A game-theoretic model of marketing strategy using consumer segmentation.

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Abstract. Game theory evolves like a biological system with species that evolved under natural selection. Game theory as a means of predicting the distribution of individual behaviour in various fields of business. Companies must learn the best marketing strategies and estimate the steps of their competitors. Marketing strategy analysis is related to decision making when there are two or more parties in a condition of competition or conflict. In this research, determining the marketing strategy is done by paying attention to consumer segmentation. With consumer segmentation generated marketing strategies for certain consumers at a predetermined size. Consumer segmentation is important for producers, among others: the company can manage its products well, know the needs and standards of consumers, and get the optimal marketing strategy.

1. Introduction

Companies must estimate the best marketing strategy that must be done or at least estimate the steps of the competitors. One theory that can be used to analyze these marketing strategies is to use game theory. Game theory is a part of science that deals with decision making when there are two or more parties in a condition of competition or conflict [1, 2, 3].

Technological developments have provided many benefits in progress in various aspects. One of the business opportunities and challenges that are very attractive to technology companies is the field of communication. One of the communication technology products currently being widely marketed is mobile phones. Mobile or mobile phone is one of the technological products that is an important requirement. Marketing strategy for consumers yield to the division for targeted consumers. Consumer segmentation is important for producers, so companies can find out consumer desires and optimal marketing strategies.

Several brands of mobile phones on the market, including the three best-selling cellphone brands in Indonesia in 2018, namely X which reached 28% of sales, Y which reached 25% of sales, and Z which reached 18% of sales [4]. Each producer competes to create a quality product and is of public interest. The marketing mix factor has a large role in various fields of business and business. In terms of maintaining its existence, each producer carries out a marketing mix activity in an effort to attract the interest of the public using their products.

In this research, determining the marketing strategy is done by paying attention to consumer segmentation. Consumer segmentation is a marketing strategy to divide consumers into certain divisions at a predetermined size. Consumer segmentation is important for producers to be able to manage their
products well, know the needs and standards owned by consumers, and get an optimal marketing strategy.

2. Basic game theory

Game theory is a mathematical model that is used in situations of conflict or competition between various opposing interests as competitors. This theory was developed to analyze the decision-making process of different competitive situations and involves two or more interests. This section provides our basic game theory. We give the marketing strategy (Section 2.1), we use population and sample (Section 2.2), and validity and reliability tests (Section 2.3). Section 2.4 the clustering process aims to minimize the occurrence of objective functions set in the K-Means Clustering Algorithm. Next, Section 2.5. Provides an applied version of the model in which is most integrated between game theory and supporting theory.

2.1. Marketing strategy

Marketing is an activity carried out by individuals or groups to create economic value from a product. The purpose of marketing is that consumers know in detail about the product, the company explains in detail the matters relating to marketing to consumers from the introduction of product quality, price, promotion, and delivery of products quickly until consumers understand in detail the product. Marketing strategy is a strategy to serving markets or market segments that are targeted by entrepreneurs so that the high and low of sales is determined by the merits of the market strategy by entrepreneurs to achieve organizational goals.

The marketing mix is a collection of controllable marketing variables that are used by business organizations to achieve marketing goals and marketing objectives. The marketing mix variable is a measure of the strength of a company or organization in competing for customers and profits.

2.2. Population and sample

The population is the sum of all objects whose characteristics are to be assumed. Population will give a precise picture of various events, but large numbers, large areas, large variations which will require a cost and a long time [5].

The sample is a portion of the population whose characteristics are to be investigated and considered to be representative of the entire population. The number of population that is too much we will take to be sampled in the hope that the number of samples we take can represent the existing population. In determining the sample size you can use the Slovin formula as follows:

\[n = \frac{N}{1 + (Ne^2)}\]

where:

- \(n\) : sample size
- \(N\) : population
- \(e\) : presisi value 95 or sig. = 0,05 (using margin of error 5).

2.3. Validitas and reliability test

Validity test is a test used to determine the appropriateness of items in a list of questions in defining a variable. This list of questions generally supports a certain group of variables. The testing technique that is often used to test validity is to use Bivariate Pearson correlation or Pearson Moment Product using the following formula [6].

\[r_{xy} = \frac{n \Sigma xy - (\Sigma x)(\Sigma y)}{\sqrt{[n \Sigma x^2 - (\Sigma x)^2][n \Sigma y^2 - (\Sigma y)^2]}}\]

where:

- \(r_{xy}\) : correlation coefficient
- \(x\) : item's score
- \(y\) : total score
The results of the validity test can be seen in the calculated value $r_h$. If $r_h > r_{table}$ then the question items correlate significantly to the total score (valid). If $r_h < r_{table}$ the question items do not correlate significantly to the total score (invalid).

