ATTRIBUTE PREFERENCES, PARTICIPATION INTENTION AND ECONOMIC VALUE OF CARBON OFFSET PROGRAMME FOR AIRLINE PASSENGERS IN MALAYSIA

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By

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May 2019

Chairman   **: Associate Professor Abdul Rahim Abdul Samad, PhD**
Faculty   **: Economics and Management**

Air transportation is one of the fastest growing in terms of demand. People prefer to board a plane for travelling due to several factors including the airfares which are affordable for people from all walks of life. Although carbon dioxide (CO_2) emissions from air transportation only contribute 4% (which equals to nearly 781 million tonnes of carbon dioxide (CO_2) for every flight) of total pollution, it is one of the fastest growing sources of greenhouse gas emissions (GHG). In order to reduce CO_2 emissions, there are various alternatives that have been adopted by airlines including the use of sophisticated technologies for operation (less carbon emissions), and the implementation of carbon offset programme. This programme helps in reducing the carbon emissions, by offsetting the emissions released to benefit "green initiatives" such as through renewable energy projects, energy efficiency and forest management projects.

This study aims to assess attribute preferences, participation intention and economic value of carbon offset programme for airline passengers in Malaysia. This study employed the Contingent Valuation Method (CVM), Choice Experiment (CE) method, and Partial Least Squares Structural Equation Modelling (PLS-SEM) method. A total of 823 passengers for CVM and CE method, and 403 passengers for PLS-SEM method were selected from Kuala Lumpur International Airport (KLIA) and Kuala Lumpur International Airport 2 (KLIA2) as respondents for this study.

The CVM derived the appropriate Malaysian flight airfare for better environmental performance. The Logit model was defined by using the dichotomous double-bounded method to elicit the value that is appropriate for the airfare from price bid. The outcomes of the study showed that as the price bid increased, the probability of saying "yes" decreased. Educated passengers with higher income agreed to pay extra for their airfare to support environmental initiatives. The estimated mean for willingness to pay among passengers with regards to the appropriate airfare towards carbon offset

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programme was RM80.44, which the value is a guideline to charge as an additional charge on top of the original airfare.

By using CE method, the attributes identified for carbon offset programme were CO_2 emission, type of project, project location and voluntary payment. The Conditional Logit and Mixed Logit model were applied to estimate the marginal value of the attributes and the attributes that were most preferred. The results showed passengers chose forest management as the most important attribute for carbon offset programme and the marginal value for this attribute was RM84.82, in which it is based on the best model selected (Mixed Logit model with interaction).

The New Ecological Paradigm scale, the Theory of Planned Behaviour and variables from past literature were used to measure general environmental attitudes, intermediate beliefs, and specific behaviour attitudes and norms. The PLS-SEM method was used to investigate the factors influencing Malaysian passengers towards carbon offsets. The results showed that only general environmental attitudes and specific environmental attitude had a direct relationship with intentions. While testing for an indirect relationship, it was revealed that the general environmental attitude did not have an indirect relationship with intention, as it was mediated by intermediate beliefs and specific attitude.

The findings of this study provide policy recommendation to policymakers, airlines and passengers of an alternative to reduce the CO_2 emissions. By having information regarding the appropriate airfare, it will help the airline to impose a reasonable fee on top of their airfare in support of environmental concerns. In addition, this study can encourage the airlines management, government and other related parties to take drastic action by implementing the carbon offset programme in Malaysia based on the selected attribute that passengers preferred which is forest management. The information obtained in terms of monetary value will help to convince Malaysian airlines to implement the carbon offset program accordingly. This study is expected to motivate people to contribute money in realising this programme and to support the country's effort in moving towards becoming a low-carbon economy.

Abstrak tesis yang dikemukakan kepada Senat Universiti Putra Malaysia Sebagai memenuhi keperluan untuk ijazah Doktor Falsafah

KEUTAMAAN ATRIBUT, NIAT PENYERTAAN DAN NILAI EKONOMI BAGI PROGRAM MENGIMBANGI KARBON UNTUK PENUMPANG PESAWAT DI MALAYSIA

Oleh

NUR FATIHAH BINTI SHAARI

Mei 2019

Pengerusi : **Profesor Madya Abdul Rahim Abdul Samad, PhD**
Fakulti : **Ekonomi dan Pengurusan**

Pengangkutan udara merupakan salah satu pemintaan pengangkutan yang semakin meningkat. Pemilihan terhadap pengangkutan udara adalah lebih tinggi disebabkan oleh beberapa faktor seperti kos penerbangan yang ditawarkan adalah mampu milik oleh setiap lapisan masyarakat. Walaupun pengangkutan udara hanya menyumbang sebanyak 4% daripada jumlah keseluruhan pencemaran udara (iaitu hampir 781 juta tan pelepasan karbon dioksida(CO_2)), tetapi ianya merupakan salah satu sumber kesan rumah hijau yang paling pesat berkembang. Dalam usaha untuk mengurangkan pelepasan CO_2 ke ruang udara, syarikat penerbangan telah mengguna pakai beberapa cara antaranya penggunaan teknologi yang lebih canggih (kurang menghasilkan karbon dioksida), dan inisiatif lain adalah dengan melaksanakan program pengurangan karbon. Program ini dapat membantu dalam mengurangkan pencemaran yang dihasilkan sewaktu perjalanan, iaitu dengan mengimbangi pelepasan karbon kepada kaedah yang lain seperti tenaga boleh diperbaharui, kecekapan tenaga dan projek pengurusan hutan.

Kajian ini dijalankan bertujuan untuk menilai nilai ekonomi dan menentukan untuk menentukan penglibatan penumpang pesawat di Malaysia terhadap program pengurangan karbon. Kajian ini menggunakan kaedah *Contingent Valuation Method (CVM), Choice Experiment (CE),* dan *Partial Least Squares Structural Equation Modelling (PLS-SEM).* Sebanyak 850 penumpang telah dipilih dari Lapangan Terbang Antarabangsa Kuala Lumpur (KLIA) dan Lapangan Terbang Antarabangsa Kuala Lumpur 2 (KLIA2) sebagai responden untuk kajian ini.

Kaedah CVM digunakan untuk memperoleh harga tiket penerbangan yang sesuai bagi penerbangan-penerbangan Malaysia untuk mendapatkan prestasi alam sekitar yang lebih baik. Model Logit telah ditakrifkan menggunakan kaedah *dichotomous double-bounded method* untuk mendapatkan nilai harga tiket yang sesuai dari harga yang ditawarkan. Hasil kajian menunjukkan bahawa apabila harga yang ditawarkan meningkat, kebarangkalian untuk menjawab "ya" adalah berkurang. Responden yang berpelajaran dan memperoleh pendapatan yang tinggi bersetuju untuk membayar lebih

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untuk harga tiket mereka demi prestasi alam sekitar yang lebih baik. Purata anggaran kesanggupan untuk membayar antara responden untuk harga tiket penerbangan yang bersesuaian kearah program pengurangan karbon adalah sebanyak RM80.44, di mana nilai ini akan dikenakan sebagai bayaran tambahan ke atas harga tiket asal.

Dengan menggunakan kaedah CE, atribut yang digunakan untuk program pengurangan karbon untuk mengurangkan pelepasan CO_2 adalah jumlah pengurangan karbon, jenis projek, lokasi projek dan bayaran secara sukarela untuk program pengurangan karbon. Model *Conditional Logit* dan *Mixed Logit* digunakan untuk menganggarkan nilai marginal dan atribut yang disukai oleh penumpang. Dapatan kajian menunjukkan bahawa penumpang memilih pengurusan hutan sebagai atribut terpenting dan nilai bagi atribut tersebut adalah RM84.42.

