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臺灣旅遊吸引力的決定因素:從西方遊客的觀點
Determinants to the Attractiveness of Youth Tourism in
Taiwan: From the Perspective of Western Tourists

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中華民國 105 年 07 月

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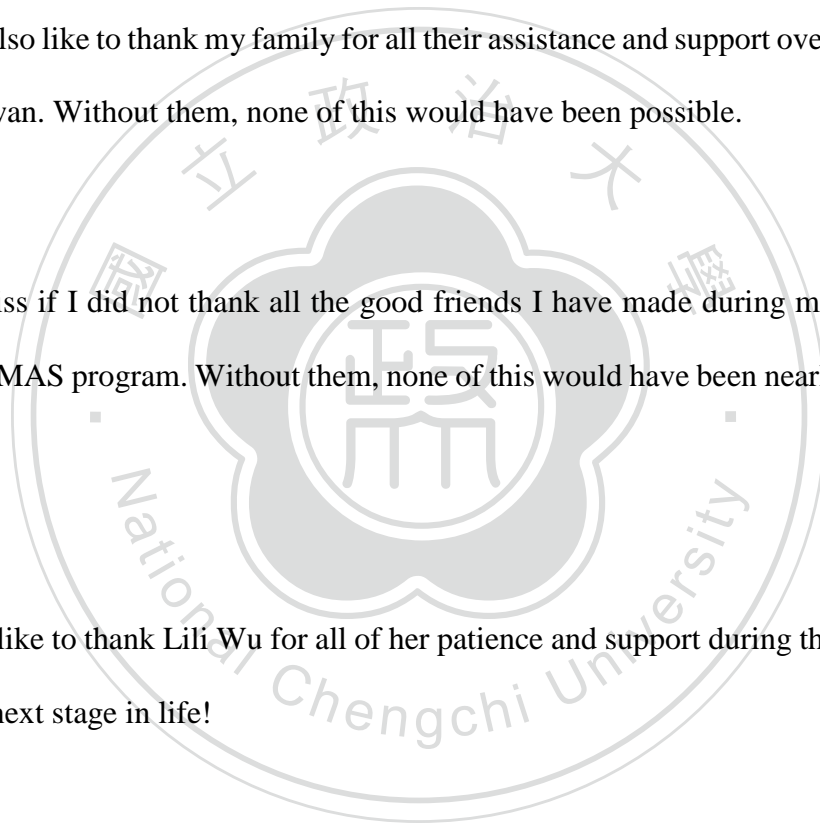
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Now on to our next stage in life!



Abstract

North American and European tourist inflow to Taiwan has been nearly stagnant for almost a decade, while China's tourists have seen a clear upward trajectory. This thesis aims to determine the travel factors that are preferred by youth tourists aged 20-30 from Europe and North America by using an in depth statistical survey conducted on tourists while visiting Taiwan. By determining these factors Taiwan's Tourism Bureau can use this information to increase satisfaction rates in youth tourists visiting Taiwan. Findings suggest that security was the largest determinant of travel satisfaction for North American and European tourists when travelling. Domestic travel and accommodations both scored high on the list of preferences for youth tourists. Little tourism research has focused on these two regions and age ranges. This thesis provides new insights.

Key Words: Travel, Tourism, Determinants, Youth Travel, Youth, Taiwan Tourism Bureau, Satisfaction, Destination, North America, Europe

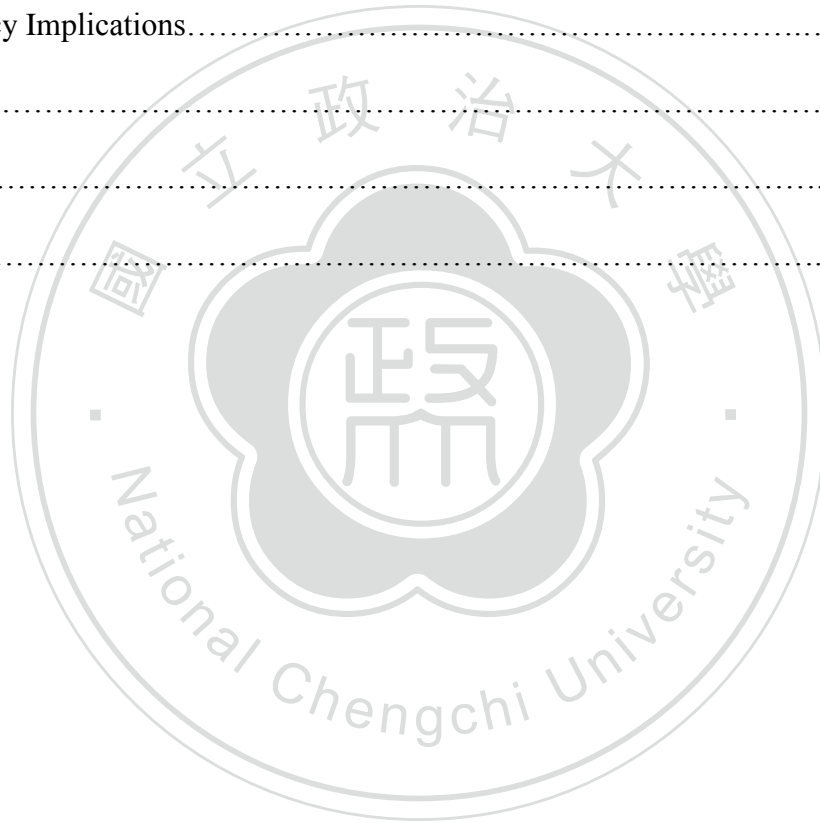
摘要

北美和歐洲的遊客來台量已經將近幾乎停滯了十年，而中國遊客卻出現了明顯的上升軌跡。本文的研究目的是要藉由深入的統計調查，確定來自歐洲和北美的20-30歲青年遊客的旅行因素。通過確定這些因素，台灣觀光局可以使用這些資訊來提高青年遊客來台旅行的滿意度，研究結果表示，安全性對於北美和歐洲的旅客有最高的滿意度，國內旅行和住宿都在青年遊客名單上得分很高，很少旅遊研究都集中在這兩個地區和年齡範圍，而本文提供了全新的見解。



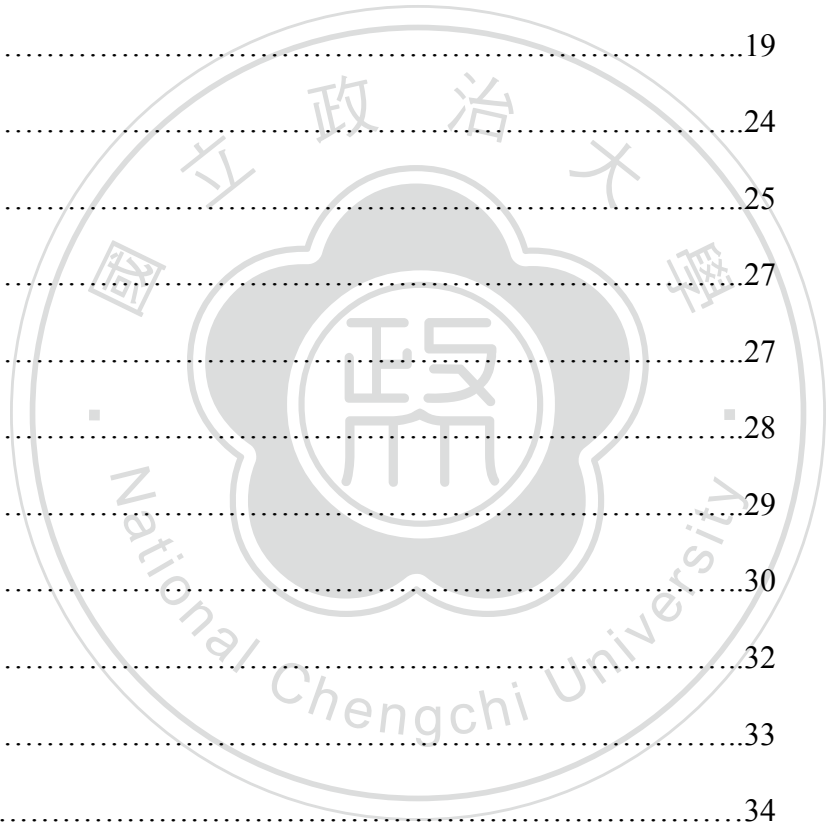
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Chapter 1 Introduction

“What gets measured gets improved” –Peter Drucker

1.1 Background

As the Taiwanese tourism market's inflow increases year over year, the European and North American markets have remained mostly stagnant. Much could be done to make these two markets more aware of Taiwan's tourism image and the opportunities the country has to offer. While Taiwan is not yet a top destination choice for people who travel in Asia, it is considered an emerging market to explore and a place to experience something different. Once a person experiences Taiwan, they will understand why so many news websites publish articles about Taiwan's diverse geography or culinary treats. You can see this perspective mirrored through Taiwan's Tourism Bureau's advertising displayed on their website. Taiwan has a lot to offer, and word of mouth is a powerful tool that has led to many young tourists coming to explore the island for themselves. From its white sand, blue-green beaches in the south, hiking all over the country, mountainous terrain in the central valley for experienced hikers, and surfing in the north, tourists have many options when it comes to soaking in nature and engaging in outdoor activities with unique night markets in each major city, cultural destinations dotted all over the island, authentic Chinese and Taiwanese dishes, and much more, Taiwan has much to offer a traveler from North America or Europe to experience something truly different. Taiwan's unique food is another factor of importance for enticing people to visit because the island offers a large variety and of authentic Chinese and Taiwanese foods. Tourists can taste Taiwan's culture with a wide variety of culinary options. Taiwan is also a rather small island and getting around is quite stress-free. This is a benefit. Youth travelers prefer convenient access to public transportation once at their target destination to get them around the country, especially train lines. North American and European travelers highly value safety when choosing a destination for travel. Taiwan has been recorded as being one of the safest countries, and this should reassure travelers and help them enjoy their time better. When

tourists are visiting the country, they will also feel a sense of security when travelling throughout Taiwan.

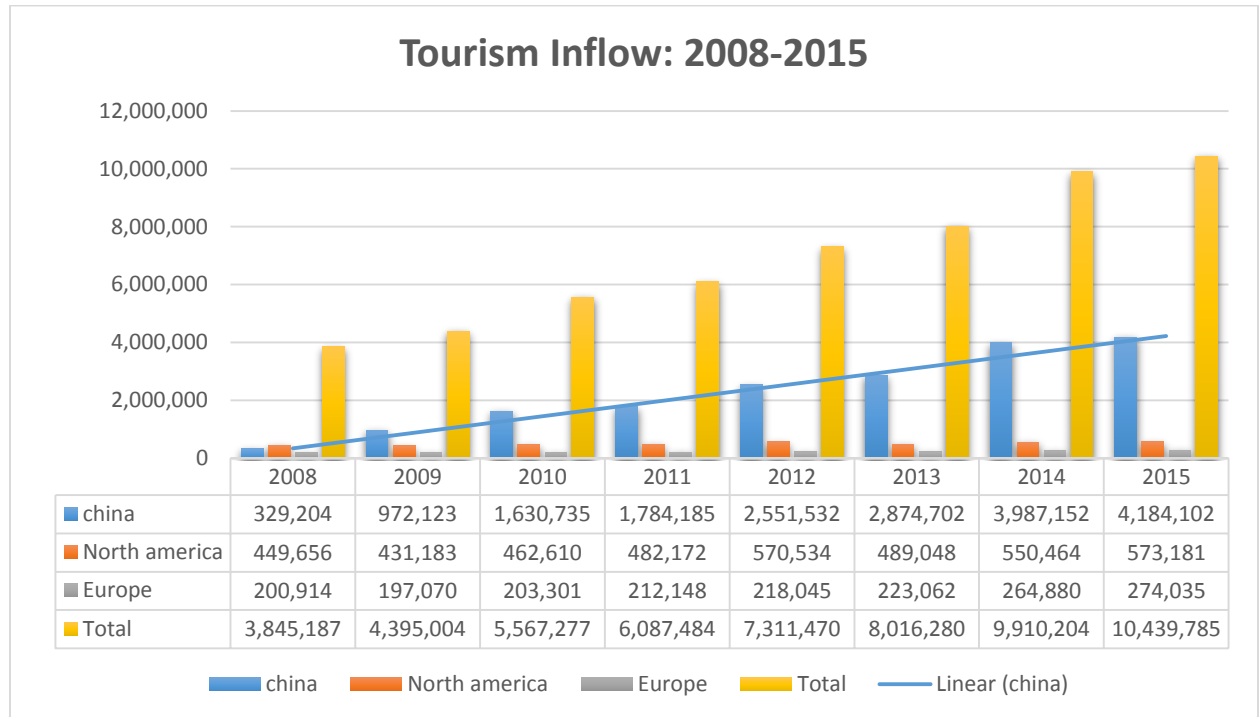
1.2 Purpose of Study

The purpose of this research is to gain a better understanding of determinants that are important for satisfaction in youth tourists (aged 20-30). By the year 2020 there will be almost 300 million international youth trips per year, and a large portion will come from North America and Europe -- with youth travelers likely to return to and give more value to a destination (UNWTO, 2011). Youth tourists on average spend more money and time on their travels than their older counterparts. They are considered a growth market globally, and their spending power is likely to increase (UNWTO, 2016). Therefore it is important to understand the travel preferences of North American and European tourists and their habits when travelling. The more their travel preferences are understood and met, the higher the satisfaction they will have with the travel destination. It has been determined that consumers will have a higher revisit intention if they are satisfied with their previous tourist experiences (Chou, 2013).

To explore factors that can increase or influence satisfaction rates for visitors to Taiwan, this paper employed a questionnaire to detail the stated preferences of visitors. This information is important in determining the likelihood of repeat visits among tourists.

Figure 1-1, Compared to Mainland China, whose tourist inflow has a constant upward trajectory, European and North American tourist inflow has been almost stagnant during the same period of time. The blue line indicates Mainland China's tourist increase, while the red and purple lines indicate North America and Europe, which have seen negligible growth from 2008-2015.

