happen.

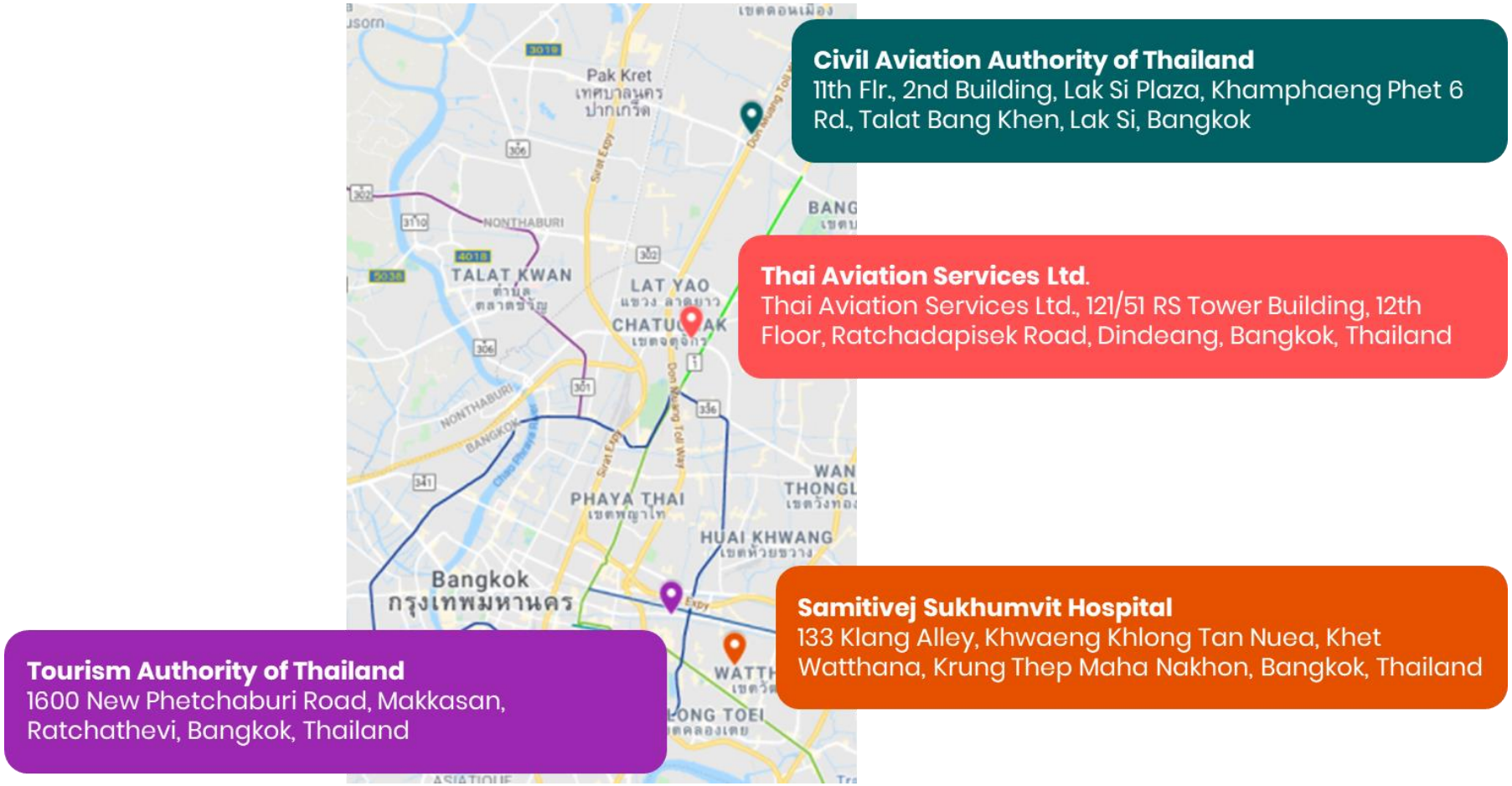
a.2 Interviewee maps



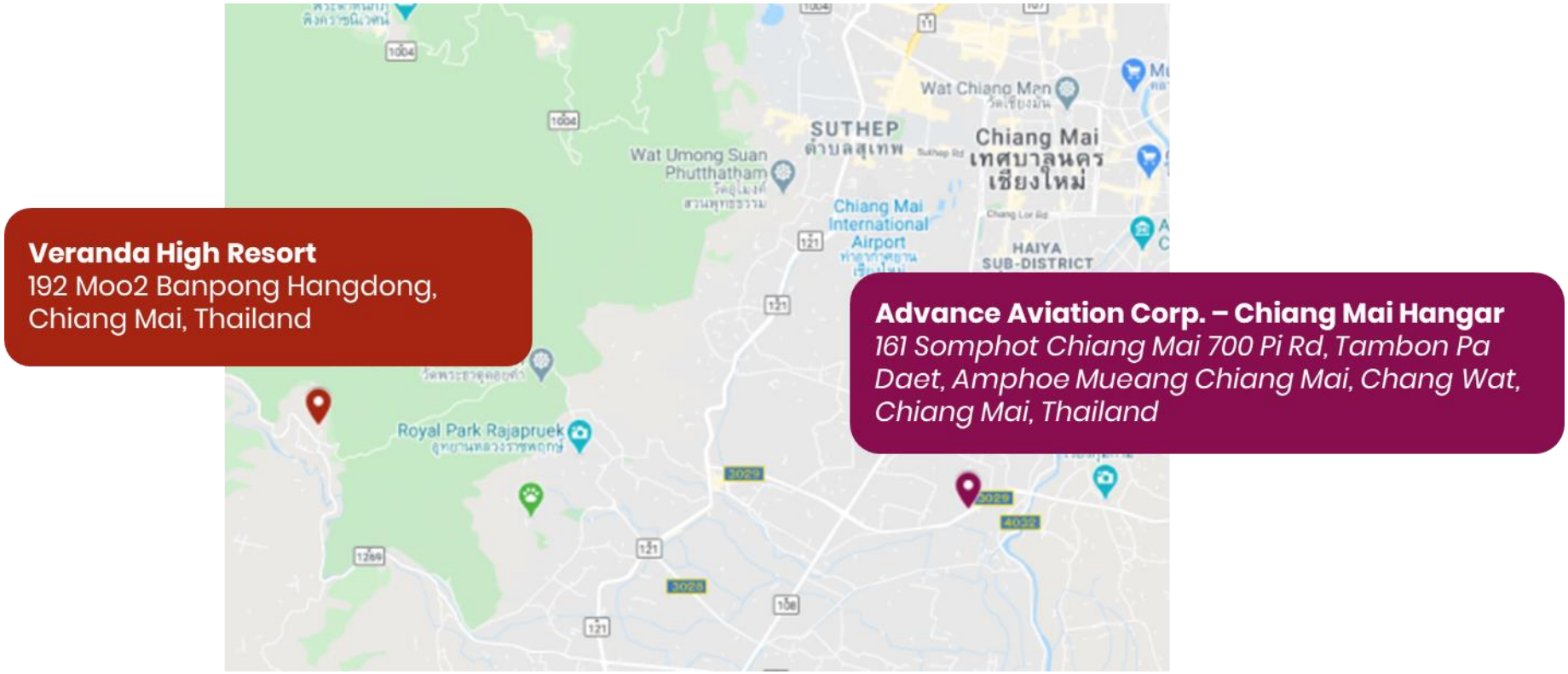
Map of interviewee locations for Cebu