Skala *The New Ecological Paradigm, Theory of Planned Behaviour* dan pemboleh ubah lain dari kajian lepas telah dipilih untuk digunakan untuk mengukur sikap umum terhadap alam sekitar, kepercayaan asas, dan sikap dan norma tingkah laku tertentu. Kaedah PLS-SEM digunakan untuk menyiasat faktor-faktor yang mempengaruhi penumpang pesawat di Malaysia terhadap pengurangan karbon. Keputusan menunjukkan sikap umum terhadap alam sekitar hanya mempunyai hubungan secara terus dengan niat. Manakala sikap umum terhadap alam sekitar menunjukkan bahawa ianya tidak mempunyai hubungan secara langsung dengan niat, diantara kepercayaan asas dan sikap khusus.

Penemuan kajian ini mencadangkan saranan dasar kepada pembuat dasar, syarikat penerbangan dan penumpang dalam usaha untuk mengurangkan pelepasan karbon dioksida. Dengan memiliki maklumat berkaitan dengan harga tiket yang bersesuaian, dapat membantu syarikat penerbangan mengenakan bayaran tambahan ke atas harga tiket asal untuk mendapatkan prestasi alam sekitar yang lebih baik. Selain itu, kajian ini juga dapat menggalakkan pihak pengurusan syarikat penerbangan, kerajaan dan juga pihak-pihak yang terlibat untuk mengambil tindakan segera, dengan melaksanakan program pengurangan karbon di Malaysia berdasarkan atribut yang telah dipilih iaitu pengurusan hutan. Di samping itu, maklumat yang diperoleh daripada nilai kewangan ini dapat meyakinkan syarikat penerbangan di Malaysia untuk melaksanakan program pengurangan karbon dengan sewajarnya. Akhir sekali, kajian ini dijangka akan memberi motivasi dan kesedaran kepada semua untuk menyumbangkan wang secara sukarela bagi memastikan program ini dapat dilaksanakan dan menyokong kearah langkah ekonomi rendah karbon.

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Special thanks to my family for their spiritual encouragement. To my parents, Shaari bin Abdullah and Noriah binti Abdul Rahman, thank you for your continous pray and support. To my siblings, Lina, Lokman Haikal, Jamilah, Alias, Ahmad and Adam, all of you are the strongest motivation for me to finish my study.

Lastly, I would like to express my sincere thanks to all friends, lecturers and staff at Faculty of Economics and Management, Universiti Putra Malaysia for their support to the successful completion of my study. Thank you Kementerian Pendidikan Tinggi Malaysia for providing scholarship for my study.

Declaration by graduate student

I hereby confirm that:
- this thesis is my original work;
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- this thesis has not been submitted previously or concurrently for any other degree at any other institutions;
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Declaration by Members of Supervisory Committee

This is to confirm that:

- the research conducted and the writing of this thesis was under our supervision;
- supervision responsibilities as stated in the Universiti Putra Malaysia (Graduate Studies) Rules 2003 (Revision 2012-2013) are adhered to.

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Supervisory Committee: Assoc. Prof. Dr. Abdul Rahim Abdul Samad

Signature:
Name of Member of
Supervisory Committee: Assoc. Prof. Dr. Syamsul Herman Mohammad Afandi

Signature:
Name of Member of
Supervisory Committee: Dr. Hanny Zurina Hamzah

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LIST OF ABBREVIATIONS

ATT	Attitude
CE	Choice Experiment
CO_2	Carbon Dioxide
CM	Choice Modelling
CVM	Contingent Valuation Method
FRIM	Forest Research Institute Malaysia
GDP	Gross Domestic Products
GHG	Greenhouse Gases
GST	Goods and Services Tax
IATA	International Air Transport Association
ICAO	International Civil Aviation Association
IPCC	Intergovernmental Panel on Climate Change
KLIA 1	Kuala Lumpur International Airport 1
KLIA 2	Kuala Lumpur International Airport 2
KTM	Kereta Api Tanah Melayu
LCC	Low-Cost Carrier
LRT	Light Rail Transit
MAHB	Malaysia Airports Holding Berhad
MAS	Malaysia Airline
MENGO	Malaysian Environmental NGOs
NEP	New Ecological Paradigm
NGO	Non-Governmental Organization
NOAA	National Oceanic and Atmospheric Administration
NRE	Ministry of Natural Resources and Environment
PBC	Perceived Behaviour Control
PLS-SEM	Partial Least Square-Structural Equation Modelling
SEM	Structural Equation Modelling
SN	Subjective Norms
TEV	Total Economic Value
TPB	Theory of Planned Behaviour
VBN	Value-Belief-Norm
VCO	Voluntary Carbon Offset
WTP	Willingness to Pay

CHAPTER 1

INTRODUCTION

1.1   Background of study

A worldwide temperature alteration is the rapid increment in temperature of the Earth's surface (both land and water) and the air. Recently, the Earth experienced increases in temperature caused by the accumulation of greenhouse gases in the atmosphere produced by human activities (Le et al., 2007). People are primarily responsible for the current environmental change. Activities such as the consumption of petroleum products and deforestation have discharged a lot of carbon dioxide (CO_2) and other greenhouse gases (GHG) to the environment which brings to an unnatural weather change. The GHG generated by human activities are being added to the atmosphere at a faster rate, and this will raise the worldwide temperatures and cause global warming (Lee et al., 2007). In addition, human activities such as deforestation and burning of fossil fuels also lead to the increase of carbon dioxide concentrations in the Earth's atmosphere.

The amount of global greenhouse gas emissions produced by the aviation industry is continually increasing. Emissions from aviation include carbon dioxide (CO_2) and water vapour; these are generated during the burning of fuel in the engine (Dessens et al., 2014). According to an Intergovernmental Panel on Climate Change (IPCC) in 1999, CO_2 emissions between 1992 and 2050 could rise by 60 percent to 100 percent. This problem will harm the environment in several ways such as desertification, increased melting of snow and ice, increases in sea level and stronger storms and extreme events frequently happening (National Research Council, 2010).

There is evidence that our earth is getting unwell and warmer. Based on the National Oceanic and Atmospheric Administration (NOAA) (2017), the global average temperature over the land and ocean surface for March 2017 was 1.05˚C above the 20th century average of 12.7˚C, and this has been recorded as the second highest global temperature since recording of temperature began in 1880. The trend for global temperature can be seen in Figure 1.1 as for how temperatures started to rise from 1880 to 2017. A change in weather and climate has accompanied the increase in the global temperature. The changes occur when too many harmful things are released into the atmosphere e.g. CO_2, which accounts for about 82% of total gases. The increased level of carbon dioxide (CO_2) in the atmosphere is turning down the global air conditioner. The impacts from CO_2 will result in changes in rainfall, where the world is confronted with issues such as floods, droughts, severe rain, and more frequent and severe heat waves. The sea is warming and becoming noticeably more acidic, and the most critical situation of all is the ocean levels are rising.

