Measuring Market Share of Petrol Stations using Conditional Probability Approach

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\textbf{Abstract.} Oil and gas production is the strength of Malaysia’s growth over past decades. It is one of the most strategic economic branches in the world. Since the oil industry is essential for the economic growth of a country, only a few undertakings have been achieved to establish. It is a very risky business. Therefore the dealer must have some information in hand before setting up a new business plan. Understanding the current business situation is an important strategy to avoid risky ventures. In this study, the aim is to deliver a very simple but essential way to identify the market share based on customer’s choice factors. This approach is presented to encourage the non-statisticians to use it easily in helping their business performance. From this study, the most important factors differ from one station to another station. The results show that the factors of customer’s choice for BHPetrol, Caltex, PETRON, PETRONAS and SHELL are site location, service quality, service quality, size of the petrol station, and brand image, respectively.

\section*{INTRODUCTION}

Malaysia is a significant producer of oil and gas. According to [1], the petroleum and natural gas mining industry contributed 9.7 per-cent of the gross domestic product (GDP) in 2010, and 8.7 per-cents in 2011. The total values of gross output in 2011 and 2012 were RM109.2 billion and RM98.1 billion, respectively [1].

Nowadays, many foreign companies such as BHPetrol, CALTEX, PETRON, and SHELL have invested in Malaysia since the government is opening the business to private companies. It has made the competition become more competitive especially when the oil price in global market is increasing [2]. Therefore, PETRONAS as a company of Malaysian oil industry has to compete with these foreign companies. As of August 2013, there were 3291 petrol stations, 332 mini stations, and 200 petrol service stations selling NGV in Malaysia [3].

Petrol service station is defined as land used to sell motor vehicle fuel and lubricants. It may include the selling of motor vehicle accessories or parts, food, drinks and other convenience goods, servicing or washing of motor vehicles, and installing accessories or parts of motor vehicle [4]. The petrol station offers a great variety of commodities. The supply of basic provisions is similar to a local shop. There are also sections for car care products, magazines, candy, and entertainment articles like CDs [5].

This service industry brings a good opportunity to the business partner for the investment, for example, PETRONAS targeted a roll out between 25 to 30 new petrol stations nationwide in 2014 with the investment of RM2 million per station. PETRONAS aims to achieve 35% of the market share from the current 30% to emerge as the market leader in Malaysia [6].

There are two types of petrol dealer programs depending on interest and requirements. First, the service stations built, equipped, and maintained by the company are either company-owned or company-leased land known as Company Owned Dealer Operated (CODO). Under the CODO programme, the company owns all assets on site whereas the dealer takes the ownership of fuels and convenience store products as well as inventory. Dealers would be the holder of all operating licenses and undertake signing of the License Agreement with the company for a period between 1 to 3 years. Dealer also pays license fees to the company. The second programme is known as Dealer Owned.
Dealer Operated (DODO) where the service stations are owned and built by dealers. The dealer owns the land, building, and some equipment. The dealer also takes ownership of fuels, convenience store, and inventories. Under DODO programme, the dealer would sign on a Retail Trade Agreement with the company for a period between 10-15 years. Dealers would also receive additional margin over and above the government’s regulated dealers’ margin [7]. To become a new dealer, the minimum requirement for working capital and bank guarantee is around RM250,000 and it can be up to RM500,000 [8].

The oil industry is one of the most strategic economic branches in the world, only a few undertakings have achieved to establish a permanent share in this market [9] since this is a very risky business. The uppermost risk that will be faced by not well-performing companies is the license will be withdrawn. Consequently, to avoid the risk, the dealer must have some important information regarding the market share of petrol stations before operating a new petrol station. Understanding the current business situation is the most important strategy to prevent from very bad losses.

In this study, the aim is to deliver very simple but essential way to identify the market share. This approach is presented to encourage the non-statisticians or specifically petrol station dealers to use it in helping their business performance. In the next section, we present the literature review on customer’s choice factor in choosing petrol stations. The statistical methodology is presented in Section 3, and it is followed by statistical results in Section 4.

**REVIEW ON CUSTOMER’S CHOICE FACTOR**

In measuring the market share, the most important thing is to determine the factors that influence customer’s choice. In this section, we deliver a brief discussion on six main factors, which are brand image, site locations, accessibility, and size of petrol station, service quality, and facilities.