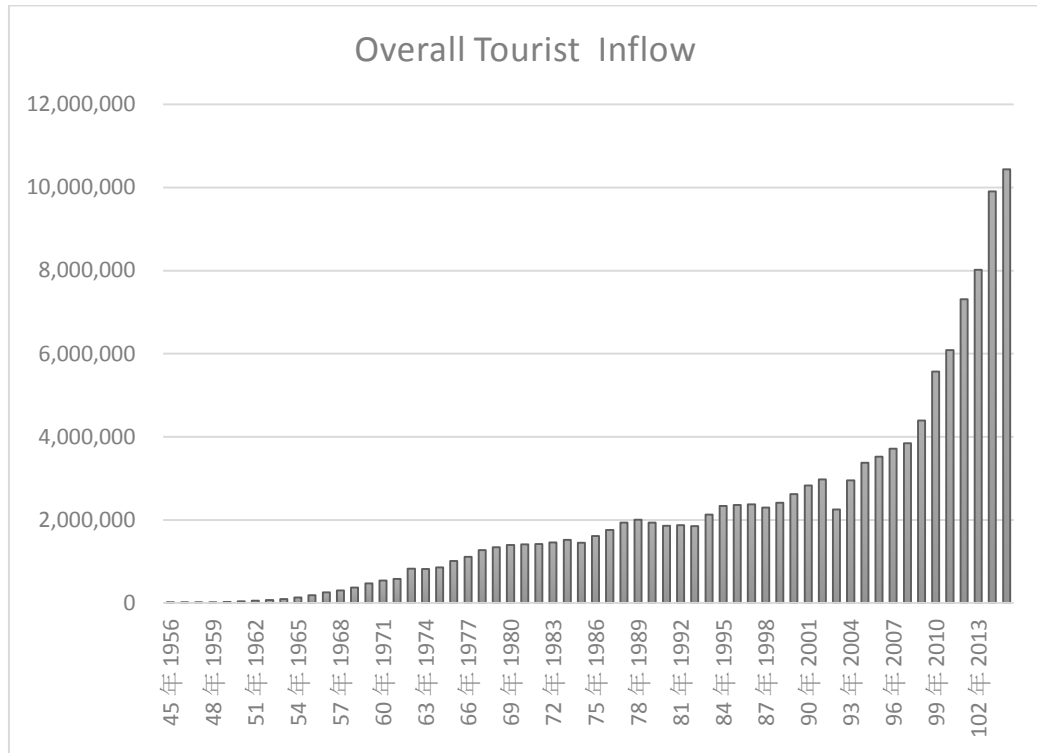
Figure 1-1 Tourism Inflow to Taiwan: 2008-2015.



Source: Taiwan Tourism Bureau

The following two figures display overall tourist inflow from 1956 – 2015. Figure 1 presents tourism inflow statistics starting with 2008, which is when Taiwan and China started to have direct flights with each other (Moore, 2008). Figure 1-2 shows a spike in tourism visitors to Taiwan after the 2008 agreement.

Figure 1-2 Overall Tourist Inflow: 1956-2015



Source: Taiwan Tourism Bureau

To gain further insight, a tourist survey was created to investigate determinants of satisfaction specific to travel to identify various travel preferences in young North Americans and European tourists. The results are discussed in a later section. This data will be available for the Taiwan Tourism Bureau or other government agencies to use and implement to increase tourism inflow from these two regions. This data can be used to inform efforts to modify policies regarding tourism. It can also be used to inform efforts to create or alter advertising strategies to help focus on specific markets. This thesis tries to differentiate itself from other journals and scholarly work by focusing on the individuals' needs and tourist habits. This research attempts to get a deeper understanding of young tourists travel preferences.

1.3 Chapter arrangement

This thesis consists of the introduction, a methodology section, a discussion section, and a conclusion. The literature review discusses information, research, and researchers used to identify the cultural characteristics of North American and European tourists and showing a theory of these two groups travel habits using other researcher's theories. Also, details why the determinants were chosen for the survey administered to respondents. It will go into detail on what outside research was useful, how it contributed to the research, and what aspects were missing or were not answered. The section also includes two interviews performed with tourism bureau representatives, one from Taiwan and one from Germany.

The methodology and data collection section includes detail on the survey design and briefly explains the statistical method applied to the data. The methodology section also includes details on the samples obtained and the method of data collection. This section will also explain how the Analytical Hierarchy Process (AHP) statistics work. Afterwards the section presents the results and analysis showing the reader tourist preferences and the overall ranking of each determinant and sub determinant of satisfaction, followed by a breakdown of each of the determinants and an explanation of why they are considered important for North American and European tourists. Limitations of the research are then presented, as well as a discussion of where future research can be applied to investigate these relationships. A policy suggestion section is intended to assist the tourism bureau with new ideas that can help increase tourism inflow. Additionally, this study conducted nonacademic round table discussions on students' perceptions of Taiwan's tourism bureau, and results of these session are included.

The conclusion reiterates the intent of the thesis and summarizes the results of the thesis. Additionally, it discusses future implications that the results have for informing efforts of the tourism bureau. Additional research that could be studied and methods for further research are also presented and discussed.

Chapter 2 Literature and Theory Review

2.1 Literature Review

The aim of this literature review is to provide relevant information regarding the research question of determinants of attractiveness of tourism destination by the perspective of western tourists. This paper is quantitative by design. While this thesis primarily employs first hand data collected through use of the study questionnaires. The second hand data will be important supplementary data. Data gathered are used to extrapolate on the results of the questionnaire. Most of the second hand information gathered to date has been obtained from international bureaus, literature journals, thesis and dissertation research, and government statistical websites. This review examines the shortcomings of the collected data, and discusses how it fits into the thesis, including questions remaining unanswered, and discuss any new research that can be performed.

2.2 Theory Review

One reason why North Americans and Europeans were chosen for this thesis research involves findings based on Hofstede's (2003) book "Culture's Consequences: Comparing Values, Behavior Institutions and Organizations Across Nations". Hofstede used four national culture dimensions, individualism, uncertainty avoidance, power distance, and masculinity to construct archetypes of national cultural value systems. Then, using Woodside et al. who applied Hofstede's dimensions to the international tourism field. Based on Hofstede's dimensions and Woodside et al.'s application of these dimensions results indicate that western countries and Asian countries have very different behaviors when it comes to travel. The studies showed that Western societies were highly individualistic, less deterred by uncertainty or risk when traveling, and less patient and more assertive when dealing with others, such as workers in the hospitality industry. To highlight the difference, Asian countries had low individualism, avoided risks, and were less assertive. It should be noted that cultures are complex and individuals not always necessarily reflect their country of origin. For travel behaviors, this indicates that North Americans and Europeans prefer not to travel in tour groups, do not mind taking risks (e.g.

adventure tourism, cycling, climbing), and prefer customer services when travelling to be handled quickly and efficiently. This theory can be used in conjunction with the results of the questionnaire, as Woodside et al. shows the characteristics of North Americans and Europeans, while the questionnaire shows what is most important to them when travelling. Used together these two resources can help researchers more accurately understand these two groups of travel behaviors. Additionally, it can help assist the tourism bureau to more accurately target the two groups when making policy or advertising campaigns.

2.3 Youth Travel

Tourism is defined by the World Tourism Organization (UNTWO, 2011) as: “Tourism comprises the activities of persons travelling to and staying in places outside their usual environment for not more than one consecutive year for leisure, business, and other purposes not related to the exercise of an activity remunerated from within the place visited.”

There has been no consensus on what ages are considered youth tourism in the specific literature, and the term has been broadly defined. The term youth seems to have a fluid meaning.

By 2010, an estimated 20% of the 940 million international travelers were youth travelers (Demeter, 2011). The market for youth travel is projected from US\$173bn in 2012 to US\$320bn, and the amount of travelers’ will go from 196 million to 300 million at the same time (Vetrak 2012). In the past ten years youth travel has grown rapidly and has contributed to countries’ economies because of youth travelers spending habits (Demeter, 2014). Most of the data collected on youth travel consisted of detailing how it is an emerging market and suggesting how more youth travelers will increase in number and in their spending power.

ITB Berlin suggests emerging destinations should produce intensive marketing investment to gain more market share and youth travelers. This shows that youth travel is more than just a niche market, and should be taken seriously by governments and companies as ways to incur revenue. The major purpose for travel from youth tourists comes in the form of

exploring and having fun. As youth travelers adopt new technology faster than the older generation, this creates information sharing, customer review, product knowledge, and word of mouth advertising opportunities (Vetrak, 2012).

2.4 Academic Interest: (How the determinants were determined)

Tourist perceptions are important to destination marketing because they will influence a person's choice of where they want to travel (Ahmed, 1991). As most tourists have travelled to a variety of different destinations, much of the perception is influenced by other destinations previously travelled, and comparison of facilities, attractions, and other service standards (Laws, 1995). Determinants for the questionnaire were chosen each for a specific reason. Food was chosen because culture and food can be synonymous (Anderson, 2005) and also gives insight into environmental, economic, and cultural circumstances. A country's history can be tasted in one bite. Nature was selected because the Taiwan Tourism website and the employees who were interviewed for this paper both talked about how attractive the scenery and nature is in Taiwan, and what an attractant it is for tourists. Safety was chosen because, when travelling, people generally think of their safety when choosing a destination. The average age of participants for the survey was 26 years of age. Cost and quality was added because people in this age range are perceived to have a smaller disposable income or depend on their parents for support. Friendliness was added to the survey because the interviewee from Taiwan asserted that while Taiwanese are friendly, but that that road signs and language localization were not as friendly as desired and something that needed to be improved upon. As transportation is needed to get to the destination and once arrived at the destination, it was important to select this determinant. During research and data collection, a very broad approach was applied to tourists. As stated before, most academic papers group all nations together to explain and interpret data relevant to Taiwanese tourism. Therefore, it is believed that because this thesis paper focuses on youth travelers from Europe and North America, this research is a unique contribution to the literature. Secondly, letting these two groups of tourists complete a survey that directly assesses their travel preferences is also believed to be specific research that has not been previously studied.

2.5. Interviews with Tourism Officials

A series of two interviews were conducted with experts in the Taiwanese Tourism Bureau industry to discuss their marketing strategies and how they entice North Americans and Europeans to travel in Taiwan. These interviews ask questions specifically related to these tourist groups.

2.5.1 Interview 1: European Office

The first interview was conducted via email with a representative from the Taiwan Tourism Bureau who resides in Europe who asked not to be identified by name. They were asked which strategies and marketing approaches they implement to attract potential tourists in Europe to travel to Taiwan. Below is a summary of their responses:

The two biggest events that they promote in Europe are the lantern festival and the cycling festival, which came attached with their corresponding promotional websites. The lantern festival was organized to create a unique event like Munich's Oktoberfest or Hokkaido's Snow Festival. We want to create an event that is known and unique on the international level that can attract tourists. It also is designed to show Taiwan culture outside of city life and tries to envision national prosperity and tranquility.

Taiwan also has the cycling festival which the bureau is trying to make Taiwan famous for in having an international-level paradise for leisure cycling. Taiwan's highway system and topography make for amazing scenery along the route. The festival has many activities and a convenient itinerary, and a not-too-difficult riding experience. The festival's goal is to try to attract tourists from around the world who love cycling.

The representative from the bureau also noted that they market and advertise accordingly. The majority of their focus directed towards France, United Kingdom, and Germany, as they are the three biggest current markets. There has been a trend for active travel in Europe that coincides with cycling travel in Taiwan. The representative further stated that within the European market, Taiwan is not widely known. Therefore their job is a combination of

raising awareness of the island and working together with the press to make sure Taiwan has ample coverage.

2.5.2 Interview 2: Taiwan Office

A government official who works at the Taipei tourism bureau office gave insight on how the tourism office in Taipei caters to different categories of tourists. She relates that the bureau tries to promote Taiwan as a tourist destination abroad that foreigners will enjoy. The bureau is primarily interested in cultural differences regarding western and Asian countries. It is divided up into three sections: Japan and Korea market, Asian market, and Western market (Europe, North and South America). Within each market, different strategies are implemented. Westerners need more time and money to travel to Asia compared to many other destinations, therefore the focus is on the older population that presumably has enough money and time to travel to such a location. They also try to attract people with special interests, such as surfing, bird watching, mountain climbing, etc.

In terms of viewing preferences for western tourists, the bureau has taken into account that westerners like to travel on their own, therefore organizations such as transportation systems, natural parks, and others were required to be more English accessible. They have also brought in western associations, such as surfing and hiking associations to write about Taiwan so it will be published on western websites to attract tourists.

The bureau also admits that travel agencies in Taiwan that deal with inbound tourists do not really play a role, as most of them usually cater to group tourists, but the bureau assist in showing these agencies the importance of western tourists. As Taiwan is not a stop over place or cheap to get to, the bureau advertises as such. They do, however, know they could do a better job at attracting tourists.

While Taiwan has a very large number of Mainland Chinese tourists, the number for western tourists is considerably lower. Unfortunately the bureau does not know why this is.

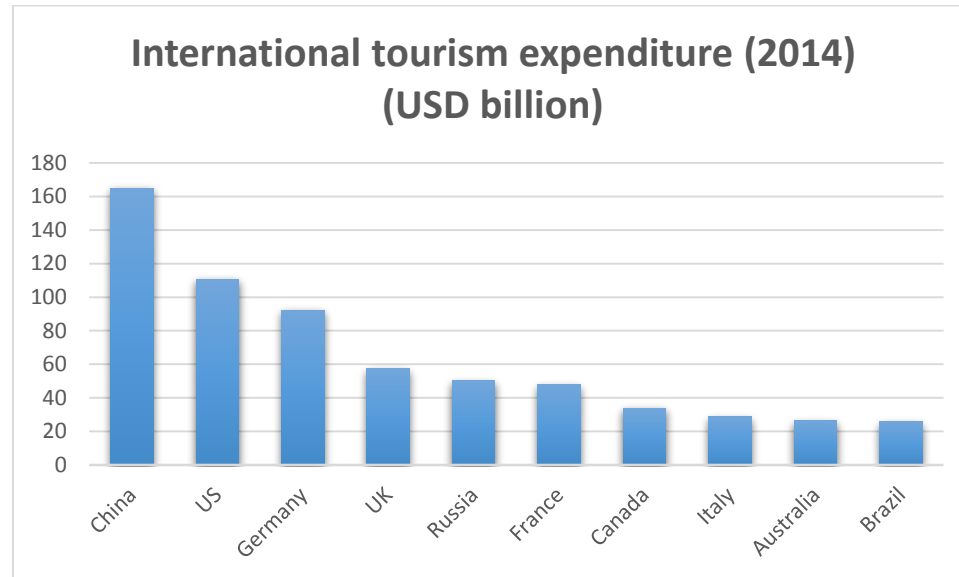
2.6 Statistics

Much of the literature and resources available on Taiwan tourism did not segregate regions or countries in their research. Most of the writings were discussing tourism in Taiwan as a whole, and not individual regions.

With China having the dominant inflow of tourists year over year followed by other countries in South East Asia, due to Taiwan's streamlining of the visa application procedure (Euromonitor, 2014), where does this leave tourists from Europe and North America? As will be shown below, North America and Europe have been almost stagnant in the number of people traveling to Taiwan. With the US and Europe having 8 out of ten of the highest international tourism expenditures in 2014 (Figure 2-1), has Taiwan's Tourism Bureau been looking at strategies to lure in these potential high spending tourists? As was stated in the introduction, China comprises the majority of tourists arriving to Taiwan, but this could lead to an over reliance on one market. Catering too much in one direction has the potential of losing tourists from other countries, and possibly being affected by any policy change from other countries. Starting in March 20, 2016, Beijing states that the number of tourists allowed to Taiwan will drop to under two million (Straitstimes, 2016). This impact could possibly reduce the number of overall tourists arriving to Taiwan by twenty percent.

While the survey conducted for this research provided the primary data for this paper, it was also necessary to collect secondhand statistics from other credible sources. Data from the Taiwan Tourism Bureau (M.O.T.C) was helpful in analyzing tourism inflow for North America, Europe, China, and every country combined. Total tourist inflow from 1956-2015 was straight forward, but when trying to ascertain individual countries or regions inbound to Taiwan, the data had to be extracted from individual spreadsheets and manually input to attain the results needed. The data from the MOTC proved valuable in showing that North American and European tourists, while having a slight uptick in travel to Taiwan has remained between 450,000-570,000 and 200,000 and 275,000 tourists per year, respectively, from 2008-2015 (MOTC, 2015).

Figure 2-1 International Tourism Expenditure by Country of Origin.



