東海大學企業管理學系

碩士論文

購買電動車的動機探討：比較台灣及印度消費者知覺差異

THE STUDY OF PURCHASE MOTIVATION FOR ELECTRIC VEHICLE: A COMPARATIVE ANALYSIS OF CONSUMER PERCEPTION IN TAIWAN AND INDIA

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ABSTRACT

Greenhouse effect, Climate change and shortage of resources have led to a change of forms of mobility. Consumer perception and their acceptance are very important for the long-term success for sustainable transport mobility. The research examines the consumer perception from four important angles: Social factor, Personal factor, Economic factor and Technological factor. Through the use of statistical analysis we understand the effect of consumer perception on the purchase behavior. In addition, we assess market specific differences between Taiwan and India to primarily focus on EV market. In order to examine the consumer perception, we conducted a web-based survey. Our respondents from Taiwan and India in average about above 50% view positively the advantages especially social factors environmental friendly and Low CO2 emission but equally above 70% view personal factors such as; limited driving range and limited charging infrastructure and economic factor; High purchase price as disadvantages of EV. We conclude that EV market is still outweighed by disadvantages and these affect consumers' purchase behavior and motivation.

Keywords: Consumer Perception, Purchase Behavior, Electric Vehicle

摘要

氣候變化和物資的缺短導致了交通方式的改變，而消費者認知和他們對科技的認同，會影響電動式交通工具的產業發展。本研究從四個重要的角度探討消費者認知：社會因素、個人因素、經濟因素和技術因素。透過統計分析了解消費者對於電動車的認知及其購買行為，並同時評估台灣和印度市場的具體差異。我們進行了一次網路問卷調查，台灣和印度的受訪者中大約有 50%以上，積極地看待電動車發展優勢，尤其在針對社會因素–環保汙染和低碳排放量等方面的優勢上的認同，但同樣有 70%以上認為電動車在行駛距離不足, 充電設施少和購買價格高等的缺點上，是影響他們購買動機的主要原因。

關鍵字：消費者認知、購買行為、電動車

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CHAPTER 1 INTRODUCTION

Global warming has become a buzzword in all the fields of our daily life. Growing industrialization around the world has contributed enormously to this global warming. If humanity has contributed to this, then human efforts must be taken to alleviate this catastrophe. Enormous amount of effort are underway globally to counter global warming, but how far we have been successful in our effort, remains to be asked. We need to know and understand what sustainability is. Consciousness and responsiveness will help us find ways on how to reduce the dangers of global warming. We are capable of building a sustainable lifestyle that we all yearn for. For this reason, we must also create a better and brighter world where we can all live in harmony with nature.

1.1 Rationale

The research aim is to give a deeper understanding of consumer motivation of Electric Vehicle (i.e., Electric bike and Electric four wheeler), with the survey examination from Taiwan and India. The findings of this research may be useful for manufacturers and suppliers of the automobile industry, governments and sustainability or green business solutions. Electric vehicles powered by a clean electricity grid offer a key pathway to achieving the greater than 80% reduction in global warming pollution we need by mid-century to avoid the worst consequences of climate change. Many countries have taken strategic step to address future energy requirements in a rapidly changing world; achieving sustainable transportation has emerged as a vital mission. On a global scale, EVs are expected to increase in the coming years. However these figures are encouraging, yet there are many hurdles need immediate attention. Some of the basic challenges are: Cost, consumer awareness and range anxiety. The current production plans and the demand for EV indicate that the technology is still at a very early stage in its lifecycle. As all disruptive technologies, experience the certain stages of technology adoption lifecycle. Manufacturers' production strategies are based on consumers' preferences and interests. The consumers are the ones who tell the market suppliers what and how they want. Due to the manufacturer's inability to meet market expectations', government policies still play a key role in influencing first mover's motivation to purchase EV technologies. Battery cost structure is mostly based on labor cost,

(which are high,) electronic parts, and volatility of key metals' price that prevents manufacturing cost to decrease. With these high production costs, the effectiveness of governments' direct price subsidizing policies is debatable. EVs operating costs are lower than compared to other transportation options, and mostly subsidized by governments. This still has not attracted the final consumers' attention. It clearly does not remove the psychological barrier for the final consumer. Another key issue, which creates psychological barriers for final consumers, is battery-charging time. Policy makers believe that several factors such as monetary incentives, gas prices, and travel distance have a direct impact on consumers.

The purpose of our study would focus on the EV's position in the current market and the possible solutions for consumer motivation for the electric mobility in both Taiwan and India; our study aims to conduct a statistical research.

1.2 Problem Statement

All over the world, efforts are being taken for sustainable transportation. The only alternative at our hand right now is 'Electric Vehicle'. The EV solution is the current solution to climate change and resource shortage but is still low in market. Little is known about the consumer motivation towards EV. However, understanding why people do not adopt is arguably at least as important as knowing about those who do adopt. The main reason behind market failure of innovations is the resistance they encounter from consumers. Initiatives have been long way started but still in the initial stage and hesitant. The most important thing is to get them to the end consumer, find out the motivating factors of consumers when making product and consumer related buying decisions related to Electric Vehicles. From this problem statement, research questions are derived:

What is the most important motivating factor for the consumer for making purchase decisions of Electric Vehicle?

The objective of this thesis is to answer above question:

1. Which are the important indicators from consumer perception to determine the consumer's motivation regarding the Electric Vehicle?
2. Which are the important indicators from technological perception of an Electric Vehicle that motivate consumers to consider using an Electric Vehicle?

1.3 Research goal and Purpose of the Study

The rapidly changing market for electric vehicles (EVs), which includes hybrid, plug-in hybrid, and battery electric vehicles (HEVs, PHEVs, and BEVs), is a small but important part of the global automotive industry. Governments worldwide are keen to see increasing penetrations of EVs due to the environmental, economic, and energy security benefits they provide. Consequently, governments have both pushed automakers to develop EVs and incentivized citizens to buy them. Furthermore, the market for vehicles that reduce fuel consumption is becoming more, making accurate predictions about a possible timeline for EV adoption can be a daunting task, as the success of EV is quite dependent on the evolution and interplay of numerous factors in the next few decades. However, both consumers and automotive industries are amidst lot of problems, which needs immediate attention before the EV market could take a leap. There is more than one reason why consumers are reluctant to embrace electric automobile. Their barriers are:

1. Lack of sufficient knowledge about EVs: EVs are predominantly a new technology to the consumers. Awareness about EVs have not yet reached the consumers at large.
2. Lack of economic benefits of EVs: Consumers tend to view the immediate high cost of EVs than looking at the economic benefits attached to it in the long run in terms of fuel efficiency.
3. Lack of sufficient charging infrastructure: Limited recharging stations are a major impediment to the wider adoption of electric vehicles. Recharging stations associated with parking lot are also additional concerns.

4. Long hours of charging: It is estimated that on average it takes about 4-5 hours for a full charge, this makes it less attractive. Technology is being developed to provide fast charging, but it is far future development.
5. Safety issues related to EVs: Lighter weights of EVs are concern for consumers to think that it is easy to prone to accidents. Batteries could be hazardous to the safety.
6. Limited range of EVs: A fully charged battery until now could run more or less 90-120km. This increases consumers' anxiety while planning long journeys.
7. High cost of batteries: The big barrier to the cost of EV is high cost batteries. The cost of battery alone makes up to 50% of vehicle production cost.
8. Social stigma: Consumers tend to think that EVs do not give social appealing and often considered cheap because in Taiwan the initial introduction of LEV (e-bicycle, e-mobility).

The focus of this study is to determine the consumer motivation and importance of product related factors such as social, personal, economic and technological factors. The focus of this study is on consumer motivation criteria i.e. socio-demographic background such as age, gender and education qualification. The aim of this study is to determine whether or not and / or to what extent both product- and consumer-related buying criteria have an influence on the consumer's decision to purchase and Electric Vehicle.

On the one hand, an analysis of already existing studies and theories are made in order to derive different buying decision criteria relating to vehicles in general. A quantitative empirical study on the importance of certain vehicle attributes is conducted, the consumers both living in Taiwan and India are surveyed. The conceptual model used in this thesis is mainly from detailed analysis of Excel.

1.4 Significance of the Study

The scope of this study is to highlight the importance of consumer perception, especially their evaluation to unfold over a long period their personal experience and social interactions. This research aims to give a deeper understanding of what factors motivate consumers to buy electric vehicles. With the examination of consumers from Taiwan and India we want to work out market specific differences and promotional campaign factors for EV. We aim to give a comprehensive market assessment and

provide strategies with the goal to overcome the barriers and leverage the advantages to attract a large number of consumers to electric mobility. The findings of this research may be useful for manufacturers and suppliers of the automobile industry, governments, as well as other public or private institutions concerned with electric mobility, sustainability or green energy business solutions.

As new electric vehicles enter automotive markets in a big way, companies will learn much more about warrantee costs, lifetime, vehicle performance over time, and user satisfaction. The growing market for electric drive will continue to spur innovation in battery technology and charging infrastructure. The scope of the study will focus on where some of challenges that have yet to be overcome. Perhaps the largest one will be non-technical. The biggest challenge that remains for the acceptance of electric vehicles is simply social or technical in nature. The clear way to shed light on these is to analyze consumer motivation.

1.5 Organization of the Study

This research paper is divided into five chapters. The first chapter provides an overview of overall problem surrounding EV market. The focus is on the EV market in Taiwan and India. It delves on the EV problem both from the perspective of consumer and manufacturer. It gives the brief picture about the various barriers from the angle of social, personal, economic and technology. Chapter 2 contains the methodology including research structure as well as data collection and usage methods. In order to get the deeper understanding of consumer motivation we make use of a quantitative study in the form of a web-based survey. In the following third chapter a special focus is put on methodology of our survey. In Chapter 4 we conceptualize the link between advantages and disadvantages of EV and from there analysis is made which gives us the possible link to the most important motivating factor for the EV purchase, then follows the discussion of the survey. Barriers as well as significant drivers are tested and ranked according to their relevance. Chapter 5 provides gives us the implications and maybe insight into strategies to overcome the identified barriers. In addition, limitations and areas of future research are discussed.

Figure 1: Structure of Thesis

Chapter 2 Literary Review

The purpose of this chapter is to discuss the background of this research and review academic literature in order to establish a theoretical framework and provide a basis for viewing this study's results in relation to established theory or previous findings.

2.1 Why Electric Vehicle

In our everyday life activities we commute from one place to another, and major source of commutation is using one's car. It has cost us a lot for our undue dependence on petroleum powered internal combustion engine. Increasing dependence on petroleum-powered car has equally increased harm to environment. The pollution from the cars contributes to unhealthy air and global climate change. Today the world is in great danger. Electric vehicle addresses this problem to a great extent (Bilotkach, V., & Mills, M. (2012). It has the potential to reduce many of these problems. Electric vehicle lowers the air pollution and global warming. This can drastically reduce the over dependence on oil, especially the Taiwan's dependence on oil warrants immediate action. Although electrification of transport could offer some respite to climate change, however this is only part of the solution (Ajanovic, A. 2014). Electric Vehicle (EVs) and Plugged in Hybrid Electric Vehicle (PHEVs) can be only green if the electricity used in Taiwan from renewable resources.

2.2 Strengths and Weakness of the Electric Vehicle

There are number of positive features: zero emission of greenhouse gas, low noise level and high efficiency and relatively low cost of the electric motor. However, there is also considerable number of negative features: Limited battery capacity, generally high prices and a lack of charging infrastructure in cities have all contributed to turning consumers away from potential electric vehicle or hybrid car purchases. EVs have unique features that stand out from their gasoline counterparts, and six out of 10 agreed that EVs are much less expensive to own in the long run than gasoline cars. While those are encouraging numbers, it is clear that automakers still have a long way to go in marketing these vehicles to the wider car-buying public. EV automakers have

much to combat to make the products appealing to consumers. While improving battery life and design is important, businesses should not forget the basics -- making sure the public know about and understand the product. The environmental legislation steers the industry towards a clean and sustainable energy solutions. Besides government subsidy infrastructure facilities are important factors to consider, easily accessible network of battery change and charging stations both require public and private sources make high investments (Jeong, B. K., & Yoon, T. E. 2013). Consumers feel averse to Electric Vehicle due to price premium, lack of charging stations in cities and extended battery-charging times. There still needs a technology breakthrough that negative features of the Electric vehicle are out balanced by its advantages.

2.3 Current and Future Market

The research institutes after their repeated survey studies have made it clear that there has always been a consumer markets for Electric Vehicles, so the desire to purchase is there, representing the basis of a market. Consumers do understand and are aware that the EVs can meet their personal and family requirements. The automobile manufacturers are aware of the potential EV market, but do not have a viable business model to push through this market. It is tough to get a new business off the ground. It is even tougher when you are trying to launch a new industry based on a new product that could alter the ways millions of people get around. The electric car industry is poised to launch a number of new products over the next few years. However, the success of electric cars is far from assured. The electric car industry, like any new industry, is facing a number of challenges. Unfortunately, those challenges are tangled in a hard puzzle, a puzzle that will be tough to unravel. (Kapoor, K., & Williams, M. 2014).

Several technologies for the EVs are under development. Though these EVs are currently very highly priced, the purchase price is expected to drop due to increasing demand, which in turn would allow quantity production. Many automobile manufacturers are planning to produce larger amounts within few years. The major challenge is costs, because electric cars cost a lot to build, they also cost more than comparable gasoline cars to buy. That makes consumers reluctant to adopt them. Electric cars could be less expensive if electric carmakers could ramp up production

volume and use economies of scale. But, for that to happen, lots of consumers need to buy electric cars -- something that likely won't happen without prices coming down (Knowles, M. 2013).

Beyond the costs, electric carmakers have a lot of convincing to do with consumers. Not everyone is sold on the idea that electric cars make sense for their life. That is because of range anxiety. Electric carmakers are finding that people are worried about how far they can travel in electric cars before their batteries peter out. In a gasoline-powered car, running low on gas is really no big deal; just pull into a gas station, fill up and in about five minutes you are back on the road.

Charging an electric car is not quite so simple. Those charging stations are another challenge -- they can alleviate a number of concerns consumers have about electric cars. Electric cars represent a vast change to the country's infrastructure. While some charging stations are out in trial phases, most charging still needs to be at home, in a garage. That means that people who live in shared housing or use street parking will likely have the hardest time charging. Of course, if infrastructure was improved and more charging stations were available, more people would buy electric cars. However, of course, changes to infrastructure will not be made until more people buy electric cars and call for it. EV will remain a niche product, due to its high purchase price and limited driving range.

2.4 Buying Decision

There exist many technical possibilities for alternatively driven vehicles like EVs. However, these possibilities are remote to potential consumers due to limited knowledge, which can be due to consumers having too little information about them. Thus, the question arises which actual attributes of an EV are of importance and relevance for the consumer. There are product related and consumer related buying decisions to consider.

2.4.1 Product Related Buying

The product related buying criteria could be based on few dimensions like investment and ongoing expenses, technical characteristics and infrastructure. The

investment and ongoing expenses include the purchase price, which is one of the important factors within the buying decisions process. The consumers' intent to maximize the marginal value is related to a higher price of EVs. Consumers are significantly more price sensitive when choosing EVs. The price elasticity depends on market share, fuel type and drive concept, i.e the higher the market share, the lower the price elasticity (Lebeau, K. et al., 2013). Thus, purchase price of consumer is a significantly more important purchase criterion than when comparing the EVs with the fuel-powered vehicles. The 50% of premium price are currently due to high battery price the consumer has to pay. Majority consumers are not yet ready to pay the premium price. This requires a significant amount of the battery price would have to be subsidized by the industry or government. Interest rates, government subsidies and quality range are very important when consumers making purchase of EVs. Maintenance cost is a critical factor (Mairesse, O et al., 2012). The battery's final durability represents the main cost component of an EV's maintenance, which currently amounts to six years. The low mechanical wear of EVs might help in the reduction of the maintenance cost of EVs.

Technical characteristics such as driving range, charging time and acceleration are important factors to consider. EVs do not come with generators thus they have only short battery life, providing limited range. The average driving range of current technologies cover only 160 Km per battery charges. The short battery life, low driving range of EVs is mainly caused by the low energy density, i.e. the battery's low capability of storing electrical energy. This does not meet the consumer's expectation. The duration of charging and refueling process is utterly important for the consumers' buying decision. The charging time of an EV is assumed to be more important than driving range. Brand variety of EVs are of great importance to consumers. Consumers value various attributes such as design and technical variables differently. They might be interested in a certain technology that they cannot find in connection with the EVs (Pearre, N. S., et al., 2011). The brand and model variety of innovative drive technologies is unlikely to increase in the near future. Providing potential consumer with large brand and model varieties is one of the essential requirements to achieve a wide dissemination of Electric Vehicles. This has come forward from the well-established auto manufacturers, since only they have the resources to provide the required infrastructure of points-of-sales and body shops.

2.4.2 Consumer Related Buying

Consumer related buying is divided into demographic and socio-economic criteria. Demographic criteria are gender and age, where else socio-economic criteria include education qualification.

2.4.2.1 Gender and Age

Gender and Age of potential consumers of EV are considered most important influence in the buying decision. Consumers who are young in age are more likely to have lower income and therefore are price-sensitive when making a purchase decision. This assumption is confirmed by a study conducted by (Dagsvik et al. (2002), which showed that consumers aged 30 and above are more sensitive to both purchase price and ongoing expenses than older consumers. This might result in age affecting the choice of driver technology. The age and gender may have an effect on the importance of technical characteristics, such as range performance. Range performance for males is more important than female. This study concludes that respondents in the age group of 26-35 years require their vehicles to cover higher driving range than respondents of higher age groups (Thiel, C., Alemanno, a, & Scarcella, G. 2012).

2.4.2.2 Qualification

A positive correlation of a higher educational background and the acceptance of alternatively driven vehicles are seen to have influenced the buying decision. However, some opine that educational background is not assumed to have an effect on the product-related buying decision. However, since this factor belongs to typical socio-demographic information, it is included in this part of the thesis.

2.5 Market Analysis of EVs in Taiwan

Taiwan Ministry of Economic affairs states that global demand for EV is expected to grow at a rapid rate. It is predicted that the market is expected to be more

than double each year, reaching 268,000 vehicles in 2011, 959,000 vehicles in 2012 and 2,107,000 vehicles in 2013. Growth will then continue at six-figure rates each year to reach 7.706 million vehicles by 2020, or approximately 10% of global sales. Taiwan's EVs industry gradually picking up the pace. It is predicted that Taiwanese EVs will account of 2% of the global market. This is a very welcome sign from a country which measures no more than 400km from tip to tail, however covers a broad range of terrain (Yang, C.-J. 2010) . The present scenario of EV in Taiwan is not as fast as rest of US or Europe because the limited domestic market makes it hard to cultivate a local brand. For the key components and systems Taiwan is still dependent on foreign vendors. Taiwan has 150 companies dedicated to the EV sector manufacturing components such as electric motors, batteries and controls. Tesla gets its electric motors from Fukuta, which is based in Taichung City, and BMW purchases many of its EV components from Taiwanese companies. Besides promoting the EV industry Taiwan is also concentrating on developing the advanced battery and control solutions to enhance the EV cost-performance for industry (Yang, C.-J. 2010).

2.6 Indian EV Market: Taiwan EV OEM's Contribution to India

There is a growing population in India with the major growth being the urban population in major cities. This rising growth causes pollution concern through the increase in the use of motorized vehicles within the urban environment. To reduce the pollution levels and the carbon emissions caused by the use of motorized vehicles, the Indian government has developed a future strategy to support E-mobility programs for the growth of the electric vehicle market in India.