Brand image is the impression of the customers about a brand. A successful brand image allows customers to differentiate the brand from its competitors, and thus increases the probability that customers will purchase the brand [10]. Brand and products are likely to be used by customers based on their own personalities. It is utmost significance to managing brand image as customers appear to depend on the brand image as long as they have little or no understanding about the product [11]. A well-communicated brand image should help to establish a brand's position, insulate the brand from competition, and improve the brand's market performance [12].

The second factor is site location. Location is defined as geographical placement of a business in a specific area or region that is maximizing system profitability to serve a specific target market. It can be used to develop sustainable competitive advantage by proposing suitable locations that are simply accessible and visible, and which may be nearby activity centres such as office complexes, shopping centres, hotels and entertainment [13]. The performance and success of any retail business are greatly to be influenced by the location factor. The location of a petrol station in an urban area should influence a higher demand for petrol than a rural area due to the high population, high median income, more cars, and high proximity to an airport [14].

Another factor is the accessibility of the site to customers. Accessibility is referred to the ease of entry to and exit from a particular site of residential area. In one study conducted by [15], they found that the accessibility affects demand of petrol. Besides that, [16] showed that petrol stations achieve the maximum potential to access when it is easy for drivers to see and to enter them. To ensure success, the services and enterprises should be situated in sites that allow easy access [17]. Street corner sites and intersection sites are preferred locations because they offer better access and also have improved visibility and higher traffic volume [16].

The fourth factor is the size of a petrol station. It is related to the availability of the number of pumping bays which is significant for the convenience of refuelling at a certain station. The convenience of customers is a crucial variable that has a significant impact on sales volume of petrol stations [13]. The number of pumps that are available to refuel cars is an important factor despite the fact that there are many other variables influencing customer’s convenience. The customers have a habit to avoid those petrol stations which are busy as they do not like to wait to refuel [18].

The fifth factor is customer service quality. Service quality for customer is an important element as a petrol station is a service industry. Customers are main assets for companies; customer satisfaction is the main focus that needs to be attained by petrol station [2]. Besides, general cleanliness, appearance, and speed of service are also included as the quality of service provided at petrol stations. This is important as it can help to improve the experience of customers, maintain the loyalty of customers and also increase the likelihood that customers repeat purchase the product at a particular petrol station [13].

The last factor taken into consideration is facilities. It is important to deliver the best environment for customers who want to take a break and have some rest [19]. The facilities such as the toilets and rest areas, food on the go such
as sandwiches, hot and cold beverages and the public services such as auto-teller machine, public telephones, televisions, and free Wi-Fi are essential features. Usually, customers do more than just refuelling the car when visiting a petrol station [20]. In this regard, many petrol stations are increasingly distinguishing themselves from other petrol stations by offering additional services. The additional services such as convenience stores, car wash facilities and specialty stores may help to increase the market share of a petrol station [14].

DATA COLLECTION

The survey was from July 1, 2015 until August 31, 2015. Primary data had been collected using self-administered questionnaires that were given to selected customers at selected petrol stations within Bandaraya Melaka by using multistage sampling technique.

The first stage is development of questionnaire. There are two yes, no questions in the form. The first is “What is the most preferable petrol company?”, and the second is “What is the reason of choosing that particular petrol station?”. In the second stage, 25 out of 70 petrol stations is selected randomly from the list of petrol station in Bandaraya Melaka using stratified sampling technique. Later, a systematic sampling technique is implemented for selection of 500 respondents. The field work study is conducted within two weeks, from 6am to 12pm.

CONDITIONAL PROBABILITY AND PARETO ANALYSIS

Two main ingredients in this analysis are conditional probability and Pareto analysis. Both were used to achieve the aim of this study. First we computed the conditional probability, and then we used the Pareto principle analysis to visualize the information.

The first method has been used is conditional Probability is often used to measure the relationship between two events. It is the probability that an event will occur given that another event has already occurred, P (event will occur | event has already occurred). The probability of event A given event B is \( P(A|B) = \frac{P(AB)}{P(B)} \).

Next, the second method is Pareto principle analysis. This analysis is also known as the 80/20 rule which means that by doing 20% of the work you can generate 80% of the benefit of doing the whole job. In terms of quality control approach, a large majority (80%) of problems are produced by a few (20%) important effects. This is also called as separating the vital few from the trivial many [21]. Pareto analysis provides facts needed for setting priorities. It organizes and displays information to show the relative importance of various problems or causes of problems.

ANALYSIS AND RESULTS

The summary of the responses given by the respondents in Bandaraya Melaka is shown in TABLE 1. As for petrol stations, PETRONAS station is the highest with 160 (32%) respondents followed by Shell 140 (28%), Petron 80 (16%), Caltex 60 (12%) and BHPetrol 60 (12%).