Source: United Nations World Tourism Organization.

Additionally, the Euromonitor Passport journal on “Tourist Attractions in Taiwan” broke down its categorical data into seven different categories (e.g., leading tourist attractions by visitors, tourist attractions visitors by category, future forecast tourist attractions by sales/category, etc.). This paper grouped all tourists together and did not specify country of origin. It also said that a large portion (Chinese and Japanese tourists) usually arrived as tourist groups. While it mentions this age group (youth travelers), it does not specify if they arrived in groups or as solo travelers. It also does not clarify if these younger travelers are westerners or if it means of every country of origin was included in the data.

While the statistics gathered from Taiwan’s Tourism Bureau, United Nations, World Travel & Tourism Council have all yielded data that is accessible and relevant by using hard statistics to differentiate between countries, this is not the case for other data collected. The Passport Euromonitor papers were less than specific when coming to its collected data. Whether it was who is coming to Taiwan, the destinations most visited around the island, or where the most money was spent by tourists, the paper put every tourists, regardless of country, into one group. It also did not state whether they consisted mostly of group tours

or individuals traveling. While some data such as the growing South East Asian influx to Taiwan was relevant, the statistics did not really help gain any new insight into tourist arrivals into Taiwan. Passport information lumped everyone together as if every tourist is the same, and this was an assumption and limitation that many of these papers had in common.

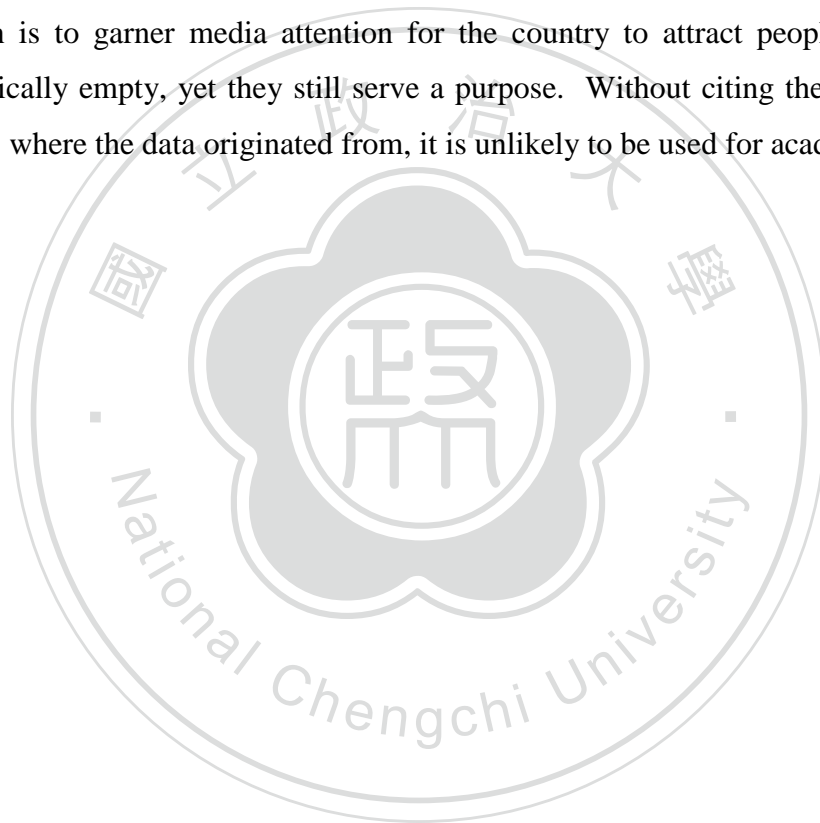
Statistics gathered for this thesis were helpful, but were lacking in a few important aspects. As stated previously, there is little statistical data that breaks down countries regarding inflow to Taiwan. The exception was the Bureau's statistical database. Also, little data was found on tourist's perceptions of Taiwan, satisfaction rates, or return intent for many countries. Many government organizations such as UNWTO have studies that determine what youth tourists prefer, but they do not include any data relating this to Taiwan.

2.7 Articles Promoting Tourism

Many new websites such as CNN, The New York Times, or Esquire frequently publish articles on their websites that highlight certain aspects that make Taiwan unique, interesting, or shows a reason to visit the country. Topics include the popularity of bookstores, the best spot for New Year's Eve, a go-to city for movie production, places to visit, and places and things to eat while on your travels in Taiwan. These articles offer quick, digestible bites of information for the reader to easily digest. These articles also show Taiwan in a positive light, as the articles are pointing out reasons to travel there. News Republic's article "Why Taiwan Offers the Best Road Trip Experience in Asia" points out some amazing places you can go all around the island. It describes the new and exciting places in Taipei while also talking about more historic sites in Tainan. The author talks of the authenticity of Taiwan and how people will see this place with eyes they have never used. In another article, by Tom Bowles, for Esquire magazine, he gushes about how amazing Taiwan's food is and how Taiwan became the hottest food destination on earth. Katie Hunt's article on CNN plays up the recent amount of famous directors and movies being produced in Taiwan, such as *Lucy*, *Life of Pi*, and the upcoming Martin Scorsese film, *Silence*. The New York Times article "Saturday Night in Taipei, and the Cool Kids

are at the Bookstore” highlights the Taiwan owned Eslite bookstore and its cultural phenomenon in Taiwan where the youth are using is at a place to relax, read books and magazines at their leisure, and maybe even find a date; “the cool people are at the Eslite Bookstore...open 24 hours a day.” As mentioned in one of the interviews, these reporters might have been paid for by a bureau of Taiwan’s government to come over here and write positive reviews, but the articles do not indicate this.

These articles have no academic purpose or foundation to solidify the point being made in their articles, but do have a commercial purpose as well as soft power purpose. The intention is to garner media attention for the country to attract people to come visit. Academically empty, yet they still serve a purpose. Without citing the research data or statistics where the data originated from, it is unlikely to be used for academic purposes.



Chapter 3 Methodology

3.1 Methodology

Figure 3-1 is used as a reference in this paper to help understand North American and European youth traveler's return rate intention based off satisfaction. The primary goal is to analyze tourists' travel preferences so the tourism bureau can use the results to produce target market- specific advertising to appeal to specific markets. It can also be used to inform decisions to modify and change policy that could benefit from these results. Cultural style from Woodside's research using Hofstede's dimensional model across nations is used in tandem with the travel habits that derived from this papers' research. Tourism image is the tourist's perception of Taiwan when they were travelling on the island. These three categories help to determine travel satisfaction. The higher the travel satisfaction, the higher the potential for return. Satisfaction level comes from understanding what tourists prefer, and this can then be used to target market advertise

Figure. 3-1 Return Rate as a Function of Elements Leading to Travel Satisfaction



3.2 Questionnaire Design

This paper employed a questionnaire that consists of three sections for the purpose of measuring the components of travel satisfaction for North Americans and Europeans travels in Taiwan and likelihood of revisiting in the future. The survey consists of three parts and in total consists of 71 questions. The survey was administered to tourists and students inquiring about their general travel preference, including that it did not pertain to Taiwan – that information was reserved for the final page of the questionnaire.

The first section consists of 33 questions based on a 9-point pairwise comparison analysis comparing two different factors against each other. This method of analysis is from the Applied Hierarchy Process or AHP. The participants were asked give preference to one choice over the other. The first section includes six different topics about tourism, and topic contained three to five options to choose from. The topics included: Nature, transportation, friendliness, food, safety, and cost and quality. The participant then had to compare each category within each topic against each other on the pairwise comparison to organize and analyze their decisions. This method is used to optimize decision making when trying to obtain results from complicated, irreversible decisions (Alexander). Respondents were unaware that the answers they were giving were being associated to Taiwan, as they were told it was general travel habits. This was done to obtain less biased results. The (1), or neutral choice within the survey can be used for either a respondent who was either on the fence with a decision and did not know how to answer, or they were too conflicted between the two choices because they think both are equally important. The scale for each possible answer ranged from 1 to 9. (1) Neutral (3) slightly favors (5) strongly favors (7) very strongly favors (9) extremely favors.

The participants were given this section with little knowledge, except that it is about tourism, but no specific goal in mind. They were also monitored by a researcher in case any questions would arise. Survey results showed a small few used extremes when choosing their answer, as if it was an either/or choice, but primarily most participants answered the questions with a more across-the-board, less rigid standard.

The second section of the questionnaire is composed of 15 questions and follows the same 9-point scale as that of the first section. In this section, the respondent is now pairwise comparing the overall determinants; each topic as a whole is being compared instead of the categories within each topic. This section's results indicate the more general trends to the factors that show what the respondents prefer when travelling. It was observed that when the respondents were completing the survey, they had a much easier time deciding between items included in the overall section than when having to complete the sub categories from the individual sections. This indicates that people are confident in their general travel habits therefore showing the overall data is more likely to be reliable, and thus safe.

The third section of the survey assesses general information and details of the tourist and their time and travels in Taiwan. This is the only section that directly pertains to Taiwan and the person taking the survey's perception of the country. This part was attached to the end of the survey and was not told to the participant when given the questionnaire. Being attached at the end and not informing the participant was done to avoid any correlation to Taiwan when responding to the previous sections. This section is a one-page containing 23 questions divided into three parts: open ended questions, 1-10 rating scale questions, and binary yes/no questions. These questions are included to get a better sense of travelers perception of Taiwan and supplement section one and section two's results and to allow comparisons from the AHP data to the panel data's additional sub factors, that can better be used to better understand satisfaction rates of those visiting Taiwan and overall return intent. The final question of the survey in section three is "Would you want to return to Taiwan?" By analyzing all the data in sections one and two, and also using the data from section three, we can examine respondent travel habits and perceptions of Taiwan. If the respondent indicate they are willing to return to Taiwan, we can use and can use the combined results to better understand their preferences and satisfaction needs. We can also use the results if the respondent said no to a return visit to Taiwan.

3.3 Analytical Hierarchy Process (AHP)

This paper uses the Analytical Hierarchy Process (AHP) method to assess results from the survey. The AHP statistics method is weighted and not based on probability. AHP was originally developed by Thomas Saaty in the 1970's as a way of dealing with weapons tradeoffs, such as their high costs and a multitude of other factors that conflicted or were not easily specified, and answers that involve difficult choices (Alexander, 2012). It helps decision makers choose the best solution from many different options when dealing with qualitative, quantitative, and even conflicting facts that all need to be taken into consideration. AHP creates a hierarchy of decisions using pair-wise comparison between each of the items paired, and they are weighted to measure the importance the items and criteria have with each other and creates a relative value (Alexander, 2012). AHP provides a mechanism for inconsistencies because human behavior is inconsistent, therefore it tries to compensate. The AHP process is widely accepted for decision making methods. While others have introduced various alternatives, Saaty's original model is still the most widely accepted, as it is considered the most reliable and has even been used for making multi-billion dollar decisions.

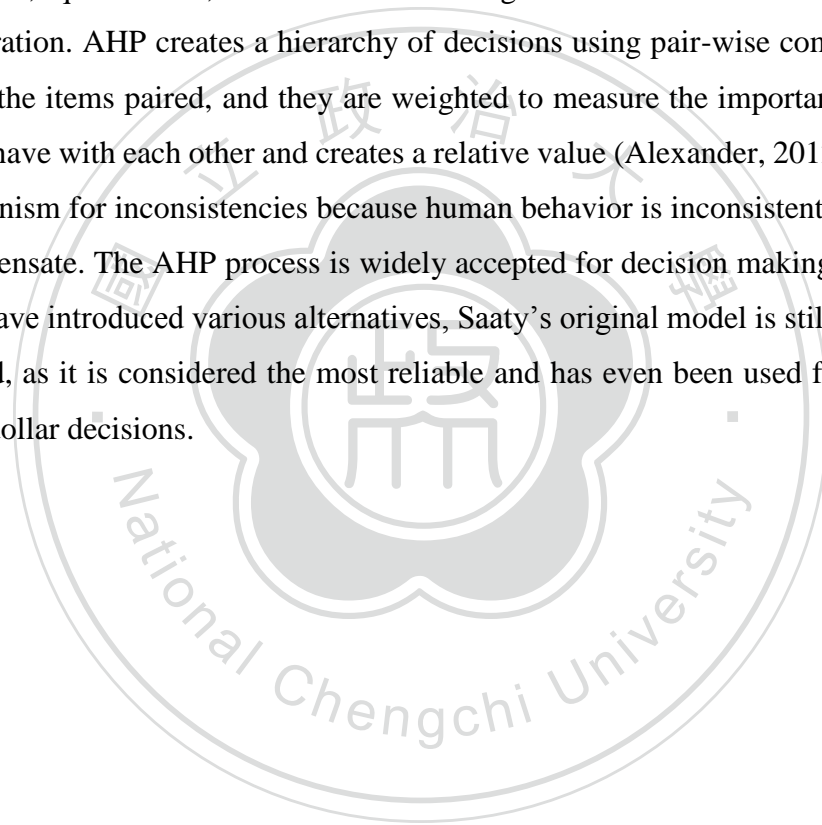


Figure 3-2. Score of Relative Importance

Intensity of Importance	Definition	Explanation
1	Equal Importance	Two activities contribute equally to the objective
3	Weak importance of one over another	Experience and judgement slightly favor one activity over another
5	Essential or strong importance	Experience and judgement strongly favor one activity over another
7	Demonstrated importance	An activity is strongly favored and its dominance demonstrated in practice
9	Absolute importance	The evidence favoring one activity over another is of the highest possible order of affirmation
2,4,6,8	Intermediate values between the two adjacent judgements	When compromise is needed
Reciprocals of above nonzero	If activity I has one of the above nonzero numbers assigned to it when compared with activity J. then J has the reciprocal value when compared with I	

Figure 3-2 shows on either side of the scale the relative importance that each item would have when answering the survey (See appendix 1).

3.4 Sample

As Taiwan sees a little under one million tourists from North America and Europe each year, the capital city of Taipei was chosen as the sample area because it is the most heavily saturated with tourist inflow. Near Sun Yat Sun Memorial Hall and Taipei Main Station were chosen because they are highly visible tourist attractions and destination locations for

the country. As a result, it was easier to find the desired target population. As Taiwan's tourism bureau statistics show (figure. 1-1), inflow from these two regions has been fairly consistent regarding the number of tourist's year over year, As such picking two high profile locations for locating potential participants would have a better chance of recruiting willing tourists to complete a survey.

In addition to recruiting tourists in the two previously mentioned locations, students living in Taiwan who have travelled here previously were also asked to participate in the survey. They were also given no mention that the survey was intended to have any connection to Taiwan. They were also told that it was about general tourism habits. Again, it was not until they filled out the final page did they realize it had any connection to Taiwan.