1
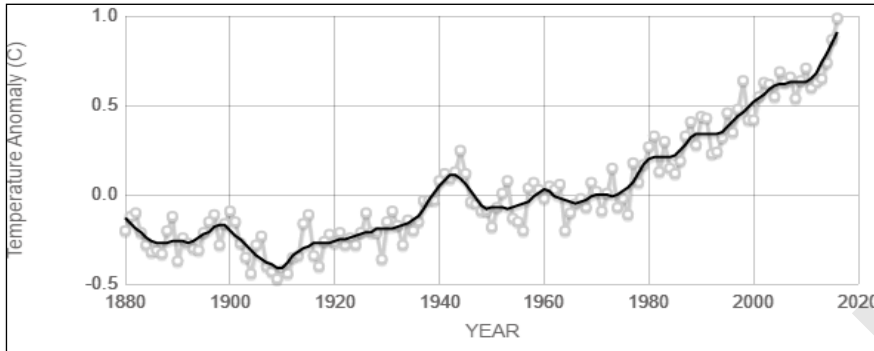
Figure 1.1: Global Land-Ocean Temperature Index
(Source: NASA's Goddard Institute for Space Studies (GISS), 2017)

Figure 1.1 is a graph representing the global land-ocean temperature index from 1880 to 2020. Global temperatures starting from 1880 until 1960 show a fluctuation trend, but started to increase from year to year until 2016. In 1880, the temperature was -0.2˚C, but decreased to -0.42˚C in 1910 and began to increase until the year 1943, where the temperature was 0.13˚C. However, starting from the year 1960 until today, the temperature keeps rising from 0.03˚C until 0.99˚C.

Malaysia is the second largest contributor of CO_2 emissions from fuel combustion among ASEAN countries (The Economist Corporate Network, 2016).The increased amount of CO_2 emissions in Malaysia has led the Prime Minister to announce that it would voluntarily reduce the GHG emission intensity of its Gross Domestic Product (GDP) by 40% by 2020 compared to its 2005 levels (Ministry of Natural Resources and Environmental, 2015). However, in 2015 Malaysia has re-pledged to reduce 45 per cent of CO_2 by 2030 from the level in 2005. According to The Economist Corporate Network (2016), even though Malaysia's emissions intensity will fall, the emissions will still increase. The trend of CO2 emissions in Malaysia can be seen from Figure 1.2.

2
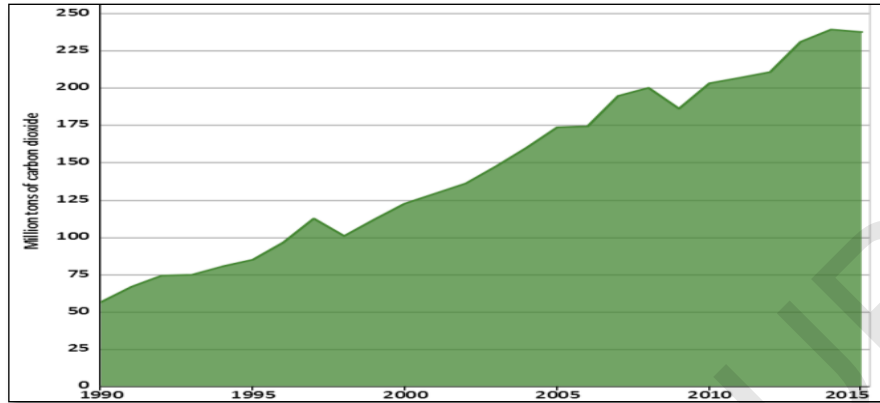
Figure 1.2: CO$_2$ Emissions From Fuel Combustion in Malaysia
(Source: International Energy Agency, 2016)

Figure 1.2 indicates a trend of CO$_2$ emissions from fuel combustion in Malaysia from 1990 until 2015. It showed that CO$_2$ emissions per capita increased from year to year from 56.38 million tons in 1990 to 200.05 million tons in 2008. However, in 2009, the trend of emissions suddenly dropped to 186.09 million tons and started to increase again in 2010 until 2015. What is more worrying about the increases in CO$_2$ emissions is the level of CO$_2$ is at the hazardous level. This increase is currently a concern among many parties because CO$_2$ emissions is a starting point for the escalation of others problems such as haze, acid rain, respiratory illness, the destruction of crops, and asthma.

However, CO$_2$ emissions does not come from only one sector, but is contributed by many other sectors such as industrial, residential, transportation, electricity and energy, manufacturing, agriculture and other energy sectors (Oh and Chua, 2010). Based on Figure 1.3, all sectors in Malaysia were represented by their level of CO$_2$ emissions. The transportation sector is one of the largest sectors that contribute to the increased level of CO$_2$ emissions compared to other sectors in 2014, which is 27% of the total CO$_2$ emissions and followed by the industrial sector. The transportation sector showed an increasing trend from 1999 to 2014, until this sector became the most significant contributor to the emissions. This happened due to the total number of vehicles owned by Malaysians which is growing, whereby in 1995, three people owned one vehicle. However, the ratio has reduced in 2010 where only 1.4 people owned one car (Shahid, Minhans and ChePuan, 2014).

3
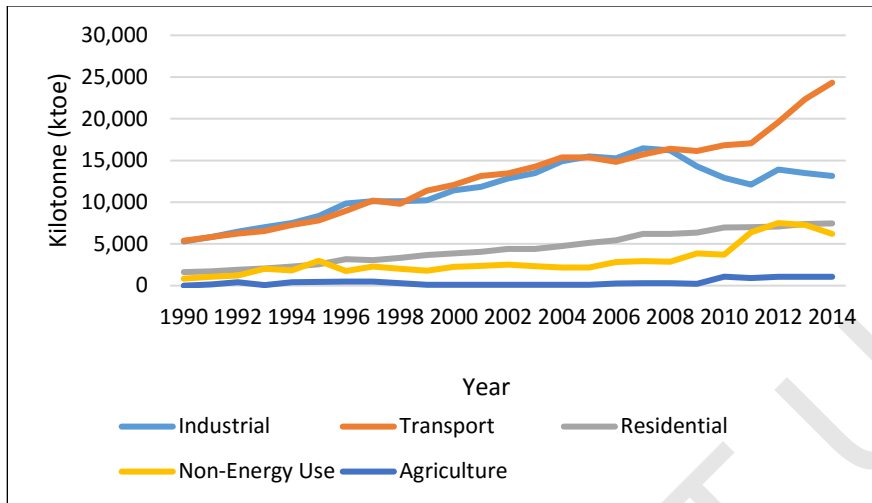
Figure 1.3: Energy Consumption by Sector
(Source: National Energy Balance, 2016)

Compared with 27% of CO_2 emissions from the transportation sector, air transportation only accounts for 4% to 9% of total CO_2 emissions in Malaysia. Even though the percentage of air transportation CO_2 emissions is the lowest compared to other modes of transportation (i.e. road, water, and rail transportation), it cannot be ignored as it will also contribute to pollution.

1.2 Transportation in Malaysia

The transportation sector is one of the major components of globalisation and is a significant contributor to the economy. In the last decade, the amount of motorised transportation in Malaysia and other countries has increased significantly. Malaysia being a rapidly developing economy, relies on transportation to make a vital contribution to the economy as it plays a crucial role in daily activities. The total number of vehicles in Malaysia has increased from about 165,861 in 1990 to 580,124 in 2016 (Malaysian Automotive Association, 2017). This increase has raised concerns about the consequences of congestion and pollution effects. Generally, an increase in population leads to the increase of transportation use. Consequently, the demand for flights has been increasing. Also, people can afford to travel using air transportation, especially with airfare discounts. Malaysia has an excellent transportation system, and it can be divided into four types of transportation modes which are road transport, rail transport, air transport, and maritime transport (Indati and Bekhet, 2014; Ong, Mahlia and Masjuki, 2012).