<table>
<thead>
<tr>
<th></th>
<th>Accessibility</th>
<th>Brand Image</th>
<th>Facilities</th>
<th>Service Quality</th>
<th>Site Location</th>
<th>Size of Petrol Station</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>BHPetrol</td>
<td>15</td>
<td>6</td>
<td>9</td>
<td>11</td>
<td>16</td>
<td>3</td>
<td>60</td>
</tr>
<tr>
<td>Caltex</td>
<td>10</td>
<td>10</td>
<td>1</td>
<td>33</td>
<td>2</td>
<td>4</td>
<td>60</td>
</tr>
<tr>
<td>Petron</td>
<td>13</td>
<td>11</td>
<td>15</td>
<td>21</td>
<td>8</td>
<td>12</td>
<td>80</td>
</tr>
<tr>
<td>Petronas</td>
<td>27</td>
<td>28</td>
<td>42</td>
<td>8</td>
<td>11</td>
<td>44</td>
<td>160</td>
</tr>
<tr>
<td>Shell</td>
<td>26</td>
<td>53</td>
<td>13</td>
<td>6</td>
<td>19</td>
<td>23</td>
<td>140</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>91</strong></td>
<td><strong>108</strong></td>
<td><strong>80</strong></td>
<td><strong>79</strong></td>
<td><strong>56</strong></td>
<td><strong>86</strong></td>
<td><strong>500</strong></td>
</tr>
</tbody>
</table>

Based on TABLE 1, the conditional probability is computed by using the formula presented in Section 4. The computational conditional probability for the first cell of TABLE 2 involves the joint probability distribution between two events which are Accessibility and BHPetrol. For example,
\[
P(\text{Accessibility}|\text{BHPetrol}) = \frac{P(\text{Accessibility} \cap \text{BHPetrol})}{P(\text{BHPetrol})} = \frac{15/500}{60/500} = 0.250
\]

The full results are presented in \textbf{TABLE 2}.

\textbf{TABLE 2.} Conditional probability between petrol companies and customer’s choice factors

<table>
<thead>
<tr>
<th></th>
<th>Accessibility</th>
<th>Brand Image</th>
<th>Facilities</th>
<th>Service Quality</th>
<th>Site Location</th>
<th>Size of Petrol Station</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>BHPetrol</td>
<td>0.250</td>
<td>0.100</td>
<td>0.150</td>
<td>0.183</td>
<td>0.267</td>
<td>0.050</td>
<td>1</td>
</tr>
<tr>
<td>Caltex</td>
<td>0.167</td>
<td>0.167</td>
<td>0.017</td>
<td>0.550</td>
<td>0.033</td>
<td>0.067</td>
<td>1</td>
</tr>
<tr>
<td>Petron</td>
<td>0.163</td>
<td>0.138</td>
<td>0.188</td>
<td>0.263</td>
<td>0.100</td>
<td>0.150</td>
<td>1</td>
</tr>
<tr>
<td>Petronas</td>
<td>0.169</td>
<td>0.175</td>
<td>0.263</td>
<td>0.050</td>
<td>0.069</td>
<td>0.275</td>
<td>1</td>
</tr>
<tr>
<td>Shell</td>
<td>0.186</td>
<td>0.379</td>
<td>0.093</td>
<td>0.043</td>
<td>0.136</td>
<td>0.164</td>
<td>1</td>
</tr>
</tbody>
</table>

The next step is to compute the market share by sorting the probability value in descending order, and then all of the values are multiplied by 100 to be converted into percentage (%). In \textbf{TABLE 3}, the results of market share for BHPetrol is delivered.

\textbf{TABLE 3.} Results of market share for BHPetrol

<table>
<thead>
<tr>
<th>Customer’s Choice</th>
<th>BHP Petrol</th>
<th>Market Share (%)</th>
<th>Cumulative (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Site Location</td>
<td>0.267</td>
<td>26.67</td>
<td>26.67</td>
</tr>
<tr>
<td>Accessibility</td>
<td>0.250</td>
<td>25</td>
<td>51.67</td>
</tr>
<tr>
<td>Service Quality</td>
<td>0.183</td>
<td>18.33</td>
<td>70</td>
</tr>
<tr>
<td>Facilities</td>
<td>0.150</td>
<td>15</td>
<td>85</td>
</tr>
<tr>
<td>Brand Image</td>
<td>0.100</td>
<td>10</td>
<td>95</td>
</tr>
<tr>
<td>Size of Petrol Station</td>
<td>0.050</td>
<td>5</td>
<td>100</td>
</tr>
</tbody>
</table>

Based on the cumulative percent (%) in \textbf{TABLE 3}, the following is the Pareto chart for BHPetrol (see FIGURE 1). Using the same approach, we construct FIGURE 2-5.