2.6.1 Indian EV Market Scenario

The transport sector in India consumes 90% of the total oil demand and this affects consumers as they are exposed to volatile fuel prices. The high usage of fossil fuels also has a negative impact on the environment due to high pollution caused by vehicle emissions. The level of investment by the government is expected to be about 3 billion Euro by 2020. Industry will need to match the government in terms of resource and cost allocation. Major Indian manufactures such as Mahindra Reva and

Hero Electric are additionally considering Carbon Credits as a way of offsetting the costs by the reduction of carbon emissions if electric vehicles are used by their customers (Kapoor, K., & Williams, M. 2014). The Indian government is still at an early stage in the implementation of its strategic plan. The Indian government has identified priority areas where there is greater potential for India to succeed, taking into account international competition and current competencies. Where there is a high priority but hard-to-develop focus, it is envisaged that progress would be through global partnerships and acquisition of technology. Indian government to create a demand for electric vehicles, it has to overcome the perception of the Indian consumer of the higher cost of EV's and poorer performance standards compared to traditional internal combustion engines based vehicles. Upfront cost is one of the key barriers to uptake of electric vehicles within the Indian population and there is limited understanding of electric vehicle technologies amongst customers. Both industry and government are acutely aware of this problem and the Indian government is trying to rectify the situation by offering consumer incentives for purchase of EV's. Import of EV parts attracts 4% duty as opposed to 8% earlier.

2.6.2 OEM for EV: Potential for Taiwan

EV parts In India there are 13 vehicles per 1000 people. This represents one of the lowest level of penetration in the world, leaving significant room for market growth in the future. The transport sector in India had continued to grow and recorded a 13% annual growth in the last five years. Increasing fuel costs, rise in pollution level and increasing government incentives will boost the uptake of electric vehicles in India. t that the Indian market for E-mobility is cost sensitive and lacks a mature technical / communication / power infrastructure (Yang, C.-J. 2010). However, there is growing interest from mainstream automotive companies both foreign and domestic to enter the EV market in India. Recently car manufacturers in India including TATA motors, General Motors, Hero Motor Corp and TVS have announced their EV rollouts but currently the automotive companies have yet to commit to the EV market in India due to lack of support from the Indian government for its roll out of the subsidies for electric vehicles.

But this is likely to change with implementation of the strategy plan by the Indian government. The customer acceptance of electric vehicles within the Indian market is rising only slowly. This is due to factors such as limited battery charging infrastructure and the high cost of vehicle ownership. The growing economic prosperity in a number of segments of the Indian population has given rise to a large relative growth in disposable income. growing number of EV technology companies are entering the Indian market and an increasing number of joint ventures and mergers are taking place in the industry, technologies relating to the EV sector such as

- Electric motors for the vehicle drive train
- Battery packs and battery management systems
- EV system integration
- EV testing
- Demo city for EV's implementation

Electric vehicles are commercialized at present to use lead acid batteries because of their lower price as compared to other type of batteries. There is a shift towards Li-Ion battery technology and this is likely to be the dominant technology in the future in terms of energy storage for electric vehicles in India. Li-Ion battery manufacturers are predominantly from Taiwan and China. India has no Li-Ion manufacturing capability. The majority of the EV components for all vehicle classes are currently sourced from China with few domestic EV components manufacturer.

There are very few EV component suppliers in India and the components they supply are for a very limited market. India represents a huge business opportunity but it also presents risks and significant barriers to entry. The biggest obstacles to overcome when entering the Indian market and doing business is the cultural differences that will be encountered. Understanding the Indian mindset, adapting how your product fits into Indian needs are the keys to success in India. Traditional Indian SME businesses are family run and hierarchical. Hierarchy plays a key role, decisions are made at the highest level, and roles are well defined. Indians place great value on relationships so take time to develop contacts and relationships (Knowles, M. 2013). Time is fluid in Indian society, so flexibility is essential. Relationships are of utmost importance and Indians will base their decisions on trust and intuition as much as on statistics and data, so be mindful of the importance of a good working relationship. Take the time to

engage in small talk and get to know your prospective partner. Rushing straight into the business issue could be perceived as disrespectful.

Chapter 3 Methodology

3.1 Research Design

Knowledge about research structure can help us to clarify the research design and facilitate the choice of an appropriate one. There are two main distinguished factors from which angle we analyze the research question advantages and disadvantages of Electric vehicle. Factors that are advantages are categorized into four groups: social, personal, economic and technology. Factors that are dis-advantageous are also equally categorized in same way to find out the most motivating factor that could be one of the influences in making purchasing decision for EV. In our study we combine advantages and disadvantages. We conduct a quantitative study that is associated with advantages and disadvantages because consumer's perceptions towards EVs are rather subjective and context dependent. In other words, we collected information about consumer perception about advantages and disadvantages that explain their motivation towards EV. This leads to two important facts: 1. the research process we gathered are subjective information and 2. Interpret this information according to our own analysis. Consequently, researcher in this study is not completely independent.

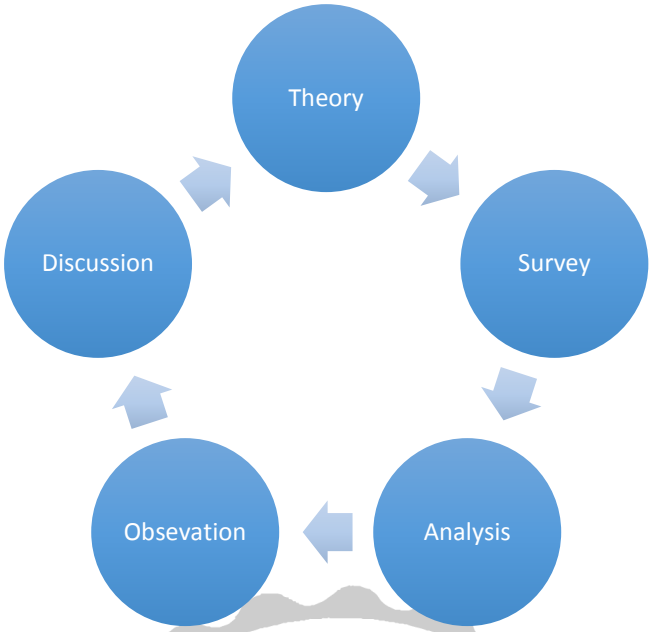

Figure 2: Reasoning Process

3.2 Data Analysis

Data provides the basis for every marketing research. Primary data refer to information collected by the researcher and secondary data consist of information that has already been collected by others. In our study, we have made constructive use of both primary and secondary data. Secondary data were used to provide information data about the EV in general. A large amount of external sources was referred about recent EV developments from both Taiwan and India. The secondary data were used to identify potential buying incentives that have the potential to increase the rate of purchasing (EV Knowles, M. 2013). Primary data through survey were examined to analyze consumer's perception towards electric vehicle. It is also used to evaluate the importance of the previous findings about purchasing EV from consumer's perspective. In our study, we have made use of quantitative survey. The reason for the approach is to allow us to quickly obtain data from a large number of respondents in order to determine attitudes and motivation that consumers have regarding electric cars.

Data Source	Primary data source- Questionnaire Secondary data source- Internet

Sampling Area	Taiwan and India
Sampling Size	133
Research Instrument	Questionnaire
Method of contact	Online Survey

Table 1: Survey Details

We have used internet as platform for our survey and could reach a sample size of 74 respondents from Taiwan and 59 respondents from India. To distribute the questionnaire, we utilized social networks with respect to the criteria time available, such a large sample size could only be achieved by using a web-based survey as communication instrument. However, using a social media as platform might distort reality and hence reduce validity. The web-based we used for our research is research software company: 'Monkeysurvey'. We must keep in mind that web based survey has its own shortcomings. Online surveys are anonymous thus participants might not answer seriously or do not take sufficient time to complete the questionnaire, it has the non-response error. Although there are shortcomings, we still consider a web-based survey as the most suitable communication instrument for our study, especially with regard to cost efficiency, time availability and accessibility of the target group.

3.3 Sampling

The next step is to design the sampling plan. The sampling has to be greater accuracy of result, speedier data collection and easy availability of the population element (Blumberg et. al., 2008). There are no exact numbers that best reflect the exact target population needed for sampling but, the sample size is sufficiently large enough to be representative. Thus, we have totally 133 participants in our survey from which 74 Taiwanese and 59 Indians participated. We put a research focus on consumers in their twenties and thirties with an academic background. They have a future high buying power segment and likely to be concerned with buying a car in the future. In our research, we have used non-probability sample for it is most suitable because it allows us to select units of the sample according to personal judgment. It is

more convenient and easy for theoretical sampling. Convenience sample is used because it gives us the freedom to include everyone who is accessible. This method is appropriate for developing an understanding of human opinion and to provide better insights into our research questions.

3.4 Questionnaire

The goal of our questionnaire was to find out the motivating factor of consumers in buying EVs. Following our research question, we are interested in how EV perception influences the purchasing decision. To answer this question, we ask participants to evaluate predefined EV characteristics according to their perception. We want to determine the motivating factor. With the aid of this survey, we want to examine the relative importance of drivers from a consumer's perspective. The type of question we focused was target questions. Initially short introduction of our research topic was given. We also informed participants about the time needed to complete the survey and assured them that their data are used confidentially and only for a academic purposes. We utilize target questions to address our research question. The target question section is divided into two parts. The first part we investigate the evaluation of consumers; the characteristics of advantages and disadvantages of EV involving Low cost per Km, Environmental friendly, charging facility, driving range, time of charging, knowledge about EV, style/brand/looks and new technology (advantages Question 1 – 8, disadvantages Question 1 -8). In the second part we aim to detect straight at the motivation or consumer specific characteristics such as environmental friendly and EV car knowledge (Question 1 – 4) and also purchase decision (Question 5 & 6). The questionnaire begins with the respondent's demographic and social variables such as gender, age and education qualification (question 1 – 3).

In the design of the questionnaire, we used multiple choice single-response scale. Simple category scales offers two or more mutually exclusive response choices (e.g. decisive, very important, important, yes, no). This response strategy is useful for demographic questions. When there are multiple options for the respondent but only one answer is sought, multiple choice, single response scale is appropriate. In this research the Likert scale summated rating is applied mostly. It consists of statements

that express either a advantages or disadvantages attitude towards the object of interest. In our research the participant is frequently asked to what extent he or she considers each question to be advantageous or disadvantageous.

Evaluation of Inaccuracy is bound to happen in the marketing research. The data and findings should be evaluated based on checking the accuracy of information obtained. Inaccuracy occurs due to measurement validity and reliability. For the validity we carefully considered our theoretical framework to ensure that the information obtained are relevant to the topic of research. Validity might have been limited in the unequal distribution of nationalities in our research and the samples were not selected randomly but through social media contacts. Thus, answers are bound to be biased to certain extent. Taking into consideration the interpretation of data, which might be biased, thorough data analysis, was done. By pre testing our questionnaire, potential errors or misunderstandings were revealed and improved for increased reliability. Coming to ethical issue all the participants were guaranteed confidentiality regarding their personal data and assured that their data were only used for academic purposes. Other ethical issues were considered when formulating the questionnaire. In order to guarantee best possible objectivity and to convey seriousness on our part, the language was kept as neutral and proper as possible.

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4. Research Analysis

4.1 Distribution of Gender, Age and Qualification: Taiwan & India

4.1.1 Gender of the Respondents

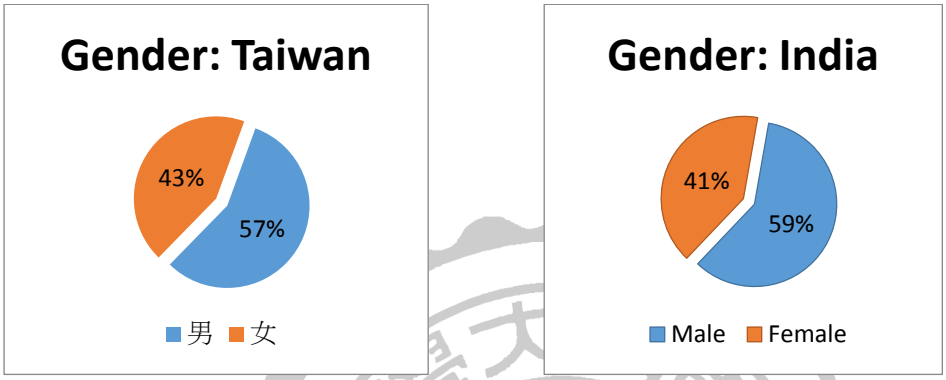


Figure 3: Distribution of Gender

Out of the respondents surveyed 42 were males from Taiwan and 35 from India, while 32 respondents were female from Taiwan and 24 respondents from India. Thus, it can be inferred that there is a balance in the number of respondents surveyed.

4.1.2 Age of the Respondents

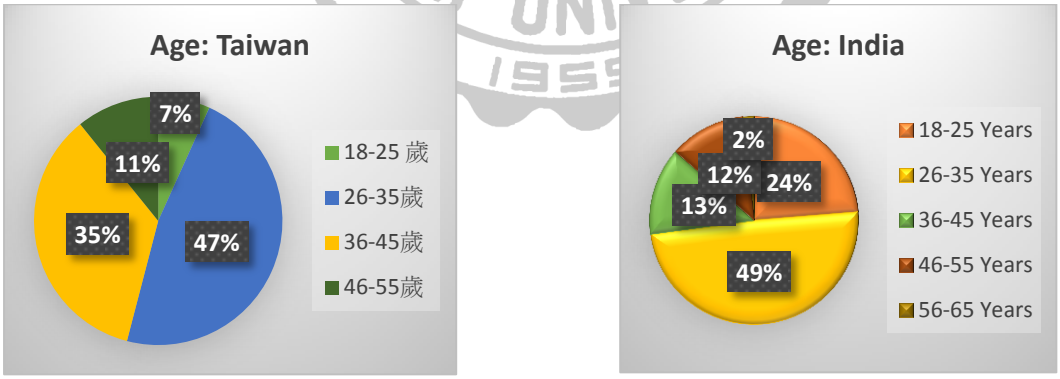


Figure 4: Distribution of Age

Total of 74 respondents from Taiwan and 59 respondents from India were surveyed for the consumer motivation towards EV. Out of the respondents' surveyed from Taiwan and India (7% & 24%) were in the age group of 18-25 years, (47% & 49%) were in the age group of 26-35 years, (35% & 13%) were in the age group of 36-45 years, (11% & 12%) were in the age group of 46-55 years and (2%) were in the

age group of 56-65 years from India and no respondents form Taiwan were in that age group. Thus it can be inferred collectively that larger part of the respondents were in the age group of 26-35 years indicating most respondents were young. This age group is the target of our study for they are the immediate potential customers of EV and their perception is of utmost importance.

4.1.3 Distribution of Education Qualification

Out of the respondents surveyed in Taiwan and India (9% & 3%) were from school, (2%) did Diploma only India, (64% & 29%) were undergraduate, (27% & 44%) were graduate and (22%) were Ph.d & above from India. This indicates that major respondents from both the countries were undergraduate and graduate this goes well with the previous age factor or 26-35 years.

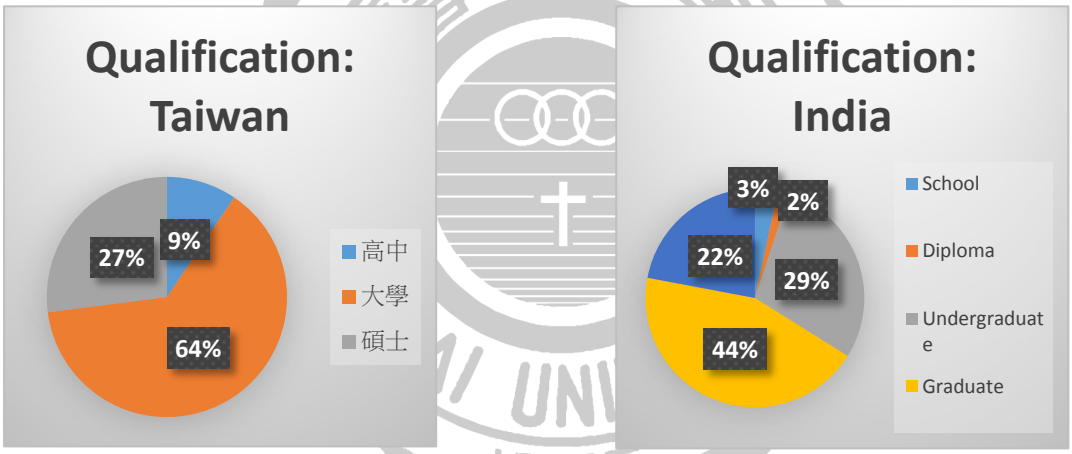


Figure 5: Distribution of Qualification

4.2 Distribution Factors in Taiwan and India: Advantages

We begin by analyzing the advantages that consumer think could be the motivating factor in their push towards the purchase. This is an important factor to analyze, for amidst lot of hurdles these advantages could be a major push to promote EV. Advantages factors are sub divided into four categories: Social, Personal, Economic and Technological factors. Now let us analyze each of these in detail.

4.2.1 Distribution of Social Factor: Advantage

Social Factor preferences regarding environmentally friendly and Low CO2 emission are the criteria presented to the participants in both Taiwan and India. The goal was to shed light on the motivating factors in the process for purchase decision concerning potential EV market.

4.2.1.1 Distribution of Environmentally Friendly

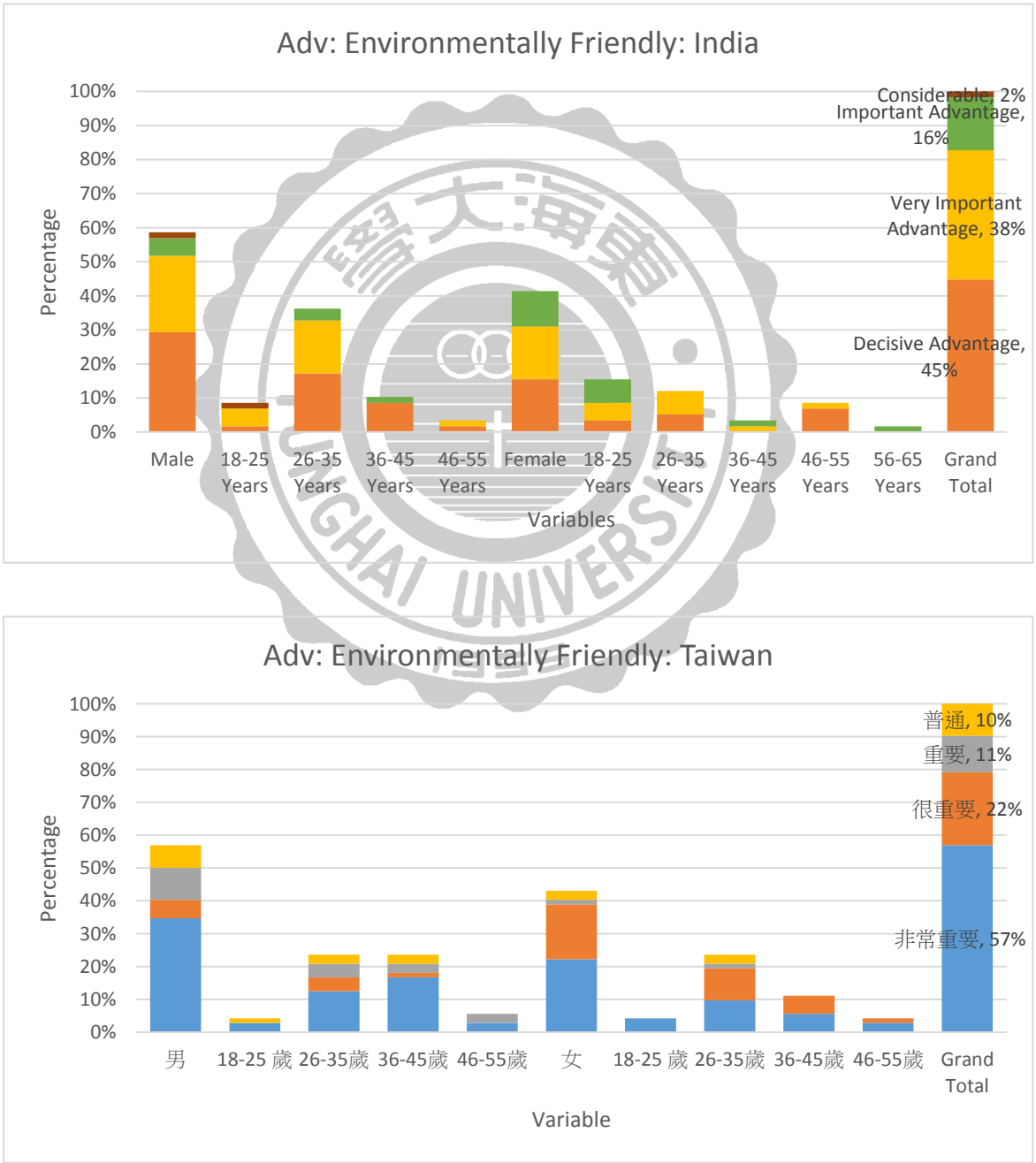


Figure 6: Distribution of Environmentally Friendly: Advantages

Considering environmentally friendly as an important social factor of advantage our survey has come out with the results showing in Taiwan 57% consider it decisive advantage and in India 45% and 38% consider very important. Thus, both in Taiwan and Indian consumers' majority consider environmentally friendly a decisive social factor. This factor could be a major push for the promotion of EV to the green minded consumers.