1.2.1 Road transport

Many locals and foreigners use road transportation. It can be divided into two types namely private transport and public transport. Private transportation modes refer to the use of private types of motor vehicles (e.g. private cars or private motorcycles). The

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continuous development in Malaysia has increased the ownership of private vehicles. Meanwhile, public transport refers to the key solution of traffic jams on the roads. Public transport consists of road transportation which also includes public transportation: public bus services, railway services (Kereta Api Tanah Melayu Berhad), Light Rail Transit (LRT1, LRT2, monorail) and public taxi services. Based on Ong, Mahlia and Masjuki (2012), public transport makes use of road space more efficiently, and it is considered as a solution for environmental pollution and road traffic.

1.2.2   Rail transport

 The increase in railway track length in Malaysia has been quite slow for the last twenty years as compared to the growth of road network according to Indati and Bekhet (2014). Rail transports in Malaysia comprise of heavy rail (including commuter rail), railway services (Kereta Api Tanah Melayu Berhad (KTM), light rail transit (LRT) and monorail. Heavy rail is mostly used for the intercity passengers while LRTs are used for intra-city urban public transport and some special use such as transporting passengers between airport buildings. Two commuter rail services are connected to Kuala Lumpur International Airport which is KLIA Transit and KLIA Express. The sole monorail line in the country is also used for public transport in Kuala Lumpur, while the only funicular (tram-train) line is in Penang. The rail network of KTM extends from east to west, as well as from the north to the south of Peninsular Malaysia. Ong, Mahlia and Masjuki (2012) reported that the railway's system has progressed to a nationwide single-track network of 1700 km spanning the entire Peninsular Malaysia.

1.2.3   Maritime transport

Peninsular Malaysia, Sabah and Sarawak are covered by sea. Various islands are popular destinations among tourists around the world. Therefore, water transportation is vital for Malaysia to connect people from the mainland to tourist attractions such as Langkawi Island, Redang Island, Pangkor Island and other famous islands in the country. Water transportations mostly use high capacity ferry. Besides that, small boat services are used as water transportation for smaller movement to travel from one island to another. In addition, there are also sea cruises and river cruises which are used by passengers who wish to travel and relax. For export and import activities, a bigger ship is used.

1.2.4   Air transport

The main air transportation in Malaysia includes commercial airlines and freight carriers. In Malaysia, travelling to East Malaysia (Sabah and Sarawak) from Peninsular Malaysia can be done using air transport. Travelling from one state to another in Malaysia can be done either from Kuala Lumpur International Airport or other domestic airports. Malaysia's national carrier is Malaysia Airlines (MAS) and the most popular budget airline in Malaysia is AirAsia. These two airlines fly to various domestic destinations as well as international routes. Other budget airlines in Malaysia

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are Firefly (under Malaysia Airlines) and Malindo Air. Air transportation will be discussed further in the next section (section 1.3).

1.3   Air transportation in Malaysia

Transportation is used to take or carry people or goods from one place to another using a vehicle, aircraft, or ship (Oxford Dictionary, 2017). Nowadays, in modern life, transportation is one of the most important elements in a person's life. The transportation sector in Malaysia can be divided into four different transport sub-sectors namely road, rail, aviation and maritime (Indati and Bekhet, 2014). However, this research only focuses on the aviation sector, particularly on the commercial airlines in Malaysia.

Among developing countries, Malaysia is one of the most active in using air transportation as one of their alternative ways while doing business or any trade. Currently, the demand for air travel has increased tremendously. According to the Boeing Company, the total number of Asian carriers is predicted to reach 14,750 in 2032, up from 5,090 in 2012 (Brandon, 2014). Also, IATA Press (2017) reported that Asia Pacific carriers recorded a demand increase of 8.3% compared to 2015, which was the second-fastest increase among the regions. Thus, the reason for an increase in air travel is mainly because of higher living standards. Rising GDP, and consequently, disposable income and living standards lead to an increase in demand for air travel for both business and leisure purposes (Forbes, 2017). Many people choose to travel for a long-haul holiday or doing business deals with other countries. The second reason is the cost of travel. As air travel becomes cheaper, a larger number of people can afford to use it, resulting in an increase of air transport traffic (Forbes, 2017).

Initially, there are 58 airports in Malaysia, of which 36 airports are located in East Malaysia (island of Borneo) and 22 airports are located in Peninsular Malaysia. Out of 58 airports, only 37 of them are operated to schedule passenger services (ICAO, 2013). There are three types of airports, i) International airport; ii) Domestic airport, and iii) Airstrips or airport for short take-off and landing port. All the information regarding the airports in Malaysia can be seen in Figure 1.4 (airport location in Peninsular Malaysia), Figure 1.5 (airport location in Sabah) and Figure 1.6 (airport location in Sarawak).

Figure 1.4: Airport Location in Peninsular Malaysia
(Sources: Ministry of Transport Malaysia, 2015)

Figure 1.4 shows the location of each airport in Peninsular Malaysia functioning for international, domestic and airstrip purposes. However, the main airports that serve domestic and international flights are Kuala Lumpur International Airport (KLIA) and Kuala Lumpur International Airport 2 (KLIA2), which are located in Malaysia's capital, Kuala Lumpur. Figure 1.5 indicates the airport locations in Sabah and Figure 1.6 presents the airport locations in Sarawak.

Figure 1.5: Airport Location in Sabah
(Sources: Ministry of Transport Malaysia, 2015)
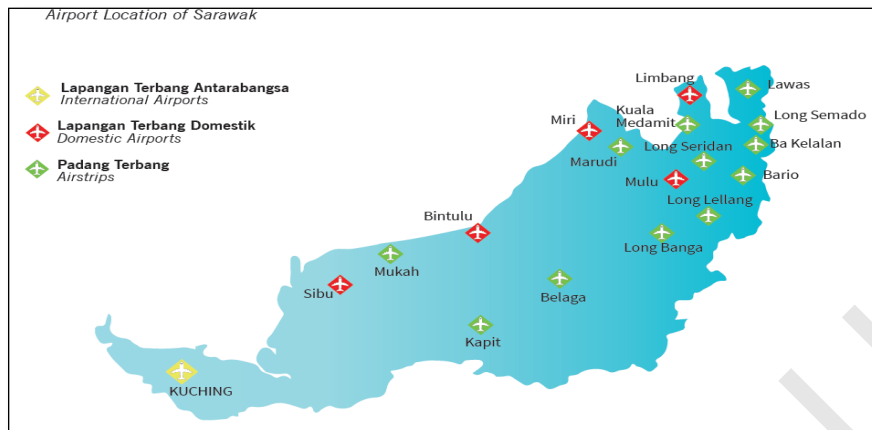
Figure 1.6: Airport location in Sarawak
(Sources: Ministry of Transport Malaysia, 2015)

KLIA is one of Asia's major aviation hubs and is a destination on its own. It is one of the airports that offer various facilities for everyone whether for entertainment, relaxation or business purposes. In fact, KLIA is the largest and busiest airport in Malaysia. KLIA is situated in the Sepang district of Selangor, located approximately 45 kilometres south of Kuala Lumpur City Centre. The airport is operated by Malaysia Airports Holdings Berhad (MAHB). Almost 70 airlines are operating at KLIA in 2015 which includes all flights (domestic + international) (MAHB, 2015).

Kuala Lumpur International Airport 2 (KLIA2) is a new Malaysian airport, located less than 2 km away from the existing KLIA. KLIA2 was built to replace the Low-Cost Carrier Terminal (LCCT). AirAsia moved into KLIA2, and this airport commenced operations effective from 9 May 2014. The Malaysia airport KLIA2 is the new low-cost carrier terminal in Malaysia and this airport hosts budget airlines such as AirAsia, AirAsia X, AirAsia Zest, Indonesia AirAsia, Thai AirAsia, Cebu Pacific Air, Tiger Air, Lion Air and Jetstar Asia. Another proof of why air transport is important is by looking at the number of passengers' movement from and to KLIA, whether by international, domestic, or transit flight which appears to be increasing. The statistics for passengers' movement is as stated in Table 1.1.

