

Analysis on Potential Users of Electronic Scooter

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1 Study Motivation

1.1 Global Warming and Environmental Awareness

Since industrial revolution, the proportion of carbon dioxide has dramatically increased. The rising sea level caused by global warming, abnormal climate and so on, have caused unprecedented impact on human life. Recently, people have gradually aware of the severity of those problems and begin to control the rate of the global warming by various ways. Governments, entrepreneurs, international organizations, and non-profit organizations all start to promote sustainable development.

Since then, people implement energy conservation and carbon reduction plan in their daily lives, and as well as Green products and alternative energy rise. Moreover, electronic scooters also rapidly develop in this eco-friendly trend.

1.2 Global Trend and Government Policies

The main reason of increasing carbon dioxide concentration is the use of fossil oil. According to the global data, we can see that carbon dioxide emission caused by transportation stands up for 20 percent of fossil oil. In addition, the energy consumed by gasoline vehicles per hour is three times of the one caused by electronic vehicles. What's more, carbon dioxide emission generated by gasoline vehicles is four times of that produced by electronic vehicle. As a result, in order to deal with energy depletion and global warming, popularizing electronic vehicles has become one of the most important policies among governments all around the world.

Based on the report conducted by TechOrange in September, 2017, governments all over the world, including United Kingdom, France, Germany, Netherlands, Norway, India, China and so on, have already formulated plans to popularize electronic vehicles. For example, Norway government plans to prohibit diesel cars from selling in 2025 and ban on the right-of-way of diesel cars in 2030. Governments of United Kingdom and France will also follow to prohibit diesel cars from selling in 2030.

1.3 The Development of Electronic Scooters in Taiwan

In Taiwan, manufacturers such as KYMCO(Kwang Yang Motor corporation), China Motor, and Gogoro have existed in the electronic scooter market. On the other hand, car manufacturers such as Luxgen and China Motor have produced electronic cars. Electronic cars in Taiwan mainly rely on import. However, speaking of scooters, there are 13 million of scooters with the population of 23 million in Taiwan. That is to

say, there are 378 scooters per square kilometers in Taiwan, which makes Taiwan has the highest density of scooters in the world. Therefore, compared to electronic cars, electronic scooters have more opportunity for development. Taiwanese government is also looking forward to seize this great opportunity and make electronic scooters grow into export industry as well as information technology industry.

In conclusion, we hope to find out the potential opportunity and prospect of electronic scooters in Taiwan by collecting questionnaires from the public and focusing on the difference between traditional motors users and electronic motors users on Facebook.

2 Collecting Datasets

2.1 Electronic Motor Industry Website

Electronic charging points data and service stations data, including longitude, latitude, and administration area of each station.

2.2 Government Open Data Platform

We collected data from “Survey of Scooter Usage Status in 2016” in the form of CSV, which included 11699 available sample. We divided scooter users into two groups, people who were willing to change to electronic motors, and people who were reluctant to change. For these two groups, we conducted comparison in terms of gender, age, education, career, income, mileage, and weekly gasoline fee. With these comparison, we could conclude primary features of potential electronic scooter users and provide inspiration for government policy.

2.3 User Interaction on Facebook

In order to reify people’s concern for electronic scooters, we conducted cross validation on Facebook fans between traditional scooters and electronic scooters. Furthermore, we wish to clarify customers and provide insights for firms with our analysis.

3 Survey Analysis Results

3.1 Consideration for Changing Electronic Scooters

According to “Survey of Scooter Usage Status in 2016”, the willingness of changing electronic scooters was influenced by three factors, *Sufficient Charging Points*, *Price of Electronic Scooters*, *Performance of Electronic Scooters*. Price and charging points were the top two influential factors, which showcased in the below Figure 1. Moreover, discount for electronic scooter parking didn’t seem appealing to potential users. To increase the willingness of changing electronic scooters, we could either decrease the

price, or enhance the performance. However, the price was determined by the market and the performance was dependent on the firm's productive technique. Therefore, we focused on the completeness of charging points since improving electronic charging points was the most efficient strategy for the government.

Figure 1. Relationship Between Consideration for Changing Electronic Scooters

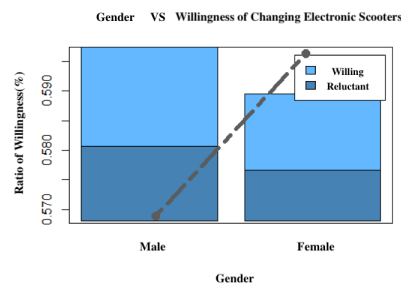


Left side of the graph is the first priority for changing electronic scooters. Right side of the graph is the second priority for changing electronic scooters.

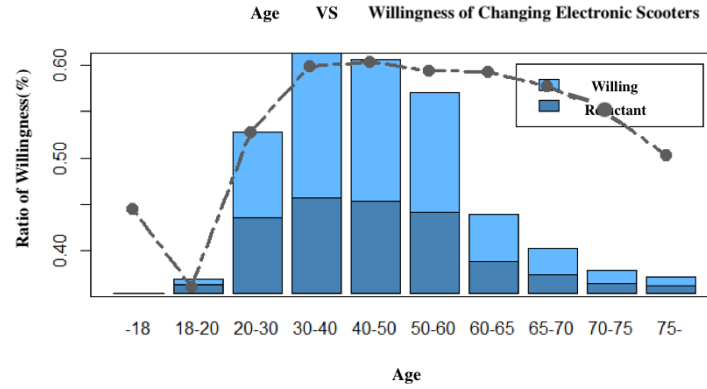
3.2 Features of Potential Electronic Scooter Users