Map of interviewee locations in Manila

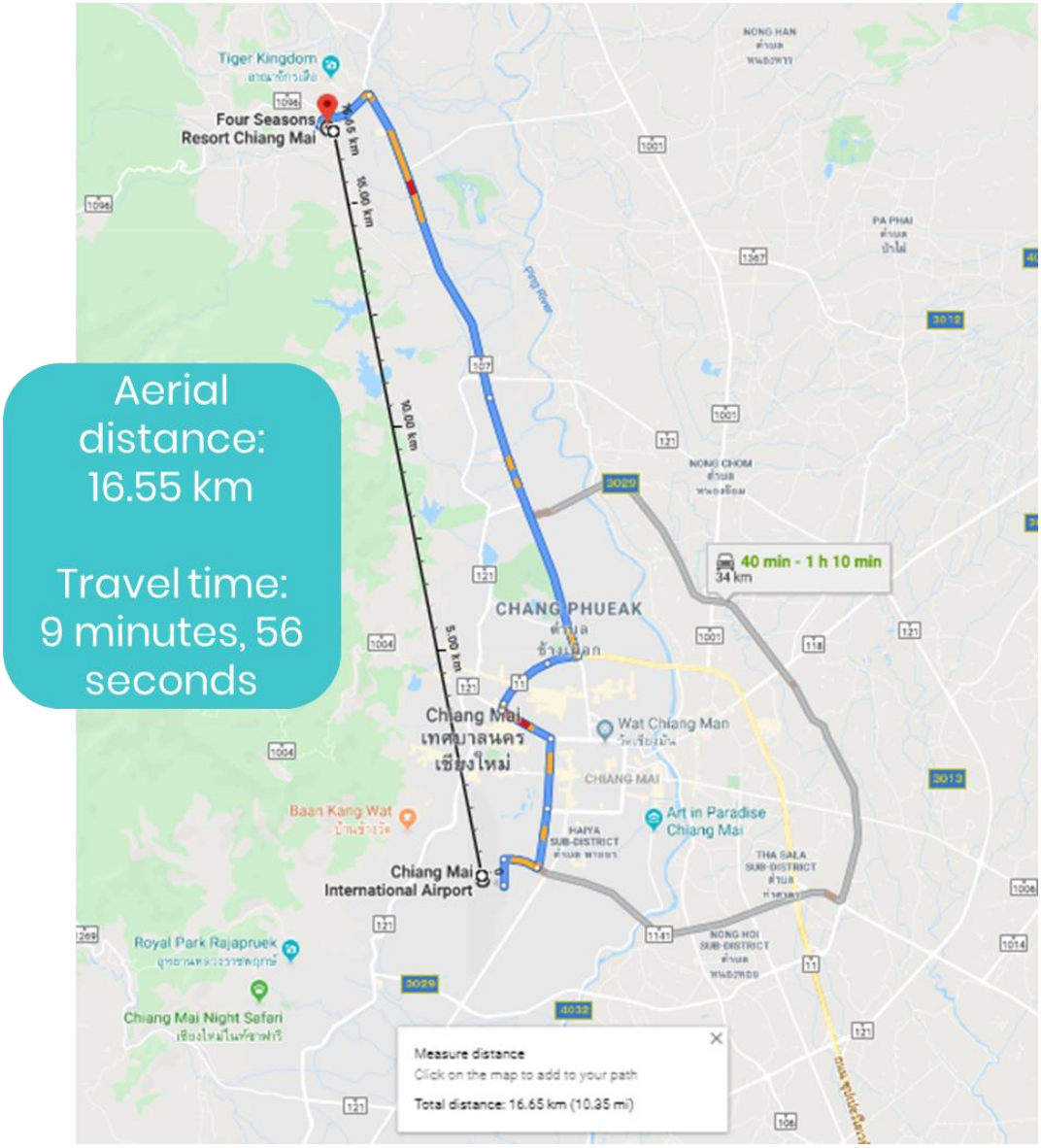


Map of interviewee locations in Bangkok

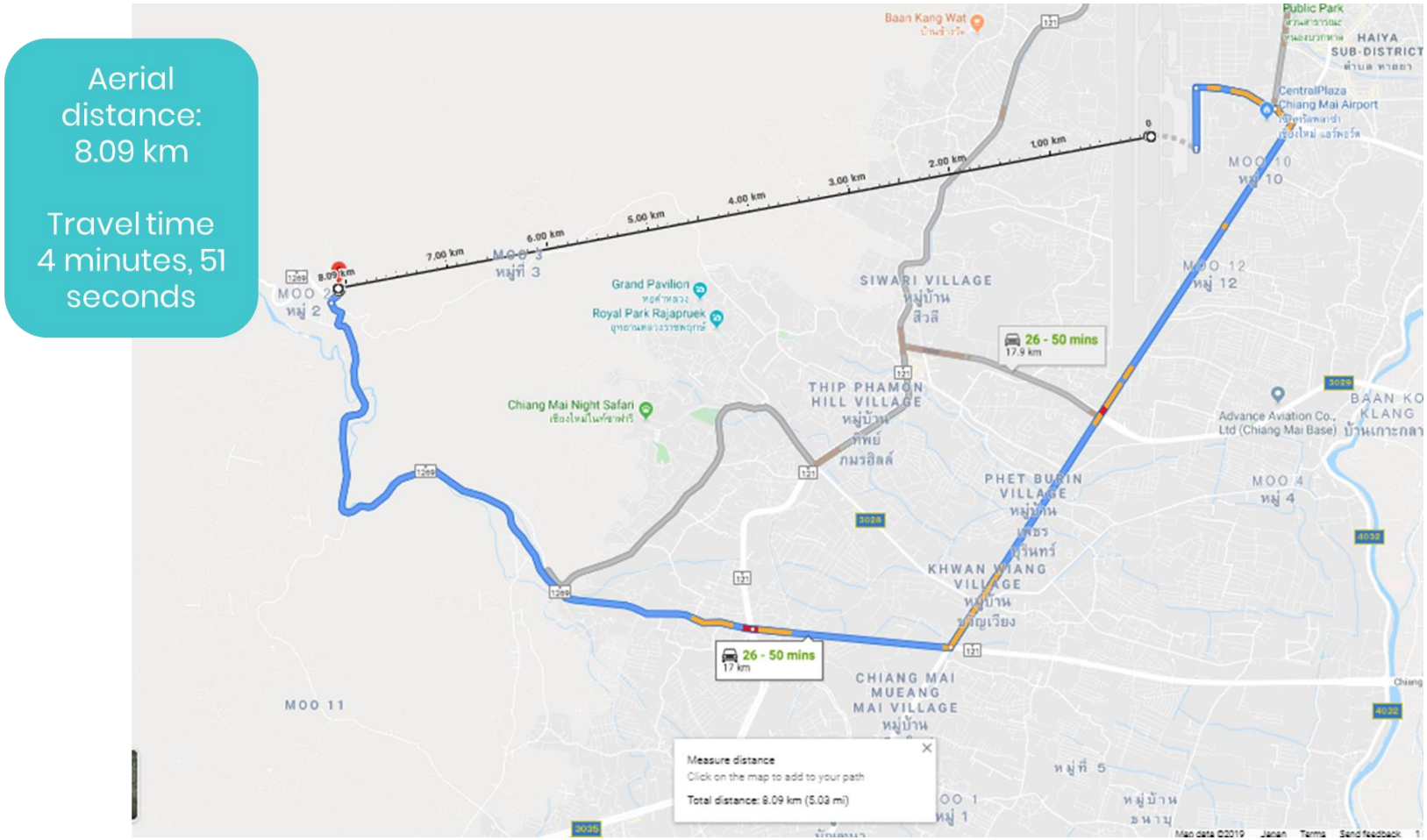