According to Table 1.1, the total number of passenger's movement is increasing from 2004 until 2015. The data were only compiled starting from 2004 as it is the first year of AirAsia's commercial operation. The number of passengers' movement increased after AirAsia became one of the commercial airlines in Malaysia. However, there are also other Malaysian commercial airlines apart from MAS and AirAsia which are Firefly and Malindo Air.

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Table 1.1 : Passengers' movement at Kuala Lumpur International Airport
(2004 - 2015)

Year	International	Domestic	Transit	Total
2004	14,777,814	23,544,270	1,108,562	39,430,646
2005	16,566,435	23,948,120	1,056,079	41,570,634
2006	17,651,866	23,955,547	860,543	42,467,956
2007	19,670,834	24,878,600	636,525	45,185,959
2008	20,723,584	26,158,770	565,522	47,447,876
2009	22,740,774	28,060,843	533,690	51,335,307
2010	27,658,727	29,570,367	700,371	57,829,465
2011	30,441,067	32,922,125	646,466	64,009,658
2012	32,379,493	34,275,100	541,127	64,009,658
2013	37,894,553	41,131,669	560,862	67,195,720
2014	39,780,623	42,981,566	585,814	79,587,084
2015	40,044,823	43,784,946	590,000	83,348,003

(Sources: MAHB, 2004-2015)

The aviation sector in Malaysia is mainly divided into two categories which are commercial airlines and also freight carriers (Indati and Bekhet, 2014). According to Zainol and Romle (2007), the airline industry focuses more on providing services and can be divided further into four main areas of services which are passenger services, baggage or cargo services, engineering services and catering services. Passenger service is the area of service selected for this study because it is part of the commercial airlines. There are two types of commercial airlines in Malaysia, namely country's flag carrier, and low-cost carrier (LCC). Country's flag carrier is referring to Malaysia Airlines (MAS) (O'Connell and Williams, 2005) and LCC consists of five airlines in total (AirAsia, Berjaya Air, FireFly, MASwings and Malindo Air) (Yee and Pei, 2014).

Air travel is needed in Malaysia, not only for international destinations but also when travelling within Malaysia, from Peninsular Malaysia to East Malaysia (Sabah and Sarawak) and vice versa. Due to this situation, the need to travel using air transport or ships are the only options available (Man and Justine, 2011). Due to this problem, the first flights in Malaysia operated in 1947, travelling within domestic destinations in Malaysia. There are a few airlines in Malaysia that have commenced their operations recently. Table 1.2 shows the list of all Malaysian airlines, including commercial airlines, cargo airlines and also charter airlines.

All flights were registered under The International Air Transport Association (IATA) and The International Civil Aviation Organization (ICAO). IATA represents almost the entire air traffic of the world's airlines (which is 83% of total) and helps any aviation activity, as well as formulates industry policy on critical aviation issues. There are about 271 IATA airline members from all over the world. The primary mission of IATA is to represent, lead and serve the airline industry. Next, ICAO was established in 1944 with the objective of dealing with the administration and governance of the Convention on International Civil Aviation (Chicago Convention). About 191 Member

States and industry groups work with ICAO and the central vision of ICAO is to achieve the sustainable growth of the civil aviation system.

Table 1.2 : List of airlines in Malaysia

No.	Airline	Commenced Operations	IATA	ICAO
Commercial Airlines				
1	AirAsia	1996	AK	AXM
2	AirAsia X	2007	D7	XAX
3	Berjaya Air	1989	J8	BVT
4	Firefly	2007	FY	FFM
5	Fly Mojo	2015	-	-
6	Malindo Air	2013	OD	MXD
7	Malaysia Airlines	1972	MH	MAS
8	MASwings	2007	MH	MWG
Charter Airlines				
1	Eaglexpress	2012	-	EZX
2	LayangLayang Aerospace	1994	-	LAY
3	MHS Aviation	1983		
4	Sabah Air	1975	SA	SAX
5	Weststar Aviation	2003	-	-
Cargo Airlines				
1	Gading Sari	-	3G	GSB
2	MASkargo	1972	MH	MAS
3	Neptune Air	2009	N7	NEP
4	Raya Airways	1993	TH	RMY

(Source: Malaysia Airports Sdn. Bhd. 2017)

Table 1.2 divided the list for different types of airline services in Malaysia. It consists of the commercial airlines, charter airlines, and cargo airlines. Not all of the listed airlines above are actively operating at the moment. There are only a few airlines that operate as commercial carriers in Malaysia, for example, MAS, AirAsia, Firefly, Malindo Air, and MASwings.

Malaysia Airlines has another two subsidiary airlines, which is Firefly and MASwings. MASwings only focuses on intra-Borneo flights, and Firefly focuses on tertiary cities. This study will only focus on people who travel using MAS and AirAsia because these two airlines dominate the air transportation service in Malaysia, and these airlines operate and fly to both domestic and international destinations. Besides that, these two carriers recorded the highest number of passengers each year.

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1.3.1 Malaysia Airlines (MAS)

Malaysia Airlines (MAS) is owned 90% by the government, and it is the country's flag carrier (O'Connell and Williams, 2005). MAS is the national carrier of Malaysia, offering the best way to fly to, from and around Malaysia (Malaysia Airlines, 2015). Initially known as Malaysian Airways Limited (MAL) in 1937, this airline started to operate their first flight in 1947 and transformed from being a domestic carrier into an international carrier in the same year (Seatmaestro, 2016). However, in 1973, Malaysia Airline Limited was introduced by Malaysia and afterwards it was renamed to Malaysian Airline System, or just simply Malaysia Airlines (MAS). MAS was registered under ICAO as MAS and under IATA is MH.

MAS started operating at KLIA from 1998 until today. Today, the airline flies almost 50,000 passengers daily to over 100 worldwide destinations, competing with AirAsia to become the number one airline in Malaysia. The airline is owned and operated by Malaysia Airlines Berhad since September 2015. As a member of Oneworld® Alliances, MAS offers a travel experience around the world, in more than 150 nations to all passengers. Apart from that, MAS provides special privileges and rewards for frequent flyers (Malaysia Airlines, 2016).
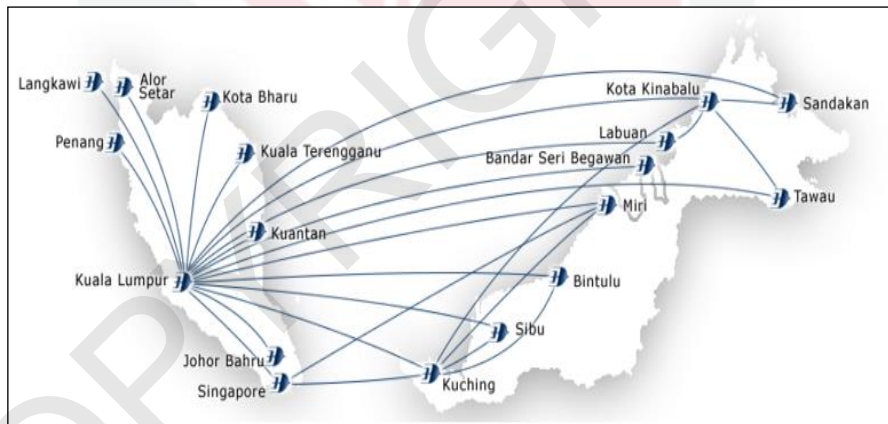
Figure 1.7: Domestic Routes for MAS
(Source: Airline Route Maps, Malaysia Airlines Domestic Route 2016)