3.2.1 Basic Variables

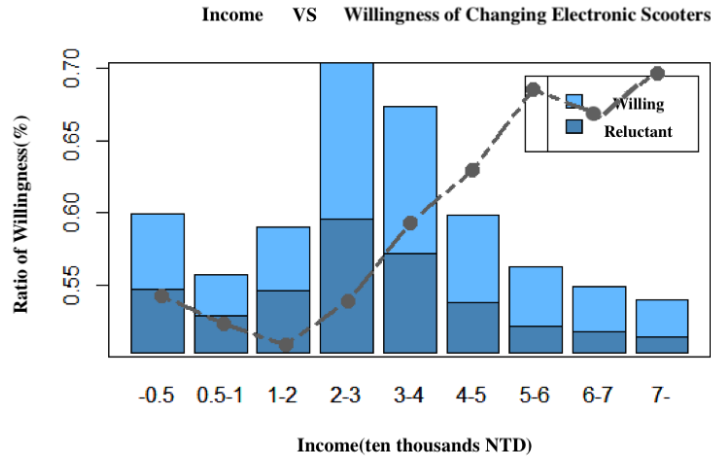
- (a) Gender: From the below graph, we can see that there is subtle difference between male and female.



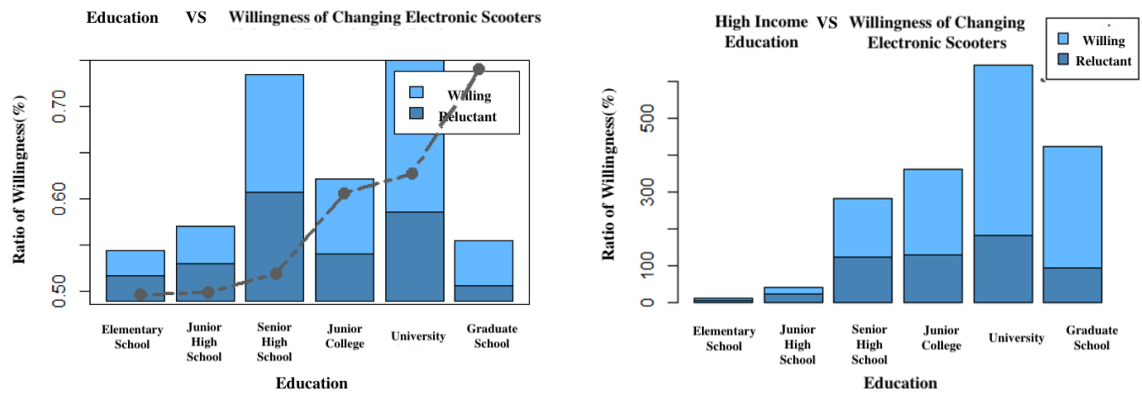
- (b) Age: From the graph below, people in middle-aged group are more willing to change electronic scooters, and willingness decreases as the age increases. It is probably because the middle-aged have relatively stable income to purchase expensive electronic motors. On the other hand, the elderly are not interested in innovative technology and need more time for adapting new things. Moreover, the elderly tend to be more frugal and cherish things more. Therefore, their willingness are low. Since samples of people below 20 are too small, to avoid bias, this part is not include in the discussion.



- (c) Income: From the graph below, people with high income are more willing to change electronic scooters. It is probably because it is more expensive to purchase electronic motors.

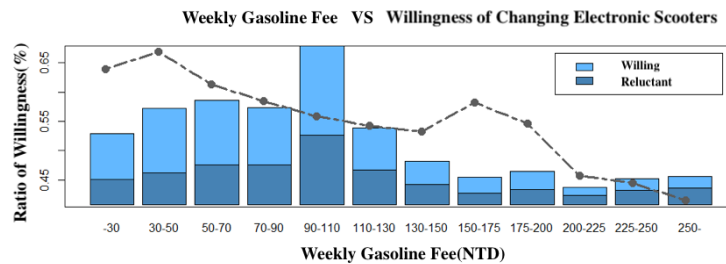


- (d) Education: From the left hand graph below, people with high education, especially Bachelors and Masters, tend to change electronic scooters more. It is probably because they pay more attention to environmental issues and are willing to spend more money for electronic motors. However, it is generally thought that high-educated people tend to have higher income. To test whether there is positive correlation between high-income and willingness of changing electronic motors, we first control income variable and then test effect on willingness in terms of education. From the right hand graph below, after controlling income, we can still see that people with high education are more willing to change electronic scooters.



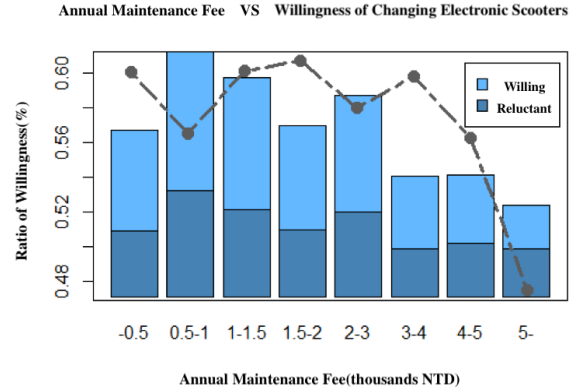
3.2.2 Spending Variables

- (e) Weekly gasoline fee: From the graph below, the higher the weekly gasoline fee is, the lower the change willingness is. It is probably because fuel consumption positively correlated with riding usage and frequency. Furthermore, people who frequently ride motors get used to their original scooter bands, models and performance; thus, they are less willingness to change.