4.2.1.2 Distribution of Low CO2 Emission

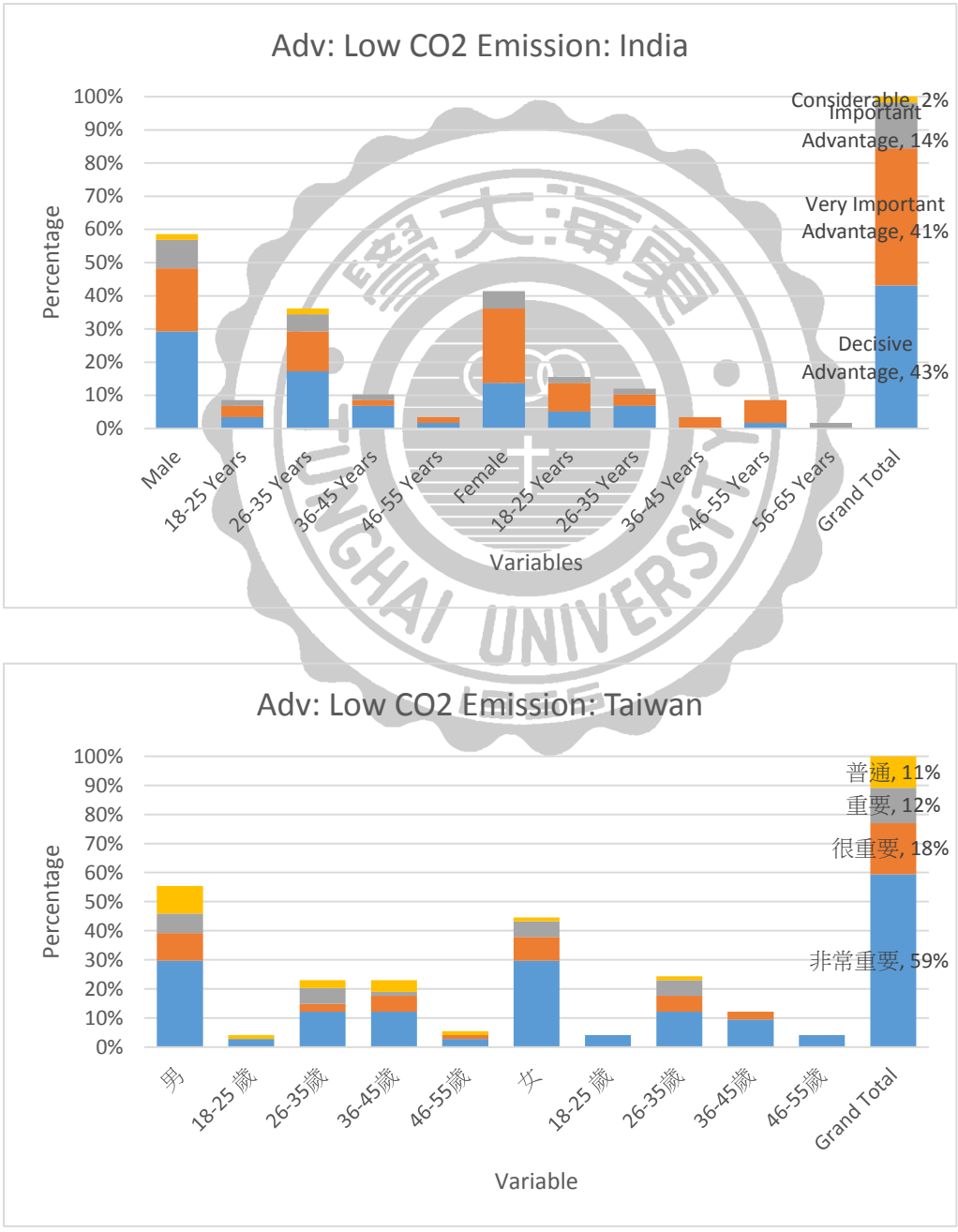


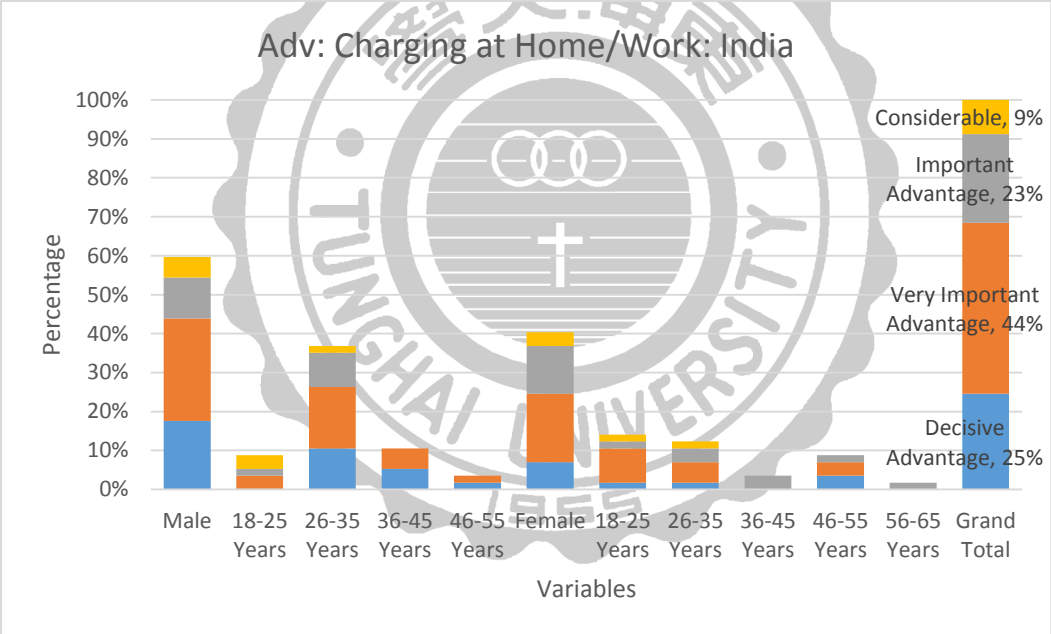
Figure 7: Distribution of Low Co2 Emission: Advantages

Associated factor in the social factor is the Low CO2 Emission. There is a fare distribution among the Indian and Taiwan consumers (43% & 59%) who consider Low CO2 Emission an decisive factor both among undergraduate and graduate.

4.2.2 Distribution of Personal Factor: Advantage

Consumers have different tastes according to their needs and wants. We have clubbed together few variables we consider personally matters to consumers, they are; Charging at Home/Work, Limited Noise and Style/Brand/Looks.

4.2.2.1 Distribution of Charging at Home/Work



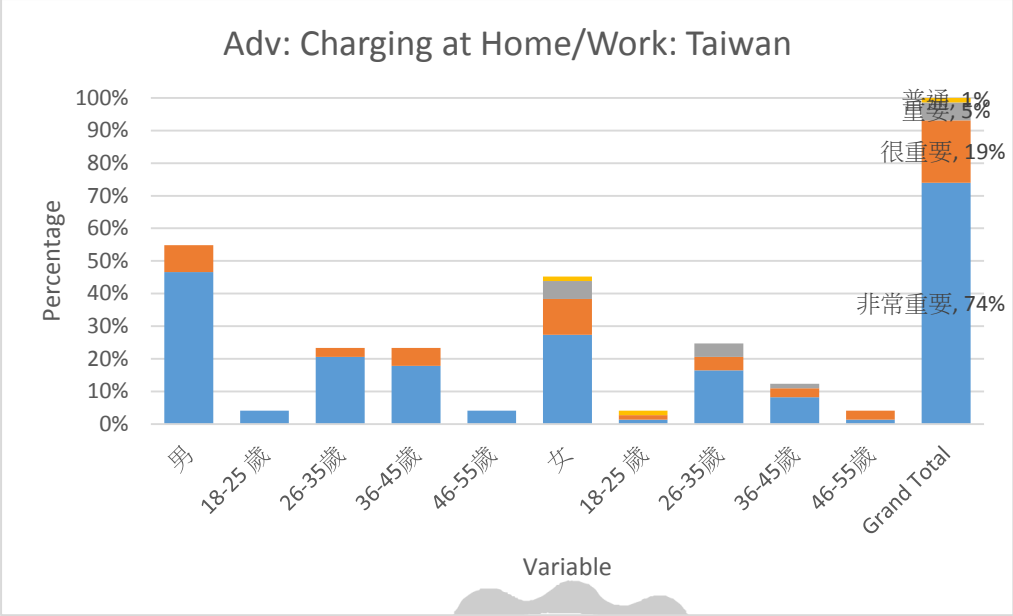


Figure 8: Distribution of Charging at Home/Work: Advantages

Majority 44% from India consider Charging at Home/Work a very important factor, where else among Taiwanese consumers especially age group of 26-35 years and total of 74% consider it decisive factor. Decisive factor for Taiwan consumers is very important advantage for Indian consumers. The limited availability of recharging stations is a major impediment to the wider consumers. Thus, they consider charging at home or work could ease their problems.

4.2.2.2 Distribution of Limited Noise/Comfort

The electric vehicle produces little or no noise. Some believe absence of noise could be a great benefit to the noise pollution and ease of riding. Again 41% Taiwanese consumers consider this a decisive advantage, but 52% Indian consumers would consider it only very important advantage. This goes to show that vehicle without noise is exciting to both consumers of Taiwan and India. Maybe they consider it less annoying and more soothing driving experience.

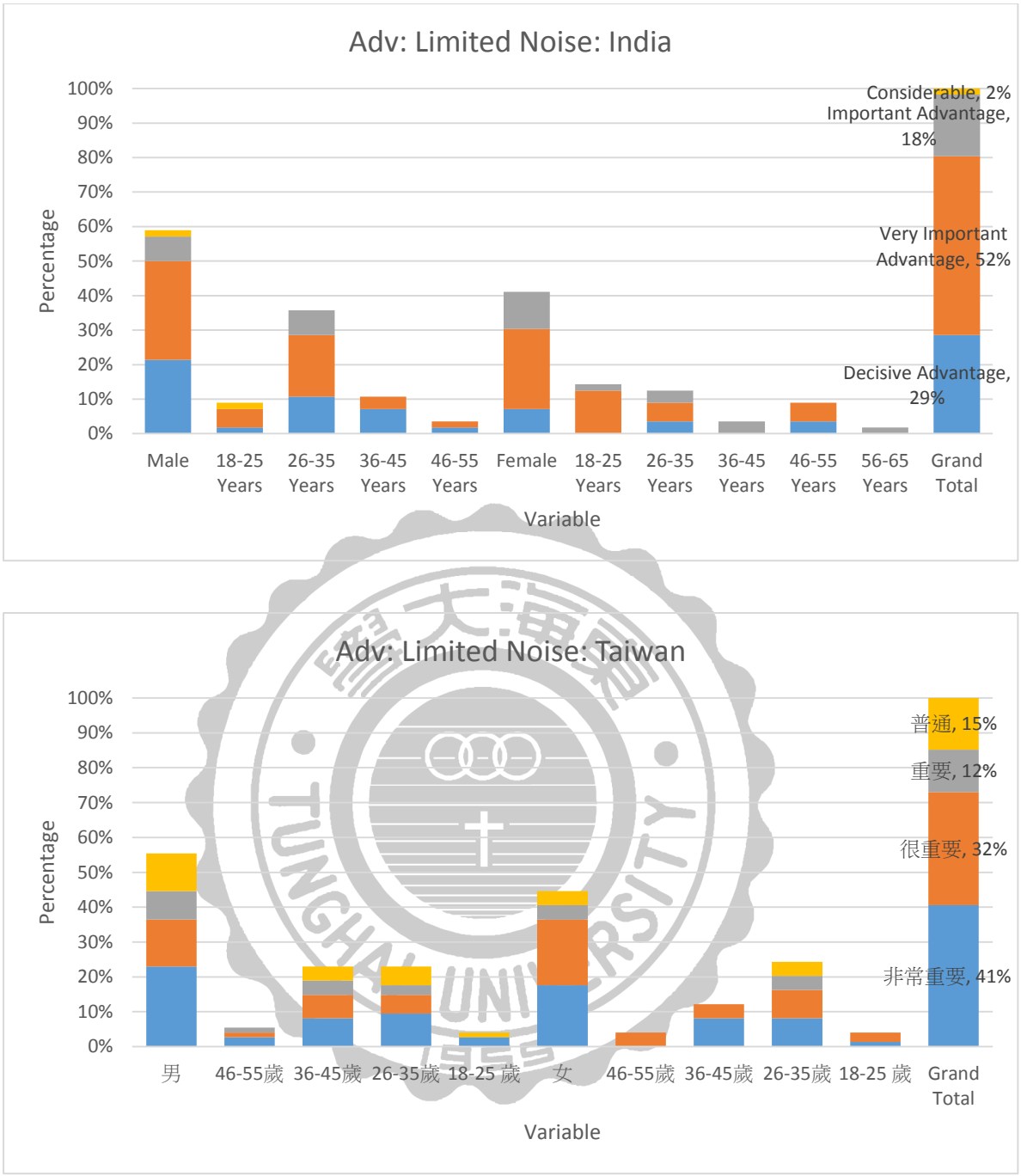


Figure 9: Limited Noise: Advantages

4.2.2.3 Distribution of Style/Brand/Looks

Consumers using fuel-based vehicles have seen the evolution of vehicles in terms of not only technology but also design and looks. This feature has to be carried on to the Electric Vehicle if it has to be promoted as an alternative. However, in our study we found that consumers are not keen in considering it decisive advantage both in Taiwan and in India. Only 22% from Taiwan and 13% of Indians consider it

decisive advantage. However, 30% from Taiwan and 43% from India still place it as very important advantage. This needs attention once the EV has reached its early adoption stage.

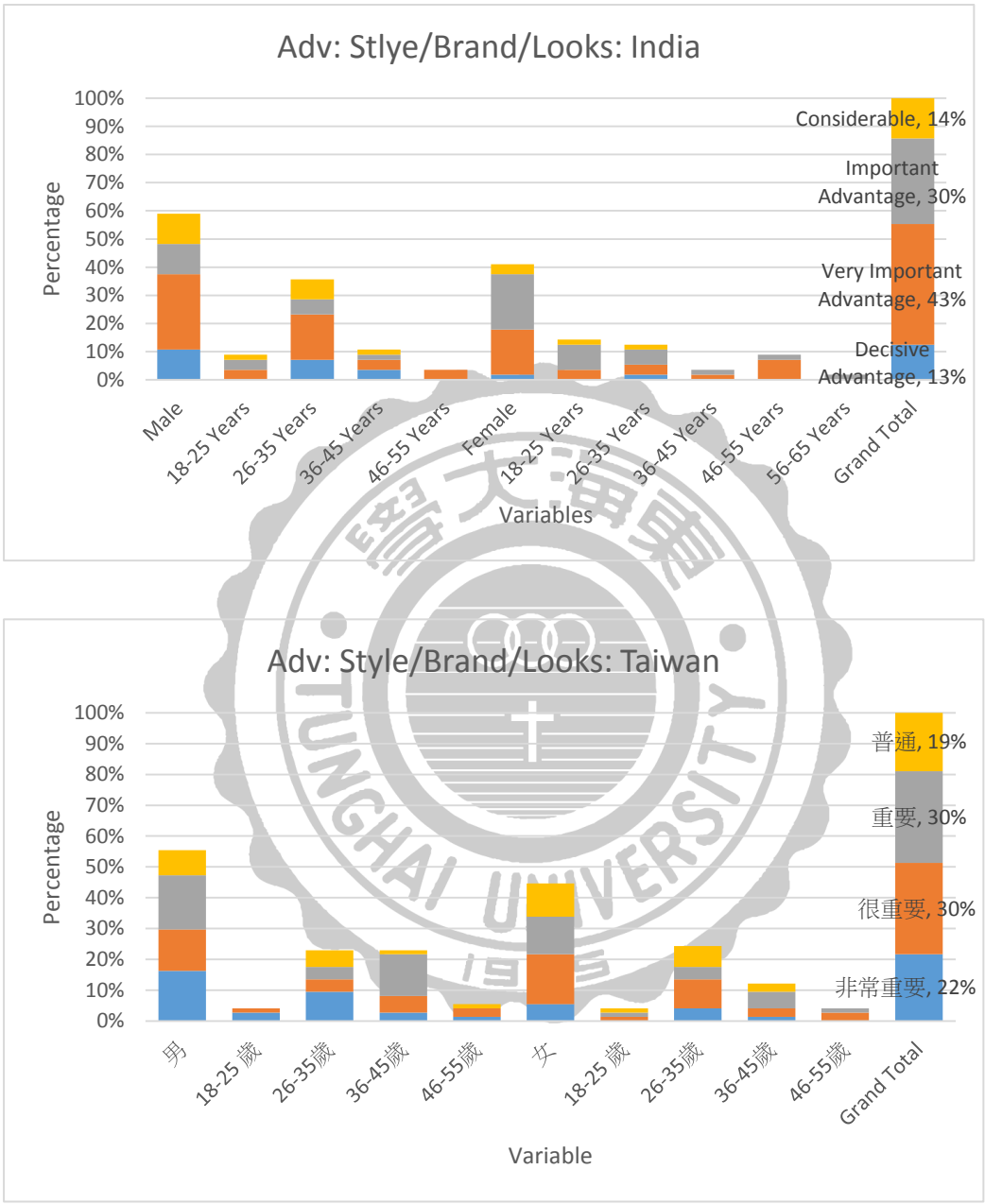


Figure 10: Style/Brand/Looks: Advantages

4.2.3 Distribution of Economic Factor: Advantage

Economic factor could be one of the facilitators in consumer purchase of EV. Irrespective of country and state of economy considerable number of consumers are price sensitive. Price likely to affect the consumers' purchase decision. Reduction on

cost per Km and Government subsidy might encourage households to adopt Electric vehicles. For the variable Low cost per Km 30/71 Taiwanese consumers both male and female aged between 26-35 years, consider this a decisive advantage and 42% of Indian consumers consider this a very important advantage. For the variable, Government Subsidy 47% of Indians consider it very important advantage and 29/73 of Taiwanese consumers consider it decisive advantage which forms the majority among the Taiwanese consumers.