Reliability (reliability) is a measure of the stability and consistency of respondents in answering matters relating to the contract constructs which are dimensions of a variable and are arranged in the form of a questionnaire. The reliability test can be done together with all questions. Reliability testing uses Cronbach's Alfa formula because this research instrument is in the form of a questionnaire and a multilevel scale. Cronbach’s Alfa formula is as follows [6],

$$r = \frac{k}{(k-1)} \left[1 - \frac{\sum \sigma_b^2}{\sigma_t^2}\right]$$

where :
$r$ : reliability instrument coefficient (Cronbach’s Alfa)
$k$ : number of question
$\sum \sigma_b^2$ : item of varians total
$\sigma_t^2$ : varians total

The reliability test results can be seen in the value of Cronbach’s Alfa. If the Cronbach’s Alfa value $> 0.60$ then the variable dimension contract question is reliable. If the Cronbach’s Alfa value $< 0.60$ then the variable dimension contract question is unreliable.

2.4. K-Means clustering method

K-Means Algorithm Method is one of the algorithms in the clustering function. The clustering process aims to minimize the occurrence of objective functions set in the clustering process which are generally used to minimize variations within a cluster and maximize variation between clusters or in other words data that has the same characteristics are grouped in the same cluster and data that has different characteristics grouped into other groups. Determination of the centre value in each cluster based on the value of the range that is in the existing data source by selecting in accordance with the selected centre value. The Euclidean distance formula is used as follows:

$$d = \sqrt{\sum_{k=1}^{n} (p_k - q_k)^2}$$

where :
$d$ = object distance
$p_k$ = coordinat of object $p$
$q_k$ = coordinat of object $q$
$k$ = order of coordinat

2.5. Game theory

Game theory was developed to analyze the decision-making process of different competitive situations and involves two or more interests. In the game, participants are competitors. The advantage for one is a loss for the other. Each participant chooses and implements his strategies which he believes will result in victory. The game settlement with the payment matrix $m \times n$ and has no saddle points and domination methods cannot be used to reduce the size of smaller payment matrices, linear programming is a more efficient settlement method. In solving the problem of game theory using a linear program using the simplex method, which is forming a linear program and finding the optimum solution. The steps in linear programming game theory are as follows:

1. Player I is a line player (maximizing player), so it can be expressed hope of winning player I in a sign of greater inequality. Thus, the general form of a linear program for players is

$$\text{Min } f_o = X_1 + X_2 + \cdots + X_m$$

subject to...
\begin{align*}
a_1X_1 + a_2X_2 + \cdots + a_mX_m & \geq 1 \\
a_{12}X_1 + a_{22}X_2 + \cdots + a_{m2}X_m & \geq 1 \\
& \vdots \\
a_{1n}X_1 + a_{2n}X_2 + \cdots + a_{mn}X_m & \geq 1 \\
\end{align*}
\[ f_0 = \frac{1}{V} \sum \frac{x_i}{V} = X_i ; \ X_i \geq 0 ; i = 1,2,\ldots,n \]

2. Player II is a column player (minimizing player), so it can be expressed hope of winning Player II in a smaller inequality sign. Thus, the general form of linear programming for Player II is
\[ \text{Maks } g_0 = Y_1 + Y_2 + \cdots + Y_n \]
subject to
\begin{align*}
a_{11}Y_1 + a_{21}Y_2 + \cdots + a_{1n}Y_n & \leq 1 \\
a_{21}Y_1 + a_{22}Y_2 + \cdots + a_{2n}Y_n & \leq 1 \\
& \vdots \\
a_{m1}Y_1 + a_{m2}Y_2 + \cdots + a_{mn}Y_n & \leq 1 \\
g_0 = \frac{1}{V} \sum \frac{y_j}{V} = Y_j ; \ y_j \geq 0 ; j = 1,2,\ldots,n \]

3. Improved game theory using consumer segmentation

The process of data collection is done by using a data collection tool in the form of a questionnaire. The questionnaire was distributed to active students of a tertiary institution as a respondent, there were 2 types of questionnaires distributed namely preliminary questionnaires and advanced questionnaires. The preliminary questionnaire is used to find out the research variables, which are the factors that are of interest by consumers in buying mobile products. The preliminary questionnaire was distributed to 35 respondents. From the results of the questionnaire, established research variables which will later be used as attributes, namely: battery life, camera quality, mobile design, internal memory capacity, and price.