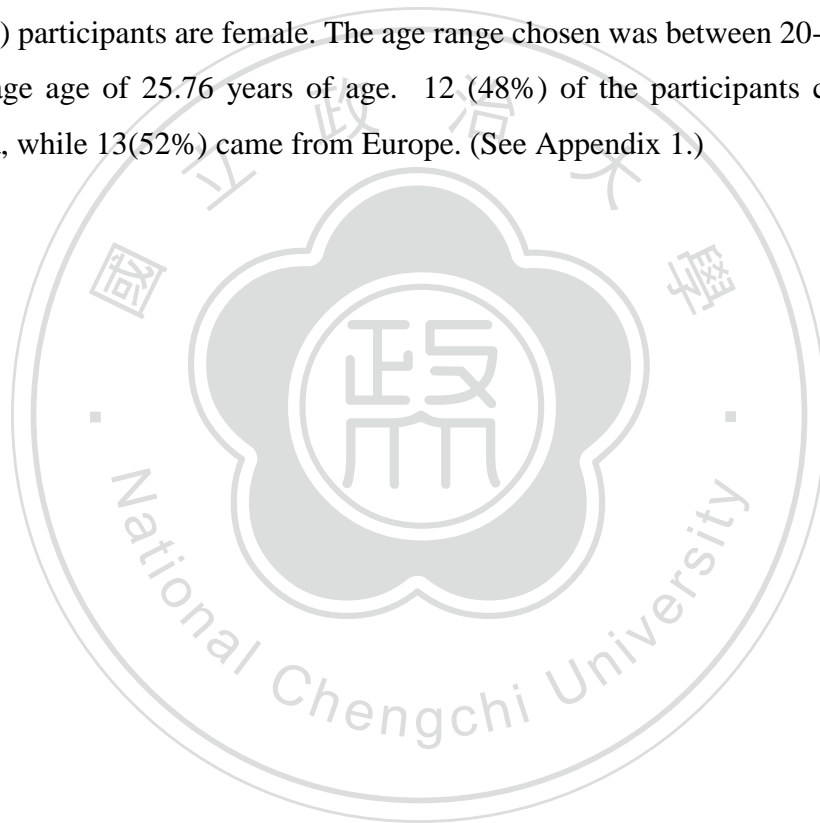
3.5 Data Collection

The sample for this study was composed of European and North American participants who were either visiting or have visited Taiwan at some point. For anyone who took the survey and was not from either of these two regions, their data was not included in the final analyses. The data collection occurred between the months of November and December, 2015. Most of the data was collected over this two-month period. The respondents were approached and asked if they could complete a survey about tourism. The topic of Taiwan tourism was not mentioned. They were then asked if they would be willing to participate in the survey. The willing participants then completed the questionnaire while a researcher stood close by in the event any questions arose.

The most willing participants were European and North Americans between 20 and 30 years old. It was observed that older tourists were much less willing to sacrifice their time to fill out what was considered by many taking it to be a time consuming process. Most of the respondents were individuals, but on occasion groups of friends travelling together completed the survey, although not all group members were willing to fill out the survey. With that in mind, the researcher decided to only select one person from the group to fill out the survey, as this would also yield more varied results than if the entire group were

willing to participate. Participants were selected at random times of the day and wherever was possible, as the researcher carried around multiple copies of the survey at all times. Some surveys were discarded because they were not sufficiently completed. Some surveys were also discarded because the researcher incorrectly perceived the person's nationality, assuming they came from Europe or North America. The researcher did not want to directly ask if someone came from the two regions, as some people might have taken offense to the selectiveness of the survey or the question may have biased responses to the survey.

The Survey was completed by 25 participants. 15 (60%) of the participants are male, and 10 (40%) participants are female. The age range chosen was between 20-30 years old with an average age of 25.76 years of age. 12 (48%) of the participants came from North America, while 13(52%) came from Europe. (See Appendix 1.)



Chapter 4 Results and analysis

4.1 Results and Analysis

Data were analyzed using the AHP methodology. 25 participants met the criteria for inclusion in the study. Results indicated that of the determinants of the survey, safety was the most important. As figure 4-1 shows, safety (.243) was the most important factor for a person when travelling by a noticeable margin. Within the safety dimension, security (.524) was the defining factor of what people want in terms of safety, compared to food safety (.226), which was the second most important factor. As will be explained in a later section, this bodes well for Taiwan, as it is perceived to be one of the safest countries in the world. People visiting Taiwan feel overwhelmingly safe here. Many participants indicated how safe it felt while travelling around Taiwan and how at ease they could be.

Food (.196) had two strong results with authenticity (.443) and variety (.345) scoring significantly, indicating people have a strong desire to eat unique and authentic foods when they travel. Vegetarian (.059) was at the bottom of the list. For the determinant of cost and quality (.182), the determining factor seems to be attractions (.429) for people when they visit. This indicates travelers would like to visit popular attractions, yet not pay too much when visiting. Taiwan has many low cost and free attractions that are in line with this determinant. Accommodations (.281) and transportation (.231) were not as important to the visitor, but are probably be taken into consideration when travelling. Souvenirs (.059) were almost a non-factor as many participants told the researcher that “they did not care” about purchasing gifts for anyone. This could be age related where younger tourists have little interest, but older tourists might favor this factor more heavily. During the administration of the surveys, many people noted that how Taiwan could feel so chilly, yet so wet at the same time during the winter. Even some people from colder climates such as Russia also confirmed this perception. So when it came to nature (.176), it was no surprise when the results showed overwhelmingly that weather (.477) was the most important factor. As Taiwan has a range of cold/wet winters and hot/humid summers, this indicator is important as people have widely different temperature comfort zones. On a more human note, under the friendliness (.121) section, people (.530) were the major determinant, compared to language (.271) and people’s ability to speak the travel destinations mother

tongue. Difficulty reading road signs (.198) when travelling outside major tourist spots was a factor for some. While transportation (.083) was the last determinant on the list, it should still be considered an integral part of travelling. Taxis (.240) and airport access (.239) were of equal importance, but they were not considered nearly as important when travelling as trains (.449) were. This might indicate that when people are visiting a new place, this mode of transportation while travelling is an important variable for satisfaction. While many Taiwanese use motor cycles/scooters (.073) on a daily basis, it seems 20-30 year old North Americans and Europeans had very little desire to rent or use them.



Figure 4-1. Descriptive Analysis of Survey Results

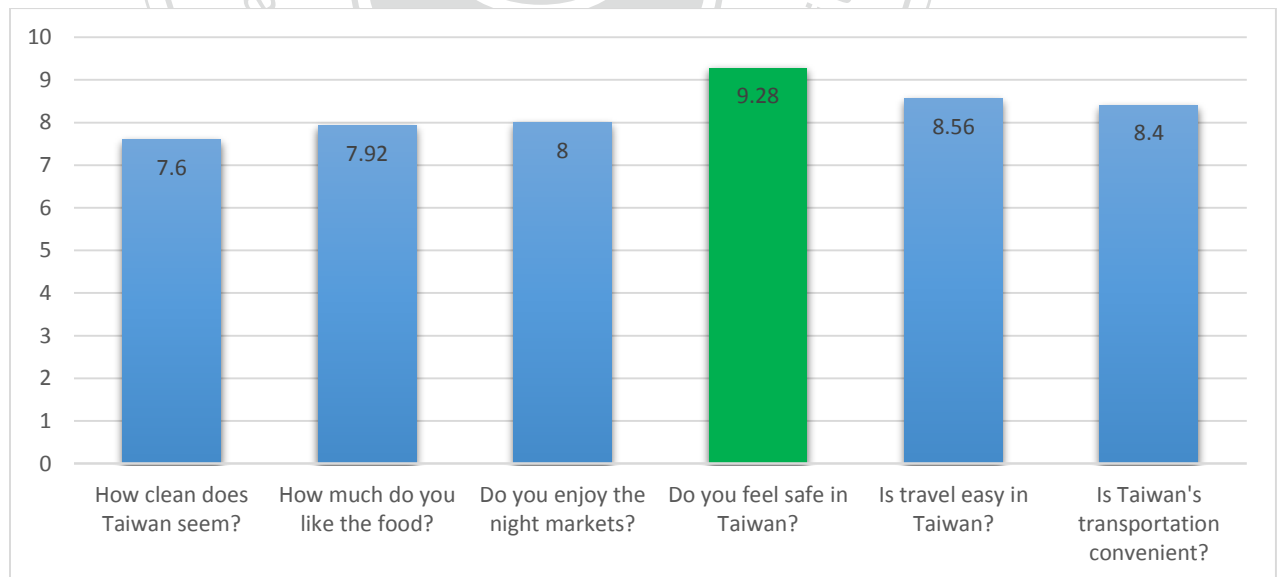
Rank	Item	Prob.	Sub-item	Prob.
1	safety	0.243	security	0.524
			food	0.226
			pollution	0.153
			traffic	0.097
2	food	0.196	authenticity	0.443
			variety	0.345
			healthy	0.157
			vegetarian	0.056
3	cost/quality	0.182	attractions	0.429
			accommodations	0.281
			transportation	0.231
			souvenirs	0.059
4	nature	0.176	weather	0.477
			beaches	0.222
			mountains	0.167
			hiking	0.134
5	friendliness	0.121	people	0.53
			language	0.271
			road signs	0.198
			trains	0.449
6	transportation	0.083	taxis	0.24
			airport	0.239
			motorcycles	0.073

4.2. Taiwan specific results and analysis

As stated above, the last page of the surveyor asked the respondent to answer questions pertaining specifically to Taiwan. As you can see in figure 4-1. of all the questions asked,

the feeling of safety (9.28) was highest ranked. This bodes well for Taiwan, as people feel safe while travelling in Taiwan, respondents said safety was a primary concern for them as a tourist. The Institute for Economics and Peace portrays Taiwan as one of the safest countries in the world, using a range of metrics, such as crime levels, prison population, safety in society, domestic and international conflict, and more. North Americans and Europeans are less concerned with how they get to the destination country, but more concerned with how easy or convenient travel is once they have reached their destination. As for how much people liked the food and night markets, both received high marks as many of the respondents mentioned how different and satisfying the food in Taipei was. Food was highly ranked and many respondents acknowledged they enjoyed the food, but some did admit certain culinary dishes were not to their liking. This did not seem to dissuade them from ranking food highly. Others also made mention of how unique and novel the night markets were when visiting them. The lowest rank was given to how clean Taiwan felt. While it still ranked in at 7.6, this survey was only done in Taipei, thus it is not known if the respondent had travelled to other cities, or they were only visiting Taipei, therefore giving a skewed response with only the one location in mind.

Figure 4-2. Taiwan Specific Survey Questions



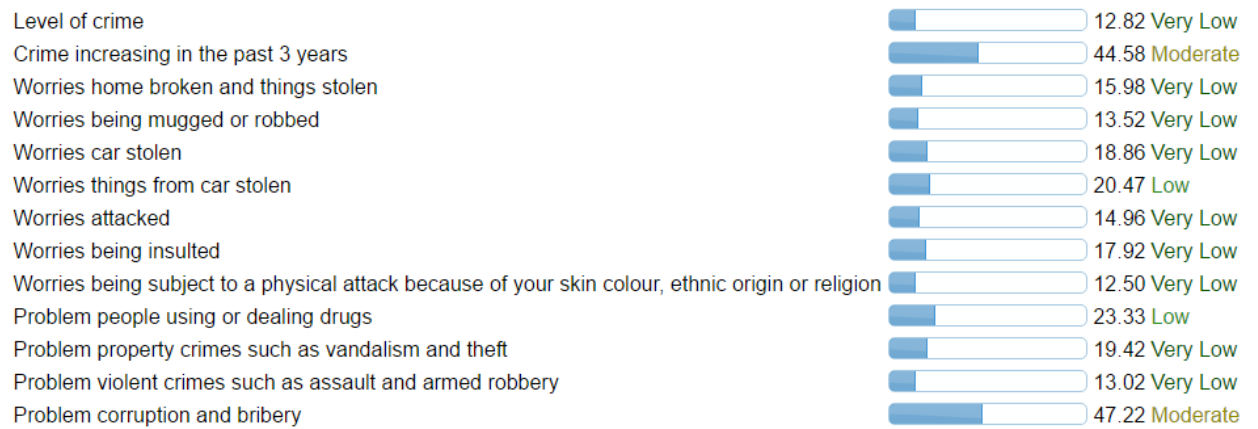
4.3 Safety

Security was regarded as the single most important factor in the whole survey regarding travel. This bodes well for Taiwan, as participants perceived a feeling of safety while in Taiwan, as indicated by the survey and included in the previous chart (9.29/10). While there is no hard data available for ranking Taiwan's safety when traveling to the country, websites such as CNN and lifestyle9.org have compiled data from the 2015 Global Peace Index (GPI) using 23 different metrics, and have determined that Taiwan is one of the safest countries in the world. Indicators for determining Taiwan's safety included: Taiwan has a low crime rating, safe public transportation, low political violence rating, terrorism, and civil unrest was low, among other factors.

To further confirm tourists' perceptions of safety in Taiwan, Numbeo has compiled data on 123 people who have visited Taiwan and asked them their perception of crime rates in the country. The survey is based on a 100-point scale. While the statistics in the graph below are not specific to North American and European tourists specifically, it does help reaffirm the overall consensus of how safe Taiwan is perceived (see figure 4-2). Visitors have indicated that when in Taiwan they feel a very high level of safety when walking around (day or night), and think there is a low probability of being mugged or robbed. They also feel the overall level of crime is very low and are mostly unconcerned with being attacked. In almost every category, the respondents chose Taiwan's safety perception as incredibly low. Interestingly, there was a moderate uptick in what they thought was crime increasing over the past three years. Further research should be done to understand why this trend is so different than the rest of the safety categories included on the chart survey.

Figure 4-3. Numbeo Database (Visitor Safety Perception)

Crime rates in Taiwan



Safety in Taiwan



Contributors: 123

Last update: July, 2016

These data are based on perceptions of visitors of this website in the past 3 years.



Of the 118 countries covered by Numbeos database, Taiwan was ranked fourth safest (See figure 4-4.). It garnered a very low crime index from the respondents (19.52), and at the same time received a very high safety index (80.48).