4.2.3.1 Distribution of Low Cost Per Km

From the point of view of consumer market uptake of EVs will depend upon a number of issues, such as green energy cost and cost per unit of electricity. Given the current energy price the cost of electricity per unit is much less than the fuel thus consumers view Low cost per Km as an advantage. Consumers from Taiwan (43%) and India (30%) consider it decisive advantage. This could be one of the important factors in promotional campaign of EVs.

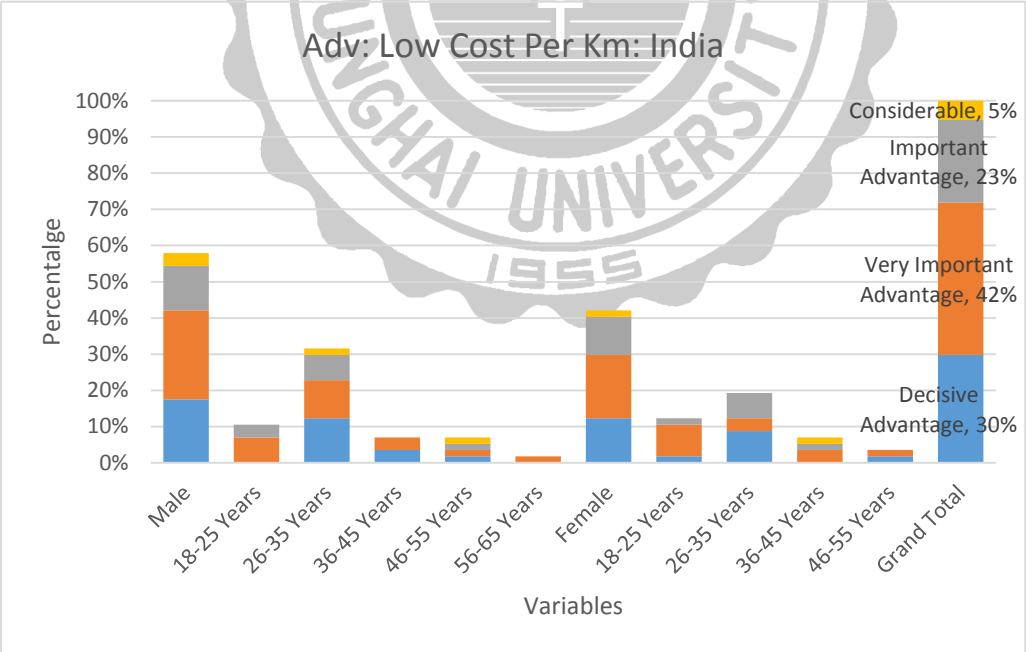
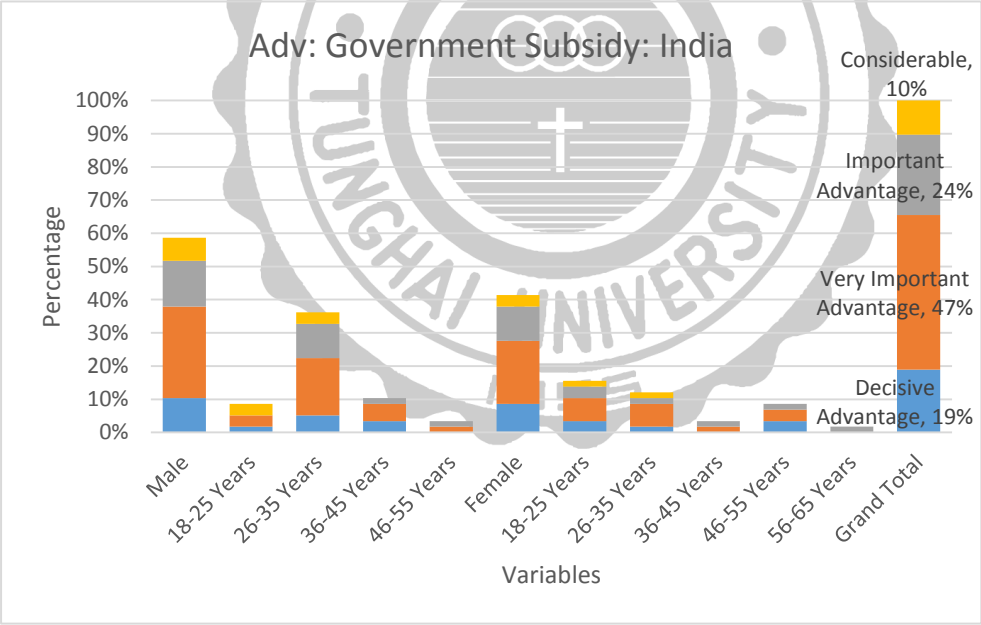


Figure 11: Low Cost Per Km: Advantages

4.2.3.2 Distribution of Government Subsidy



Despite government subsidies, sales of EVs are a bit shaky. A big part of the problem is that both governments Taiwan and India have no viable strategy in place to promote EVs. However, consumers still expect that governments do something substantially for the promotion. 49% of consumers from Taiwan consider it decisive advantage though only 19% of Indian consumers consider it decisive advantage.

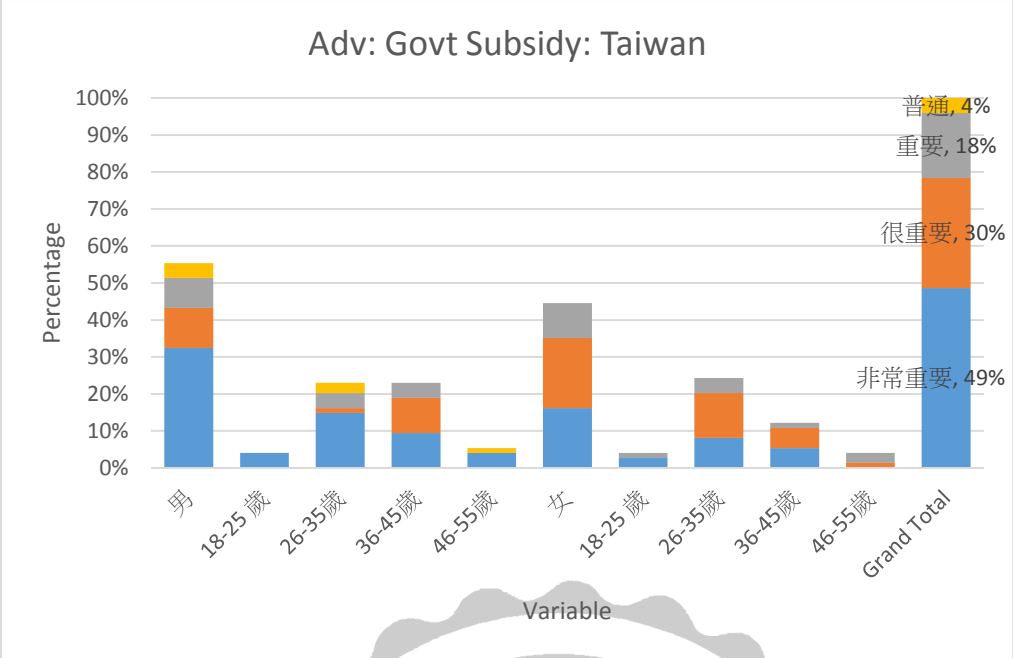


Figure 12: Government Subsidy: Advantages

4.2.4 Distribution of New Technology Factor: Advantage

Technological Factor occupies an important factor as to the speedy promotion of Electric vehicle in the consumers' hands. It is still in advancement stage however, consumers are eager to see a cut through edge in the technology, which would prompt them to EV stores. About 42% of Taiwan consumers consider it decisive advantage and 51 % of Indian consumers see it as a very important advantage.

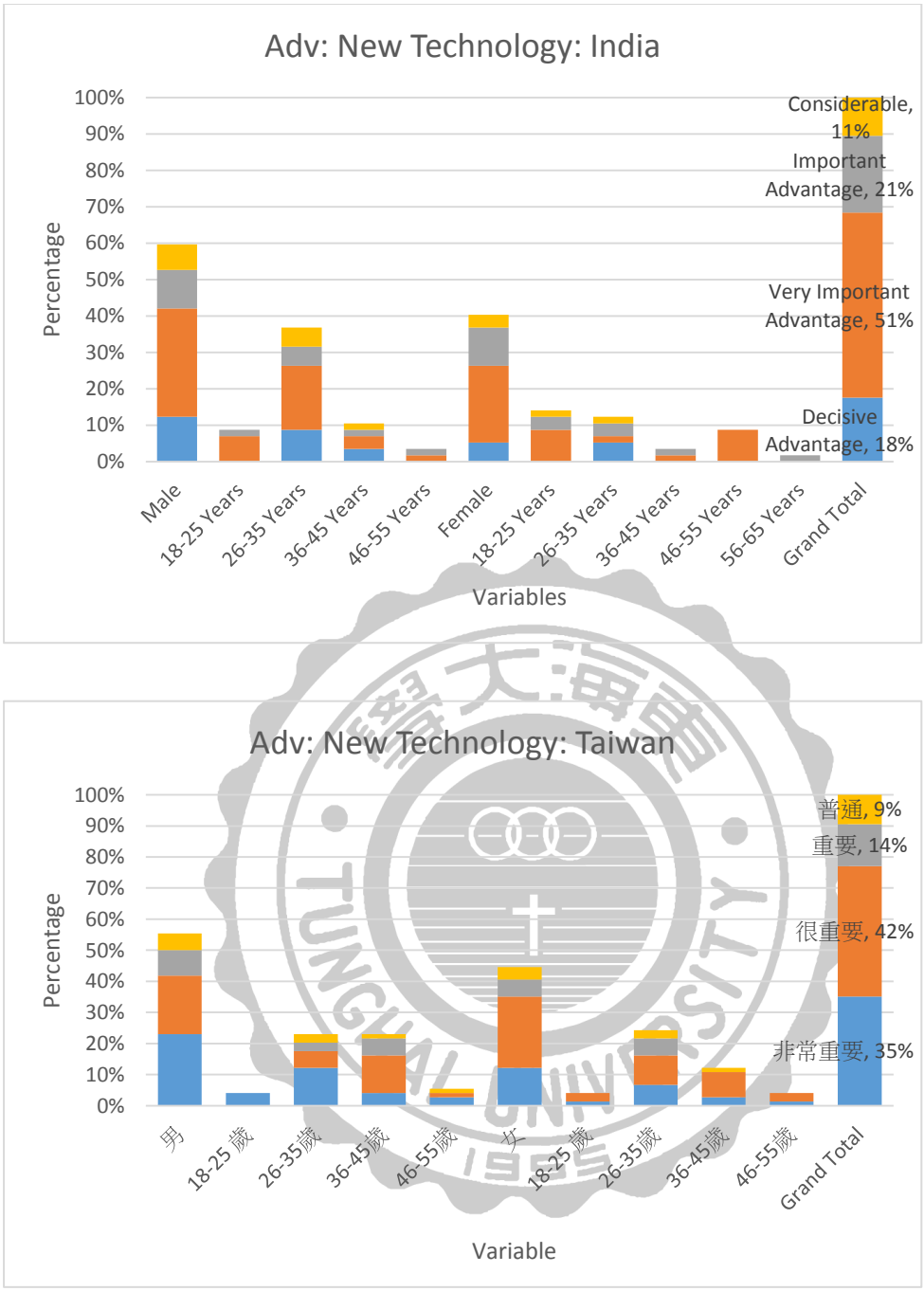


Figure 13: New Technology: Advantages

4.3 Distribution Factors in Taiwan and India: Disadvantages

4.3.1 Distribution of Social Factor: Disadvantage

Social factors we considered while analyzing the social advantages are quite different from the disadvantages. The following social disadvantages: Limited charging infrastructure, Long charging time and less noise: safety concerns are dealt

here. These are considered some of the pressing disadvantages because these are the immediate concerns of the potential consumers in both Taiwan and India.

4.3.1.1 Distribution of Less Charging Infrastructure

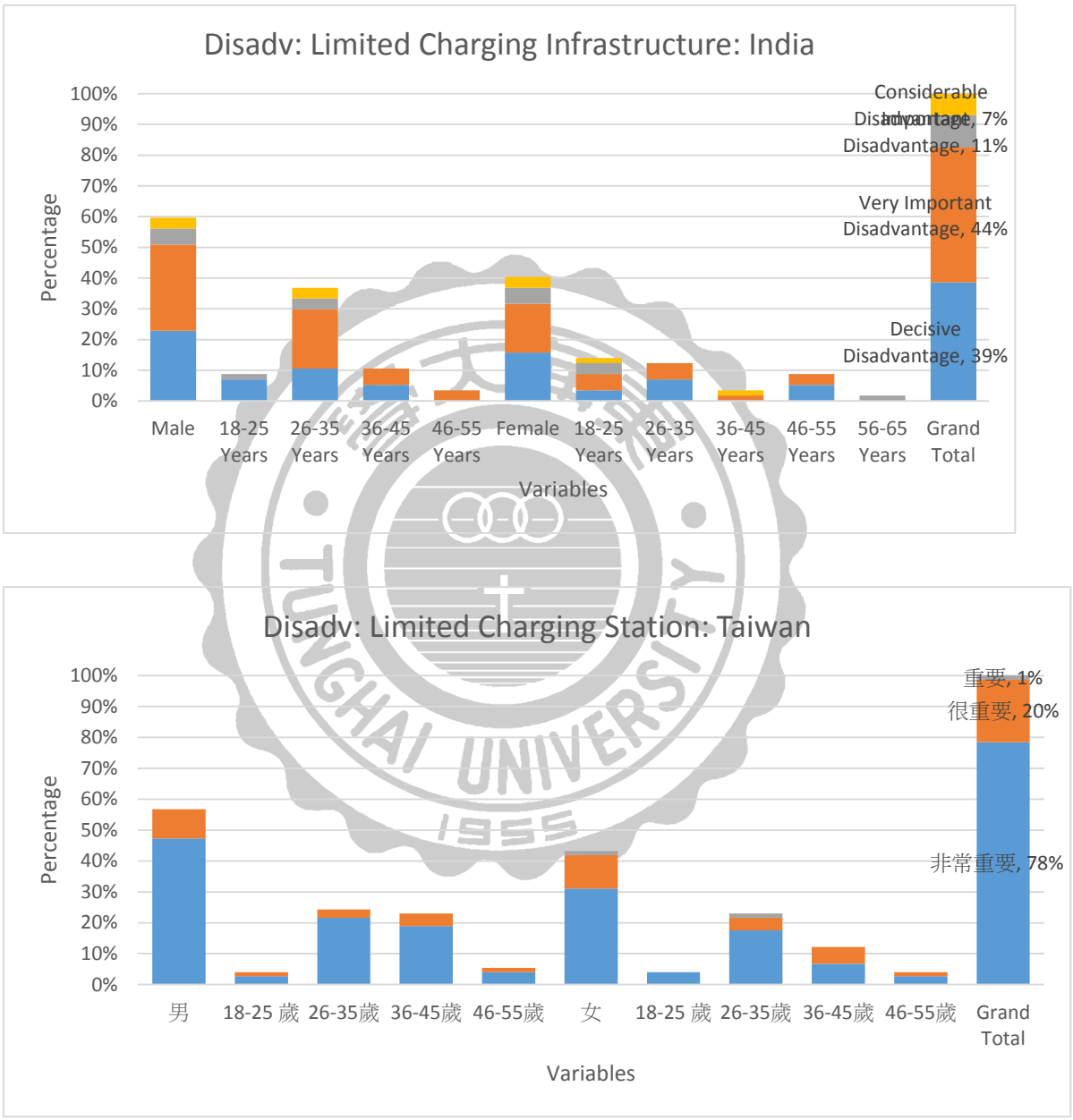
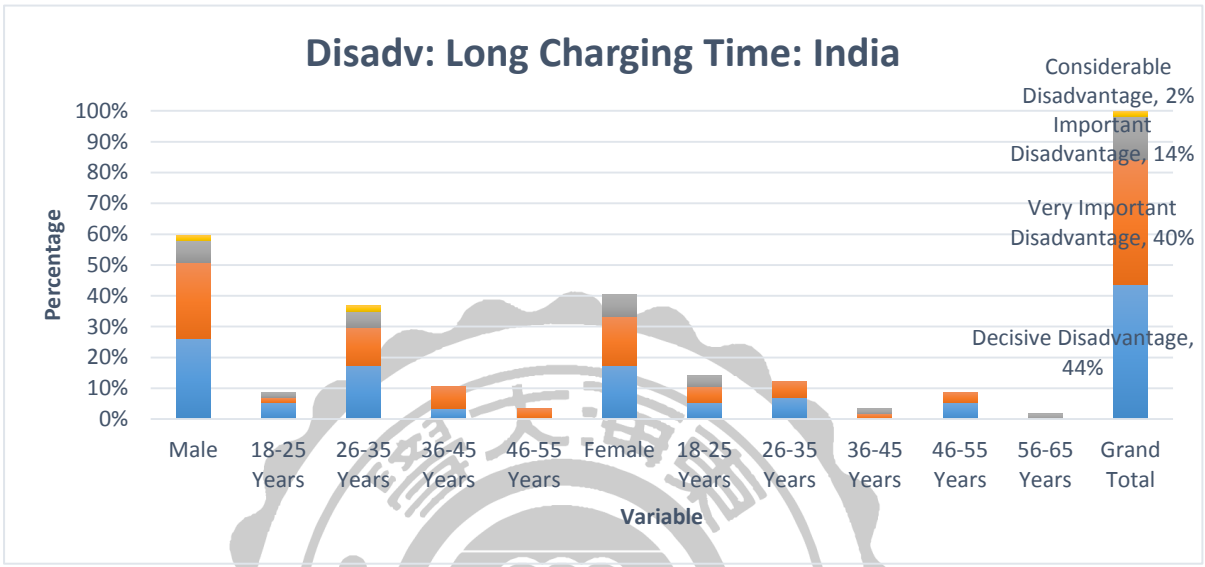


Figure 14: Limited Charging Station: Disadvantages

Taken together it is important to note that the consumer perception of Taiwanese differ from Indians in terms of grading. 78% of Taiwanese consider charging limitation as decisive disadvantage, where 39% of Indians consider as decisive but 44% consider very important disadvantage. This is a very important factor to notice

because consumers shifting from fuel powered vehicles to Electric vehicles are deeply worried about this infrastructure.