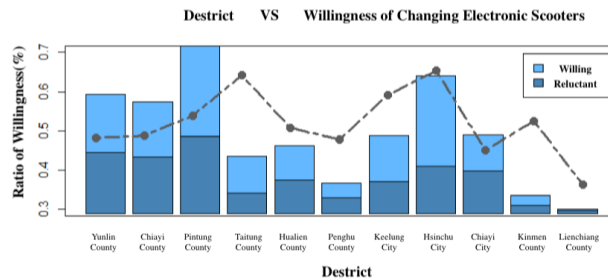
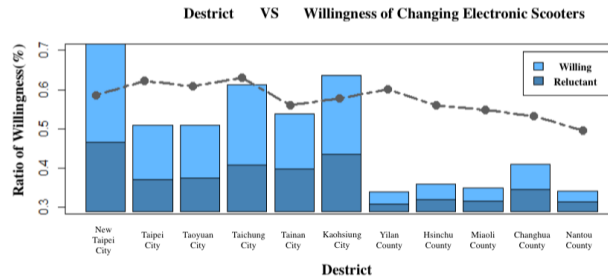
- (f) Annual maintenance fee: From the graph below, there is subtle difference in change willingness between people with annual spend lower than \$5000 NTD. On

the other hand, people who spend over \$5000 NTD on maintenance lay more emphasis on their own scooters, and they are attached to their original scooter bands, models and performance, reluctant to re-adapt to electronic scooters; thus, they are less willingness to change.



3.2.3 Distance Variables

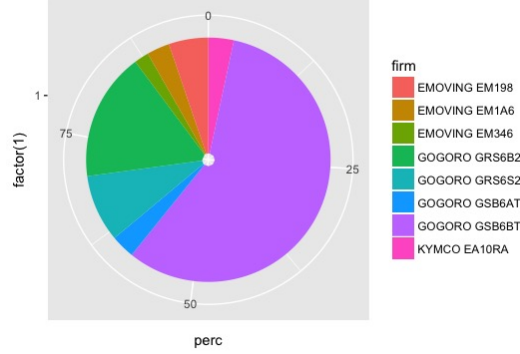
- (g) District: From the two graphs below, change willingness is much higher in cities (Taipei, New Taipei, Taoyuan, Taichung, Tainan, Kaohsiung) where sufficient electronic charging points are. Also, scooter users are active in above six cities. This result verifies the former fact of potential consumers' concern. That is to say, enough charging points would indeed affect customers' willingness to change electronic scooters.



3.3 Distribution of Electronic Charging Points

From the below Figure 2, till 2017, Gogoro has the highest market share in electronic scooter industry (83.17%). Therefore, we will focus on discussing charging points of Gogoro to reduce complexity.

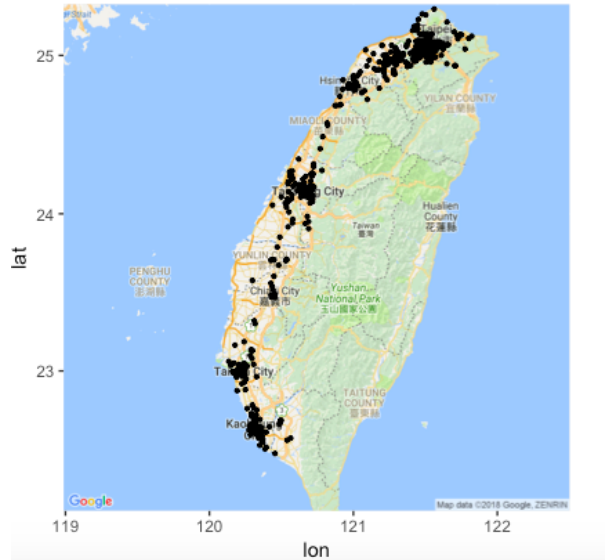
Figure 2. Market Share of Electronic Scooter Firms in Taiwan



3.3.1 Distribution in Taiwan

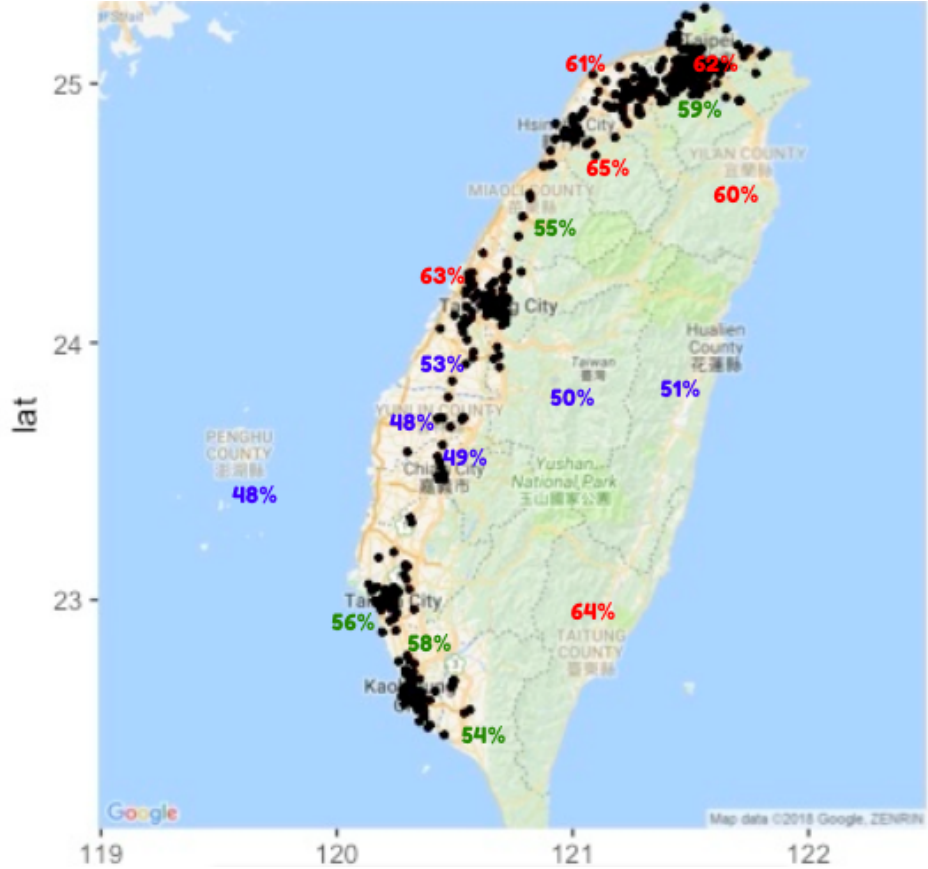
From the below Figure 3, electronic charging points are centralized in six cities, Taipei, New Taipei, Taoyuan, Taichung, Tainan, and Kaohsiung. In Eastern Taiwan and Penghu, there are no charging points.

