Analysis of Customers Transfer Opportunities Using Markov Chain at 3 Meatballs Culinary in Galuh Mas Karawang

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\textbf{Article Info}

\textbf{Article history}
Received : February 18, 2022
Revised : March 23, 2022
Accepted : April 21, 2022
Published : April 30, 2022

\textbf{Keywords:}
MSMEs;
Meatball Culinary;
Galuh Mas Karawang;
Consumers transfer;
Markov Chain.

\textbf{ABSTRACT}

The area of MSMEs meatballs culinary in Galuh Mas Karawang is a busy area and is often visited by the public. The purpose of this research is to determine the size of the consumer opportunities for the three meatballs culinary such as Ambon Meatballs, Malang Meatballs and Sopo Nyono Meatballs, and to predict the probability of their transfer in the coming period to the three meatballs culinary. The research sample consisted of 167 respondents who were only visitors and direct customers in March 2021. The research method was in the form of a questionnaire and analysis using the markov chain. The results showed that the steady state meatballs culinary in the 10th period of November 2021, it reached a balance point with the percentage for Ambon Meatballs is 54%, in the second place Sopo Nyono Meatballs is 25% and the lowest is Malang Meatballs 21%.

DOI: https://doi.org/10.35891/jkie.v9i1.2550

1. Introduction

The Micro, Small and Medium Enterprises (MSMEs) sector plays an important role in the Indonesian economy and even supports Indonesia’s economic growth. The contribution of MSMEs to the economy of a country is not only in developing countries, but also includes developed countries who MSMEs contribute 43.5% of workers globally (Nugroho (Nugroho & Arafah, 2020)). MSMEs are considered very important because they have characteristics that differentiate them from large businesses, namely MSMEs are labor-intensive businesses, using local raw materials, and as providers of goods and services that are the basic needs of low-income people (Faizah & Suib, 2019). Karawang Regency is one of the areas with a very rapid growth of MSMEs.

The MSMEs culinary area located in Galuh Mas Telukjambe, Karawang there are three meatballs culinary such as Ambon Meatballs, Malang Meatballs and Sopo Nyono Meatballs are never empty of visitors who like and hobby to eat meatball. The increasing number of visitors, makes meatballs culinary players more competitive to attract consumers in choosing their place. This competition is seen from the quality tight taste of meatball, price and facilities offered. The price is relatively affordable, but the guaranteed quality of raw taste coupled with the large portion of meatball provided by meatballs culinary players makes consumers especially the wider community very interested.
In addition, understanding consumer behavior in choosing chicken meatball noodles is an important thing in an effort to increase the market share of each meatballs culinary player. Market share can be defined as the share of the market controlled by a company, or the percentage of sales of a company to the total sales of its biggest competitors at a certain time and place. The size of the market share will change from time to time in accordance with changes in consumer tastes, or changes in consumer interest in a product. One technique for predicting future market share is to use the markov chain analysis (Masuku et al., 2018).

2. Literature Review

Markov chain is a stochastic process which has the characteristic that a phenomenon in the future is not influenced by past phenomena but only by current phenomena. This technique can be used to predict future changes in dynamic variables on the basis of changes in these dynamic variables in the past (Lestari et al., 2019). Markov chain was first introduced by AA Markov to predict the behavior of a system transition from one state to another. In the markov chain there is what is called a transition matrix and there is also the term steady state. The transition matrix is the long-term behavior of random visitors that is governed by traits (such as value eigen and eigenvector) on a particular matrix, whereas steady state is a condition that the transition probability matrix has reached a certain period of time in a fixed state (Subagyo et al., 2018).

Many researchers have used markov chain to solve various problems faced, including the following:

| No. | Title                                                                 | Result                                                                                                                                                                                                 |
|-----|-----------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1.  | Analysis of the Increase in COVID-19 Patients in Indonesia Using the Markov Chain Method (Aritonang et al., 2020) | The results of the calculations show that the probability of adding patients between the range 1 to 91 people is equal to 0.21197, between 92 to 182 people is equal to 0.05644, between 182 to 272 is equal to 0.08408, between 273 and 363 is equal to 0.16337, between 364 to 454 of 0.13999, between 455 to 545 is equal to 0.14512 , between 546 to 636 people is equal to 0.07189, between 637 to 727 people is equal to 0.07695, and greater than 728 people is equal to 0.05014 |
| 2.  | Markov Chain Method to Calculate Insurance Premiums in Dengue Hemorrhagic Fever Patients (Yasin et al., 2019) | Based on the research results obtained a model matrix probability transition with the order 5 x 5. With the one-year life insurance premium paid to Dengue Hemorrhagic Fever (DHF) patients at each transition opportunity adjusted to the respective conditions of gradient I, II, and III, with the maximum value of the premium paid, namely in the first gradient state that passes to death with score $A_{x_{104}} = Rp.1.372.500.$ |
3. Analysis of the market share for powder detergent in Surabaya for the brands with the smallest market share using the Markov chain method and the SWOT method (Lestari et al., 2019)