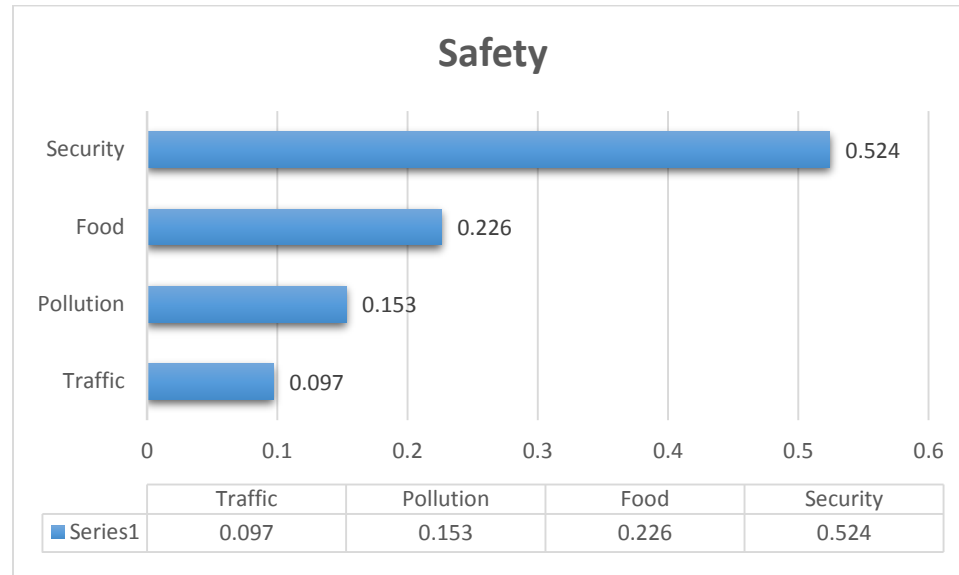
Figure 4-4. Numbeo: Crime and Safety Index

113	Hong Kong	20.31	79.69
114	Japan	19.98	80.02
115	Taiwan	19.52	80.48
116	Georgia	19.26	80.74
117	Singapore	16.49	83.51
118	South Korea	14.99	85.01

Showing 1 to 118 of 118 entries



Figure 4-5 The relative Importance of Safety Factors



Source: Survey Results

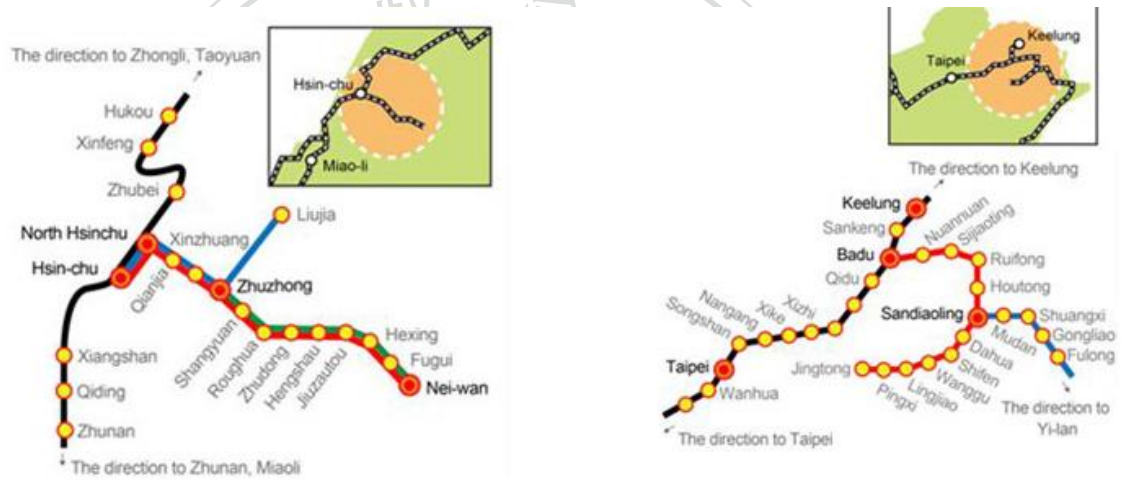
4.3 Transportation

While transportation ranked last on the survey in terms of importance, it is notable that within this section, a majority of respondents said that trains were the most important factor when it comes to transportation. Having an infrastructure of travel destinations that are accessible to railroad routes could potentially increase the number of tourists to target destinations. Taiwan could use the Trans-Siberian railroad or the Canadian National railway system as reference. These train lines traverse large sections of their respective countries and these are both unique and special tourist attractions that draw people to travel to their respective countries. While Taiwan is considerably smaller than these two nations, it does have a rail system that encompasses the island and shows off the many different landscapes and topography Taiwan has to offer. Based on results of this study, travelers don't particularly care how they get to their destination, as taxis and airport access were considerably less important. This suggests that the Tao Yuan airport's Distance to Taipei is not a deterrent. Taiwan has two different and attractive train options. First is the High

Speed Rail (HSR) that runs along the western border from Taipei in the north, down to Kaoshiung City in the south.

Second is the regular train line that runs across the whole island. This train services all the major cities and also goes through a few local routes, such as Pingxi and Neiwan (See Figure 11.). The train route also includes a few scenic routes that travels through forests, mountains, rolling hills, and the outskirts of cities for incredible views. The figure below shows an example of where the local routes are located. Local routes are usually located at a transfer station.

Fig. 4-6. Scenic Train Routes Of Taiwan

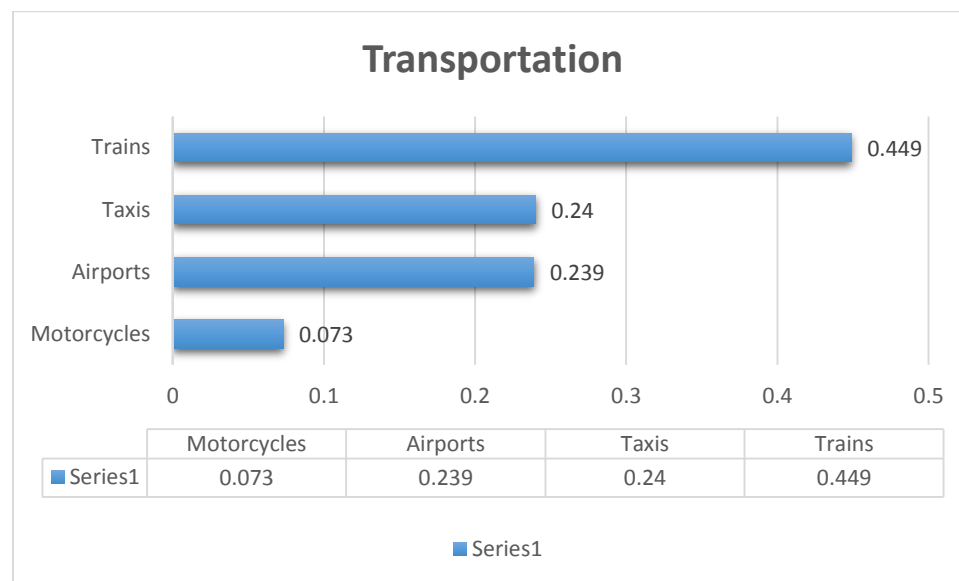


Source: Taiwan Railways Administration

This is a positive for the train industry in terms of youth travelers. The UNWTO indicates that youth travelers engage in travel more as a form of learning and getting to better understand other cultures and lands, while the older generation consider train travel a form of relaxing vacation and do not explore as much. It can be argued that youth travelers would prefer to take a slower train as they can absorb all the scenery that Taiwan has to offer while going to their next destination. A caveat of the current railroad system is the train cars themselves and the ticket stations. Many of the survey takers noted that they did not realize that their ticket could either be for a standing option or seat option. Some of the tourists said this somewhat hampered their train trips when they boarded the train. They

stated being most disappointed when they have to have a standing car only. Besides ticket confusions, some noted it was hard to actually book a ticket, especially in the east of Taiwan. They said they were unaware that they needed to book tickets in advance to procure one for their preferred departure times.

Figure 4-7. The Relative Importance of Transportation Factors



Source: Survey Results

4.3 Cost and quality

This section is unique because of the age parameters included within this paper, as the target age range of respondents 20-30 years of age. Respondents in the survey heavily favored attractions where they could get the most “bang for your buck”. Interestingly, Travelers in this age range actually spend more money than older generations. The WTTC puts leisure spending at 83.9% for tourists, and 76% of respondents also were here purely for leisure. Youth travelers on average spend USD\$2,600 on primary trips, compared to the \$950 dollar average. This is due to younger travelers taking longer trips, and therefore they end up spending more in total. Another benefit that youth travelers enjoy is that 36%

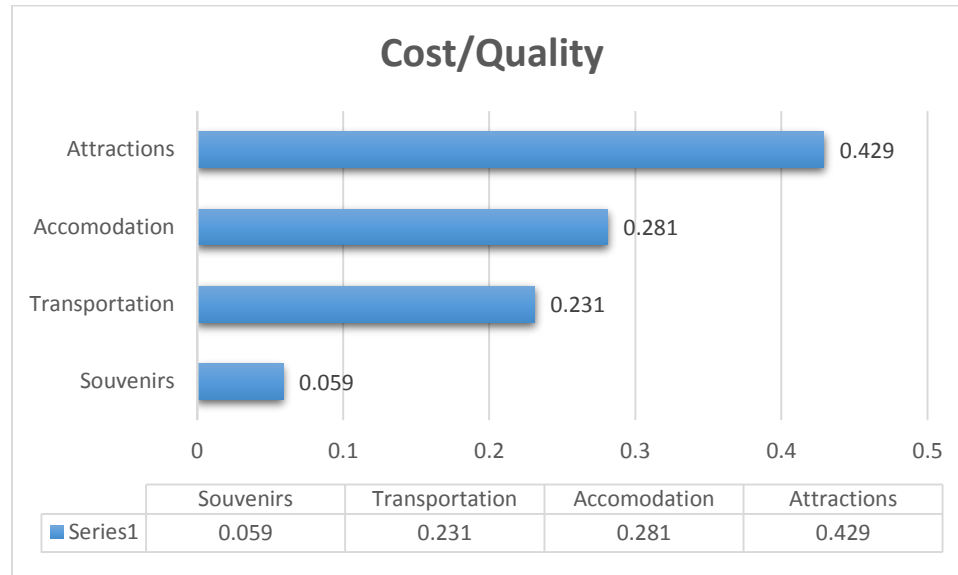
were in part provided funds to travel by their family, further increasing their spending power. Current generation youth travelers consider travel as part of their identity, self-development, a way of meeting new people, and a form of learning. They consider travel to be a lifetime value, and later in life they will often return to places they have visited previously (UNTWO, 2011).

While the aforementioned statistics show younger tourists spend more money in the long-term, they still are conscious of trying to get the best value for their money.

Additionally, while there is no hard data available on this topic, hostels (accommodations) in Taiwan are in a grey area when it comes to legality. An entire paper could be written about this topic, but for this thesis only a small synopsis will be given to support the accommodations preference from the survey takers. To set up a hostel, owners have to adhere to street, building, and fire code regulations, while also finding a location that is accommodating to said regulations and a location that is also conveniently accessible for tourists. Even after a hostel is abiding by all the rules and regulations, it can still take up to a few months to a year to receive a hotel license. Many hostels are set up illegally and do not follow such rules. This can lead to fines or closures of the hostels.

It could be argued since 20-30 year olds view travel as a way of meeting new people from different cultures and backgrounds, as well as using the hostel to create new experiences, addressing these factors can attribute to an improved satisfaction rate while in Taiwan. Backpackers are usually in the. If Taiwan wants to increase its hostel culture, then new rules need to be made to streamline the process for hostels to be built legally and safely, and allow for legal short-term stays. Also, hostels should have to obtain a hostel license and not a hotel license, as these two businesses have different operating styles.

Figure 4-8. The Relative importance of Cost and Quality

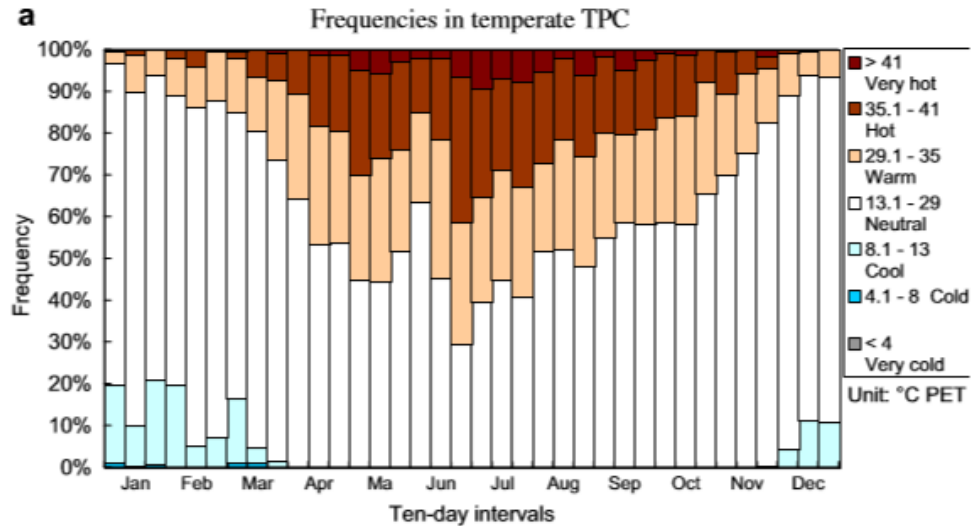


Factors Source: Survey Results

4.4. Nature

Nature was the most dominant preference for travelers (Figure 4-9.), as some respondents were quite vocal about how cold a winter in Taipei can be. Weather is important for tourists when choosing a destination and for the tourist destination's success (Matzarakis and Pin, 2009). This is important because with the exception of Taiwan's few major cities, the whole of the island is primarily rural. Tourists are more concerned with weather conditions in rural areas than in urban ones. In a paper written by Tzu-Ping Lin and Andreas Mazarakis, they use statistics and surveys to determine thermal perceptions of people from temperate zones. Figure 15 suggests that North Americans would be comfortable within a temperature range of 8.1 degrees Celsius up to 35 degrees Celsius.

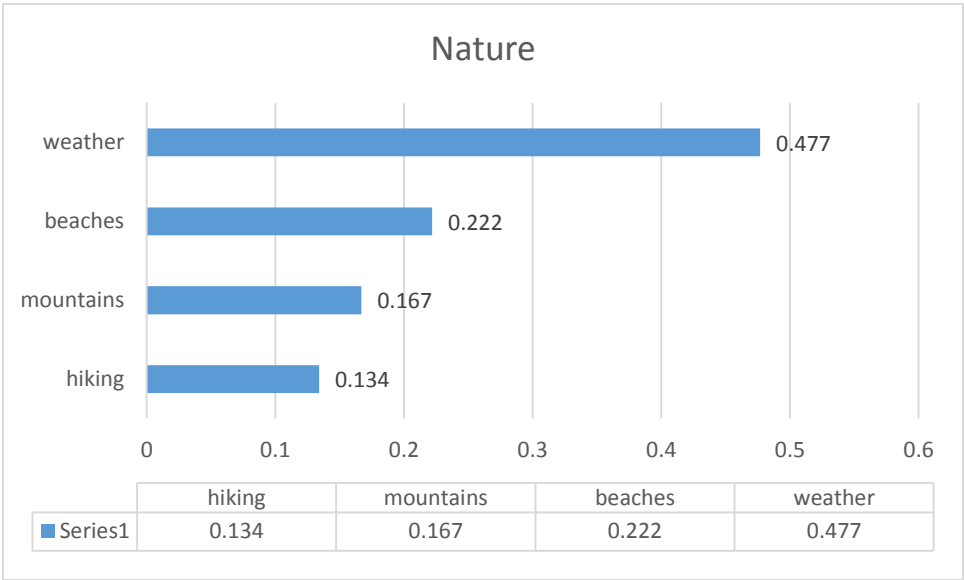
Figure 4-9. Frequencies in Temperate Climate People



Source: (Matzarakis, 2009).

Figure 13 above shows a one year period with ten-day intervals describing the times of the year where the perceived comfort levels are optimal in Kaoshiung city. Regarding Taipei, spring and autumn seasons were the most comfortable. This data can be used by the tourism bureau for rural areas to better gauge what times of the year North American and European tourists would feel most comfortable visiting famous destinations, buildings, or landmarks. This data can also be used for tourists themselves to determine their own travel schedule based on weather conditions, as younger travelers usually don't adhere to any traditional travel times (UNWTO, 2011).

Figure 4-10. The Relative Importance of Nature Factors



Source: Survey Results



Chapter 5 Conclusion and Implications

5.1 Conclusion

Whether a tourist wants quality cuisine or adventurous night market food, they can find it here in Taiwan. If a tourist wants to see a vast variety of geographical locations without having to travel far distances, Taiwan has it on offer. If a tourist wants to explore thousands of years of an ancient culture through museums or natural attractions, that is also on display in Taiwan. Travel in Taiwan can be accomplished by travelling via the train routes that put Taiwan's beauty on display. A safe and friendly island, Taiwan has much to offer in the way to attract and satisfy a tourists' needs on many levels. Unfortunately for North Americans and Europeans in their tourism inflow to Taiwan has been stagnant for tourists from these countries over the past decade.