\textbf{FIGURE 1.} Market Share of BHP Petrol
Based on FIGURE 1, the highest market share of BHP Petrol is 26.67% which is the site location factor. Followed by the other five factors, it is 25.0% for accessibility, 18.33% for service quality, 15.0% for facilities, 10.0% for brand image, and 5.0% for size of petrol station. Based on Pareto principle, those 80% of market share of BHP Petrol are influenced by factors of site location, accessibility and service quality. Moreover, it is suggested for BHP Petrol to improve their market share by focusing more on the other 20% of factors, such as facilities, brand image and size of petrol station.

![FIGURE 2. Market Share of CALTEX](image)

FIGURE 2 shows that the service quality factor has accumulated 55.0% which is the highest percentage in the market share of CALTEX. It is only 16.67% for both accessibility and brand image, followed by 6.67% for size of petrol station, 3.33% for site location, and 1.67 % for facilities. Based on Pareto principle, those 80% of market share of CALTEX are influenced by factors of service quality and accessibility.

![FIGURE 3. Market Share of PETRON](image)

In FIGURE 3, the highest percentage of customer’s choice factor is service quality which accumulates 26.25%. For other factors, it is 18.75% for facilities, 16.25% for accessibility, 15% for size of petrol station, 13.75% for brand image, and 10% for site location. By using Pareto principle, 80% of market share are contributed by factors of service quality, facilities, accessibility and size of petrol station. The other 20% of market share are made up by factors of brand image and site location. In order to gain more market share, factors of brand image and site location should be taken into consideration by PETRON dealers.
Based on FIGURE 4.5, the size of petrol station gives the highest percentage which is 27.5% in the market share of PETRONAS. In comparison with the factor of facilities, it accounts for 26.25% which has only a slight difference by 1.25%. The percentage of other four of customer’s choice factors are 17.5% for brand image, 16.88% for accessibility, 6.88% for site location, and 5% for service quality. According to Pareto principle, the first three factors are accounted for as 80% of market share. Otherwise, the other 20% of market share are from accessibility, site location and service quality. To improve the market share of PETRONAS, dealers have to focus on the other 20% factors which are accessibility to petrol station, site location of business, and service quality.

From FIGURE 5, the market share of SHELL has shown that brand image has accumulated to 37.86% which was the highest percentage of customer’s choice factor. The percentage of other five of customer’s choice factors are 18.57% for accessibility, 16.43% for size of petrol station, 13.57% for site location, 9.29% for facilities, and 4.29 % for service quality. According to Pareto principle, those 80% of market share are contributed by factors of brand image, accessibility and size of petrol station, while 20% of market share are accounted for by factors of site location, facilities and service quality.

**SUMMARY AND CONCLUSION**

This study indicates that the most of the customers choose to refuel at BHPetrol due to site location (26.67%). Compared with other factors, service quality is the most influencing factor for choosing CALTEX and PETRONAS.
which have high percentages of market share by 55.0% and 26.25%, respectively. For PETRONAS stations, the size of petrol station is the main concern (27.5%), and on the other hand, SHELL customers are looking for brand image, which achieves the highest percentage of market share by 37.86% compared to other factors. In summary, among the other factors, the customers are looking for accessibility factor. It is proven when this factor is included in 80% of Pareto principle for all petrol stations. Based on all figures, it shows that the customers also put the focus on service quality, facilities and size of the location.

As a conclusion, there are two limitations of this study that should be considered. First, the results are based on petrol station around Bandaraya Melaka only, and therefore they do not necessarily represent Melaka in general. Second, the customer’s choice factors are limited to six factors only. However, to the best of our knowledge this is the first study in our country that is aimed to investigate the market share by using probability statistics approach. We hope the finding of this study will encourage dealers and businessmen to carry out more research before proposing a new business plan since this is a very simple approach and easy to implement.

REFERENCES

   http://www.statistics.gov.my/index.php?r=column/cthemeByCat&cat=96&bul_id=RTZQN29tWUpPcVUyjBhXOPv/DBzdz09&menu_id=TXdvYTtvQXVITFhVOUj6NVVESVBNUT09