The follow-up questionnaire was used to determine the preferences or importance of each product attribute in the opinion of consumers and to find out the characteristics of consumer data. The method of taking sample data is done by using the Slovin formula. The sampling process is carried out by taking a simple random sample proportionally to each faculty with the intention that the number of samples for each faculty is proportional to the population, where the sample size of each faculty is taken proportionally using the Cochran formula.

The number of students in 2019 was 17352 students. By using the Slovin formula and the fault tolerance limit that can be tolerated by 5, the number of samples to be used in this study are as follow:
\[ n = \frac{N}{1 + (Ne^2)} = \frac{17352}{1 + (17352)(0.05)^2} = 390.98693 \approx 391 \]

The proportion of students taking each faculty is calculated proportionally. The results of calculations for the number of samples needed for each faculty and the number of samples obtained in distributing questionnaires are shown in Table 1. Thus the questionnaire data that will be used as many as 400 questionnaires filled out by respondents completely and correct.

In this study the validity testing was performed with a precision value of 95, meaning a 5 significance level out of 400 questionnaires, so the \( r \) for the degree of correlation in the table is 0.098. Validity and reliability testing is done for part II questionnaire, namely questionnaire level of importance of each attribute according to consumers. The validity test calculation uses Bivariate Pearson correlation (Pearson Moment Product). The results of the validity test using SPSS 16.0 are shown in Table 2. In testing the validity, because \( r_h > r_{table} \), it can be concluded that the data for Part II is valid for each attribute.
### Table 1. Number of required and Student Samples Acquisition of Each Faculty

| Faculty No. | Nh   | nh\text{required} | nh\text{obtained} |
|------------|------|-------------------|-------------------|
| 1          | 1256 | 29                | 29                |
| 2          | 3557 | 81                | 81                |
| 3          | 1942 | 44                | 44                |
| 4          | 1840 | 42                | 42                |
| 5          | 1449 | 33                | 33                |
| 6          | 1056 | 24                | 28                |
| 7          | 1436 | 33                | 33                |
| 8          | 1677 | 38                | 38                |
| 9          | 914  | 21                | 21                |
| 10         | 2225 | 51                | 51                |
| Total      | 17352| 396               | 400               |

### Table 2. The value \( r_h \) each Attribut

| Attribut                  | \( r_h \) | Decision |
|---------------------------|-----------|----------|
| Battery life              | 0,605     | Valid    |
| Camera quality            | 0,463     | Valid    |
| Internal memory capacity  | 0,597     | Valid    |
| Affordable prices         | 0,598     | Valid    |
| Design                    | 0,516     | Valid    |

Reliability test can be seen in the value of Cronbach’s Alfa if the value of Cronbach’s Alfa > 0.60 then the variable dimension contract questions are reliable. This test is carried out for the part II questionnaire. In accordance with Table 3, The Cronbach's Alfa value of 0.703 is obtained, which means the value is greater than 0.6 so that it can be concluded that part II questionnaire data are reliable.

### Table 3. Reliability value

| Cronbach’s Alfa | Decision |
|-----------------|----------|
| 0,703           | Reliable |

3.1. Data transformation

Data transformation is a step to change ordinal data into interval data. The data transformation in question is to change the data of the level of importance of respondents who are still in the form of an ordinal scale, converted into the form of an interval scale. The purpose of this data transformation is to provide a standard value so that the value really has the same weight value on the attribute values. The method used for data transformation is the successive interval. The steps using the Successive Interval method are counting the frequency of respondents in choosing an ordinal scale, calculating proportions ie dividing each frequency by the number of respondents, calculating cumulative proportions namely counting by summing the proportions in sequence for each value, calculating the z value obtained from the standard normal distribution table and it is assumed that the cumulative proportion is in normal standard distribution, calculating the density value of \( z \) function, and calculating the scaling.

3.2. Consumer segmentation

Consumer segmentation is useful for dividing consumers into relatively homogeneous segments based on the level of importance of the attributes studied. The formation of this segmentation is based on attribute priority data starting from what is considered very important to attributes that are considered very unimportant by consumers. The segmentation is done using part II questionnaire data that has been transformed data in appendix C and the segmentation method used is the K-Means Clustering method.
The number of segments to be used is 4 segments because the level of importance of the respondents includes very unimportant, unimportant, important, and very important. Segment membership for each cluster can be seen in Figure 1.