Figure 3. Electronic Charging Points in Taiwan



From the below Figure 4, Northern Taiwan (Taipei, New Taipei, Keelung) and Central Taiwan both have high-density charging points and high willingness, which fits with the fact that customers' willingness to change electronic scooters depend on sufficient charging points.

Figure 4. Relationship Between Electronic Charging Points and Willingness Ratio

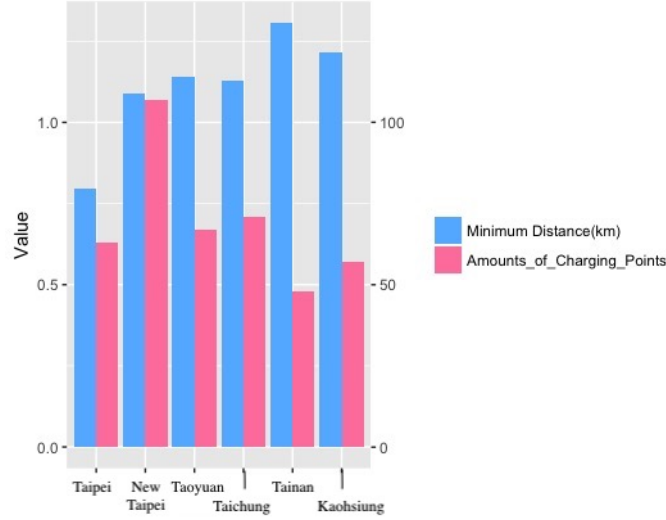


3.3.2 Distribution in Six Cities

Since some counties have less than 10 charging points, even 5 charging points, for example, Miaoli County has merely 3 charging points and Pintong County has only 4 charging points. Hence, we focus on analyzing comparison between six cities(Taipei, New Taipei, Taoyuan, Taichung, Tainan, Kaohsiung) where charging points are centralized. Making use of longitude and latitude data to calculate distance between two randomly selected points, we can find out average minimum distance for each city. From analysis results, we can see that average minimum distance are mostly around 1km; only Taipei's distance is less than 1km. In addition, the amounts of charging points are negatively correlated with the average minimum distance. Taipei and New

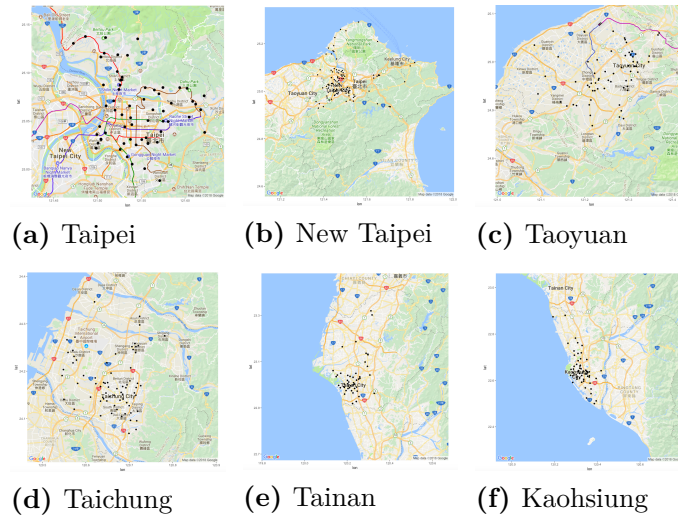
Taipei City have the highest amounts of charging points, and also their minimum distance are the shortest when compared to others. Tainan has the lowest amounts of charging points among six cities; thus, its minimum distance is the longest.

Figure 5. Average of Minimum Distance and Amounts of Points



From the below Figure 6, we can see that charging points in Taipei are evenly distributed, but other cities' distribution are centralized in one area. For instance, in New Taipei City, charging points are centralized in Zhonghe and Yonghe district where population are also large. In Tainan and Kaohsiung, the phenomenon of centralization are more apparent, which also verifies the analysis that their minimum distance are top2 longest.