4.3.1.2 Distribution of Long Charging Time



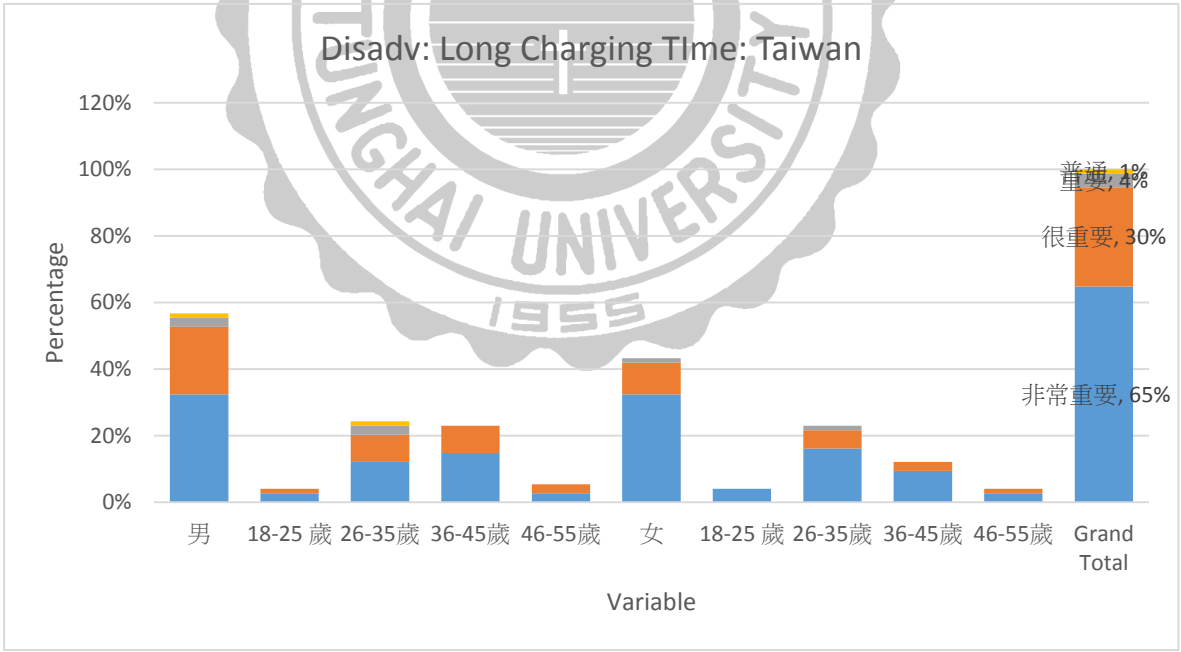


Figure 15: Long Charging Time: Disadvantages

Consumers used to fuel the tank in minutes are concerned about the long charging time when they shift to Electric vehicles. This is clearly seen from the survey results where 65% of Taiwanese consumers have considered this as a

decisive disadvantage and Indian consumers about 44% and 40% consider this as decisive and very important disadvantage. Lot has to be done to come up with a viable solution to this, especially advancements in battery technology that can charge the battery to full in minutes.

4.3.1.3 Distribution of Less Noise: Safety Issue

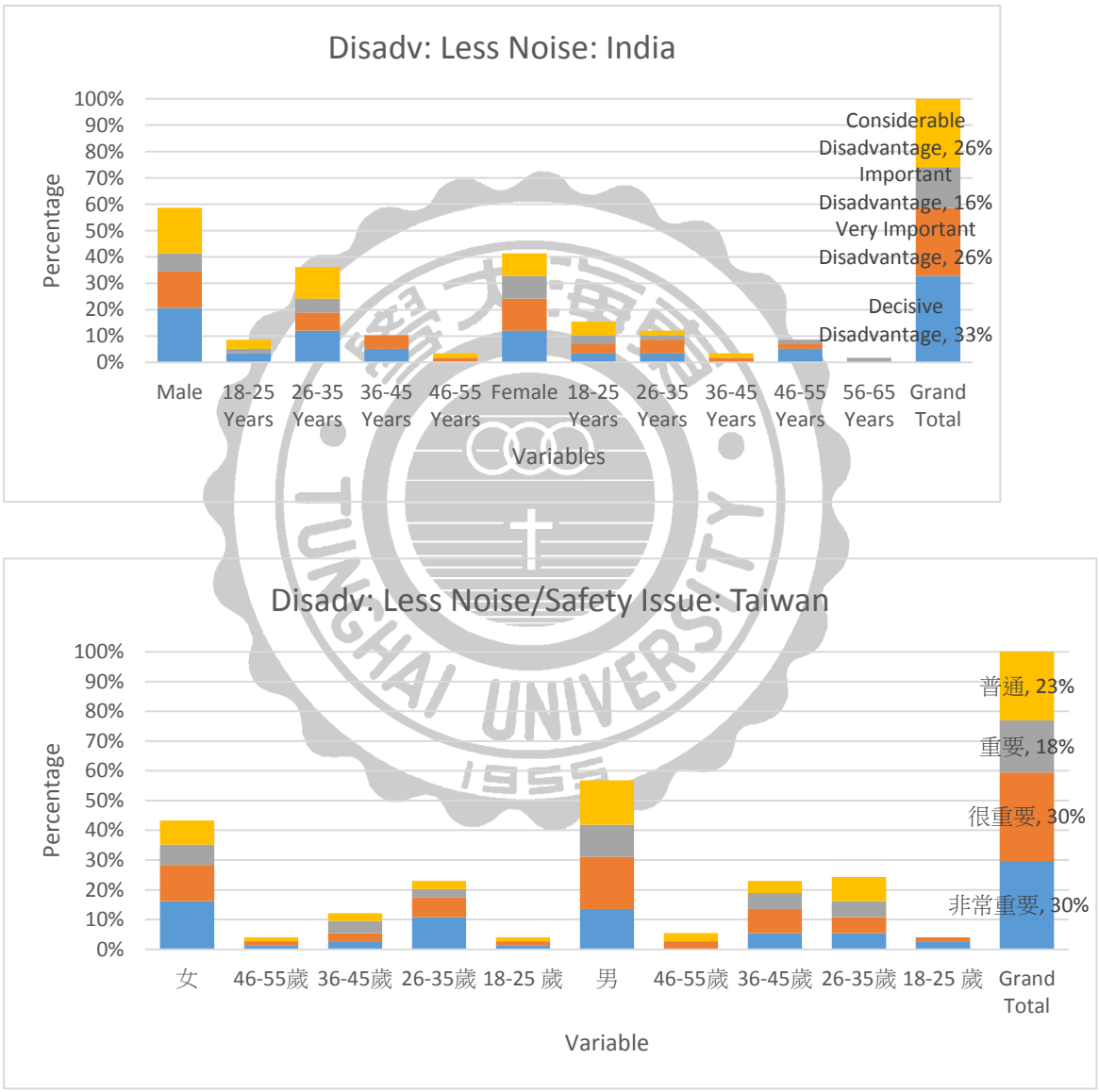


Figure 16: Less Noise/Safety Issue: Disadvantages

It is very interesting to note that the consumers who consider less noise as comfort and luxury the same consumers are concerned about the safety issue. However, less noise has not occupied an major portion to be either decisive or very important

disadvantage. Lot is being done to fix an alternative sound machine with the engine to create sound in the EVs.

4.3.2 Distribution of Personal Factor: Disadvantage

4.3.2.1 Distribution of Limited Knowledge

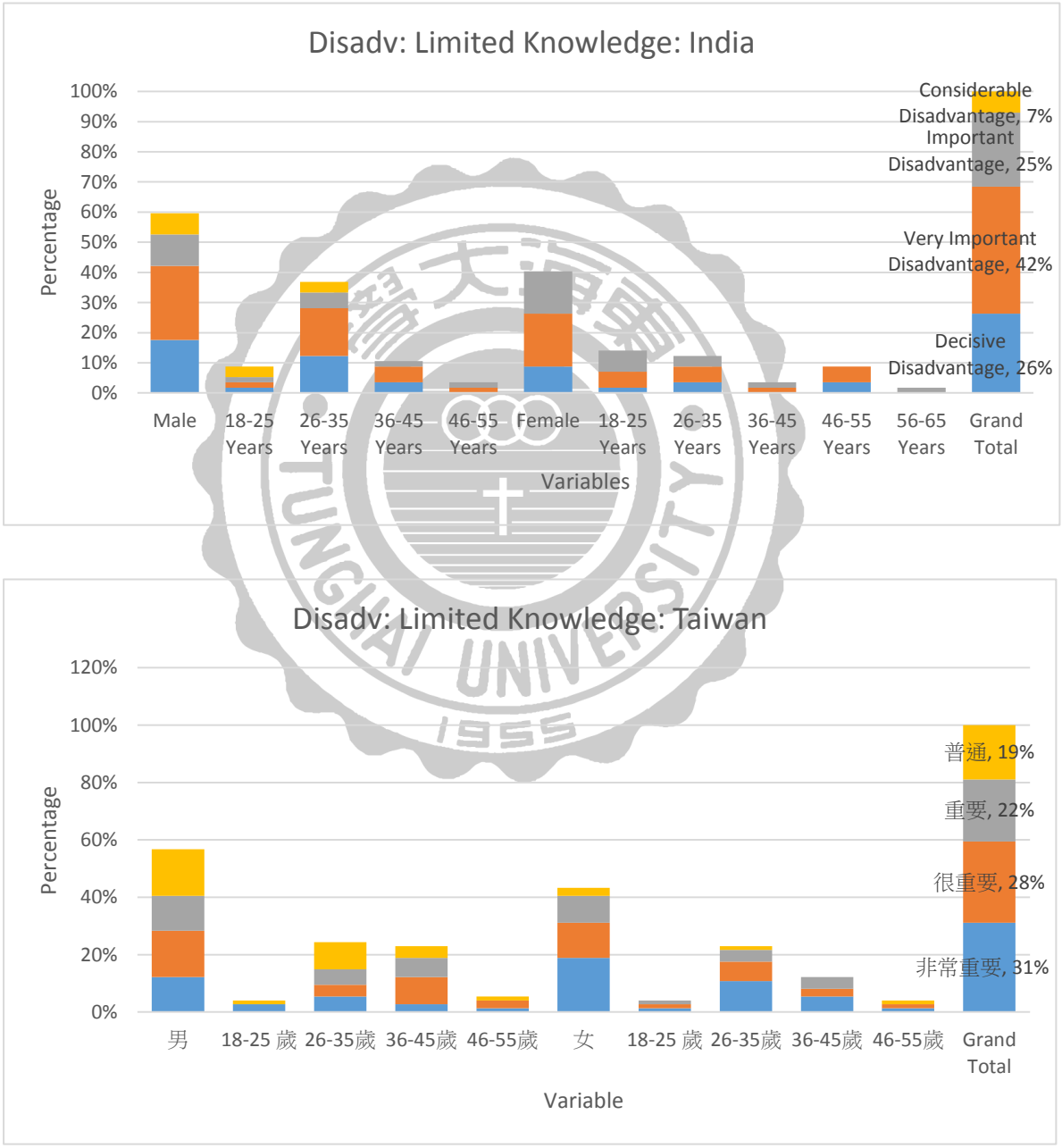
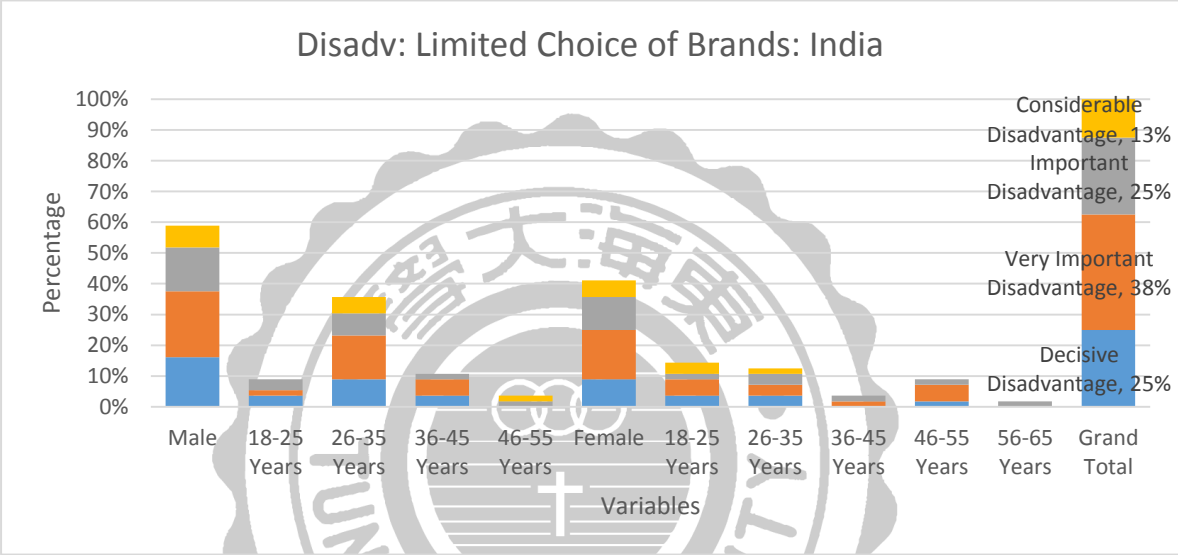


Figure 17: Limited Knowledge: Disadvantages

Lack of Knowledge about EV is one of important reasons potential consumers keep themselves away from showing up to EV showrooms. Among Indians only 26% consider this decisive disadvantage but 42% consider it very important disadvantage, among Taiwanese it is fairly distributed 31% & 28% consider it decisive and very important disadvantage.

4.3.3.2 Distribution of Limited Choice of Vehicle Brands



Brands in the EV are slowly evolving. Tesla has to be credited for promoting high Electric cars in the market and creating high customer value. Due to lot of barriers and uncertainties there are very few auto manufacturers are coming forward with the EVs. Consumers are divided over their opinions in both India and Taiwan. Among Indians 25% & 38% decisive and very important, disadvantage respectively and among Taiwanese 20% & 26% respectively. Though consumers seem to have not attached too much importance to it yet it is an important factor to notice.

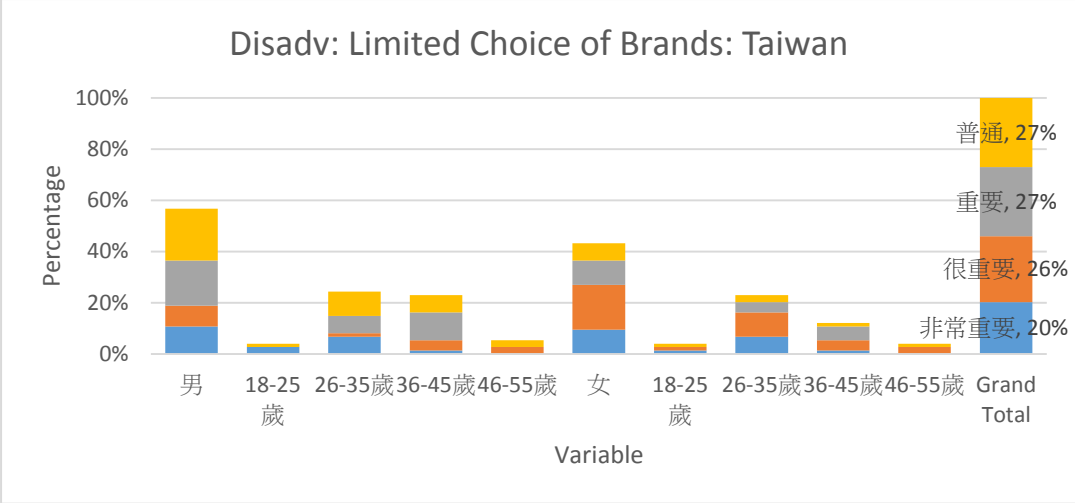
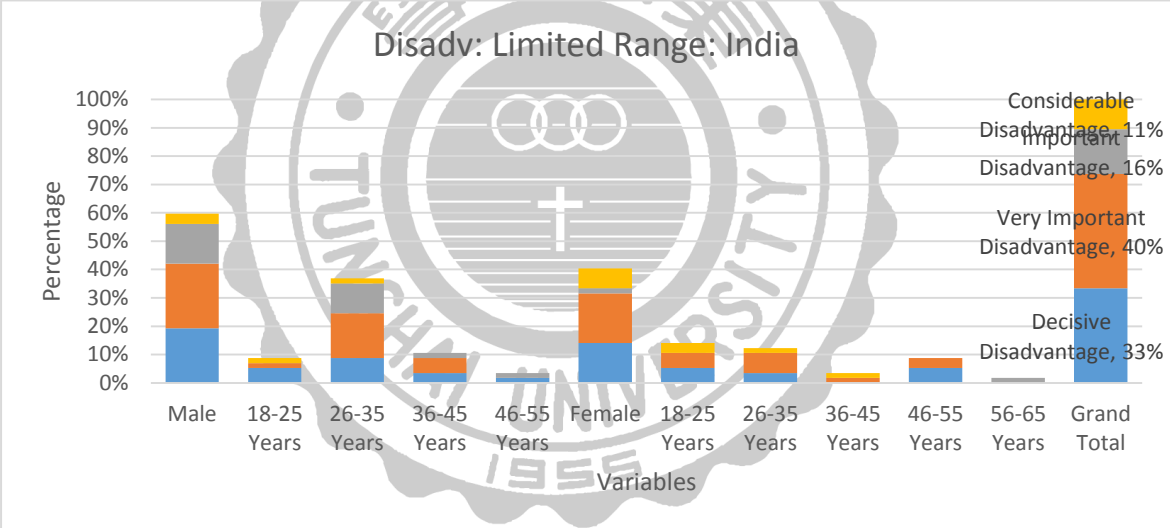


Figure 18: Limited Choice of Brands: Disadvantages

4.3.3.3 Distribution of Limited Driving Range



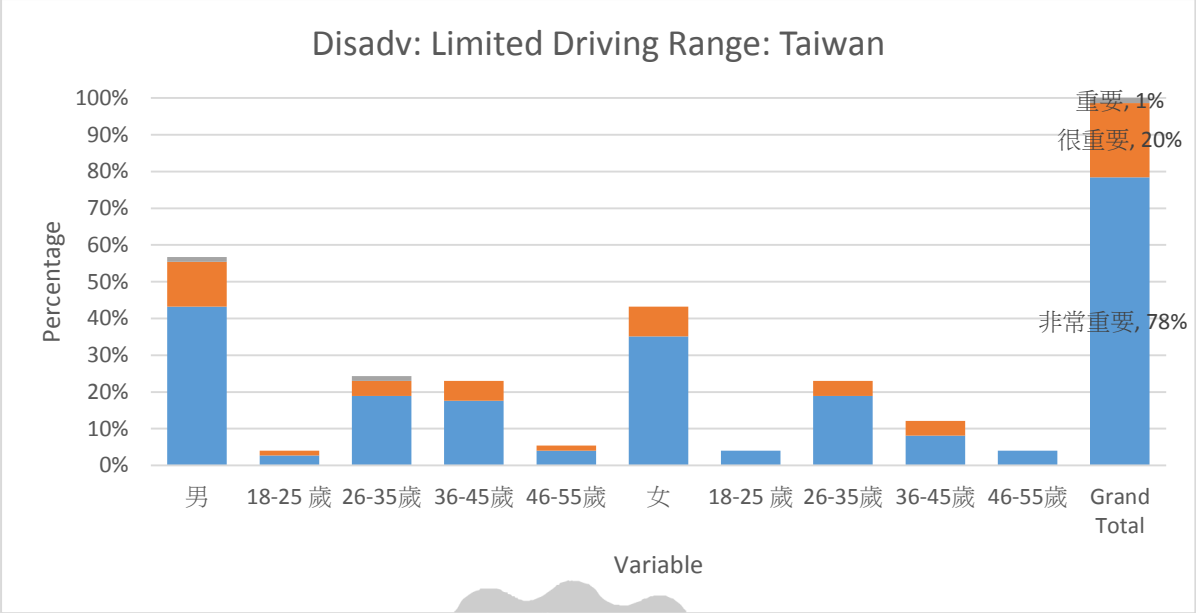
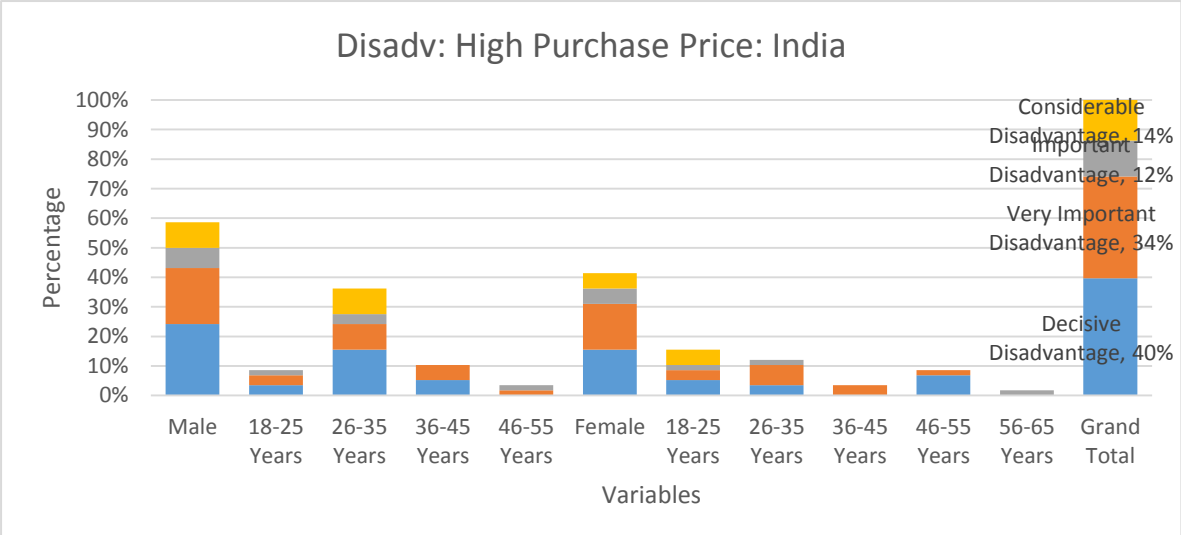


Figure 19: Limited Driving Range: Disadvantages

Limited driving range remains a main bottleneck for the EVs. A battery has a limited driving range per charging and takes a long time to charge. The existing technology only enables stationary charging, which means that an EV has to be parked during the duration of its charge replenishment. No wonder, Taiwan consumers about 78% have rated it decisive disadvantage and Indian consumers 33% & 40% have rated it decisive and very important disadvantage respectively. This poses a major problem for the higher adoption of EV.