Figure 1. Segment membership for each cluster

3.3. Determination of Consumer Characteristics

The data processed is part I questionnaire and segmentation results. The method used to determine consumer characteristics is the Crosstab method and using SPSS 16.0 software. The results of data processing can be seen in Table 4.

| No | Consumer Characteristics | Segment (%) | Total |
|----|--------------------------|-------------|-------|
|    |                         | 1 | 2 | 3 | 4 |     |
| 1  | Consumer purchasing power |   |   |   |   |     |
|    | <Rp1.000,000.00          | 0,8 | 0,2 | 2,0 | 0 | 3,0 |
|    | Rp1.000.000,00 –          | 8,2 | 1,8 | 7,2 | 4,5 | 21,8 |
|    | Rp2.000.000,00           | 21,2 | 6,8 | 9,8 | 6,2 | 44,0 |
|    | Rp2.000.001,00 –          | 14,2 | 6,0 | 4,8 | 6,2 | 31,2 |
|    | Rp3.000.000.00           |   |   |   |   |     |
| 2  | Year of handphone production |   |   |   |   |     |
|    | 2015                     | 2,5 | 1,2 | 3,0 | 1,8 | 8,5 |
|    | 2016                     | 10,2 | 3,8 | 6,0 | 4,2 | 24,2 |
|    | 2017                     | 14,0 | 2,8 | 5,2 | 7,0 | 29,0 |
|    | 2018                     | 16,5 | 7,0 | 8,5 | 3,5 | 35,5 |
|    | 2019                     | 1,2 | 0,0 | 1,0 | 0,5 | 2,8 |
| 3  | The reason to buy a cellphone brand |   |   |   |   |     |
|    | Battery life             | 6,5 | 2,2 | 5,2 | 3,0 | 17,0 |
|    | Camera quality           | 9,2 | 3,8 | 2,2 | 5,2 | 20,5 |
|    | Internal memory capacity | 8,5 | 4,0 | 4,2 | 1,5 | 18,2 |
|    | Affordable prices        | 11,8 | 4,0 | 9,0 | 2,8 | 27,5 |
|    | Design                   | 8,5 | 0,8 | 3,0 | 4,5 | 16,8 |
| 4  | The purpose of buying a cellphone |   |   |   |   |     |
|    | Means of communication   | 29,2 | 10,5 | 15,8 | 10,2 | 65,8 |
|    | Playing games            | 4,8 | 0,8 | 2,2 | 1,2 | 9,0 |
|    | Online business media    | 2,0 | 0,8 | 1,5 | 1,2 | 5,5 |
|    | Lifestyle                | 6,5 | 2,2 | 2,0 | 4,0 | 14,8 |
|    | Others                   | 2,0 | 0,5 | 2,2 | 0,2 | 5,0 |
| 5  | How to get handphone information |   |   |   |   |     |
|    | Electronic media         | 23,8 | 6,8 | 12,5 | 8,8 | 51,8 |
|    | Print media              | 2,5 | 1,0 | 2,2 | 2,0 | 7,8 |
|    | Salesperson              | 6,0 | 2,8 | 2,2 | 1,8 | 12,8 |
|    | Family/friends           | 10,0 | 3,5 | 5,8 | 3,2 | 22,5 |
|    | Others                   | 2,2 | 0,8 | 1,0 | 1,2 | 5,2 |

Based on Table 4, it can be seen that most of the goals of consumers buying mobile phones are communication facilities. Sources of information about mobile phones are obtained through electronic media. In the first to third segments, shows the purchasing power of consumers amounting to Rp 2,000,001 - Rp 3,000,000. In the first to third segments, most consumers own a handphone in 2018, indicating that most students have the latest and most recent type of handphone, while in the fourth segment, most consumers have a handphone in 2017. In the first and third segments, most of the reasons consumers buy a handphone are because affordable prices, which means that most respondents prioritize
affordable prices. In the second segment, the reason consumers buy mobile phones is a lot of internal memory and affordable prices, while in the fourth segment because of good camera quality.

4. Priority of Consumer Attributes
The data used are part I questionnaire data namely first priority questionnaire data and part III questionnaire data namely comparison questionnaire data. The first priority questionnaire data results are shown in Table 5 and the comparative questionnaire data are shown in Table 6. The method used is the Analytical Hierarchy Process (AHP) in Multi-Criteria Decision Making to obtain the attributes that are most prioritized by users [7]. Analytical Hierarchy Process is a decision support model that breaks down complex multi-factor or multi-criteria problems into a hierarchy.