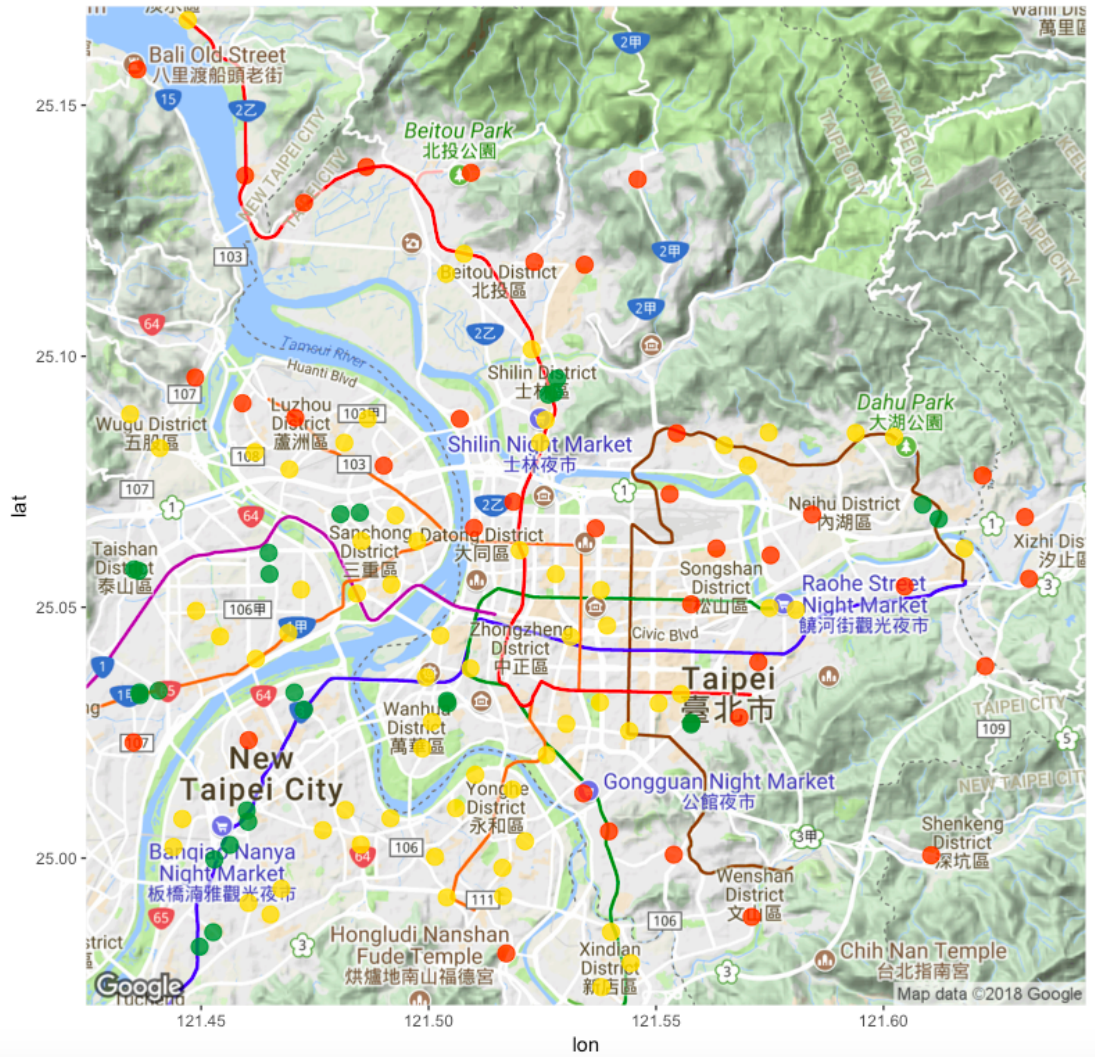
Figure 6. Electronic Charging Points in Six Cities



3.3.3 Distribution in Taipei and New Taipei City

From the below Figure 7, charging points are centralized in district that population are large, such as Banqiao, Sanchong, Zhonghe, Yonghe, Zhongzheng, and Wanhua, and distance between two charging points are small. On the contrary, the distance between two charging points are large are located in districts that are close to the terminal of metro or mountain area, such as Beitou, Wenshan, Shengkeng, and Xizhi. In terms of policy analysis, it is important to consider the adequacy of charging points outside the downtown area. Moreover, people's interaction behavior between electronic scooters and mass transportation also can be effective force points to implement public policy.

Figure 7. Electronic Charging Points in Taipei and New Taipei City

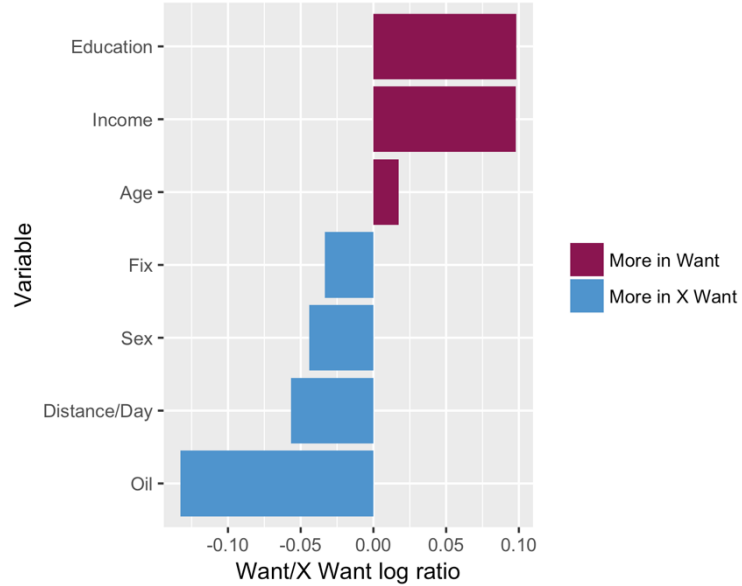


Red: Longest(Distance to Nearest Charging Point > 1km)
Yellow: Middle(Distance to Nearest Charging Point = 1km)
Green: Shortest(Distance to Nearest Charging Point < 1km)

3.4 Conclusion

From the below Figure 8, in terms of basic variables, middle-aged, high-educated and high-income people are more willing to change electronic scooters; in terms of spending variables, people with lower weekly gas fee and annual maintenance fee are more willing to change; in terms of charging points distribution, since metropolis have sufficient charging points, people's willingness are much higher. Furthermore, electronic charging points are centralize distributed in six cities. On the other hand, for districts that electronic charging points are not located, were not included in discussion because of lacking of data.