4.3.4 Distribution of Economic Factor: Disadvantage



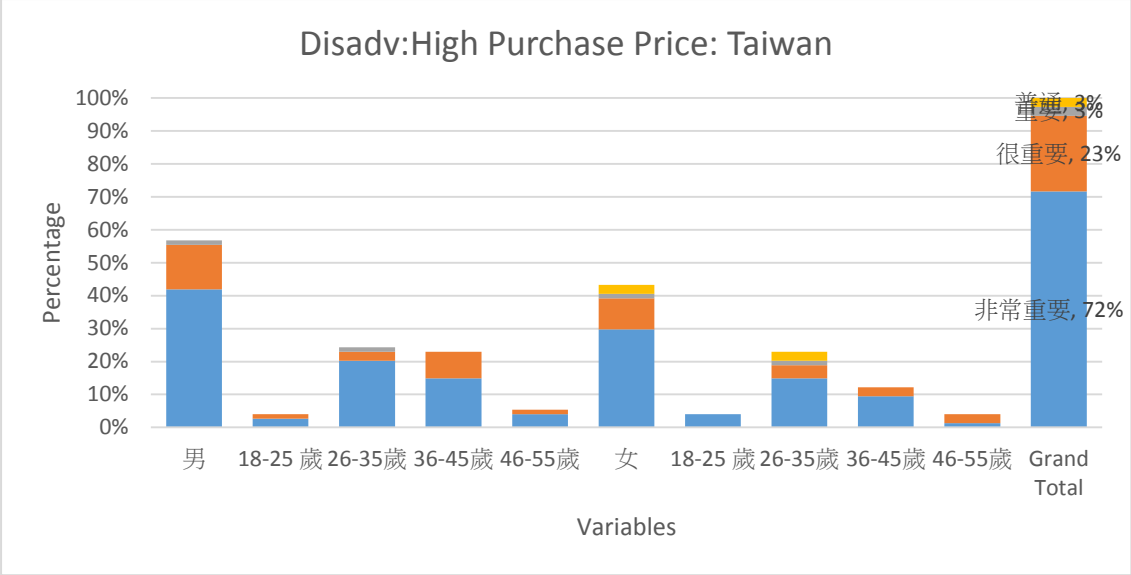
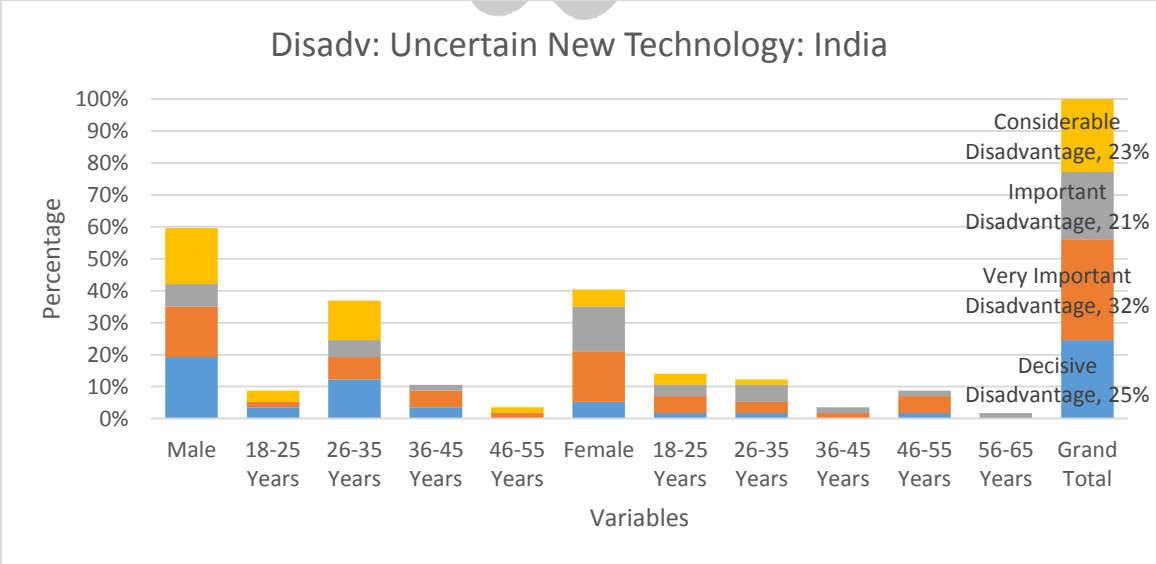


Figure 20: High Purchase Price: Disadvantages

EVs now are more expensive to buy than their fuel powered vehicles because of the new technology that goes into these vehicles. Competitive tax incentives by the respective governments should alleviate this problem. However, consumers concern over the high purchase price of EV only shows lack of pricing strategy. Taiwanese consumers about 72% consider high purchase price as decisive disadvantage and Indian consumers about 34% & 40% consider both decisive and very important disadvantage respectively.

4.3.5 Distribution of New Technology Factor: Disadvantage



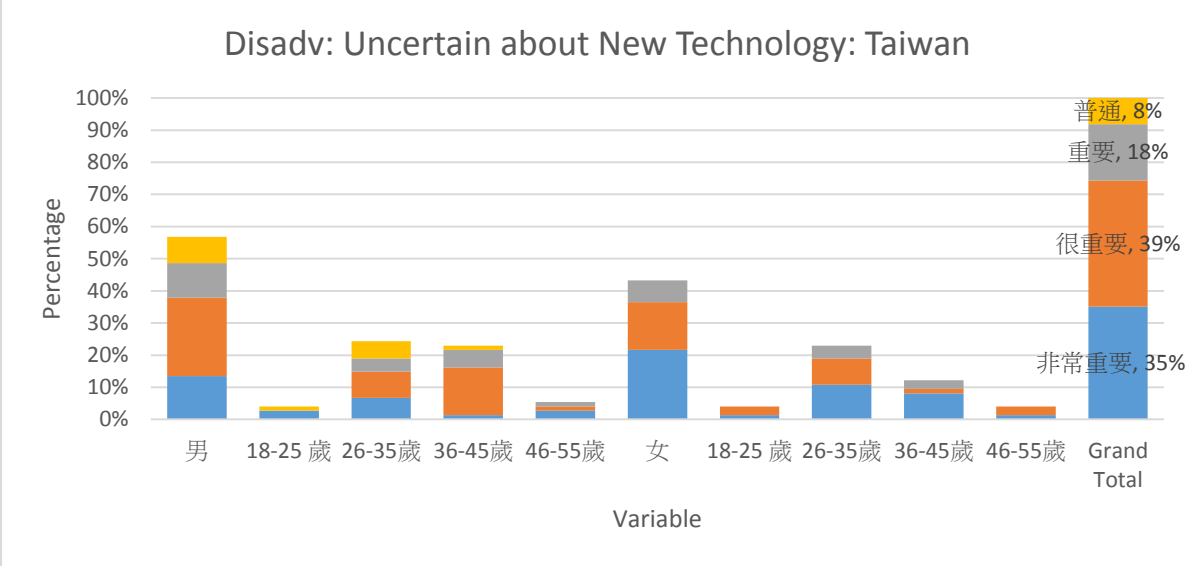


Figure 21: Uncertain about New Technology: Disadvantages

It is difficult to develop a reliable forecast for EVs, given the considerable list of uncertainties that will impact EV purchases in the coming years. Advancements in battery technology, government willingness to subsidize investments in new technology, consumer willingness to pay a premium for this new technology given uncertain economic conditions all contribute to the disadvantages. Consumers from Taiwan and India have fairly placed their concern between 32% (average) from decisive disadvantage to very important disadvantage.

4.4 Distributive Analysis of Factors between Taiwan and India

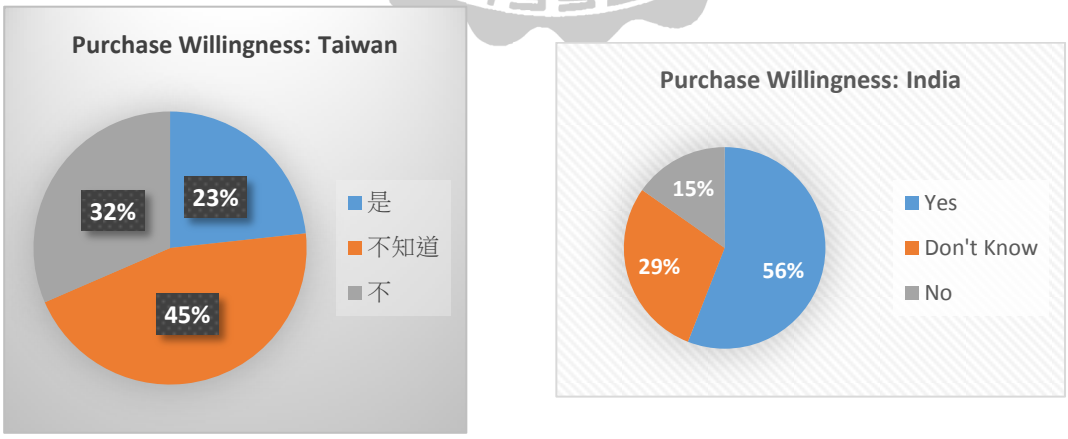


Figure 22: Consumer Purchase Willingness among Taiwan and Indians

If electric vehicles are to reach a broad market, to increase the purchase willingness among the consumers, it is essential to sort out the disadvantages and leverage the advantages. First, we asked the participants their opinion about the EVs and electric mobility in general to assess their perception, it is not necessary that all these participants had EVs with them as their primary mode of transport. We asked them to assess from their perceived experience of having used electric mobility at least few times or from the heard or read opinions of others from which they draw their own conclusions or ideas. The outcome of the research suggests relatively high perception compatibility.

Despite perceiving considerable disadvantages in EV purchase consumers from Taiwan and India have shown willingness to purchase EV. It is quite shocking to find that participants from Taiwan about only 23% have shown interest to purchase the EV and about 45% remain undecided. Where else among Indians 56% participants have shown willingness to purchase EV and only 29% remain undecided. We measured that social factor is the only factor that significantly match perceptions of both consumers from Taiwan and India. Contrary to our expectations, besides the social factors being compatible the other factors personal, economic and technological perceptions differed significantly from consumers of Taiwan and India. Most of these factors Taiwan consumers consider decisive were only considered very important to the consumers from India. This might be due to the involvement of consumers in EV mobility which might vary from country to country. However we consider this a significant analysis because the developed economy of Taiwan could prove to be a study ground for the developing economy of India. Once the EV market is saturated in Taiwan this could be in part be a study model for the infant EV market of India.

4.4.1 Motivating Factor Analysis: Consumer Purchasing Motivation

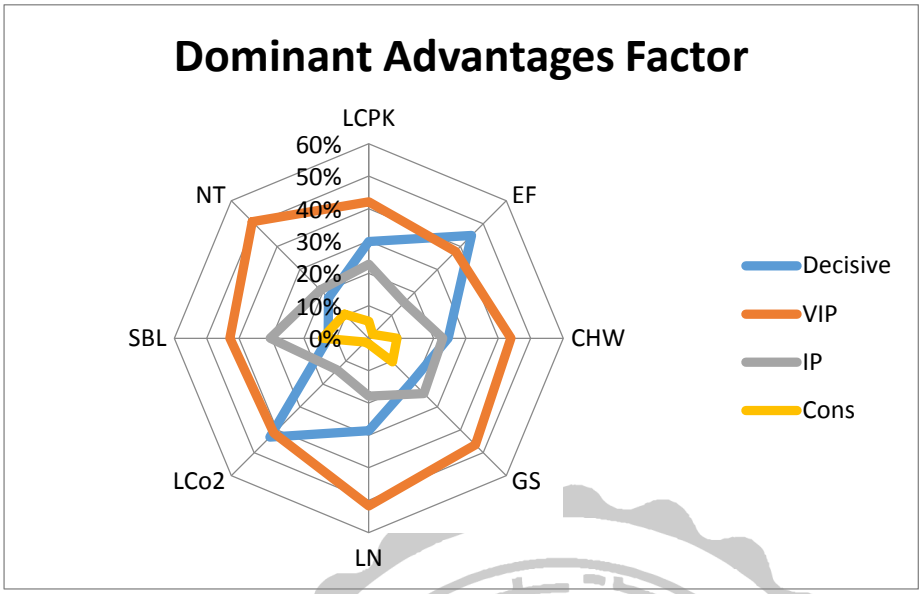


Figure 23: Dominant Advantages Factor

In our questionnaire 2, questions were directly aimed at the participants to answer in price their perception without keeping the options open. We found that though social factor i.e., Environment friendliness and Low CO2 emission occupies a decisive advantage in the promotion of EVs yet our next focus should be to draw a road map to leverage on the factors consumers consider as very important i.e., charging at home/ work, New technology and Less noise. Low cost per Km and Government subsidy plays a role second best to the very important factors.

Table 2: Comparative Analysis of Motivating Factors

Factors	Variables	Taiwan				India			
		DA	VIPA	IPA	CA	DA	VIPA	IPA	CA
Social Factor	Environmentally Friendly	∨				∨			
	Low CO2 Emission	∨				∨			
Personal Factor	Charging at Home/Work	∨					∨		
	Less Noise	∨					∨		
	Style/Brand/Looks			∨	∨		∨		
Economic	Low Cost per Km	∨					∨		

Factor	Government Subsidy	√					√		
Technology Factor	New Technology		√				√		

Among social advantage there is equal decisive distribution of perception among consumers of Taiwan and India. It is very interesting to note that personal and economic factors considered decisive by the Taiwan consumers are considered very important advantage among the Indian consumers. This shows the difference of priority given by the consumers of respective countries. As the EV enters the respective market of the country, respective countries can use the following factors to promote EV in their region.

4.4.2 De-motivating Factor Analysis: Consumer Purchasing Motivation

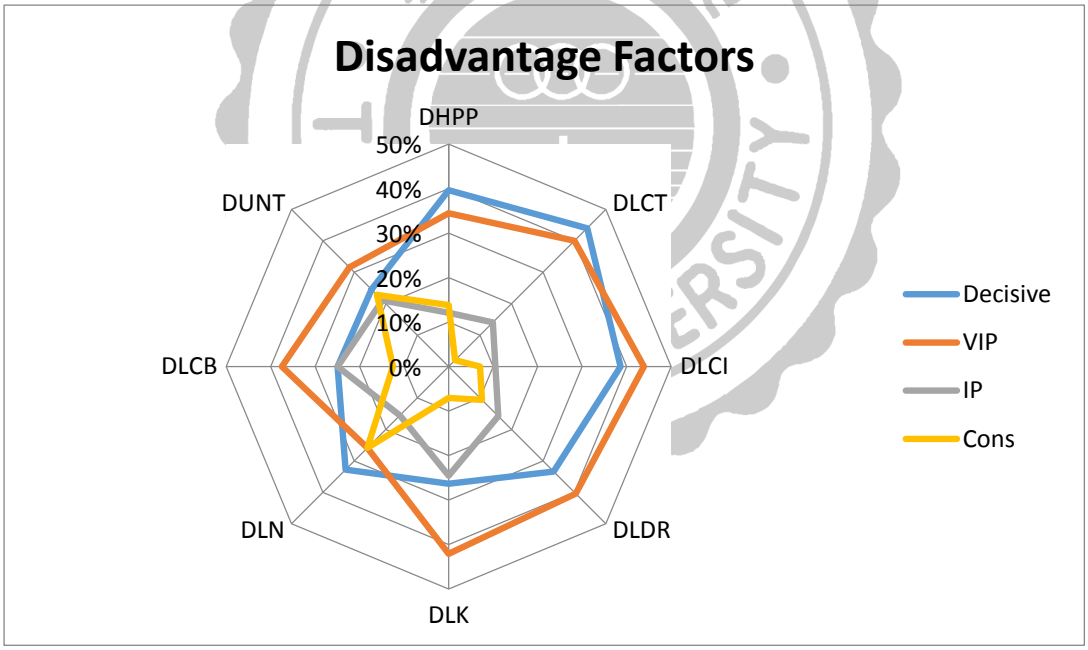


Figure 24: Dominant Disadvantage Factors

Leveraging on the advantages of the EV it is also important that we take notice of disadvantages factors. Among most decisive disadvantages factors there are two very predominant i.e., long charging time and high purchase price and among very important disadvantages are Limited charging infrastructure and Limited knowledge. This requires immediate attention from the part of efficient pricing strategy, improved

technology and consumer education/awareness. When it comes to the evaluation of value for money, there is a slight tendency towards a negative perception. Almost most of the respondents 72% from Taiwan and 40% from India rate the value for money as disadvantageous compared the fuel powered vehicles. This negative perception might be due to several reasons. Maybe, those who perceive the EV as low value for money might be more price sensitive than the rest of the respondent or they are not aware of potential savings due to lower cost and buying incentives.

Table 3: Comparative Analysis of De-motivating Factors

Factors	Variables	Taiwan				India			
		DDA	VIPDA	IPDA	CDA	DDA	VIPDA	IPDA	CDA
Social Factor	Less Charging Infrastructure	×					×		
	Long Charging Time	×				×			
	Less Noise: Safety Issue	×	×			×			
Personal Factor	Limited Driving Range	×					×		
	Limited Knowledge	×					×		
	Limited Choice of Brands			×	×		×		
Economic Factor	High Purchase Price	×				×			
Technology Factor	Uncertain New Technology		×				×		

Among Taiwan consumers less charging infrastructure, long charging time, less noise; safety issue, Limited driving range, limited knowledge and high purchase price are perceived decisive disadvantage. Where else among Indian consumer perception only three variables; long charging time, less noise; safety issue and high purchase price are decisive disadvantage. Besides, the decisive disadvantages for Taiwan consumers; less charging infrastructure, limited driving range, limited knowledge and limited choice of brands are very important disadvantage for Indian consumers. This difference in perception may be due to varied driving behavior of consumers of

different region but once the market gets saturated in India too, probably the decisive disadvantages faced by Taiwan consumers could be the problem of Indian consumers too. This is a futuristic view of the market.

5 Discussion and Analysis

Lot of studies and research has been done regarding EV but relatively little is known to what extent consumer actually value EV. There are few factors very attractive and efficient enough to implement and maintain but practically ineffective, because consumers hardly value them. This research is interested in the actual motivation of consumers regarding EV purchasing behavior. The insights generated out of our research study and analysis would provide governments, EV manufacturers and decision makers with necessary information for effective implementation. These data can help governments to assess incentives not only by their costs but also by the perceived benefit of the consumer; once these incentives are deployed it can be critically re-assessed with regards to their effectiveness.