| Attribute                | Number of Respondents |
|--------------------------|------------------------|
| Battery life             | 52                     |
| Camera quality           | 84                     |
| Internal memory capacity | 92                     |
| Affordable prices        | 111                    |
| Design                   | 61                     |

| Attribute                | Mobile Brand |
|--------------------------|--------------|
| X                        | Z            | Y            |
| Battery life             | 223          | 109          | 68           |
| Camera quality           | 175          | 46           | 179          |
| Internal memory capacity | 156          | 163          | 81           |
| Affordable prices        | 73           | 249          | 78           |
| Design                   | 260          | 46           | 94           |

|                  | Ba | Ca | Me | Pr | De |
|------------------|----|----|----|----|----|
| Battery life     | 1  | 84/52 | 52/92 | 52/111 | 52/61 |
| Camera quality   | 52/84 | 1 | 84/92 | 84/111 | 84/61 |
| Internal memory capacity | 92/52 | 92/84 | 1 | 92/111 | 92/61 |
| Affordable prices | 111/52 | 111/84 | 111/92 | 1 | 111/61 |
| Design           | 61/52 | 61/84 | 61/92 | 61/111 | 1 |
|                  | 400/52 | 400/84 | 400/92 | 400/111 | 400/61 |

After getting the comparison matrix, then the data normalization is performed on the comparison matrix. Eigenvector values are generated from the average relative weight values for each row. Normalization matrix and eigenvector (weight vector) values are shown as follows:

|      | Ba | Ka | Me | Pr | De |
|------|----|----|----|----|----|
| Ba   | 0,13 | 0,21 | 0,23 | 0,2775 | 0,1525 |
| Ca   | 0,13 | 0,21 | 0,23 | 0,2775 | 0,1525 |
| Me   | 0,13 | 0,21 | 0,23 | 0,2775 | 0,1525 |
| Pr   | 0,13 | 0,21 | 0,23 | 0,2775 | 0,1525 |
| De   | 0,13 | 0,21 | 0,23 | 0,2775 | 0,1525 |

Furthermore, the calculation is performed to get the calculation of the maximum eigenvector (t) value and consistency testing in the comparison matrix of criteria, if it is not consistent then the data
collection needs to be repeated. After getting the weight vector value, the comparison matrix will be multiplied by the weight vector matrix to get the value $AW^T$ which will then be calculated to get the value of $t$.

$$AW^T = \begin{bmatrix} 1 & 52/84 & 52/92 & 52/111 & 52/61 \\ 84/52 & 1 & 84/92 & 84/111 & 84/61 \\ 92/52 & 92/84 & 1 & 92/111 & 92/61 \\ 111/52 & 111/84 & 111/92 & 1 & 111/61 \\ 61/52 & 61/84 & 61/92 & 61/111 & 1 \end{bmatrix} \times \begin{bmatrix} 0.13 \\ 0.21 \\ 0.23 \\ 0.2775 \\ 0.1525 \end{bmatrix} = \begin{bmatrix} 0.6500 \\ 1.0500 \\ 1.1500 \\ 0.8325 \\ 0.4575 \end{bmatrix}$$

Consistency testing is done by calculating the value of the consistency index ($CI$) first which will then be calculated again to get the value of the consistency ratio ($CR$). If the value of $CI= 0$, then the comparison matrix for criteria is consistent. The value of $CR \leq 0.1$ then the comparison matrix for the criteria is quite consistent, and if the $CR \geq 0.1$ then the comparison matrix for the criteria is not consistent. In this case, $CI = 0$, the comparison matrix for the criteria is consistent. Calculations and tests on the objective matrix of each sub-criterion use the data in Table 6. From the calculations that have been made, the results show that the five objective matrix sub-criteria have been consistent. Then the scoring calculation is done to get the ranking of the three brands of mobile phones. Scoring is done by forming a scoring matrix where the elements of each row are the eigenvector values of each corresponding criterion.

The objective weight values for each attribute are shown as follows: the value for the battery life attribute is $W_{BA} = 0.13$, the value for the camera quality attribute is $W_{Ka} = 0.21$, the value for the internal memory capacity attribute is $W_{Me} = 0.23$, the value for the affordable price attribute is $W_{Ha} = 0.2775$, and the value for the design attribute is $W_{De} = 0.1525$. The final score of each attribute can be done by adding up the multiplication results of each row element corresponding to the scoring matrix with the objective weight values in the comparison matrix. The scoring calculation matrix is shown as follows:

$$\begin{bmatrix} 0.5575 & 0.4375 & 0.39 & 0.1825 & 0.65 \\ 0.2725 & 0.115 & 0.4075 & 0.6225 & 0.115 \\ 0.17 & 0.4475 & 0.2025 & 0.195 & 0.235 \\ 0.091875 & 0.0897 + 0.05064375 & 0.099125 & 0.1300 \\ 0.02415 & 0.093725 & 0.17274375 & 0.0175375 & 0.2300 \\ 0.0221 & 0.093975 & 0.046575 & 0.0541125 & 0.0358375 & 0.1525 \end{bmatrix} \times \begin{bmatrix} 0.1300 \\ 0.2100 \\ 0.2300 \\ 0.2775 \\ 0.1525 \end{bmatrix}$$

- $S_X = 0.072475 + 0.091875 + 0.0897 + 0.05064375 + 0.099125 = 0.4038$
- $S_Z = 0.035425 + 0.02415 + 0.093725 + 0.17274375 + 0.0175375 = 0.3436$
- $S_Y = 0.0221 + 0.093975 + 0.046575 + 0.0541125 + 0.0358375 = 0.2526$

Thus, a final diagram of a tiered analytical process is obtained as shown in Figure 2.