The MAS routes for domestic destinations stands at about 40 destinations including Sabah and Sarawak. Figure 1.7 shows the map of domestic routes for MAS. Malaysia Airlines operates scheduled services to local destinations including Alor Setar, Kota Bharu, Kuala Terengganu, Penang, Sabah and Sarawak, etc.
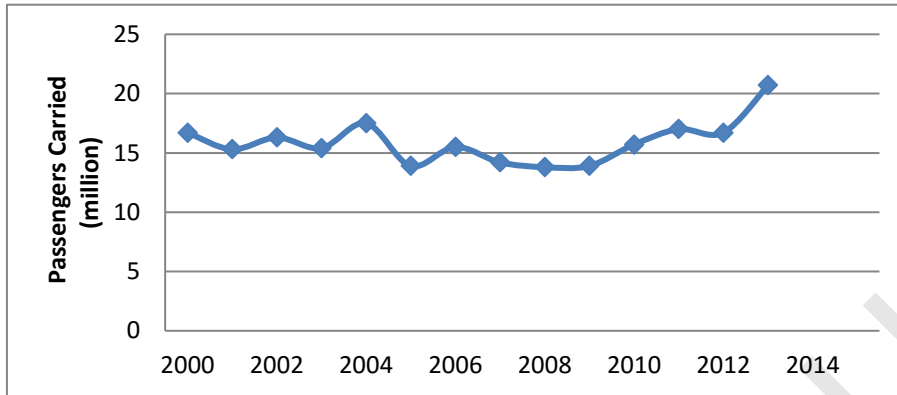
Figure 1.8: Malaysia Airlines (MAS) Passengers Carried
(Source: MAS Annual Report, 2000-2015)

Figure 1.8 demonstrates the trend of passengers carried for Malaysia Airlines (MAS) starting from 2000 until 2013, as the latest statistic was obtained from the MAS' annual report for 2014. Starting from the year 2000, the number of passengers carried by MAS is uneven, where it increased and decreased every year starting from the year 2000 until 2013. Beginning in 2006, the number of passengers dropped every year until 2011. This may be due to the promotion introduced by its competitor which is AirAsia, the low-cost carrier. MAS has their own passengers' characteristic and most of the time, their passengers are among government employees. MAS enjoyed its status as the only airline that monopolised the air travel industry in Malaysia and also the nation's flagship carrier since 1974. However, since 2001, when AirAsia began to enter into this industry as a low-cost carrier, MAS faced stiffer competition in the aviation industry (Ong and Tan, 2010).

1.3.2   AirAsia

AirAsia is the first low-cost carrier in Malaysia. Under the leadership of Tony Fernandes, this airline commenced operations in 2002 and during that time, its base was at the Low-Cost Carrier Terminal (LCCT), Kuala Lumpur. AirAsia was registered under IATA using the code AK and under ICAO, it used the code AXM. "Now Everyone Can Fly" is the slogan for AirAsia to promote its flight tickets to customers at the lowest price compared to the full-service carrier. This airline started domestic operation to various destinations within Malaysia which never had any air connection before, linking them with the nation's capital, Kuala Lumpur (Roy, 2014). However, Fernandes's vision of AirAsia turned it to become one of the well-known airline brands in the world (Poon and Waring, 2010). In 2002, AirAsia was the first to introduce ticketless travel in Asia, allowed customers to purchase a ticket using credit cards, and the purchase can be made through their phone. Next in 2003, it was the first airline to introduce SMS ticketing and started to enlarge their market by adding the very first international flight to Phuket (Roy, 2014). In 2007, Air Asia began to offer long-haul flights to international destinations under another airline, AirAsia X.

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In the year 2015, AirAsia has operated over 221 routes, out of which 75 unique routes are not served by any other airline (Figure 1.9) (Air Asia, 2015). Indeed, AirAsia has widened its network across Asia and Australia where it is represented by AirAsia Indonesia, Thai AirAsia, Philippines AirAsia, AirAsia India, AirAsia Japan, AirAsia X, Thai AirAsia X and Indonesia AirAsia X (AirAsia, 2016). According to AirAsia's annual report 2015, the total number of guests carried is 50.7 million, including a number of passengers from Thai AirAsia's group, Indonesia AirAsia's group, Philippines' AirAsia's group, AirAsia India's group and Malaysia AirAsia's group. Malaysia AirAsia's passengers in 2015 stands at 24.3 million, and this number has increased since its inception. Figure 1.10 shows the total number of AirAsia's passengers from year to year (2005 until 2015) (AirAsia 2005, 2006, 2007, 2008, 2009, 2010, 2011, 2012, 2013, 2014, 2015).
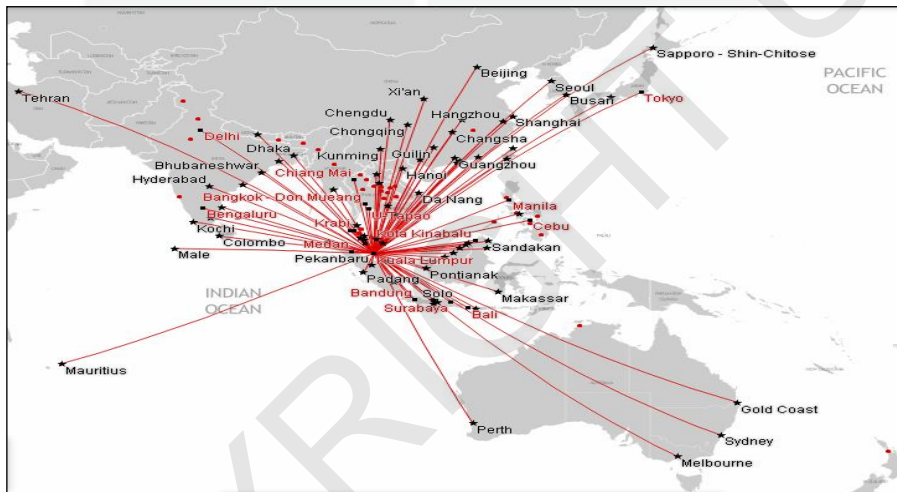
Figure 1.9 : Air Asia Routes Map from KLIA2
(Source: AirAsia.com 2016)
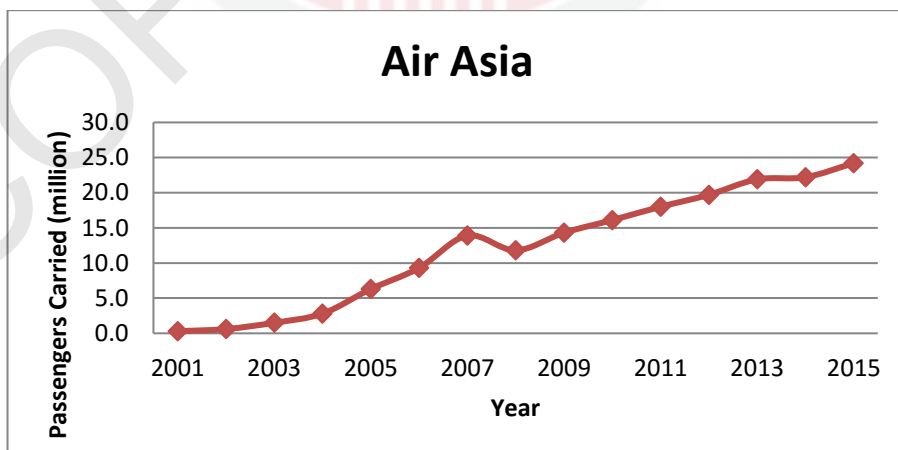
Figure 1.10 : Passengers Carried by AirAsia
(Source: AirAsia Annual Report 2000-2015)

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Figure 1.10 shows the trend of passengers carried by AirAsia starting from 2001 until 2015. Passengers carried by AirAsia in 2001, which is the first year of operation is only 0.3 million passengers. The number of passengers keeps increasing until today (based on data as at 2015). AirAsia's marketing strategies have been successful as the number of passengers carried keeps increasing from year to year. One of the techniques employed is by running an advertisement, offering free flights on many occasions (AirAsia, 2014) and by utilizing online networking, in order to get closer to their fans, make travellers feel like they are a part of AirAsia's family and with that, AirAsia spread the market with web-based social networking (AirAsia, 2014).