Figure 8. Features of Potential Electronic Scooter Consumers



4 Facebook Analysis Results

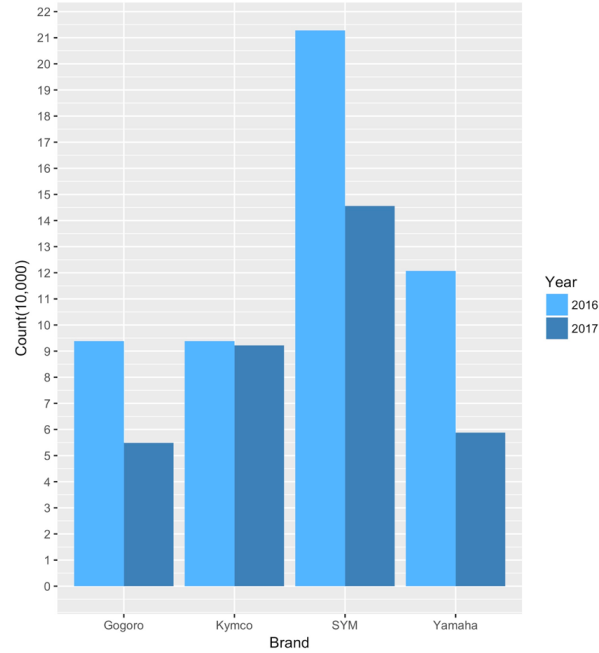
In this section, we collect data from Facebook to analyze people's concern for electronic scooters, and analyze the degree of overlap between consumers of traditional scooters and electronic scooters. We consider users who directly interact with the fan pages by either like or leave comment on the posts pay attention to scooters and are viewed as potential customers. Gogoro fan page is represented as electronic scooters, and SYM, KYMCO and YAMAHA fan pages are represented as traditional scooters, since they are top3 motorcycle sellers in Taiwan.

4.1 Volume of Facebook Interaction in 2016 and 2017

From the below Figure 9, we can see that in 2017, interaction have decreased in all four fan pages. Also, restricted to access for these data, we can only concentrated on

intersection of users.

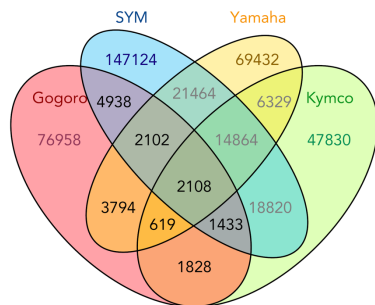
Figure 9. Facebook Interaction Between Users and Fan pages



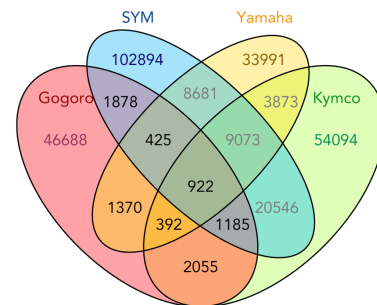
4.2 Venn Diagram

From the below two diagrams, no matter in 2016 or 2017, the intersection between three traditional scooter fan pages are much bigger than the intersection between Gogoro and theirs. This showcases there are difference between traditional scooters and electronic scooters in Facebook users. Moreover, three traditional scooter fan pages have their own loyal users who only show concern to them, indicating that those users are stoked to the brand instead of contacting various information. That is to say, many people only give attention to one sole brand.