In an attempt to reinvigorate the stagnant inflow of North American and European tourists, an Applied Hierarchy Process statistical analysis was created by using a three-part pairwise comparison survey to more specifically understand the determinants of the travel preferences of these two groups of tourists to prefer. The tourists' preferences were then applied to real world policy suggestions to help inform marketing strategy efforts. Additionally, identifying European and North American travel styles by applying Hofstede's cultural dimensions, in tandem with Woodside's international tourism field studies, helps to further understand the traveling habits of North American and European tourists. To determine on the efforts of the Taiwan Tourism Bureau, two interviews were conducted to determine marketing strategies and policies implemented to entice these two groups to travel to Taiwan.

The results of this thesis indicate that safety (security) is the prominent determinant of travel satisfaction for European and North American tourists when travelling. This should be taken into consideration by the Taiwan Tourism Bureau when marketing to these two groups. Also, these two target groups have a strong preference for convenient domestic travel, especially trains, when they are trying to get to their target destination. Weather should also be taken into account because tourists from these regions are not used to a different such as Taiwan's and will most likely not acclimate easily to the weather, so the

travelers should be aware of the climate in Taiwan. The Tourism Bureau could also take into consideration that youth travelers actually spend more money than older travelers, as they often spend more time in one area trying to learn the culture, language, and people.

This research focuses on two specific groups of tourists within a certain age range. The research design of this thesis builds upon previous empirical data research to create new information and data for the tourism industry to use to better understand the travel habits and preferences of the customer, while at the same time helping to make marketing strategies more concise and policies better reflect the desires of the tourists. This research attempts to benefit both parties simultaneously.

5.2 Discussion

Additional research was conducted focusing North Americans and Europeans aged 20-30. The first round of research was performed by creating a Facebook page and asking the question: “Before coming to Taiwan, how much of a presence can you remember Taiwan having as a travel destination in your country or noticing a push to get people to Travel here?” The second round of research involved a focus group and was conducted in a meeting room with a group of students to ask them what they thought of Taiwan’s tourism presence in their home country and how they were introduced to the island. The overwhelming majority of responses replied next to none or none, in terms of perceived presence. One student noted an advertisement on a bus in Los Angeles, California, and another student recalled observing one in New York City. While many people said they were unaware of Taiwan’s travel bureau and its marketing endeavors, they did explain how they came to know about Taiwan. Many of the students said they were introduced to Taiwan because they knew somebody who had worked, studied, or travelled here. They extrapolated on this by mentioning most were studying Mandarin Chinese or working as an English teacher in Taiwan. It seemed that word of mouth from friends and family had a far bigger impact with regards to visiting the country than the Tourism Bureau in each students’ home country.

A few of the participants in the discussion brought up Taiwan's tourist presence within the country itself. Some of the critiques were that there were very few pamphlets and brochures to pick up when arriving at the airport. Those responding felt the presence of the tourism bureau's marketing was lacking at the airport terminal. Additionally, one student even brought up the lack of marketing presence around Taiwan, such as at the Taipei 101 and subway stations. Taipei 101 is Taiwan's most noticeable landmark, and one person remarked that the only tourism section in the entire station was hidden away in a secluded corner that is not easy for the public to access. A general consensus was that when westerners travel in Taiwan it was perceived the bureau did not really pursue marketing and promotions for people who were already on the island. While youth tourists might be more adventurous in their travels, they did note that it would be nice to see some advertising of attractions while in country.

5.3 Gay Tourism

Gay tourism was not originally intended as a topic upon starting this paper, but upon research for this paper, it became evident that there was an abundance of literature on the topic, and therefore needed to be addressed. Further research can be done on this topic and an independent paper could focus on how to relate the data to Taiwan tourism.

If Taiwan were to permit marriage between same-sex couples, this would make Taiwan indisputably the most homosexuality-affirming place in the whole of Asia, and also to make Taiwan (and Taipei in particular) a gay friendly island is arguably an existential geopolitical need to "gain global legitimacy" (Cheo, 2014). This could make Taiwan become an international destination that would attract more travelers.

Many destinations have become more open to accommodating gay tourists, and they have also identified that having a gay tourism section is a very profitable sector of tourism. Gay and lesbian tourists account for about 6-7% of global tourism. Financially they tend to have a higher disposable income than their non-gay counterparts, as they make up around 10% of the global travel market (Euromonitor, 2010). For example, in 2011, the average American planned on spending USD\$1,058 on leisure or business travel, conversely gay

tourists planned on spending \$1,300 on their travel expenditures (World Tourism Organization). As shown in figure 3 previously, western countries account for 8 out of 10 biggest travel spenders by nation.

As future growth in tourism is expected to come from the Asia-Pacific region (Passport), it should also be of importance to try to attract more inflow from the west, as they still have the highest purchasing power when it comes to destination travel.

Many papers point out that countries more accepting of gay lifestyles and gay tourists have a much higher rate of gay tourists, but Asian countries are still relatively underdeveloped when it comes to gay travel, such as Hong Kong and Singapore for example (Cheo, 2014).

Some limitations on the research for now is whether gay tourism should be focused on group travels, cruises, or resorts, or whether individual travel should also be a focus. This is because gay travelers need to feel comfortable at the travel destination; this ranges from the host destination being friendly/tolerant of gay culture to the tour groups understanding the needs and expectations of the gay traveler (Euromonitor, 2011).

Figure 4 is used as a reference in this paper to understand North American and European youth traveler's return rate intention based off satisfaction. The primary goal is to analyze tourists travel preferences so the tourism bureau can use the statistics to produce target market specific advertising to appeal to specific markets. It can also be used to modify and change policy they think could benefit from this data. Cultural style from Woodside's research using Hofstede's dimensional model across nations is used in tandem with the travel habits that derived from this paper's research. Tourism image is the tourist's perception of Taiwan when they were travelling on the island. These three categories help to determine travel satisfaction. The higher the travel satisfaction, the higher the potential for return. Satisfaction level comes from understanding what tourists prefer, then used to target market advertise This graph is not shown to propose a hypothesis, but to provide a more lucid understanding of the methodology being used in determining consumer satisfaction.

5.4 Policy Implications

As all data has now been recorded and analyzed, this section is intended to provide potential suggestions for Taiwan's tourism bureau to consider. When using this information, the goal is to help increase tourism inflow from North America and Europe by pinpointing their tourist specific travel needs and habits. The bureau can examine all of the findings of this research and craft new ideas for policy and marketing strategies. At the same time,

The security of Taiwan should be more heavily advertised, but this should be done subtly. This feature of Taiwan could be used during promotional videos or with marketing strategies. It should be a part of the message when advertising, but not the entire message. Since this was the largest determinant for tourists completing the survey, it should in some fashion be used in policy change or advertising strategy initiatives.

Food safety should also be addressed in future marketing endeavors, as it seemed many travelers came here based off word of mouth or because they knew someone who lives or have lived here. Therefore, the traveler might be alerted to the fact that Taiwan has had some food issues in its recent past, with problems such as plasticizer in its bottled beverages, tainted starch, counterfeit olive oil, and a food oil scandal that revealed many restaurants and food stalls were unknowingly using old, reused oil produced in China. While progress has been made by creating an independent body to ensure food safety standards are progressing (Ferry 2015), tourists (and the general public) cannot independently determine if food is safe to eat. Tourists want to know if the food they consume is safe. Two steps could be taken as a start to ensure customers know they are receiving quality food. First, food bought at a grocery store that needs to be regulated could have a seal on the product in Chinese and English that shows quality assurance. Second, restaurants and food stalls should be monitored on a regular basis by inspectors. The inspectors can then give the businesses a simple alphabetical or numerical rating that is placed at the front of the store or in the window that easily displays that restaurant's food safety and cleanliness score.

In addition to displaying food safety scores, the bureau could introduce food contests. Foreigners could be selected from abroad after applying to a contest to come to Taiwan

and take photographs of food using their unique photography styles. During the interview with the German office representative of the Taiwan Tourism Bureau, she noted that they advertise Taiwan cuisine to the European market. To promote further, they could bring the contestants to Taiwan to go around the island taking pictures of all the diverse foods the island has to offer. The contest could focus on particular food venues the bureau would like to promote, and also let the contestants find food that they deem interesting and unique. As youth travelers use the newest forms of technology and media, the results of the winning pictures and videos could then be promoted on social media sites such as Instagram, Twitter, snapchat, Facebook, and others for word of mouth advertising to the younger target market.

Additionally, food critics from North American and European countries could be invited to Taiwan to go to some of the countries night markets, most famous restaurants, and cultural cuisine establishments where they can review their meals while in the country. Then when they have returned to their home country, articles can be written promoting the uniqueness and novelty of the night market food, the famous restaurants, and their chefs regarding their cooking skills. This will let readers know of Taiwan's unique culinary cuisine on offer and entice them to visit.

Taiwan's tourism bureau could hold a contest where the winner will come to the island for a set period of time to film and document their travels around Taiwan. The bureau can set up an itinerary of places, people, and things they should see, but also give them some personal time to explore the island to let the people see through their own perspective. This will enable potential visitors to see Taiwan in a perspective more akin to their own. This contest could be similar to the Tourism Australia television show "The Best Job in the World". This show could be used as a framework, and then the bureau could hire a television crew and creative team to give Taiwan's version its own perspective.

The weather in Taiwan is a departure from North American and European climates. These two regions are not as acclimated to the humid hot summers nor the wet cold winters. Many visitors did not expect such extreme weather when arriving. The tourism website could produce a weather section that includes a weather calendar. This calendar could include a seven-day forecast for incoming travelers. Additionally, a calendar for the typhoon season

and any potential typhoons that might make landfall to the island could be included. For each major city, a yearly weather gauge displaying average weather depending on the season could be developed. This would give tourists a better understanding of when it would be appropriate for them to travel to Taiwan.

As stated in the data collection section, trains were the most important form of travel once travelers arrived. More investment should be put into advertising train travel for the scenic beauty and landscapes they traverse through. As youth tourists enjoy discovering new locations, having scenic trains would be something that increases youth travelers' satisfaction rates while in Taiwan. To enjoy these trains, customers must purchase tickets, but this is a little harder for a tourist to accomplish.

Computers located at 711, Family Mart, High Life, and OK Mart all use computer terminals where Taiwanese citizens can conveniently pay bills, buy concert tickets, add money to accounts, and even purchase High Speed Rail, slow train, and bus tickets. Unfortunately, these machines are programmed primarily in Chinese, and navigating its user interface is not very streamlined. The computer systems could introduce one of the options on the screen to be shown as "English Options". These options would be more limited than what a native resident would have access to, could include all the necessities that a traveler might desire. It could include features where, through a streamlined, easy to use interface, travelers can quickly purchase HSR tickets, slow train tickets, and bus tickets. In addition to tickets, perhaps users can call for a taxi any time of the day. This can be done as many travelers keep the hotel address or address of where they want to go on hand. And they can also use google maps to notify the driver of where to go. Finally, refilling SIM cards for mobile phones with calling minutes and mobile data packages can be done at the terminal, and the receipt could be handed to a cashier for purchase.

Motorcycles and scooters seemed to be of little importance to tourists, though this might be because to rent them, you need to obtain a Taiwan scooter license. This paper proposes an alternative to modify the current inability for travelers to rent scooters. Currently, tourists go outside of major cities to more rural areas to rent scooters. The owners of these establishments are more relaxed when it comes to who is legally allowed to rent them. There would be stipulations, however. For instance, you would have to have a valid driver's

license or motorcycle license from your home country to rent a scooter. Also, it would be forbidden to drive in any major city because traffic culture is most likely different than the traveler's own country. The tourist renting the scooter could receive a tutorial of the basics of riding a scooter. Scooters would also be limited to no higher than 125cc, as that is the normal license given when applying for a license by a Taiwanese resident.

The Taiwanese tourism bureau should put more emphasis on advertising and catering to youth travelers. As previously stated, they tend to travel for longer periods of time, spend more money, and are not limited by specific travel times, such as during holidays. Youth tourists also tend to put a special importance to being more social during their travels. This can help spread information by word of mouth about their positive experience in Taiwan to other friends and on social media.

Road signs in Taipei and Taipei city are fairly easy to navigate. This is because they use a Romanization system called *pinyin*. As you venture farther away from Taipei, the road signs often switch to a different system called Wade-Giles. This can make it harder for a tourist to get to their intended destination because travel guides and travel sites predominantly use the pinyin system. As there are many different methods of Romanization, it should be considered by the bureau to change all signs to the pinyin system. This would make it easier for travelers find their travel destination.

The Taoyuan International airport has very few pamphlets and fliers that advertise what to do while in Taiwan. Upon arrival, tourists coming out of the exit gate could go to a large display that includes QR codes that advertise some of Taiwan's most famous sites, landmarks, night markets, and restaurants, with a picture of the landmark and a small description included. Customers could then use their smartphones or other electronic devices to obtain more data using the QR codes. Once the QR is activated it could provide additional details about the destination. It could also include the phone number, hours of operation, address, and a maps feature so it will be easier for the tourist to get to the location. Additionally, to reduce the amount of pamphlets needed to advertise so many different destinations, only one pamphlet style would need to be produced and placed at the advertising booth.

Taiwan should also consider creating a section in its tourism bureau for gay travel. It can advertise how gay friendly Taiwan is and try and entice more people to come to what is the largest yearly gay pride parade in Asia.

5.5. Limitations

The results yielded from this survey were limited in scope. The two main limitations are that the survey only focuses on quantifying results for North American and European tourists with an age range of 20-30 years of age, thus limiting the generalizability (or external validity) of the survey results. The older population was much less willing to take part in such a lengthy questionnaire. As such, modification of the survey would be needed to accommodate older generation's willingness to participate, or an incentive to participate would need to be included. The participants were told at the beginning that this survey in no way pertained to Taiwan or Taiwan tourism. That being said, since all participants were in Taipei at the time of filling out the questionnaire, it is unknown whether or not being in Taipei had any influence on participant responses. It is also unknown if they travelled to any other cities or locations outside of Taipei, or if they will after they have completed the survey, possibly limiting their perception of Taiwan to Taipei only. It could be argued that even though the people were told this is not a Taiwan-based survey, the fact that they were in Taipei could have had a subconscious priming effect on the outcome of the results.

As this research encompasses multiple determinants of travel satisfaction, it takes a broader approach to understanding what North American and European tourists prefer when travelling. With this research each determinant was given limited attention compared to identifying one determinant and researching it more thoroughly. As this thesis did not divide the determinants into separate, more thorough research papers, further research could be performed by others focusing on a single determinant. More limited was the age range. Respondents were in their 20's, and if this paper had used different age groups, the results of the analysis could be different. Finally, only two regions were used in this study.

If further research were to be conducted, other researchers could mix and match various regions into the research, as to get a much broader picture of different types of travel preferences. Another limitation is sample size (N only equals 25), but the reason for this is the length of time it takes to complete the survey instrument.