1.4 Airlines carbon offset programmes

Since aviation is a sector that increasingly contributes to climate change due to the rapid development of the industry (Mair, 2011), the aviation industry contributes to the share of greenhouse gas (GHG) emissions as the speediest source compared to other emissions sources (The Economist, 2006). Even though airlines get a terrible environmental rap of fuel-burning emissions, some airlines have made a few strides in reducing their travelling mileage, where flights produce high carbon footprints. According to Gössling et al., (2007), there are different measures which are now under discussion to decrease GHG discharges from the aviation industry and some of the steps taken are by technological changes (using alternative fuels), structural change (air travel administration) and government development like emissions taxes and emission trading schemes.

While most of the above steps have been implemented, there is another method that is being considered by the aviation industry currently. Voluntary carbon offset (VCO) schemes are one of the proposed plans that is increasingly used. The main aim of this VCO is to change over, convert or 'neutralise' the emissions released from some specific movement, by compensating or transforming it to other environmental-friendly projects in another segment (Blash and Farsi, 2002). Recently, the VCO programmes are getting popular especially in the aviation industry. The United States and Europe are the nations that have many eco-friendly airlines (Seatmaestro, 2017).

Those carriers in the United States and Europe have been making a few strides in reducing their fuel utilisation or being more fuel efficient in which it will have a lesser impact on the environment in general. However, there are also some airlines, called eco-friendly airlines, which promotes cabin services as a green in-flight service. Besides, some of the eco-friendly airlines also make use of green design (less paint, utilising white shading), employing waste-reduction programme (recycle and reuse the waste), using local ingredients for meal preparation, offering sustainable food, and giving eco-friendly hand towels on all flights (Chen, 2013). Besides, the eco-friendly airlines also urge passengers to utilise reusable chopsticks, or bringing it from home, give out reusable cups for in-flight use (Chen, 2013) and they also provide carbon offset options for customers (ICAO, 2007). In the context of the aviation segment, airlines, for example, Qantas, Jetstar and Virgin Australia are airlines that as of now offered VCOs to their customers, accredited by Carbon Neutral Program. Table 1.3 shows the list of air carriers that engage in the VCO programme.

Table 1.3 : Top U.S. and European airlines with eco-friendly services

United States	
Alaska Airlines (3 leafs)	United Airlines (3 leafs)
Jet Blue (3 leafs)	Delta (2 leafs)
U.S. Airways (2 leafs)	Southwest (2 leafs)
Air Canada (1 leafs)	American Airlines (1 leafs)
Europe	
Air France (top European eco-friendly)	British Airways (3 leafs)
Lufthansa (3 leafs)	Virgin Atlantic (3 leafs)
Easy Jet (3 leafs)	Cathay Pacific (2 leafs)
Ryan Air (2 leafs)	Air New Zealand (1 leafs)

(Source: Seatmaestro, 2017)

Based on Table 1.3, it categorised the airline companies based on country (the U.S and European). There are around eighteen airlines that were recorded and awarded by Greenopia for their achievement of being an eco-friendly carrier in the world. Greenopia is the main online registry for green, sustainable and socially conscious organisations and it provides a platform that independently rates and ranks green services and products. 1 leaf means that airlines have a "solid green commitment" and 4 leaves represent "best in class". According to Seatmaestro (2017), Virgin America earned the title as the most environmental-friendly airline in the U.S., as Virgin America incorporates valuable fuels practices, progress in using an alternative fuel type, participated in recycling programmes, provides green food options, has a green building plan and offers carbon offsets. As some airlines in other countries implemented carbon offsets as their approach to reduce carbon footprint, airline companies in Malaysia also took certain actions in a strategy to decrease carbon emissions.

Part of the action taken by AirAsia to minimize environmental footprint is by charging customers for any baggage checked-in during flight. Passengers need to pay for luggage checked in, unlike baggage carried into the cabin which is free. However, the cabin baggage carried has a limit in terms of its weight, and if passengers exceed the limit, then passengers need to pay for the excess. This condition leads AirAsia's passengers to bring less luggage during travel thus reduces the airline's weight. Besides that, other ways of minimising environmental footprint established by AirAsia is by using the highest grade kerosene fuel which emits less CO_2 than gasoline in cars (AirAsia, 2016). Another step taken is by cooling the flight by switching-off one air conditioner in the aircraft when the ambient temperature in the plane is comfortable. Apart from imposing a condition to bring less baggage, AirAsia already takes further steps in an effort to reduce carbon footprint in its daily operations. #Green24 is one of the climate awareness movements initiated by AirAsia to educate people and promote climate action (AirAsia, 2016). It is one of the social responsibility initiatives undertaken by AirAsia to encourage climate action at home, at the workplace, in cities and the country as a whole. It was launched at the end of 2015, and this programme is still ongoing until today.

Malaysia Airlines also made a move in decreasing carbon emissions from their flights. There is an environmental sustainability management that has been done by this company. MAS is the only airline that launched a voluntary carbon offset programme in Malaysia. Launched in 2008 (MAS, 2015), MAS takes part in enhancing carbon stock and promoting biodiversity conservation. However, this programme is still not showing any progress until today. The latest update on this project was in year 2013, where the project progressed to Phase 3 which is tree planting in a 4 hectare landfill. However, these two airlines are still in the process to ensure that their programme to reduce carbon emission works continuously.

1.5   Problem statement

Generally, the demand for air transportation increases from year after year, due to the number of facilities offered (e.g. low-cost ticket prices, flight services to many countries and electronic services that allow passengers to buy tickets via online ticketing) and the increase in standards of living. According to the World Bank (2017), the number of air travel passengers in Malaysia increased by 391.60% between 1990 and 2015. In 1990, 10.24 million passengers were carried via air transportation; while in 2015, the number was 50.35 million. Air Transport Action Group (ATAG) (2017) stated that there are over 4.1 billion passengers which were carried by the world's airlines and it is expected to grow substantially over the next 20 years because of the huge growth planned in aviation worldwide. However, those increases can lead to the occurrence of the most worrying issue, because it could result in other problems, such as climate change and global warming. Aviation is one of the sectors that contribute to the climate change because it produces hazardous emission sources like carbon dioxide (CO_2) (Mair, 2011; Gossling et al., 2007). Globally, flights emitted 859 million tonnes of CO_2 in 2017, and it is expected to reach 4% to 15% by 2050 (Sustainable Carbon, 2016). The fact that emissions can be identified individually during flying is important for the single or round trip.

Currently, the airline companies are now trying to get more passengers on board by offering cheaper airfares. A study by O'Connell and Williams (2005) revealed that people would shift to the Low-Cost Carriers (LCC) because of the airfare. Similar reason could be found for people who prefer to travel using AirAsia more often than Malaysia Airlines (MAS) (Ong and Tan, 2010). The airline industry is rapidly growing to some degree due to regulatory and taxation policies which does not reflect the real environmental costs of flying. This current price is worrying because it does not reflect the real environmental impact in which the current airfare only includes administration fee, passenger service charge, and services tax (AirAsia, 2017; Malindo Air, 2017; Malaysia Airlines, 2017). There should be a consideration of charging additional payment on top of the airfare to set up a fund to implement a carbon offset programme.