2016 Fanspages VennDiagram



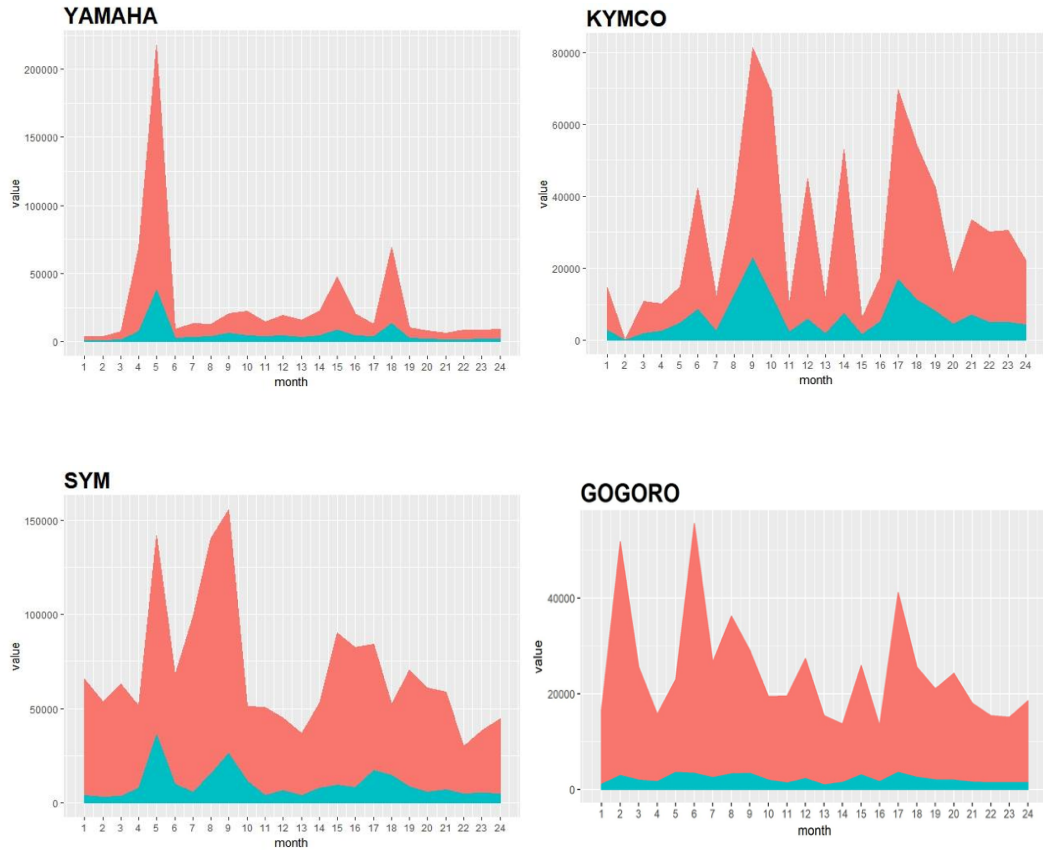
2017 Fanspages VennDiagram



4.3 Intersection Diagram

4.3.1 Monthly Activity Amount of Fan pages

After looking at the above venn diagrams, we divided annual data in to monthly data. Started from January in 2016 to December in 2017, we analyzed users from one of the four fan pages and checked whether they have also actively engaged in other three fan pages. Take YAMAHA as an example, the red part is for monthly users who are active in the fan page, and the blue part is for users engaged in other fan pages at the same time. Therefore, we can infer that people who only focused on one specific fan page take up great proportion of users in the brand. In addition to YAMAHA, we can also see this fact in other three fan pages.



4.3.2 Three Traditional Scooter Fan Pages

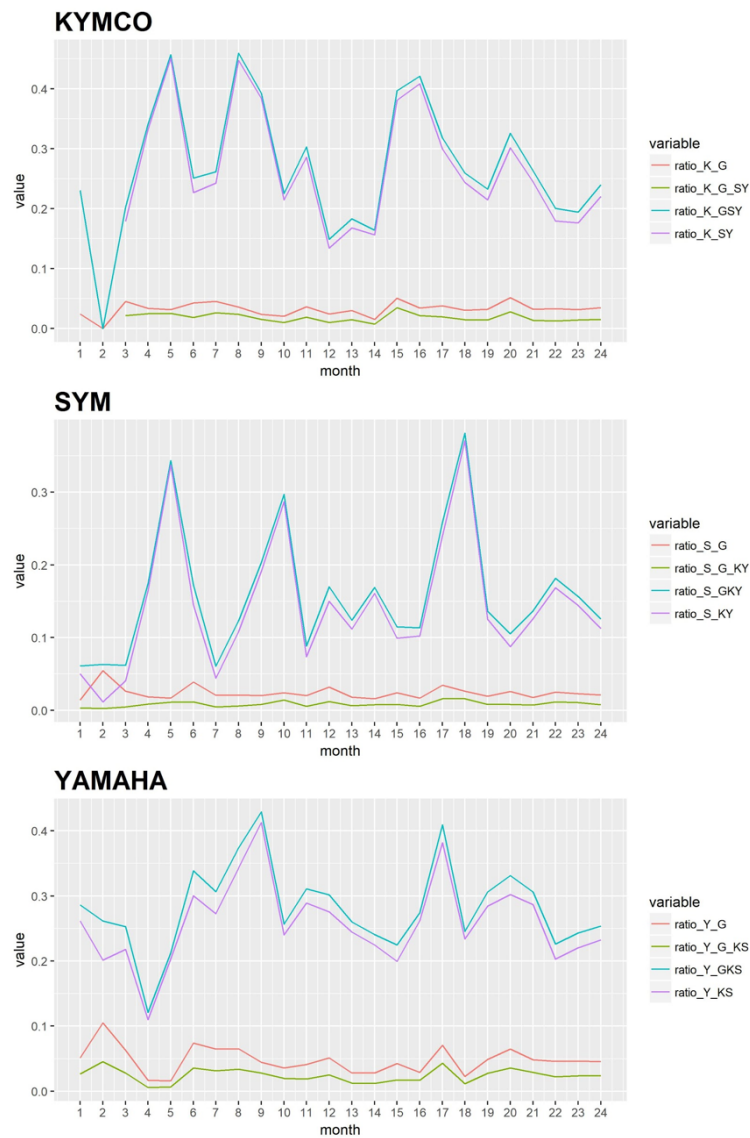
In this section, we focus on users who were also active in other fan pages simultaneously and analyze their activity statuses between those four fan pages.

Take KYMCO as an example, the upper blue line (ratio_K_GSY) is the total amount of users who were also active in other fan pages simultaneously to monthly users of the fan page ratio; the purple line (ratio_K_SY) is users who engaged in other traditional scooter

fan pages (SYM and YAMAHA) among KYMCO's fans; the red line (ratio_K_G) is users who engaged in Gogoro among KYMCO's fans; and the lower green line (ratio_K_G_SY) is users who both engaged in other traditional scooter fan pages and Gogoro fan page to monthly users of the fan page ratio.