4.1. Game Matrix

At this stage, pay off matrices or usually called game matrices are made for each product that competes with each other, including pair $X$ with $Z$, pair $X$ with $Y$, and pair $Z$ with $Y$. At this stage, $X$ as the first player ($P_1$), $Z$ as the second player ($P_2$), and $Y$ as the third player ($P_3$). The numbers in the game matrix show the results or pay off from the different game strategies, where these results are a measure of effectiveness, which is the percentage of market share that each player gets. [7]. The game matrix filling is based on data from the comparison questionnaire results of each brand of the mobile phone shown in Table 7. The game matrix $P_m$ filling with $P_n$ is obtained from the equation:

$$P_m a_i P_n a_j = [P(X_i) - P(Y_j)] \times 100$$

(15)
Mobile Selection Priority

| Affordable prices | Internal Memory Capacity | Camera Quality | Design | Battery Life |
|-------------------|--------------------------|---------------|--------|-------------|
| 0.2775            | (0.23)                   |               | (0.1575) | (0.13) |

Figure 2. Final Diagram of a Tiered Analytical Process

where:

\[ P_m a_i P_n a_j = \text{Percentage of calculation results from } P_m \text{ on the attribute } i \text{ to } P_n \text{ on the attribute } j \]

\[ P_m = \text{Player } m (m = 1, 2, 3) \]

\[ P_n = \text{Player } n (n = 1, 2, 3) \]

\[ X_i = \text{The comparison } P_m \text{ questionnaire on the attribute } i (i = 1, 2, ..., 5) \]

\[ Y_j = \text{The comparison } P_m \text{ questionnaire on the attribute } j (j = 1, 2, ..., 5) \]

\[ P(X_i) = \text{Probability of acquisition } X_i \]

\[ P(Y_j) = \text{Probability of acquisition } Y_j \]

The game matrix is created for each product that competes with each other as follows:

1. Game matrix \( X - Z \)

In making this game matrix, \( X(P_1) \) as a row player and \( Z(P_2) \) as a competitor become a column player. The game matrix \( X \) with \( Z \) is obtained from the calculation result of the percentage of \( P_1 \) in the \( i \) attribute to \( P_2 \) in the \( j \)th attribute according to Equation (15). The percentage of calculation \( X(P_1) \) in attribute \( i \) to \( P_2 \) in attribute \( j \) to fill in the first row of the game matrix is shown as follows:

- \( P_1 a_1 P_2 a_1 = \frac{223 - 109}{400} \times 100 = 28.5 \%
- \( P_1 a_1 P_2 a_2 = \frac{223 - 46}{400} \times 100 = 44.25 \%
- \( P_1 a_1 P_2 a_3 = \frac{223 - 163}{400} \times 100 = 15.00 \%
- \( P_1 a_1 P_2 a_4 = \frac{223 - 249}{400} \times 100 = -6.50 \%
- \( P_1 a_1 P_2 a_5 = \frac{223 - 46}{400} \times 100 = 44.25 \%

The calculations for filling in the game matrix in the second to fifth rows also correspond to Equation (15). After filling in the game matrix, the maximal values for the row players and the minimax values for the column players can be seen in Table 7.

Table 7. Matrix Game X with Z

| \( x \) | \( y \) | \( z \) | \( y_1 \) | \( y_2 \) | \( y_3 \) | \( y_4 \) | \( y_5 \) | Row Minimum |
|--------|--------|--------|--------|--------|--------|--------|--------|------------|
| \( x_1 \) | 28.50 | 44.25 | 15.00 | -6.50 | 44.25 | -6.50 |
| \( x_2 \) | 16.50 | 32.25 | 3.00  | -18.50| 32.25 | -18.50|
| \( x_3 \) | 11.75 | 27.50 | -1.75 | -23.25| 27.50 | -23.25|
| \( x_4 \) | -9.00 | 6.75  | -22.50| -44.00| 6.75  | -22.50|
| \( x_5 \) | 37.75 | 53.50 | 24.25 | 2.75  | 53.50 | 2.75  |