5.1 Comparative Analysis of Factors effecting Purchase Decision between Taiwan and India: High Motivating Factor

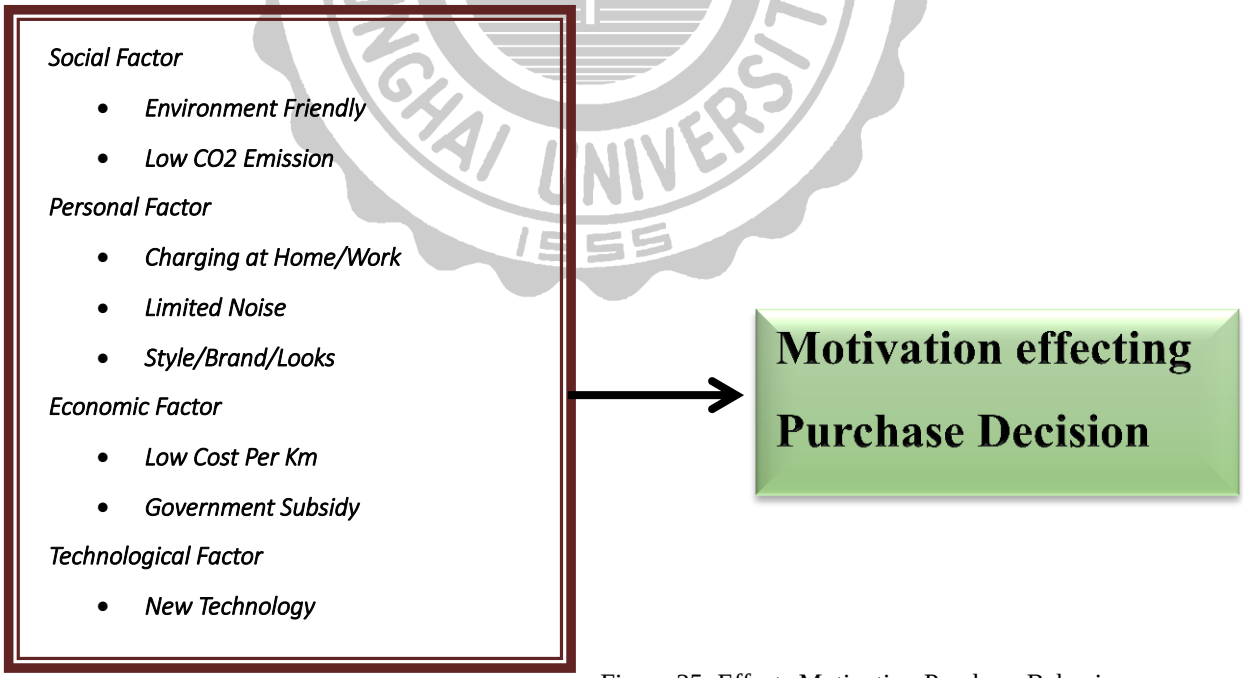


Figure 25: Effects Motivating Purchase Behavior

Advantages factors refers to the degree to which consumers perceives the factors that supersedes the hurdles. These could be the significant variable for adoption drive. The

variables are grouped into four categories. These advantages could prove to be of superior value for the consumers and manufacturers.

5.1.1 Social Factors

As the automotive industry is picking up the momentum in the 21st century, uncertainty over whether or not electric vehicles (EVs) will become a key part of the mainstream global car-buying market remains largely unchanged. In general, our results reveal a positive image towards electric cars. This favorable perception could be derived from the green image that most people associate with them. The green image is very context specific and therefore means different things to different people. In terms of Environment friendliness consumers from Taiwan about 55% and 44% from India have positive perception towards EVs. The others about 16% from Taiwan and 22% from India have second opinion might be the result of high cost, limited range or uncertainties about the future developments concerning EV infrastructure. It is a matter of effective marketing strategies to change the perception in a favorable manner by delivering the positive and right message.

EVs require a different value chain and processes to support them. Growing public acceptance encourages to putting more greener and fuel-efficient vehicles on the road are developing. One of the main values is the social value. One of the important factors will be integrating and collaborating different factors to provide a new mobility ecosphere. The social factors in our survey was primarily focused on perceived values of Environment friendly and Low CO2 emission, because consumers link an eco-friendly mindset to EV mobility (Pearre, N. S., Kempton, W., Guensler, R. L., & Elango, V. V. 2011). Transforming this value into reality will lie in the ability of OEMs to address current consumer concerns about EVs and give consumers what they expect in e-Mobility experience. In our study from two different consumers from two different countries we found that between both consumers, they have placed decisive advantage to environmentally friendly and Low CO2 emission. This shows high level of awareness among the consumers for the environmental concern. However, those who making a decision on their next car purchase is only 57% among Indian consumers and 29% among Taiwan consumers.

5.1.2 Personal Factor

Cars have symbolic meaning and benefits for the consumers. For most of the consumers a car's ability to "make them what they want to be" is often more important than its other advantages. Thus, we include the vehicles' style/brand/looks, charging at home/work and less noise as vehicle's image of an EV to determine whether the perceived personal value of an EV is considered an advantage towards EV purchase decision. It is more important to note that, the perceived image of an EV is highly dependent on a consumer's personal context. In general, the image of an EV is positively associated with personal character of a consumer. Given the EV market at present, it lacks a proper network of charging stations, because EVs represent only a small niche market so far. By providing investments, incentive to either establish charging stations at home or work, governments can provide additional value to the consumer and thereby overcome the EVs rather small range. The purpose of this research was to find the consumer perception on this factor in both Taiwan and India and we found that consumers from both countries consider this very important factor.

5.1.3 Economic Factor

There are several advantages to EV ownership that have encouraged sales including Lower cost per Km, low maintenance cost, government subsidy (sales and tax incentives), fewer maintenance cycles and avoidance of volatile fuel prices at the oil pump. When it comes to the perception of these economic factors, there is a slight tendency towards a positive perception. Almost half of the respondents about 32 out of 74 that is 43% respondents from Taiwan consider it decisive advantage and 25 out of 59 that is 42% from India consider it very important advantage. Probably consumers from both the countries are aware of the potential savings due to lower cost and buying incentives.

5.1.4 Technological Factor

Besides financial incentives, government is also trying to increase the attractiveness of technological benefits for the users. Technological incentives aim at making EVs easy to use for the public in general, increasing their visibility, and gathering information about how EVs are and could be used on the roads.

5.1.5 Analysis on High Motivation

Taiwan: Advantage

Table 4: Dominant Motivating Factors in Taiwan

Variables	Decisive Advantage	Very Important Advantage	Important Advantage	Considerable Advantage
Low Cost Per Km	43%	28%	16%	12%
Environmentally Friendly	57%	22%	11%	10%
Low CO2 Emission	59%	18%	12%	11%
Charging at Home/Work	74%	19%	5%	1%
Less Noise	41%	32%	12%	15%
Style/Brand/Looks	21%	30%	30%	19%
Govt Subsidy	49%	30%	18%	4%
New Technology	34%	42%	14%	10%

India: Advantage

Table 5: Dominant Motivating Factors in India

Variables	Decisive Advantage	Very Important Advantage	Important Advantage	Considerable Advantage
Low Cost Per Km	30%	42%	23%	5%
Environmentally Friendly	45%	38%	16%	2%
Low CO2 Emission	43%	41%	14%	2%
Charging at Home/Work	25%	44%	23%	9%
Less Noise	29%	52%	18%	2%
Style/Brand/Looks	13%	43%	30%	14%
Govt Subsidy	19%	47%	24%	10%

New Technology	18%	51%	21%	11%

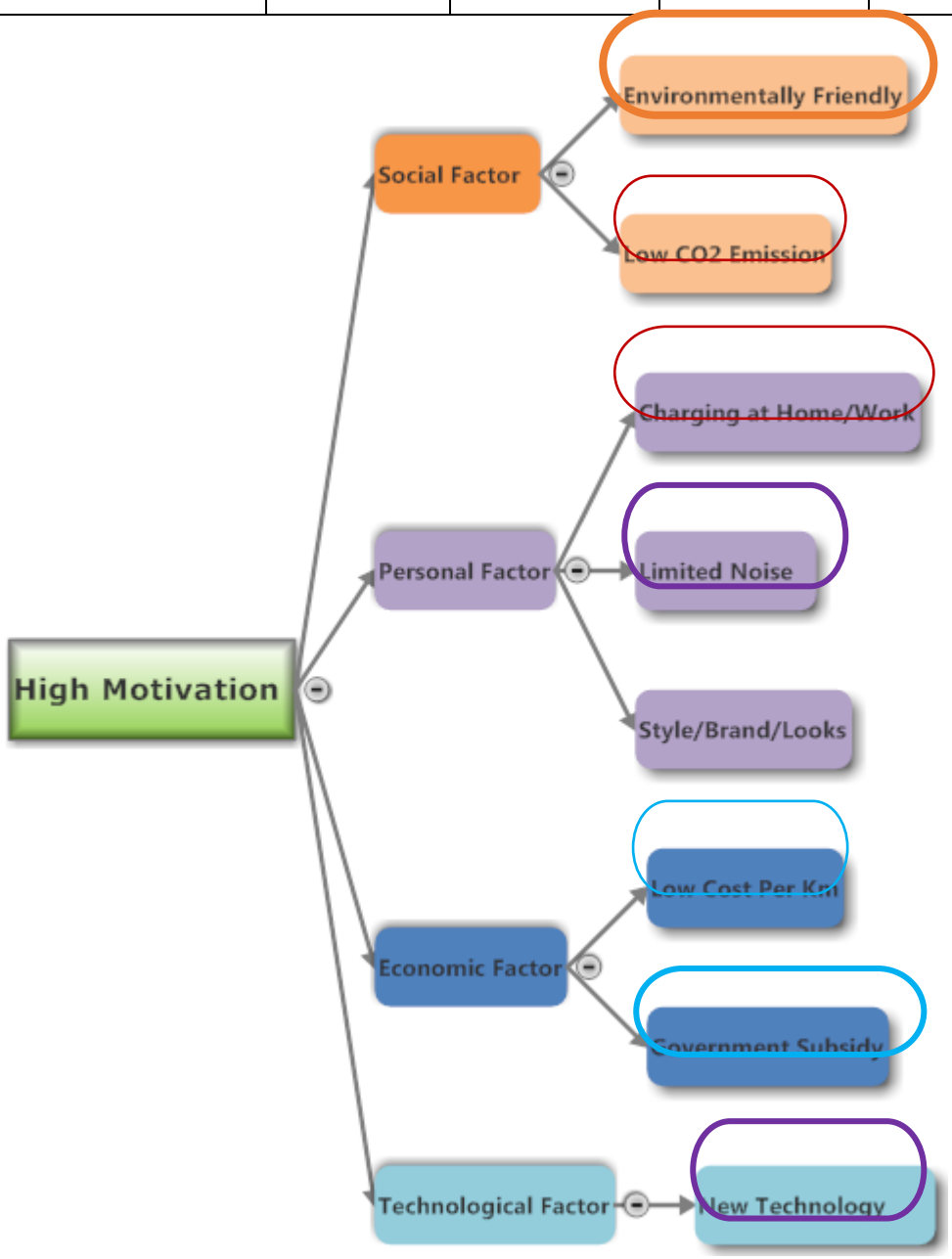


Figure 26: Identified Motivating Factors

Social Factor is a dominant advantage in pursuing and motivating the customers for the Electric mobility. Nevertheless, will that alone be enough to push the electric mobility market? Potential consumers from Taiwan shed a clear light on it by putting emphasis on the other important factors comprising Economic, Personal and Technological factor. It is very interesting to note, that the consumers have pushed no predominant factors to very important or considerable advantage from both the countries. This clearly shows that the variables we have given the participants to

assess are considered either decisive or very important. However, the thing to notice is which goes to the priority and how to target the potential consumers.

Taiwanese consumers perceive personal factor: charging at Home/Work as a very decisive advantage. Besides social factor, Government subsidy and Low cost per Km are considered very decisive advantage in economic factor for a move towards purchase of electric vehicle. Indian potential consumers besides considering social factor a decisive advantage, less noise and new technology is given very important advantage (Ustaoğlu, M., & Yıldız, B. 2012). These are very important indications to both auto manufacturers and Government to notice. While government should give attention providing subsidies and auto manufacturers, should leverage such subsidies and come up with a attractive business model taking into account the style/Brand/Looks, less noise and improvement in technology.

5.2 Comparative Analysis of Factors Affecting Purchase Decision between Taiwan and India: De-Motivating Factor

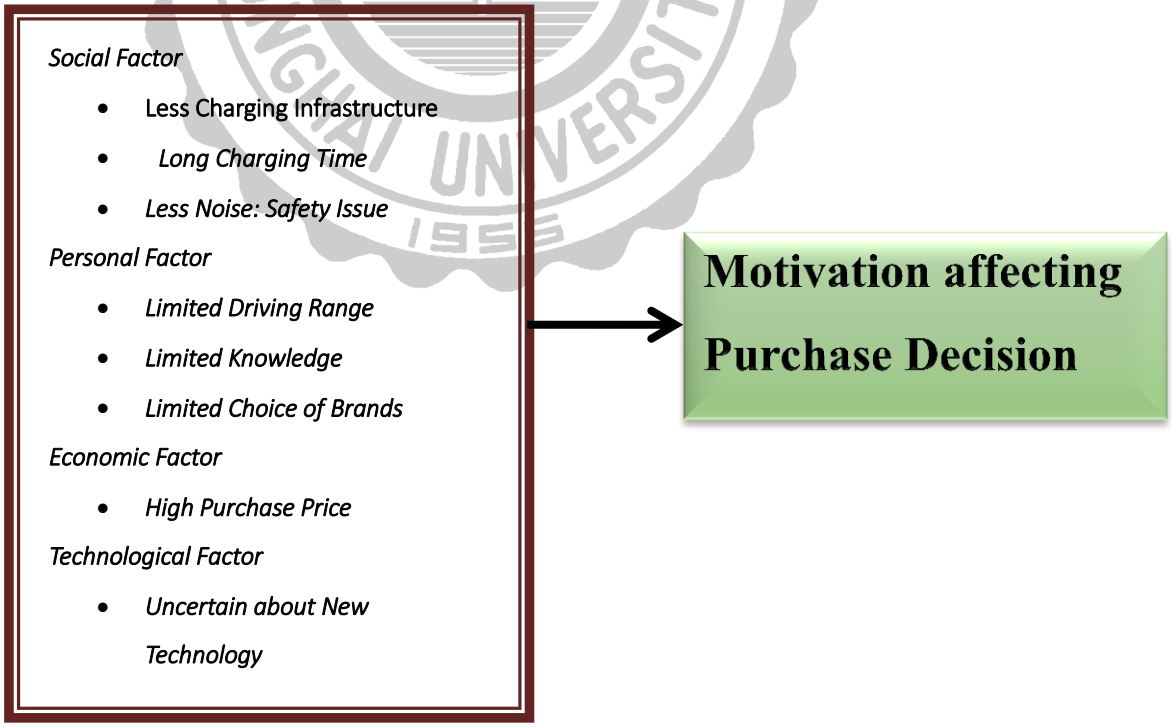


Figure 27: Factors Affecting Purchase Behavior

These are the individually perceived barrier towards purchase of an EV also driven by disadvantages. Consumers experience uncertainties regarding lot of relevant characteristics. Our research study has found that among several specific disadvantages less charging infrastructure and Long charging time were identified as important factors affecting consumer purchase decisions. In the following section different forms of disadvantages and their impact on purchase decision are discussed.

5.2.1 Social Factors

The relevance of social disadvantage in the context of EV shows that cars can project a certain image of their owners. In the process of consumption, stereotyping, other people interpret a vehicle's image and draw conclusions about its holder. In Taiwan, since the EV mobility started with the Old people, it has been perceived that users of EV are more elderly. Thus, individuals might hesitate to buy an EV, because they are concerned that other people perceive them as too outdated or green geek. Added disadvantages including less charging infrastructure, long charging time and less noise probably pose a barrier to purchase barrier.

The absence of engine noise is often considered a desirable feature but it is argued that low volume of engine sound poses a threat to the safety of pedestrians, especially to the visually impaired. Regarding engine sound, more respondents 40% from Taiwan and 49% from India perceive it as very important advantage. However, 31% from Taiwan consider it very important disadvantage and 33% from India consider it decisive disadvantage; the variance is quite not proportional which implies that there is no clear tendency towards one option (Hidrue, M. K., et al., 2011). This clearly shows that the consumer perception from both the sides about less noise is very subjective. For those average 31% of consumers from both the countries less noise entails a risk for pedestrians and cyclist. For the same average 45% of the consumers less noise means reduction in noise and is therefore perceived as favorable. Clearly, this contrary consumer preference poses a challenge for car manufacturers.

Our current research study emphasizes that half of the lifetime carbon-dioxide emissions from an EV come from the energy used to produce the car. Especially the battery production produces a great amount of CO2 emissions. By contrast, the production of a gas-powered car accounts for 17% of its lifetime carbon-dioxide

emissions (Lomborg, 2013). Disposal or recycling of the battery adds additional emissions to the balance. Hence, the overall carbon footprint of an EV is yet far away from the zero emission image most of the consumers do have. One could argue that in contrast to the ordinary early adopters of cars, highly involved consumers are aware of this eco-bias and postpone or reject the adoption of an EV. Therefore, we expect that involved consumers are more aware about the actual state of eco-friendliness of EVs and likely perceive it as less advantageous than non-involved consumers perceive (Wells, P., & Nieuwenhuis, P. 2012). Consumers who are green oriented would not be attracted by marketing strategies that emphasize its environmental friendly or low CO2 emission, more promising would be to provide them also with necessary technology advantage with more charging stations, reduce charging time that reduces consumer's fears and uncertainties.

5.2.2 Personal Factor

Personal factors associated with EVS are typically limited driving range, limited knowledge and limited choice of brands. Our survey found that closely after high purchase price as an impediment to EV purchase is the driving range. Over average 50% of respondents from both the countries say range is a decisive disadvantage. The survey was done only with educated and among affluent respondents. It is difficult to compare the value of driving range relative to other vehicle attributes. The vehicle with the notably highest all electric range is the Tesla, is also priced at the higher end of the cost.

Likewise, our survey found that respondents most often pay attention to the style/brand and looks of the EV. EVs are least popular for lack of attractive style/brand and looks in a competitive price. Consumers from Taiwan rate 29% and India 40% Style/Brand/Looks as very important advantage. Consumers are of this perception because EVs that have come out in big scale are smaller in size and different look. There is a common belief among consumers that EVs are ugly looking much like plastic toy cars. Consistent with our perception, consumers have negative opinion about style/brand/looks of EV because consumers are used to choose among a wide variety of ICE vehicles and therefor might dislike the limited EV models available (Jeong, B. K., & Yoon, T. E. 2013). Though efforts are being made to make

it more attractive, yet many people are not used to this and they might observe it as somewhat unfavorable.

In general consumers rate the driving range as decisive and very important disadvantage. EVs range is rated the most disadvantage factor about 78% of Taiwan consumers consider it decisive disadvantage and 40% of Indians consider it very important disadvantage. The interesting fact is that the number of kilometers reached by EV is not only dependent on the battery capacity but also driving condition. Since a fast driving shortens range, it is not surprising that 78% from Taiwan and 40% from India consider range of the EVs a second weakest point.