Map of interviewee locations in Chiang Mai

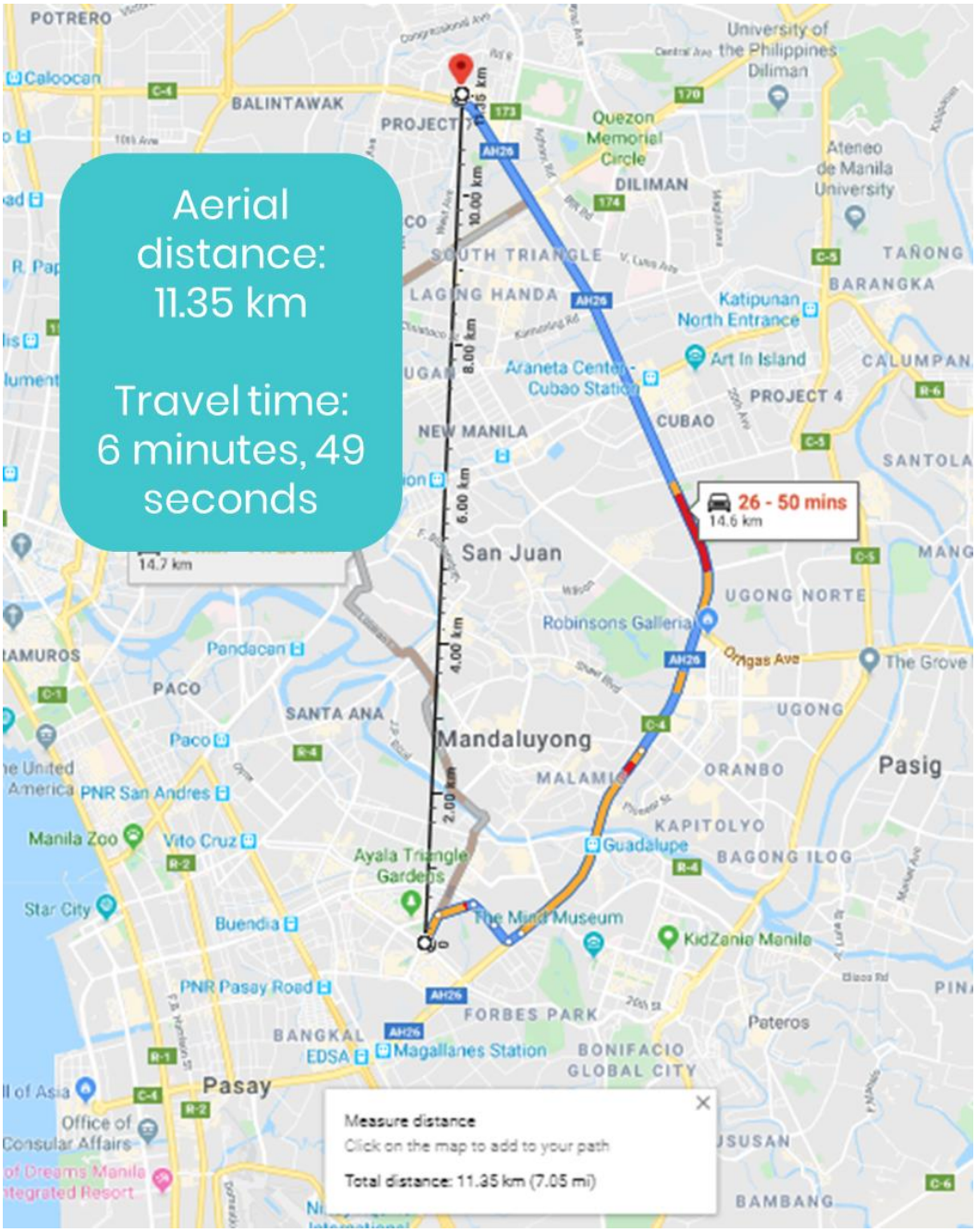
a.3 Use case maps



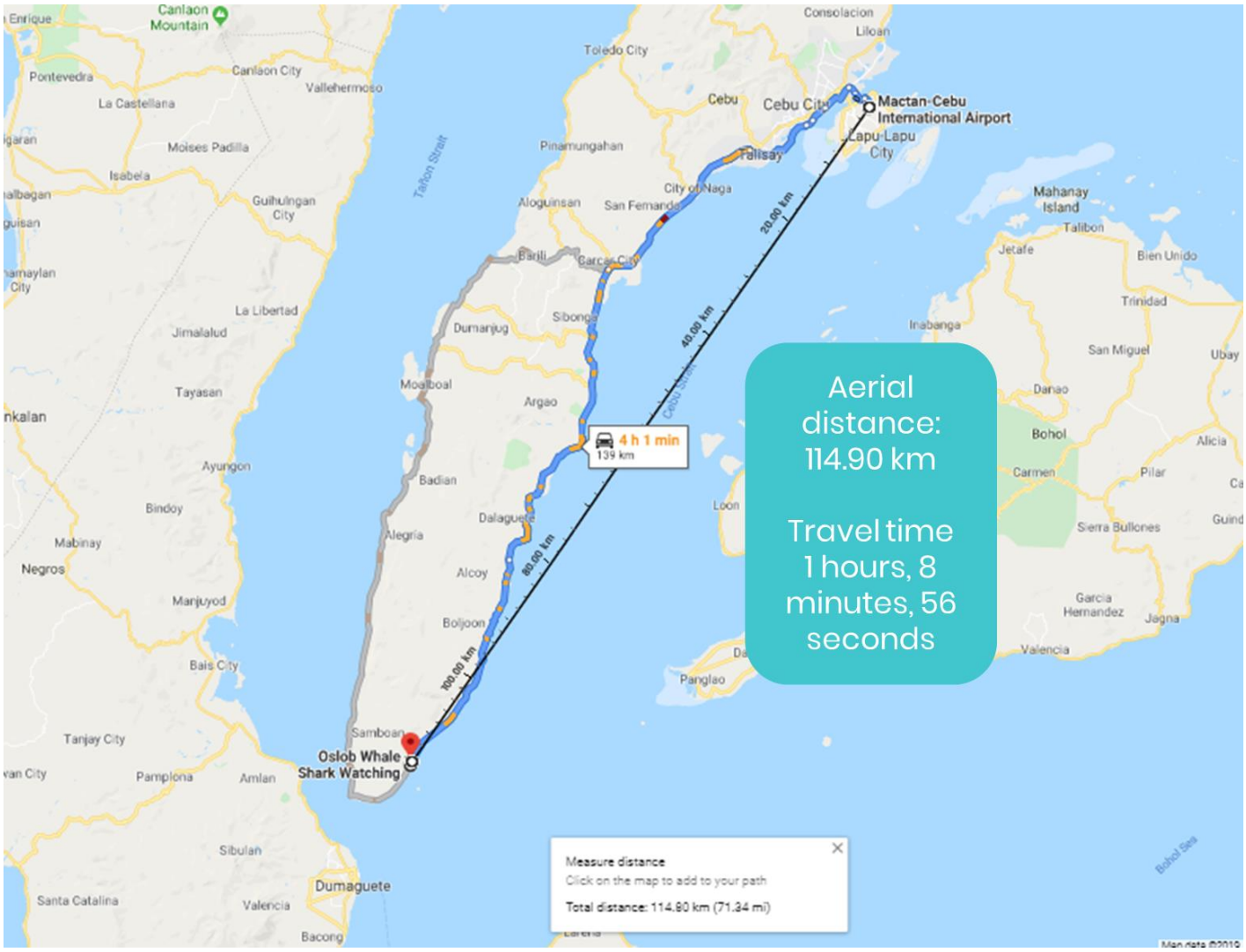
CHIANG MAI
Route: Chiang Mai International Airport to Four Seasons Resort. (34 km)
Travel time on land: 40 minutes to 1 hour, 10 minutes



CHIANG MAI
Route: Chiang Mai International Airport to Veranda High Resort. (17 km)
Travel time via land: 26-50 minutes



MANILA
Route: The Peninsula Hotel (Makati) to SM City North Edsa (Quezon City) – 14.7 km via car
Travel time via land: 26-50 minutes



CEBU
Route: Mactan-Cebu International Airport to Oslob. - 132 km via car
Travel time via land: 4 hours, 1 minute