Column Maximum 37.75 53.50 24.25 2.75 53.50
Based on Table 8, obtained a maximum value of 2.75 and a minimum value of 2.75. Because the maximum value is the same as the minimax, there is a saddle point of 2.75. So company X and Z use a single strategy, where company X uses strategy \( x_5 \), namely design of 100 in order to produce a maximum profit of 2.75 while company Z uses a strategy of \( y_4 \), which is an affordable price of 100 in order to produce a minimal loss of 2.75. The completion of the game theory can also be solved using a linear program that is formulated as Linear program for row players (\( P_1 \)) of the row matrix as follows:

**Objective function:**

\[
\text{Minimize } f_0 = X_1 + X_2 + X_3 + X_4 + X_5 \\
\text{subject to:}
\]

\[
\begin{align*}
28.5X_1 &+ 16.5X_2 + 11.75X_3 - 9X_4 + 37.75X_5 \geq 1 \\
44.25X_1 &+ 32.25X_2 + 27.5X_3 + 6.75X_4 + 53.5X_5 \geq 1 \\
15X_1 &+ 3X_2 - 1.75X_3 - 22.5X_4 + 24.25X_5 \geq 1 \\
-6.5X_1 &- 18.5X_2 - 23.25X_3 - 44X_4 + 2.75X_5 \geq 1 \\
44.25X_1 &+ 32.25X_2 + 27.5X_3 + 6.75X_4 + 53.5X_5 \geq 1 \\
X_i &\geq 0 ; i = 1,2,...,5
\end{align*}
\]

We get the minimum value \( f_o = 0.364 \) with \( X_5 = 0.364 \). Thus, the optimal game value is \( V = \frac{1}{f_o} = \frac{1}{0.364} = 2.75 \). Since \( x_i = \frac{X_i}{f_o} \), the optimal marketing strategy for \( X \) players is the design of \( x_5 = \frac{X_5}{f_0} = \frac{0.364}{0.364} = 1 \approx 100 \).

**Linear program for column players (\( P_2 \)) of the column matrix**

**Objective function:**

\[
\text{Maximize } g_o = Y_1 + Y_2 + Y_3 + Y_4 + Y_5 \\
\text{subject to:}
\]

\[
\begin{align*}
28.5Y_1 &+ 44.25Y_2 + 15Y_3 - 6.5Y_4 + 44.25Y_5 \leq 1 \\
16.5Y_1 &+ 32.25Y_2 + 3Y_3 - 18.5Y_4 + 32.25Y_5 \leq 1 \\
11.75Y_1 &+ 27.5Y_2 - 1.75Y_3 - 23.25Y_4 + 27.5Y_5 \leq 1 \\
-9Y_1 &+ 6.75Y_2 - 22.5Y_3 - 44Y_4 + 6.75Y_5 \leq 1 \\
37.75Y_1 &+ 53.5Y_2 + 24.25Y_3 + 2.75Y_4 + 53.5Y_5 \leq 1 \\
Y_j &\geq 0 ; j = 1,2,...,5
\end{align*}
\]

The maximum value is obtained \( g_o = 0.364 \) with \( Y_4 = 0.364 \). Therefore, the optimal game value is \( V = \frac{1}{g_o} = \frac{1}{0.364} = 2.75 \). Because \( y_j = \frac{Y_j}{g_o} \), the optimal marketing strategy for \( Z \) players is an affordable price of \( y_4 = \frac{Y_4}{g_o} = \frac{0.364}{0.364} = 1 \approx 100 \). So, an affordable pricing strategy is the optimal strategy for \( Z \).

2. **Game matrix X - Y**

In making this game matrix, \( X(P_1) \) as a row player and \( Y(P_3) \) as a competitor become a column player. The game matrix \( P_1 \) with \( P_3 \) is obtained from the percentage calculation result of \( P_1 \) in the \( i \) attribute to \( P_3 \) in the \( j \) attribute according to Equation (15). After filling in the game matrix, the maximal values for the row players and the minimax values for the column players can be found in Table 9.