5.2.3 Economic Factor

In this section we discuss financial statues towards EV adoption. In our survey done of consumers found that EV purchase price is the most dominant or decisive disadvantage, with about 78% of respondents from Taiwan and 40% from India. Primary reason for this is the high cost of battery, if the battery cost comes down then we can expect competitive price for the EVs also. Purchase incentives are market specific benefits usually introduced by a government and other decision makers to enhance the EVs economical value. At present Taiwan and Indian government, follow rather distinct policies to foster electric mobility, which leads to differing EV attractiveness from market to market. Our study has found that incentives to certain extent influence the consumer's perception of a EVs advantage or disadvantage. This will help us to draw conclusions about the actual effectiveness to promote EV. In our survey, both consumers from Taiwan and India consider this a very important advantageous factor for the promotion of EV. EVs purchase price benefits can take place in form of exemptions of the value added tax (VAT) or a market specific registration fee both in India and in Taiwan, which can account for a major share of the overall initial investment (Jeong, B. K., & Yoon, T. E. 2013). Another incentive is the exemption of operating expenses like car tax. This is a common incentive, which can be applied in nearly all of our target markets. Consumers can also benefit from two other incentives namely free battery charging and free parking for EVs.

5.2.4 Technological Factor

EVs face barriers to adoption because they are a radical environmental technology. EVs technology is quite a barrier primarily because the technologies entail changes in consumer habit (recharging the battery instead of refueling the vehicle) and a lack of charging infrastructure, raising the level of uncertainty associated with the EV technology. Uncertainties associated with the technological robustness of the vehicles, their life expectancy and the long-term costs involved are also the aspects that EV manufacturers will have to consider. In capitalizing on the extensive connectivity inherent in electric vehicles, automakers can bring a unique "connected driving" experience to consumers who are adopting new technology. EV manufacturers can benefit from the exchange by collecting extensive data from consumers about how they use EVs and how the vehicles perform on the road and then use this data to further cater to driver needs and safety concerns. Connected solutions can provide consumers reassurance in areas ranging from safety to navigation by providing extensive driver assistance.

5.2.5 Analysis on De-Motivation

India Disadvantage

Table 6: Dominant De-motivating Factors in India

Variables	Decisive Disadvantage	Very Important Disadvantage	Important Disadvantage	Considerable Disadvantage
Limited Charging Infrastructure	39%	44%	11%	7%
Long Charging Time	44%	40%	14%	2%
Less Noise: Safety Issue	33%	26%	16%	26%
Limited Knowledge	26%	42%	25%	7%
Limited Choice of Brands	25%	38%	25%	13%
Limited Driving Range	33%	40%	16%	11%
High Purchase Price	40%	34%	12%	14%
Uncertain New Technology	25%	32%	21%	23%

Taiwan Disadvantage

Table 7: Dominant De-motivating Factors in Taiwan

Variables	Decisive Disadvantage	Very Important Disadvantage	Important Disadvantage	Considerable Disadvantage
Limited Charging Infrastructure	78%	20%	1%	1%
Long Charging Time	65%	30%	4%	1%
Less Noise: Safety Issue	30%	30%	18%	23%
Limited Knowledge	31%	28%	22%	19%
Limited Choice of Brands	20%	26%	27%	27%
Limited Driving Range	78%	20%	1%	1%
High Purchase Price	72%	23%	3%	3%
Uncertain New Technology	35%	39%	18%	8%

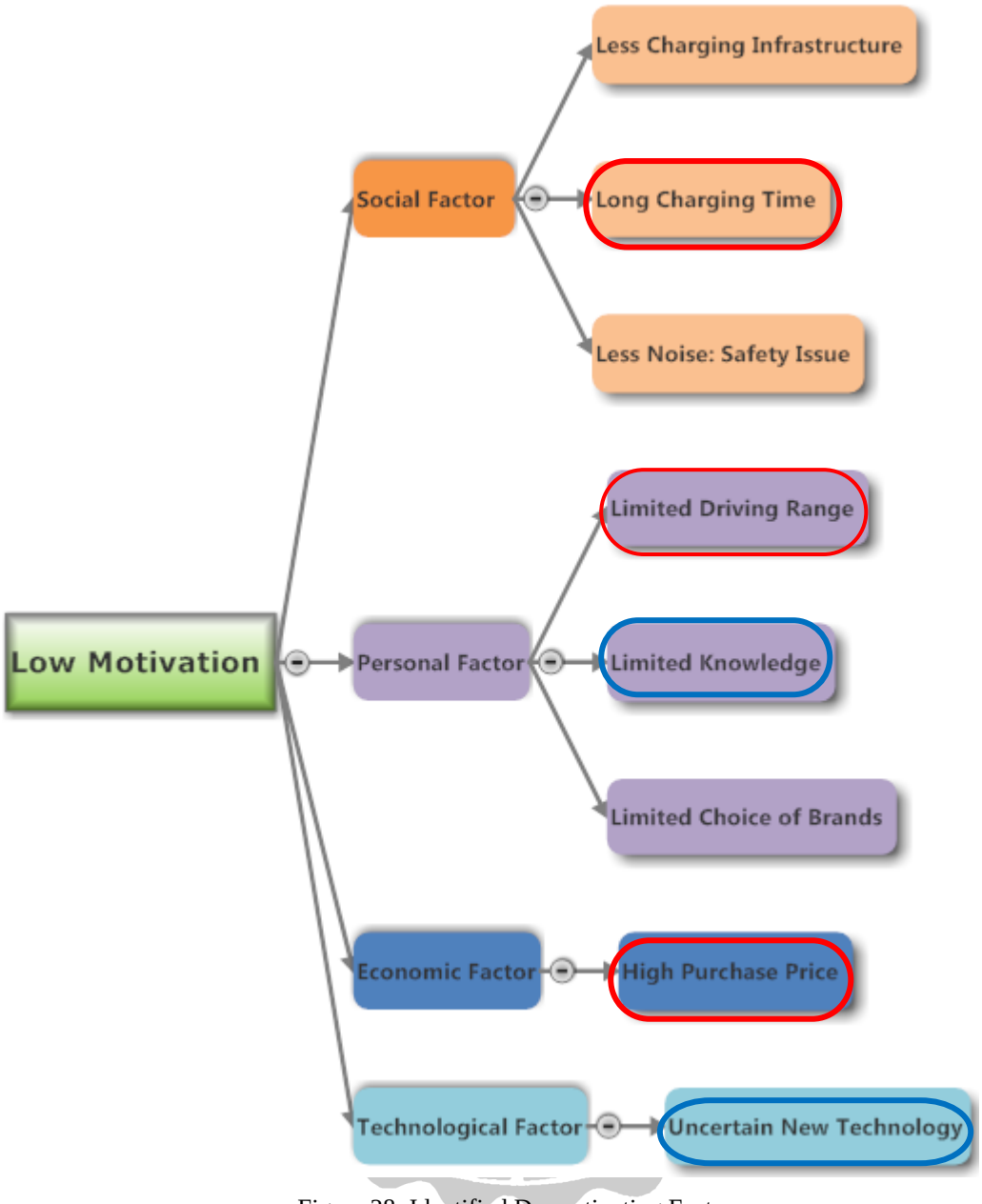


Figure 28: Identified De-motivating Factors

Personal factor acts as a low motivation among potential consumers from both Taiwan and India. Personal factors like limited driving range and limited knowledge are the dominant factors. Social factor like environmentally friendly and low CO2 emission among advantages could be a promotional factor for high motivation but it has to be backed up by overcoming the low motivation factors. Besides personal factors, economic factor (high purchase price) and technological factor (uncertain new technology) are also contributing to low motivating factor. This clearly shows that both potential customers from Taiwan and India need proper awareness and education regarding EV. Before widespread adoption becomes a reality, however, a number of

obstacles must be cleared. For the masses, they need more information. The auto industry should educate consumers, focusing less on environmental messages and more on the feasibility and advantages of EV ownership. In addition, auto manufacturers should utilize the connected aspects of the electric vehicle to deliver a uniquely enhanced driving experience – with features from remote access to automated drive features – for today's connected consumer. Finally, industry leaders must collaborate extensively – and outside their existing ecosystem – to facilitate widespread EV adoption. These partnerships will enable the infrastructure necessary and could alleviate some of the price concerns associated with EVs.

While many signs point toward a bright future for electric vehicles, several issues threaten their broader adoption, including a lack of knowledge among consumers and driver concerns regarding range and price. Automakers must convince consumers that EVs offer the same convenience and value as conventional vehicles. To do this, they need to better educate consumers about EVs and, in doing, focus on the right messages to alleviate concerns. Many consumers have limited – if any – knowledge about electric vehicles, and many who profess knowledge are still misinformed in some areas. Our survey revealed that average 40% of potential consumers from both Taiwan and India believe they have little to no understanding of electric vehicles (Thiel, C., Alemanno, a, & Scarcella, G. 2012). However, despite this lack of knowledge, almost average 57% of consumers from Taiwan and India surveyed expressed their willingness to consider an EV when buying their next car.

Although survey results concede that consumers are drawn to "green" messages and the idea of ecofriendly purchasing, most believe these messages are not the sole factor when making purchasing decisions. The "green" messages and associated high motivate feelings are outweighed by price, range and other considerations. Price is, after all, consumers' number one driver for transitioning. It is particularly important that automakers emphasize the lower overall cost of ownership when educating consumers about electric vehicles. Equally important, they must listen to consumers' request for more innovative pricing models. Automakers could potentially offset the initial cost to purchase an EV by employing novel business and pricing models.

6 Conclusion

6.1 Limitations and Future Research

In conclusion of this thesis we try to bring back the question we posed before the start of this thesis: What is the most important motivating factor for the consumer for making purchase decisions?

Several decisions made when designing this research have a limitation to the overall quality of its findings. Due to the scope and size of this study, we were restricted in the number of factors and reasons taking into account. The following section points out specific shortcomings to support in judging the quality of this research.

According to the literature used in the context of this study as well as the empirical study, the following can be concluded: Four dominant factors determine the perception towards using and thus, the consumers' acceptance of purchase of EV. Whether or not electric vehicles will become commonplace in the global mass-market or will dominate in the alternative vehicle segment is dependent on the consumer perception. This point of view shows that within the automotive industry all these factors have been accomplished. However, the uniqueness of the success factors differs from country to country and OEM to OEM. Among the markets and OEMs where the success factors are highly developed includes establishing EV markets like Taiwan and India.

Until date, the field of research about factors determining the electric mobility is still rather small and inconsistent with regard to its operationalization. We synthesized different existing concepts to contribute to this field. When terming the different variables of consumer perception we followed the established terminology. Some of them implied concrete actions in the decision process, but in fact we measured the consumer perception on hypothetical willingness to purchase EV instead of specific decision like rejection or adoption. Future research should elaborate on the integration of the resistance concept in the innovation decision process. While consumer education is important, automakers must also rely on innovation to help drive EV adoption. We suggest they tap into the innovative technology inherent in the vehicle

itself to enhance the driver's experience through various connected features. In addition, the industry must be aggressive in developing new business models while forging new partner- ships to build the infrastructure necessary for widespread EV adoption.

Sample

We utilized an online questionnaire to measure the consumer perception on various factors both advantages and disadvantages acting as an indicator for the electric mobility. Besides the typical shortcomings of this research method there are several limitations regarding sample quality and data collection. To reach a high number of respondents with a comparably small use of resources, we distributed the survey online. Especially, social networks helped to spread it among a large number of people. However, this accompanies many disadvantages. Besides gender and age, sample also represents consumers with an academic or higher education background. Moreover, the fact that the participants of the survey were mainly friends or friends of friends probably biased the response behavior. Participants might have indicated a more favorable perception as act of courtesy or to show support or appreciation for the research topic. We also noticed that people with interest in EV mobility were more likely to participate than those who are not. Many actually hesitated or even ignored to participate with their insufficient knowledge. This effect is also reflected in the gender distribution of the sample, which is slightly male dominated both in Taiwan (57%) and India (59%). when designing the questionnaire we chose English and Chinese as language of the people thereby to target the respective market.

When conducting the analysis we did not make use of any statistical tools (e.g. IBM SPSS statistics) for testing the data with hypothesis. We used MS Excel for our study and detailed analysis purpose. It is likely, that not all of our results are significant. Furthermore, we designed the questionnaire utilizing grading scale with four grades, to allow the participants to provide a differentiated picture of their perception. Future research should analyze this data collection for more in-depth results.

6.2 Summary

Climate change and global resource shortage have led to the rethink of traditional individual mobility. Although, EVs are a promising alternative to overcome these problems, they are characterized with low acceptance among consumers. Therefore, this research aimed to give a better understanding of why consumers resist buying electric vehicles. For this purpose we designed the Advantages & Disadvantages Model, a theoretical framework that conceptualizes the link between high motivation and low motivation among the consumer perception. In addition, it incorporates the effect of consumer characteristics and buying motivation. In order to examine this theoretical model we conducted a consumer survey of both Indians and Taiwanese with a social media-distributed online questionnaire. The analysis of the data allowed us to answer the three initially raised formulated research sub-questions.

1. Which are the important indicators determining the consumer's motivation regarding the Electric Vehicle?

   The first sub-question aimed to examine the consumer perception and motivation for the identification of the relevant factor variables. First, an overview of how consumers generally perceive the EV is provided. Furthermore, the analysis reveals that almost two third of the consumers surveyed can be considered high motivation towards the purchase of EVs (57%). Moreover, it suggests that the EV currently faces several barriers, those are range, style/brand/looks, speed, high purchase price, limited noise: safety concern and acceleration. The EV is also related to several uncertainties that reflect above barriers. In particular uncertainties regarding the charging process and the expansion of a charging station infrastructure pose fundamental obstacles. The analysis also revealed that the relevance of these barriers vary from market in Taiwan to market in India.

2. Which are the important indicators of an Electric Vehicle motivate consumers to consider using an Electric Vehicle?

   The second sub-question aimed to investigate the important indicators of consumer perception considering the purchase of EV. Regarding the advantages which act as important indicators of consumers' perception considering the purchase of EV, we examined the existence of four factors (environmentally

friendly, Low CO2 emission, charging at home/work and Low cost per Km). Actually, the high purchase price of EVs does not scare off consumers because of Low cost per Km, provided consumers are educated properly or made aware of them. Consumers from both Taiwan and India involved in Electric vehicle mobility perceive less beneficially the ecological friendliness of EVs. They have negative opinion about EVs, even though they consider themselves green-minded. Nevertheless, this conception could change; if more consumers exposed to the innovation the better they identify its strengths and weakness. Negative media coverage also acts as barrier and make consumers opinion less favorable about them. Our research has made a revealing outcome that government subsidy do enhance the perceived economic value of EV. This might help for governments and other decision makers in designing consumer-oriented incentive systems.

We conclude, that various consumer perception both advantages and disadvantages of EV, the barriers still prevent the EV from a broad market acceptance. This study shows the effectiveness of government subsidy in Taiwan and India of buying EV. However, most markets do not deploy buying government incentives extensively. In the future, considerable research on government incentives and business model should be created to support for the creation of new markets to increase EV purchase. Once established, EV has the power to significantly change the mobility behavior of both individual people and the society at large.

EVs have several advantages to becoming the transportation mode of the 21st century. The drawbacks on the other hand compel consumers to make complex and balanced assessments when deciding if they should purchase an EV. EV manufacturers are also starting to deploy EVs in their fleets due to the numerous benefits they convey. Benefits as we have survey in our research: environmental, lower levels of energy spent, financial incentives, less noise contribute to the reputation of the business

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Appendix- Questionnaire A Taiwan

探討購買電動車的動機:比較台灣及印度的差異

親愛的朋友們, 我是劉安道, 印度人. 我是東海大學企業管理的研究生. 下列是碩士論文的調查: 探討購買電動車的動機:比較台灣及印度的差異. 這調查發只為了研究而已沒有任何目標. 謝謝大家的支持.感謝你們.

性別

- 男
- 女

年齡

- 18-25 歲
- 26-35歲
- 36-45歲
- 46-55歲
- 56-65歲

*

教育

- 高中
- 大學
- 碩士
- 博士

調查問卷1: 電動汽車的優勢與缺點

優勢

	非常重要	很重要	重要	普通
油價因素				
環保汙染				
充電設施的普及				
政府補貼				
有舒適低噪音				
低碳排放量				
風格/品牌/外觀				
新技術				

缺點

	非常重要	很重要	重要	普通
購買價格高				
行駛距離不足				
充電設施少				
充電時間過長				
使用操作的知識不足				
行人無法察覺來車(低噪音)				
汽機車品牌的選擇有限				
新技術不確定				

調查問卷2: 激勵因素

1. 什麼動機會讓您購買電動車？

- 環保/低碳排放量
- 費用：購買價格/轉售價值/保險/稅
- 款式/設計/品牌/技術
- 可靠性，安全性和性能
- Other:

2. 什麼激勵不會讓您購買電動車?

- 使用操作的知識不足
- 費用
- 充電時間
- 車輛性能：速度，大小，外觀.
- Other:

3. 電動車的好處?

- 減少對化石燃料的依賴
- 環保
- 維護成本低
- 操控簡易
- Other:

4. 電動車輛的缺點?

- 充電時間過長
- 充電基礎設施少
- 充電不方便
- 購買成本
- Other:

5. 未來你打算買一輛電動車嗎?

- 是
- 不
- 不知道
- Other:

你認為電動車的技術是否已成熟?

- 是
- 否
- Other:

意見

請您有任何意見可提一下. 謝謝.

Questionnaire B India

FACTORS MOTIVATING CONSUMERS TOWARDS ELECTRIC MOBIL

Hi all, my name is Leo Antony, I am a graduate student at Tunghai University (Business Administration). The survey is about the motivating factors that affect or influence the consumers buying an Electric Vehicle . The questionnaire is aimed only for the research purpose only and will not be distributed to any other non-related division. Remain grateful for your support and help.

Gender
Sex

- Male
- Female

Age
Category

- 18-25 Years
- 26-35 Years
- 36-45 Years
- 46-55 Years
- 56-65 Years

Qualification
Education

- School
- Diploma
- Undergraduate
- Graduate
- PhD & Above

Questionnaire 1: Advantage and Disadvantages of Electric Vehicle
Advantageous Factors

	Decisive Advantage	Very Important Advantage	Important Advantage	Considerable
Low Cost Per Km				
Environmentally Friendly				
Charging at home/Work				
Government Subsidy				
Limited Noise/ Comfortable				
Low Co2 Emission				
Style/Brand/Looks				
New Technology				

Disadvanteogeous Factors
Disadvantage

	Decisive Disadvantage	Very Important Disadvantage	Important Disadvantage	Considerable Disadvantage
High Purchase Price				
Limited Driving Range				
Less Charging Infrastructure				
Long Charging Time				
Limited Knowledge				
Less Noise (Safety issue for Pedestrians)				
Limited Choice of Vehicle Brands				
Uncertain about New Technology				

Questionnaire 2

1. What would motivate you buying an Electric Vehicle?

- Environmentally Friendly/ Low Co2 Emission
- Cost: Purchase price/ Resale Value/ Insurance/ Tax
- Style/ Design/ Brand/ Model and Technology
- Reliability, Safety and Performance

2. What would discourage you buying an Electric Vehicle?

- Lack of Knowledge
- Cost
- Recharging
- Vehicle Performance: Speed, Size, Looks etc

3. Benefits of owning an Electric Vehicle?

- Reduce the dependency on fossil fuels
- Environmentally Friendly
- Low Maintenance Cost
- Easy to Drive

4. Drawbacks of Owning an Electric Vehicle?

- Re-charging takes time
- Low charging stations
- Re-charging is inconvenient
- Initial cost of Purchase

5. Do you plan to buy an Electric Vehicle in the future?

- Yes
- No
- Don't Know

6. Do you think Electric Vehicles are too early a Technology to go for? Would you prefer buying a hybrid car (both fuel & Electricity)?

- Yes
- No
- Others

If you have any personal suggestions or opinions, you are most welcome.