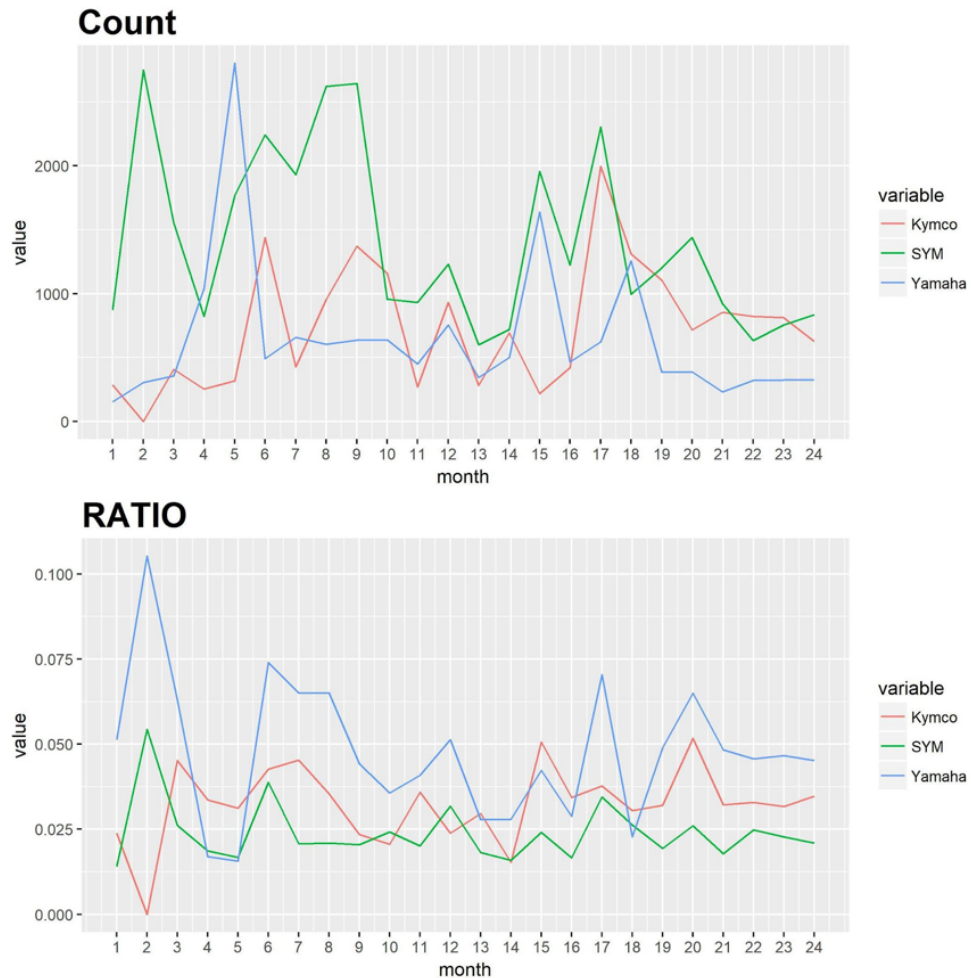
From the below three graphs, we can see that among users who both engaged in other traditional scooter fan pages and Gogoro fan page, most of them also pay attention to other traditional scooter fan pages, and merely of them give concern to Gogoro. This fact can also be seen in graphs of SYM and YAMAHA.

In conclusion, except users of SYM have once more actively engaged in Gogoro fan page; 72 data from three fan pages have only less than 5 data which Gogoro's ratio is larger than the others.



4.3.3 Gogoro Fan Page

In this section, we focus on users from three traditional fan pages who were also active in Gogoro fan page. From the perspective of Count, the total amount of users is only 2000; among these, users from Kymco is the least and users from Sym is the most. From the perspective of Ratio, we control user amount from each fan page and find out that Sym has the largest amount of its own users; thus, its ratio is the smallest. In sum, except the ratio of Yamaha has once reached 10%, the rest are only 5%, which stands up small proportion in terms of total users.



4.4 Conclusion

- (a) High Ratio of One Specific Fan Page Users: From venn diagrams and intersection diagrams, most users of four fan pages only pay attention to the own fan page. From the perspective of brand, consumers are fixed to one specific scooter brand.

- (b) Varied Intersection Diagrams: From previous intersection diagrams, three traditional scooter fan pages have different intersection relationship either with other traditional scooter fan pages or with Gogoro fan page.
- (c) Willingness and Reality: From the previous survey analysis, most of the willingness to change electronic scooters are bigger than 40%; however, the intersection ratio between traditional scooter and electronic scooter fan pages is less than 10%. This indicates that people's willingness to change are far beyond their attention to electronic scooters in reality.

4.5 Future Prospects

- (a) Policy Perspective: By analysis, we know the features of potential consumers so that the government can either compare current policies to adjust or come up with more appropriate new initiatives. Instead of subsidy, how to convert people's willingness into real action is the big issue for implementing policy.
- (b) Marketing Perspective: We can compare and analyze the marketing media and commercial strategies of each scooter firm to predict patterns and derive business models that are suitable for each firms.
- (c) Electronic scooter Industry: From the current features of potential consumers, we can construct a more suitable electronic scooter system to meet potential consumers' needs and increase consumers' using experience. Moreover, this can create more business opportunities and fit in current market trend. This will not only enhance electronic scooter industry, also popularize electronic scooters.

4.6 Limitation of the Study

- (a) Survey Data Limitation: Variables in the survey are mostly categories, not specific numerals; thus, we can not conduct cross-product method or advanced analysis.
- (b) Facebook Data Limitation: Limited by authorization, we can only crawl Facebook posts, like records and comment data by API.
- (c) Other Interference Factors: There are still other factors that will affect our analysis, such as the difference in fan page models, and the influence on willingness due to government policy of subsidy.

5 Reference

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- (2) <https://buzzorange.com/techorange/2017/09/12/5-countries-that-ban-gasoline-vehicles/>

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- (5) <https://www.lev.org.tw/subsidy/Download.aspx>
- (6) <https://www.gogoro.com/tw/>
- (7) <https://data.gov.tw/dataset/6216>