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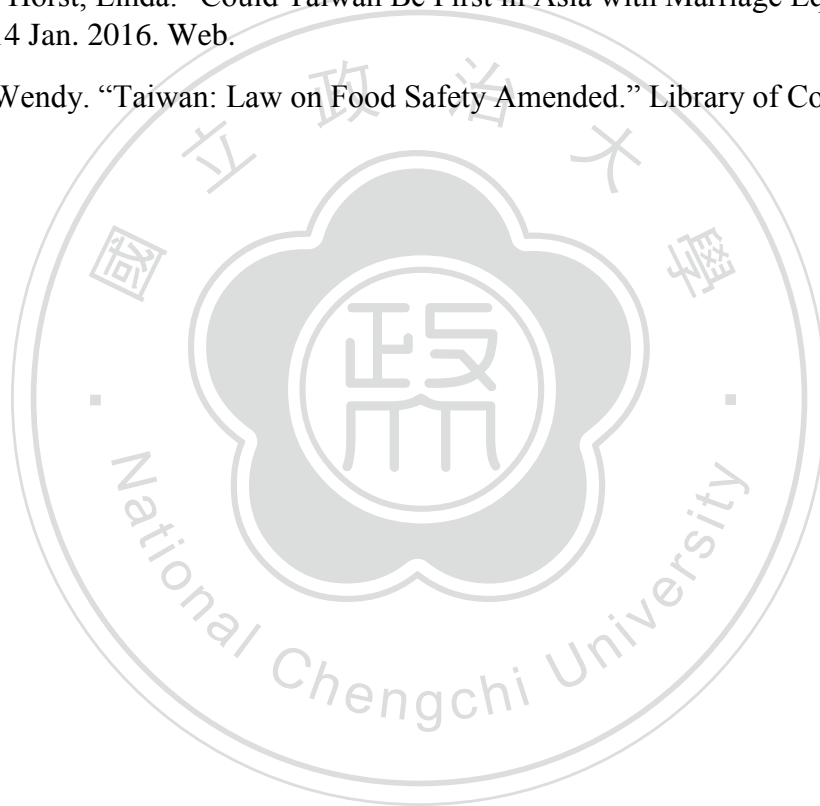
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Appendix A: Tourist Survey

This is the survey that was conducted on participants in Taipei city in November and December 2015. This survey was created by the author. It used the Applied Hierarchy Process method to assess the determinants for tourist satisfaction

Table A-1

		Nature																		
		More Important			Equal Importance											More Important				
		9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9		
Mountains	.																		Beaches	
Mountains		9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Hiking	
Mountains		9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Weather	
Beaches		9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Hiking	
Beaches		9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Weather	
Hiking		9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Weather	

Table A-2

Transportation

	More Important									Equal Importance									More Important
Motorcycles	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Airport	
Motorcycles	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Taxis	
Motorcycles	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Trains	
Airport Access	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Taxis	
Airport Access	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Trains	
Taxis	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Trains	

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Table A-3

Friendliness

	More Important									Equal Importance									More important
Road signs	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Language	
Road signs	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	People	
Language	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	People	

Table A-4

Food

	More Important									Equal Important									More Important																
Variety	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Healthy Options
Variety	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Vegetarian
Variety	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Authenticity
Healthy Options	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Vegetarian
Healthy Options	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Authenticity
Vegetarian	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Authenticity

Table A-5

Safety

|

	More Important									Equal Importance									More Important								
Food	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Pollution									
Food	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Security									
Food	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Traffic									
Pollution	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Security									
Pollution	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Traffic									
Security	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Traffic									

Table A-6

Cost and Quality

	More Important									Equal Importance									More Important									
Accommodation	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Transportation										
Accommodation	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Attractions										
Accommodation	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Souvenirs										
Transportation	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Attractions										
Transportation	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Souvenirs										
Attractions	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Souvenirs										

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Table A-7

OVERALL

Nature	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Transportation
Nature	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Friendliness
Nature	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Food
nature	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Safety
Nature	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Cost and quality

Table A-8

Transportation	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Friendliness
Transportation	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Food
Transportation	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Safety
Transportation	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Cost and quality
Friendliness	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Food

Table A-9

Friendliness	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Cost and Quality
Friendliness	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Safety
Food	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Cost and Quality
Food	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Safety
Safety	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Cost and Quality

Table A-10

Gender: Male Female Nationality: _____

Age: _____ Reason For coming to Taiwan: [Business] [Pleasure]

Profession/Job: _____

How many days you will be in Taiwan? _____

How much money will you spend each day (not including hotel)? NT\$ _____

How many other people are you travelling with? _____

How many other countries are you visiting on your travels? _____

	Very little	A lot
How clean does Taiwan seem?	<input type="checkbox"/> 1 2 3 4 5 6 7 8 9 10 <input type="checkbox"/>	
How much do you like the food?	<input type="checkbox"/> 1 2 3 4 5 6 7 8 9 10 <input type="checkbox"/>	
Do you enjoy the night markets?	<input type="checkbox"/> 1 2 3 4 5 6 7 8 9 10 <input type="checkbox"/>	
Do you feel safe in Taiwan?	<input type="checkbox"/> 1 2 3 4 5 6 7 8 9 10 <input type="checkbox"/>	
Is travel easy in Taiwan?	<input type="checkbox"/> 1 2 3 4 5 6 7 8 9 10 <input type="checkbox"/>	
Is Taiwan's transportation convenient?	<input type="checkbox"/> 1 2 3 4 5 6 7 8 9 10 <input type="checkbox"/>	

Are you comfortable using English during your travels? Yes / No

Did you go to Taiwan before? Yes / No

Do you have friends or relatives in Taiwan? Yes / No

Did you know anything about Taiwan before coming? Yes / No

Does language affect your ability to travel in Taiwan? Yes / No

Will/did you buy electronics in Taiwan? Yes / No

Have you been to China? Yes / No

Would you want to visit Taiwan again? Yes/No



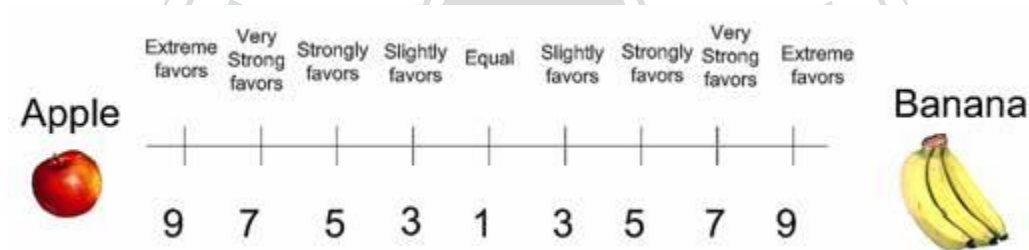
Appendix B: Applied Hierarchy Process

The following paper was provided by Chang Jung Christian University (長榮大學). It outlines how the AHP method works. This methodology was used to analyze the above survey.

Source: web.cjcu.edu.tw/~lcc/Courses/TUTORIAL/AHP%20Tutorial.doc

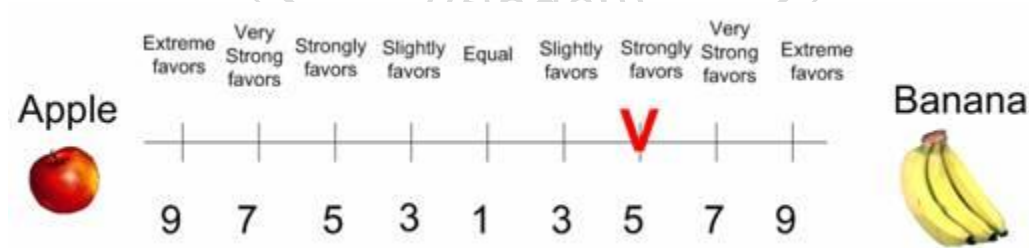
Pair-wise Comparison (What is pair-wise comparison?)

Now let me explain what paired comparison is. It is always easier to explain by an example. Suppose we have two fruits Apple and Banana. I would like to ask you, which fruit you like better than the other and how much you like it in comparison with the other. Let us make a relative scale to measure how much you like the fruit on the left (Apple) compared to the fruit on the right (Banana).

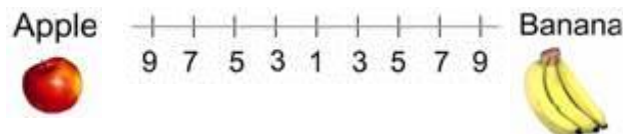


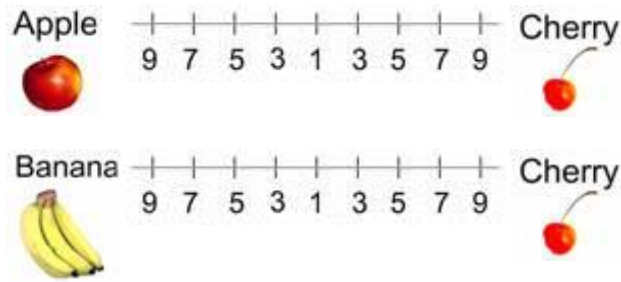
If you like the apple better than banana, you tick a mark between number 1 and 9 on left side, while if you favor banana more than apple, then you mark on the right side.

For instance I strongly favor banana to apple then I give mark like this



Now suppose you have three choices of fruits. Then the pair wise comparison goes as the following





You may observe that the number of comparisons is a combination of the number of things to be compared. Since we have 3 objects (Apple, Banana and Cheery), we have 3 comparisons. Table below shows the number of comparisons.

Table 7: Number of comparisons

Number of things	1	2	3	4	5	6	7	n
number of comparisons	0	1	3	6	10	15	21	$\frac{n(n-1)}{2}$

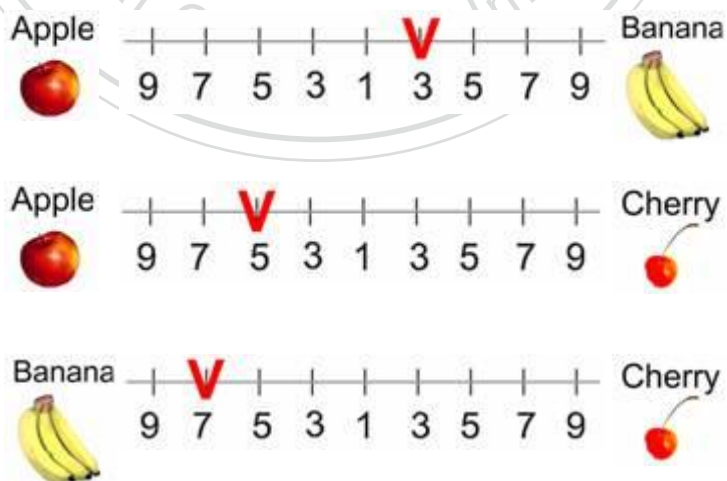
The scaling is not necessary 1 to 9 but for qualitative data such as preference, ranking and subjective opinions, it is suggested to use scale 1 to 9.

In the next section you will learn how to analyze this paired comparisons

Making Comparison Matrix (How to make reciprocal matrix?)

By now you know how to make paired comparisons. In this section you will learn how to make a reciprocal matrix from pair wise comparisons.

For example John has 3 kinds of fruits to be compared and he made subjective judgment on which fruit he likes best, like the following



We can make a matrix from the 3 comparisons above. Because we have three comparisons, thus we have 3 by 3 matrix. The diagonal elements of the matrix are always 1 and we only need to fill up the upper triangular matrix. How to fill up the upper triangular matrix is using the following rules:

1. If the judgment value is on the **left** side of 1, we put the **actual judgment** value.
2. If the judgment value is on the **right** side of 1, we put the **reciprocal** value .

Comparing apple and banana, John slightly favor banana, thus we put $\frac{1}{3}$ in the row 1 column 2 of the matrix. Comparing Apple and Cherry, John strongly likes apple, thus we put actual judgment 5 on the first row, last column of the matrix. Comparing banana and cherry, banana is dominant. Thus we put his actual judgment on the second row, last column of the matrix. Then based on his preference values above, we have a reciprocal matrix like this

$$A = \begin{matrix} & \begin{matrix} \text{apple} & \text{banana} & \text{cherry} \end{matrix} \\ \begin{matrix} \text{apple} \\ \text{banana} \\ \text{cherry} \end{matrix} & \begin{bmatrix} 1 & \frac{1}{3} & 5 \\ & 1 & 7 \\ & & 1 \end{bmatrix} \end{matrix}$$

To fill the lower triangular matrix, we use the reciprocal values of the upper diagonal. If a_{ij} is the element of row i column j of the matrix, then the lower diagonal is filled using this formula

$$a_{ji} = \frac{1}{a_{ij}}$$

Thus now we have complete comparison matrix

$$A = \begin{matrix} & \begin{matrix} \text{apple} & \text{banana} & \text{cherry} \end{matrix} \\ \begin{matrix} \text{apple} \\ \text{banana} \\ \text{cherry} \end{matrix} & \begin{bmatrix} 1 & \frac{1}{3} & 5 \\ 3 & 1 & 7 \\ \frac{1}{5} & \frac{1}{7} & 1 \end{bmatrix} \end{matrix}$$

Notice that all the element in the comparison matrix are positive, or $a_{ij} > 0$.

Next section will discuss about how you will use this matrix.

Priority Vectors (How to compute Eigen Value and Eigen vector?)

Having a comparison matrix, now we would like to compute priority vector, which is the normalized Eigen vector of the matrix. If you would like to know what the meaning of Eigen vector and Eigen value is and how to compute them manually, go to my other tutorial and then return back here. The method that I am going to explain in this section is only an approximation of Eigen vector (and Eigen value) of a reciprocal matrix.

This approximation is actually worked well for small matrix $n \leq 3$ and there is no guarantee that the rank will not reverse because of the approximation error. Nevertheless it is easy to compute because all we need to do is just to normalize each column of the matrix. At the end I will show the error of this approximation.

Suppose we have 3 by 3 reciprocal matrix from paired comparison

$$A = \begin{matrix} & \begin{matrix} \text{apple} & \text{banana} & \text{cerry} \end{matrix} \\ \begin{matrix} \text{apple} \\ \text{banana} \\ \text{cerry} \end{matrix} & \begin{bmatrix} 1 & \frac{1}{3} & 5 \\ 3 & 1 & 7 \\ \frac{1}{5} & \frac{1}{7} & 1 \end{bmatrix} \end{matrix}$$

We sum each column of the reciprocal matrix to get

$$A = \begin{matrix} & \begin{matrix} \text{apple} & \text{banana} & \text{cerry} \end{matrix} \\ \begin{matrix} \text{apple} \\ \text{banana} \\ \text{cerry} \\ \text{sum} \end{matrix} & \begin{bmatrix} 1 & \frac{1}{3} & 5 \\ 3 & 1 & 7 \\ \frac{1}{5} & \frac{1}{7} & 1 \\ \frac{21}{5} & \frac{31}{21} & 13 \end{bmatrix} \end{matrix}$$

Then we divide each element of the matrix with the sum of its column, we have normalized relative weight. The sum of each column is 1.

$$A = \begin{matrix} & \begin{matrix} \text{apple} & \text{banana} & \text{cerry} \end{matrix} \\ \begin{matrix} \text{apple} \\ \text{banana} \\ \text{cerry} \\ \text{sum} \end{matrix} & \begin{bmatrix} \frac{5}{21} & \frac{7}{31} & \frac{5}{13} \\ \frac{15}{21} & \frac{21}{31} & \frac{7}{13} \\ \frac{1}{21} & \frac{3}{31} & \frac{1}{13} \\ 1 & 1 & 1 \end{bmatrix} \end{matrix}$$

The normalized principal Eigen vector can be obtained by averaging across the rows

$$w = \frac{1}{3} \begin{bmatrix} \frac{5}{21} + \frac{7}{31} + \frac{5}{13} \\ \frac{15}{21} + \frac{21}{31} + \frac{7}{13} \\ \frac{1}{21} + \frac{3}{31} + \frac{1}{13} \end{bmatrix} = \begin{bmatrix} 0.2828 \\ 0.6434 \\ 0.0738 \end{bmatrix}$$

The normalized principal Eigen vector is also called **priority vector**. Since it is normalized, the sum of all elements in priority vector is 1. The priority vector shows relative weights among the things that we compare. In our example above, Apple is 28.28%, Banana is 64.34% and Cherry is 7.38%. John most preferable fruit is Banana, followed by Apple and Cheery. In this case, we know more than their ranking. In fact, the relative weight is a ratio scale that we can divide among them. For example, we can say that John likes banana 2.27 (=64.34/28.28) times more than apple and he also like banana so much 8.72 (=64.34/7.38) times more than cheery.