There are a few airlines from all over the world which have already implemented not only voluntary but the mandatory carbon offset programme. According to IATA (2017), more than 30 IATA member airlines have presented an offset programme, either integrated into their web-sales engines or to an outside offset supplier such as Kenya Airways, Thai Airways etc. Only one in ten passengers pay to offset the

emissions from their flight, and less than 1% of its emissions were voluntarily compensated for by passengers in 2014 and 2015 (Qantas Airlines, 2017 and Jetstar Airways, 2017). Even though some other airlines have been successful with this programme, there are also airlines which unsuccessful in implementing the programme, due to insufficient information in the context of carbon offsets. Malaysia is one of the countries which is yet to implement a voluntary carbon offset programme in the aviation industry. Back in 2008, Malaysia Airlines (MAS) was the first airline in Southeast Asia to offer the voluntary carbon offset scheme. However, this programme is considered as a failure and has been discontinued because it did not receive any support from passengers and there is no group to support and promote the programme as well (P. Elizabeth, 22 December 2016).

A previous study has listed potential attributes to be used such as project location, type of projects, and cost or voluntary payment and each of the attributes have different levels (MacKerron et al., 2009 and Choi and Ritchie, 2014). However, not all countries can implement the same attribute because it entirely depends on the passengers' choice. Besides, the cost or voluntary payment also needs to be revised based on passengers' financial circumstances. Thus, there is a need to study which attribute from the passengers' choice is important, and verify the appropriate level of voluntary payment which should be charged.

Chang, Shon and Lin (2010) have explored factors that influence the participation of air passengers in the carbon offset programme, however there is still a low level of participation among passengers in this carbon offset programme. Some of the reasons for not participating is because of passengers' perception that the responsibility to reduce emissions should not be passed to the passengers. Passengers think that the aviation industry and government should be responsible for these issues. This happened due to lack of awareness and knowledge about the importance to take care of the environment (P. Elizabeth, 22 December 2016).

There are a few studies performed to determine the factors influencing passengers' intention to embark on a carbon offset programme using specific attitude, general attitude (pro-environmental attitudes) and intermediate belief as the variable of study (Choi, Ritchie and Fielding, 2015). However, none of these are being carried out in the case of the aviation industry in Malaysia. Major factors that drive Malaysian travellers to be involved with carbon offset programme are not fully identified. Thus, Choi, Ritchie and Fielding (2015) found some limitations on their study where they suggested a consideration to add another latent construct in intermediate belief variables. In order to address this research gap, this research will take into account another latent construct namely variable knowledge to be included into the intermediate beliefs variable for a better understanding about voluntary carbon offsetting behaviour. Hence, if the Malaysian passengers' attitude and knowledge towards the environment improved, there is a good chance that the sustainable passengers' behaviour will improve as well. Generally, when passengers become more environmentally conscious, they will act differently to protect the environment.

1.6   Research questions

Based on the research objectives of this study, the research questions are as follows:
1.   How much value of WTP will be added into the airfare?
2.   What are the determinants of WTP for the carbon offset programme?
3.   What is the value of each attribute for carbon offset programme?
4.   What are the factors that influence the involvement of air passengers in the carbon offset program?

1.7   Objectives

The general objective of this study is to assess the attribute preferences, participation intention and economic value of carbon offset programme among airline passengers in Malaysia
.
Specific objectives:
The specific objectives of this study are as follows:
a)   To determine the carbon offset value of Malaysian airline companies to have a
        better environmental condition
b)   To estimate the value of attributes for carbon offset and the socio-
        demographic determinants of willingness to pay
c)   To examine factors influencing the involvement of air passengers in carbon
        offset programme

1.8   Significance of the study

High demand for air transportation is expected to undergo substantial changes in future. This expectation happened because the total number of passengers keeps increasing from year to year. Thus, it may lead to a severe environmental problem which is climate change. Airline companies can then take action to control the environmental issues together with the response regarding the environment among passengers. To avoid this problem, airlines may impose an environmental tax or payment through the airfare, and it is important to know how much passengers are willing and able to pay for environmental care. Hence, this research will provide complete information about passengers' willingness to pay for carbon offset. The information can help the airlines companies and also assists in making a better estimation of the amount to charge the passengers.

Identifying passengers' preferences for the attributes of voluntary carbon offset projects will provide valuable information to any related stakeholders such as the aviation industry, government agencies such as Ministry of Transportation, Ministry of Natural Resources and Environment (NRE) and Forest Research Institute of Malaysia (FRIM), and together with Non-Governmental organization (NGO) such as Malaysian Environmental NGOs (MENGO). This information will help to provide a specific type of voluntary carbon offset (VCO) project to be implemented in the real aviation industry in Malaysia. Discovering the passengers' preferences towards VCO projects may help in assessing the level of each attribute and defining which attribute is the

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most preferred by passengers. These attributes will represent on which attribute that passengers understand and know the benefits of that projects. Besides, the monetary value or the price charged for these projects will give hope to the aviation industry regarding a way to reduce or prevent the emissions released by its players.

A stated preference economic valuation can be used to provide information for the aviation industry for it to become a more sustainable industry in Malaysia. It gives the management of the airline, government and other related parties with the necessary information to take any drastic actions. Carbon offset programmes are useful for any organisation to adopt. This study aims to encourage people to contribute money to make this program happen and achieve the carbon reduction goals to support the move towards a low-carbon economy. The stated preference method will be used in this study. The CVM is the most commonly used stated preference approach. This study will focus on the logit model because a dichotomous CVM is present in linear regression. In CVM, a respondent will learn about some situation (e.g. carbon offset programme) and the reason they will be charged. To date, there has not been many similar studies conducted using CVM for the carbon offset programme in Malaysia's aviation industry.

The application of economic valuation using choice modelling (CM) and the contingent valuation method (CVM) have been widely used in developing countries (Naidoo and Adamowicz, 2005). Malaysia also started to increase the number of studies using economic valuation of environmental goods and services in the country. Begum, Siwar, Pereira, & Jaafar (2007) used an open-ended CVM to find the WTP value for improving the construction of waste management. Kamri (2013) applied the CVM for the conservation of natural resources in Gunung Gading National Park, Sarawak and Afroz & Masud (2011) studied a solid waste management facility in Kuala Lumpur, Malaysia.

However, there is still not much research in Malaysia on economic valuation using the choice modelling (CM) approach. Studies which combine both stated preference methods (CVM and CM) are also still limited in terms of number of studies published. This will be added to the body of literature in the application of estimating the value of willingness to pay among Malaysian passengers towards carbon offset projects. The use of these techniques will be the first in applying CVM and CM to elicit the WTP for a carbon offset programme in the Malaysian aviation industry.

1.9   Organization of the study

The remaining chapters are organized as follows: Chapter 2 elaborates on the literature review used in this study, including all past studies about using choice modelling method, structural equation modelling, the variables used in the study and the justification of each method used. Chapter 3 discusses the methodology used in this research, which is related to the economic valuation. The model specification, the framework of the study, structuring of the questionnaire and the sampling method of the research are also presented in this chapter. Analysis of the study results and discussion are provided in Chapter 4 to answer the research questions drawn in this study. Finally, in Chapter 5, the summary and conclusion are drawn, and policy implications are inferred from the study results.

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