Based on Table 8, obtained a maximum value of 20.25 and a minimum value of 20.25. Because the maximum value is the same as the minimax, there is a saddle point of 20.25. So, company X and Y use a single strategy, where company X uses strategy \( x_5 \), namely design of 100 so that it can produce maximum profits of 20.25 while company Y uses a strategy of \( y_2 \), namely camera quality of 100 in order to produce a minimal loss of 20.25.
The completion of the game theory above can also be solved using a linear program that is by minimizing row players \( (P_1) \) and maximizing column players \( (P_3) \). So for players \( Y \) the minimum value of \( f_o = 0.0494 \) is obtained with \( X_5 = 0.0494 \) and the optimal game value \( V = \frac{1}{f_o} = \frac{0.0494}{0.0494} = 20.25 \). We have \( x_i = \frac{x_i}{f_o} \), the optimal marketing strategy for player \( X \) is a design of \( x_5 = \frac{X_5}{f_o} = \frac{0.0494}{0.0494} = 1 \approx 100 \). Whereas for players \( Y \) the maximum value of players \( Y \) diperoleh nilai maksimum the maximum value of \( g_o = 0.0494 \) is obtained with \( Y_2 = 0.0494 \) and the optimal game value \( V = \frac{1}{g_o} = \frac{0.0494}{0.0494} = 20.25 \). Since \( y_j = \frac{y_j}{g_o} \), the optimal marketing strategy for players \( Y \) is camera quality of \( y_2 = \frac{Y_2}{g_o} = \frac{0.0494}{0.0494} = 1 \approx 100 \).

3. Game matrix \( Z - Y \)

In making this game matrix, \( Z(P_2) \) as a row player and \( Y(P_3) \) as a competitor become a column player. The game matrix \( P_2 \) with \( P_3 \) is obtained from the calculation result of percentage \( P_3 \) in the \( f^{th} \) attribute according to Equation (15). After filling in the game matrix, the maximal values for the row players and the minimax values for the column players can be found in Table 9.

Based on Table 9, the maximum maximal value was 17.5 and the minimax value was 17.5. Because the maximum value is the same as the minimax, there is a saddle point of 17.5. So, companies \( Z \) and \( Y \) use a single strategy, where company \( Z \) uses the \( x_4 \) strategy, which is an affordable price of 100 in order to produce a maximum profit of 17.5 while company \( Y \) uses a strategy of \( y_2 \), which is a camera quality of 100 in order to produce a minimum loss of 17.5.

The completion of the game theory above can also be solved using a linear program that is by minimizing row players \( (P_2) \) and maximizing column players \( (P_3) \). So for the \( Z \) player the minimum value \( f_o = 0.058 \) is obtained with \( X_4 = 0.058 \) dan nilai permainan optimal \( V = \frac{1}{f_o} = \frac{1}{0.058} = 17.5 \). Because \( x_i = \frac{x_i}{f_o} \), the optimal marketing strategy for \( Z \) players is an affordable price of \( x_4 = \frac{X_4}{f_o} = \frac{0.058}{0.058} = 1 \approx 100 \). Whereas for \( Y \) players the maximum value of \( g_o = 0.057 \) with \( y_4 = 0.057 \) and the optimal game value \( V = \frac{1}{g_o} = \frac{1}{0.057} = 17.5 \). Since \( y_j = \frac{y_j}{g_o} \), the optimal marketing strategy for \( Y \) players is camera quality of \( y_2 = \frac{Y_2}{g_o} = \frac{0.057}{0.057} = 1 \approx 100 \).
4.2. Marketing Strategy Analysis
Based on the attributes that are important for consumers in choosing a cellphone, respondents are more concerned with the attributes of affordable prices. While the battery life attribute is one of the attributes that consumers least care about. Based on the ranking results, cellphone brand X ranks first, Z ranks second, and Y ranks third.

In addition, the games made by the three parties have obtained results regarding the strategies that must be used by X, Z, and Y parties in facing competition. The strategy used by X in dealing with its competitors, Z and Y, is to prioritize design attributes. X's brand mobile phone design is most favoured by consumers because of the X design that is contemporary and not out of date so much loved by young people today. However, in terms of price the X party must pay attention to the purchasing power of consumers so that consumers can buy X brand mobile phones in accordance with their abilities. The strategy used by Z in dealing with its competitors, X and Y, is to prioritize affordable price attributes. Most consumers have the purchasing power of a mobile phone of Rp. 2,000,001 - Rp. 3,000,000.00, so many consumers choose to buy a Z-brand mobile phone because the price is very affordable. However, Z must improve the quality of the camera and product design.

The strategy used by Y in dealing with its competitors, Z and Y, is to prioritize camera quality attributes. Many young people today express themselves through selfies. Therefore, Y brand mobile phones are the target of consumers because Y brand mobile phones have very good camera quality. However, the Y must increase the battery life of its products.

5. Conclusions
We use game theory to determine customer segmentation strategies. In determining consumer segmentation, we obtain the priority attributes of consumers in buying a product. Future studies can add value to the satisfaction and importance of aspects that exist in products with certain brands. Research should be conducted regularly because changes in market conditions and consumer behaviour will result in changes in consumer preferences and perceptions.

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