Aside from the relative weight, we can also check the consistency of John's answer. To do that, we need what is called Principal Eigen value. Principal Eigen value is obtained from the summation of products between each element of Eigen vector and the sum of columns of the reciprocal matrix.

$$\lambda_{\max} = \frac{21}{5} (0.2828) + \frac{31}{21} (0.6434) + 13(0.0738) = 3.0967$$

Computation and the meaning of consistency are explained in the next section.

As a note, I put the comparison matrix into Matlab to see how different is the result of numerical computation of Eigen value and Eigen vector compared to the approximation above.

$$\mathbf{A} = \begin{bmatrix} 1 & \frac{1}{3} & 5 \\ 3 & 1 & 7 \\ \frac{1}{5} & \frac{1}{7} & 1 \end{bmatrix}$$

$$[\mathbf{W}, \lambda] = \text{eig}(\mathbf{A})$$

We get three Eigen vectors concatenated into 3 columns of matrix \mathbf{W}

$$\mathbf{W} = \begin{bmatrix} 0.3928 & -0.1964 + 0.3402i & -0.1964 - 0.3402i \\ 0.9140 & 0.9140 & 0.9140 \\ 0.1013 & -0.0506 - 0.0877i & -0.0506 + 0.0877i \end{bmatrix}$$

The corresponding Eigen values are the diagonal of matrix λ

$$\lambda = \begin{bmatrix} 3.0649 & 0 & 0 \\ 0 & -0.0324 + 0.4448i & 0 \\ 0 & 0 & -0.0324 - 0.4448i \end{bmatrix}$$

The largest Eigen value is called the Principal Eigen value, that is $\lambda_{\max}^* = 3.0649$ which is very close to our approximation $\lambda_{\max} = 3.0967$ (about 1% error). The principal Eigen vector is the Eigen vector that corresponds to the highest Eigen value.

$$\bar{\mathbf{w}} = \begin{bmatrix} 0.3928 \\ 0.9140 \\ 0.1013 \end{bmatrix}$$

The sum is 1.4081 and the normalized principal Eigen vector is

$$\mathbf{w}^* = \begin{bmatrix} 0.2790 \\ 0.6491 \\ 0.0719 \end{bmatrix}$$

This result is also very close to our approximation

$$\mathbf{w} = \begin{bmatrix} 0.2828 \\ 0.6434 \\ 0.0738 \end{bmatrix}$$

Thus the approximation is quite good.

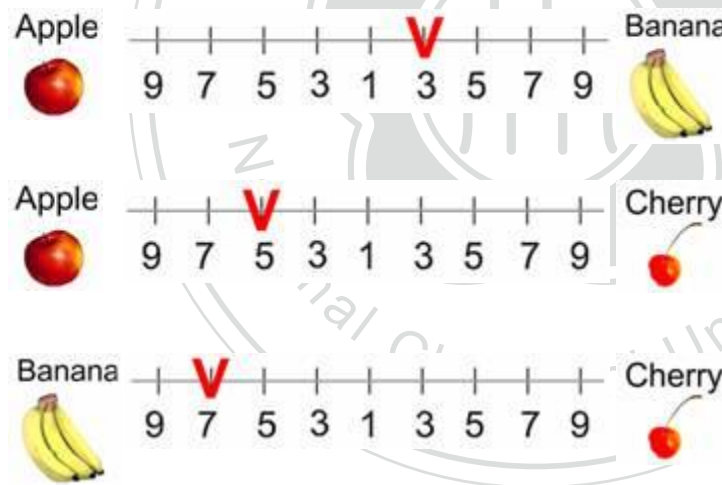
Thus the sum of Eigen vector is not one. When you normalized an Eigen vector, then you get a priority vector. The sum of priority vector is one.

In next section you will learn how to make use of information of principal eigen value to measure whether the opinion is consistent.

Consistency Index and Consistency Ratio (What is the meaning of consistent?)

What is the meaning that our opinion is consistent? How do we measure the consistency of subjective judgment? At the end of this section will be able to answer those questions.

Let us look again on John's judgment that we discussed in the previous section. Is John judgment consistent or not?



First he prefers Banana to Apple. Thus we say that for John, Banana has greater value than Apple. We write it as $B \succ A$.

Next, he prefers Apple to Cherry. For him, Apple has greater value than Cherry. We write it as $A \succ C$.

Since $B \succ A$ and $A \succ C$, logically, we hope that $B \succ C$ or Banana must be preferable than Cherry. This logic of preference is called transitive property. If John answers in the last comparison is transitive (that he like Banana more than Cherry), then his judgment is consistent. On the contrary, if John prefers Cherry to Banana then his answer is inconsistent. Thus consistency is closely related to the transitive property.

A comparison matrix \mathbf{A} is said to be consistent if $a_{ij} a_{jk} = a_{ik}$ for all i, j and k . However, we shall not force the consistency. For example, $B \succ A$ has value $3 \succ 1$ and $A \succ C$ has value $5 \succ 1$, we shall not insist that $B \succ C$ must have value $15 \succ 1$. This too much consistency is undesirable because we are dealing with human judgment. To be called consistent, the rank can be transitive but the values of judgment are not necessarily forced to multiplication formula $a_{ij} a_{jk} = a_{ik}$.

Prof. Saaty proved that for consistent reciprocal matrix, the largest Eigen value is equal to the number of comparisons, or $\lambda_{max} = n$. Then he gave a measure of consistency, called Consistency Index as deviation or degree of consistency using the following formula

$$CI = \frac{\lambda_{max} - n}{n - 1}$$

Thus in our previous example, we have $\lambda_{max} = 3.0967$ and three comparisons, or $n = 3$, thus the consistency index is

$$CI = \frac{\lambda_{max} - n}{n - 1} = \frac{3.0967 - 3}{2} = 0.0484$$

Knowing the Consistency Index, the next question is how do we use this index? Again, Prof. Saaty proposed that we use this index by comparing it with the appropriate one. The appropriate Consistency index is called Random Consistency Index (RI).

He randomly generated reciprocal matrix using scale $\frac{1}{9}, \frac{1}{8}, \dots, 1, \dots, 8, 9$ (similar to the idea of Bootstrap) and get the random consistency index to see if it is about 10% or less. The average random consistency index of sample size 500 matrices is shown in the table below

Table 8: Random Consistency Index (RI)

n	1	2	3	4	5	6	7	8	9	10
RI	0	0	0.58	0.9	1.12	1.24	1.32	1.41	1.45	1.49

Then, he proposed what is called Consistency Ratio, which is a comparison between Consistency Index and Random Consistency Index, or in formula

$$CR = \frac{CI}{RI}$$

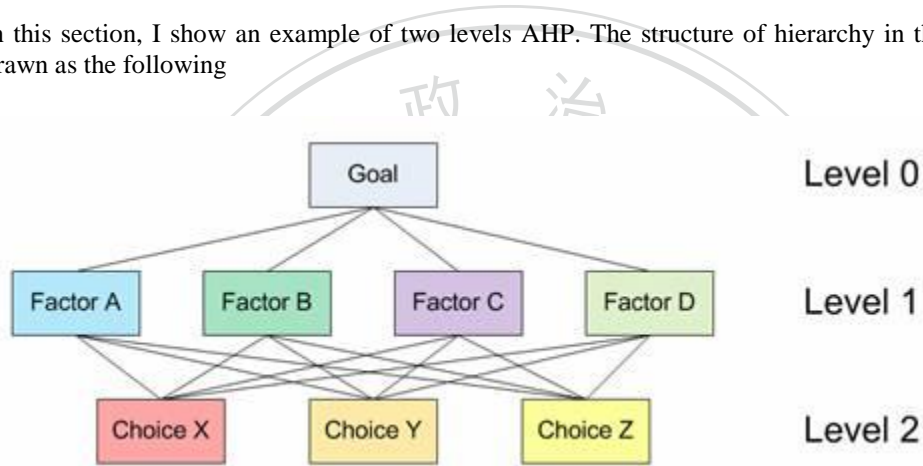
If the value of Consistency Ratio is smaller or equal to 10%, the inconsistency is acceptable. If the Consistency Ratio is greater than 10%, we need to revise the subjective judgment.

For our previous example, we have $CI = 0.0484$ and RI for $n = 3$ is 0.58, then we have $CR = \frac{CI}{RI} = \frac{0.0484}{0.58} = 8.3\% < 10\%$. Thus, John's subjective evaluation about his fruit preference is consistent.

So far, in AHP we are only dealing with paired comparison of criteria or alternative but not both. In next section, I show an example to use both criteria and alternative in two levels of AHP.

Illustrative example (how to compute in a full hierarchy?)

In this section, I show an example of two levels AHP. The structure of hierarchy in this example can be drawn as the following



Level 0 is the goal of the analysis. Level 1 is multi criteria that consist of several factors. You can also add several other levels of sub criteria and sub-sub criteria but I did not use that here. The last level (level 2 in figure above) is the alternative choices. You can see again Table 1 for several examples of Goals, factors and alternative choices. The lines between levels indicate relationship between factors, choices and goal. In level 1 you will have one comparison matrix corresponds to pair-wise comparisons between 4 factors with respect to the goal. Thus, the comparison matrix of level 1 has size of 4 by 4. Because each choice is connected to each factor, and you have 3 choices and 4 factors, then in general you will have 4 comparison matrices at level 2. Each of these matrices has size 3 by 3. However, in this particular example, you will see that some weight of level 2 matrices are too small to contribute to overall decision, thus we can ignore them.

Based on questionnaire survey or your own paired comparison, we make several comparison matrices. Click here if you do not remember how to make a comparison matrix from paired comparisons. Suppose we have comparison matrix at level 1 as table below. The yellow color cells in upper triangular matrix indicate the parts that you can change in the spreadsheet. The diagonal is always 1 and the lower triangular matrix is filled

$$a_{ji} = \frac{1}{a_{ij}}$$

using formula

Table 9: Paired comparison matrix level 1 with respect to the goal

Criteria	A	B	C	D	Priority Vector
A	1.00	3.00	7.00	9.00	57.39%
B	0.33	1.00	5.00	7.00	29.13%

C	0.14	0.20	1.00	3.00	9.03%
D	0.11	0.14	0.33	1.00	4.45%
Sum	1.59	4.34	13.33	20.00	100.00%

$\lambda_{\max} = 4.2692$, CI = 0.0897, CR = 9.97% < 10% (acceptable)

The priority vector is obtained from normalized Eigen vector of the matrix. Click here if you do not remember how to compute priority vector and largest Eigen value λ_{\max} from a comparison matrix. CI and CR are consistency Index and Consistency ratio respectively, as I have explained in previous section. For your clarity, I include again here some part of the computation:

$$\lambda_{\max} = (0.5739)(1.59) + (0.2913)(4.34) + (0.0903)(13.33) + (0.0445)(20) = 4.2692$$

$$CI = \frac{\lambda_{\max} - n}{n-1} = \frac{4.2692 - 4}{3} = 0.0897$$

$$CR = \frac{CI}{RI} = \frac{0.0897}{0.90} = 9.97\% < 10\%$$

(Thus, OK because quite consistent)

Random Consistency Index (RI) is obtained from Table 8.

Suppose you also have several comparison matrices at level 2. These comparison matrices are made for each choice, with respect to each factor.

Table 10: Paired comparison matrix level 2 with respect to Factor A

Choice	X	Y	Z	Priority Vector
X	1.00	1.00	7.00	51.05%
Y	1.00	1.00	3.00	38.93%
Z	0.14	0.33	1.00	10.01%
Sum	2.14	2.33	11.00	100.00%

$\lambda_{\max} = 3.104$, CI = 0.05, CR = 8.97% < 10% (acceptable)

Table 11: Paired comparison matrix level 2 with respect to Factor B

Choice	X	Y	Z	Priority Vector
X	1.00	0.20	0.50	11.49%
Y	5.00	1.00	5.00	70.28%

Z	2.00	0.20	1.00	18.22%
Sum	8.00	1.40	6.50	100.00%

$\lambda_{max} = 3.088$, CI = 0.04, CR = 7.58% < 10% (acceptable)

We can do the same for paired comparison with respect to Factor C and D. However, the weight of factor C and D are very small (look at Table 9 again, they are only about 9% and 5% respectively), therefore we can assume the effect of leaving them out from further consideration is negligible. We ignore these two weights as set them as zero. So we do not use the paired comparison matrix level 2 with respect to Factor C and D. In that case, the weight of factor A and B in Table 9 must be adjusted so that the sum still 100%

$$\text{Adjusted weight for factor A} = \frac{57.39\%}{57.39\% + 29.13\%} = 0.663$$

$$\text{Adjusted weight for factor B} = \frac{29.13\%}{57.39\% + 29.13\%} = 0.337$$

Then we compute the overall composite weight of each alternative choice based on the weight of level 1 and level 2. The overall weight is just normalization of linear combination of multiplication between weight and priority vector.

$$X = (0.663)(51.05\%) + (0.337)(11.49\%) = 37.72\%$$

$$Y = (0.663)(38.93\%) + (0.337)(70.28\%) = 49.49\%$$

$$Z = (0.663)(10.01\%) + (0.337)(18.22\%) = 12.78\%$$

Table 12: Overall composite weight of the alternatives

	Factor A	Factor B	Composite Weight
(Adjusted) Weight	0.663	0.337	
Choice X	51.05%	11.49%	37.72%
Choice Y	38.93%	70.28%	49.49%
Choice Z	10.01%	18.22%	12.78%

For this example, we get the results that choice Y is the best choice, followed by X as the second choice and the worst choice is Z. The composite weights are ratio scale. We can say that choice Y is 3.87 times more preferable than choice Z, and choice Y is 1.3 times more preferable than choice X.

We can also check the overall consistency of hierarchy by summing for all levels, with weighted consistency index (CI) in the nominator and weighted random consistency index (RI) in the denominator. Overall consistency of the hierarchy in our example above is given by

$$\overline{CR} = \frac{\sum_i w_i CI_i}{\sum_i w_i RI_i} = \frac{0.0897(1)+0.05(0.663)+0.04(0.337)}{0.90(1)+0.58(0.663)+0.58(0.337)} = 0.092 < 10\%$$

(Acceptable)