From the results of the research on the market share position until it reaches the market stability condition (Equilibrium) in the 31st period (July 2021) for Rinso 40%, Daia 20.8%, So Klin 18.8%, Attack 12.9% and Molto 7.5%. Molto is the brand with the smallest market share, therefore the strategy that Molto detergent can apply to occupy market share is to increase the variety of perfumes and improve quality by adding more attractive packaging designs and lower prices, as well as increasing discounts. And promotion while maintaining quality, increase promotions by increasing advertisements in all media and holding market education events to be better known by the public, maintaining product availability in every location sales so that could maintain stock availability in the market.

4. Application of the Susceptible Infected Recovered (SIR) Continuous Time Markov Chain (CTMC) Epidemic Model to the Spread Pattern of Measles (Hajriyanto & Susanto, 2019)

The research was conducted by first examining the assumptions of the CTMC SIR model on the transition probability. Next, determine the transmission rate (\(\lambda\)) which is 0.00000048 / day and the cure rate (\(\mu\)) which is 0.1111 / day using the estimation method of model parameters. The results showed that the CTMC SIR model in the form of transition probability can be applied to describe the pattern of measles spread.

5. Markov Chain Analysis to Predict Airline Consumer Movements on the Manado-Jakarta Route (Masuku, et al., 2018)

1. The Markov chain can predict odds displacement consumer airline
2. The prediction results show that the number of airlines on the Manado-Jakarta route in 2019 as follows: Batik Air 32%, Garuda 29%, Lion 21%, and Citilink 18%, in 2020 it will reached a steady state (equilibrium) with percentage Batik Air 32%, Garuda 29%, Lion 21%, and Citilink 18%

6. Analysis Bus Company Competitive Strategy Using Markov Chain Technique, Game Theory, and Short Route Models (Subagyo et al., 2018)

Based on the results of data processing using the Markov chain method, it was found that the market share reached a steady state in the 11th period with a result of 16.09% for Dedy Jaya, 29.35% for Murni Jaya, 25.13% for Sinar Jaya, 7.97% for Pahala Kencana, 10.69% for DMI, and 10.77% for Dieng Indah. While the results of the game for the game theory method, the strategy of the DMI bus has several alternatives, namely improving the means of promotion and communication so that passengers can easily get information about DMI buses. Alternative routes offered with the short route models are Terminal Klari-Toll Kranci / Pejagan –Earth Ayu - Purwokerto, with a total distance of 304 km.

Source: Data Processing
3. Research Method

The research was conducted on March 5-7, 2021. The data sources obtained were primary data which came directly from the answers of the third visitor respondents of MSMEs meatballs culinary such as Ambon Meatballs, Malang Meatballs and Sopo Nyono Meatballs. Respondent data is data obtained directly from the results of answers to questionnaires that are collected and tabulated by providing a certain score or rating. As a reference to facilitate research and reference in the data collection and processing process, the stages of the research carried out are shown in Figure 1.

![Figure 1. Stages of Research Implementation](source: Data Processing)

4. Results and Discussion

The data needed to support the analysis by the method markov chain is data total customers, data transition customer, total losses and total gain of customers as shown in Table 2 to Table 5.

Table 2. Total Customers

| No | Name of culinary       | Total Respondents |
|----|------------------------|-------------------|
| 1  | Meatballs Ambon        | 61                |
| 2  | Meatballs Malang       | 47                |
| 3  | Meatballs Sopo Nyono   | 59                |
|    | Total                  | 167               |

Source: Data Processing

Table 3. Transition of culinary Place Selection

| No | Name of culinary       | Total Previous Customers (Februari) | Gain | Loss | Total Customers Now (Maret) |
|----|------------------------|-------------------------------------|------|------|----------------------------|
| 1  | Meatballs Ambon        | 61                                  | 17   | 8    | 70                         |
| 2  | Meatballs Malang       | 47                                  | 8    | 11   | 44                         |
| 3  | Meatballs Sopo Nyono   | 59                                  | 9    | 15   | 53                         |
|    | Total                  | 167                                 | 34   | 34   | 167                        |

Source: Data Processing
Table 4. Total Gain Customers from culinary-i to culinary-j

| No | Name of culinary       | Ambon Meatballs | Malang Meatballs | Sopo Nyono Meatballs | Total |
|----|------------------------|-----------------|------------------|----------------------|-------|
| 1  | Meatballs Ambon        | -               | 7                | 10                   | 17    |
| 2  | Meatballs Malang       | 3               | -                | 5                    | 8     |
| 3  | Meatballs Sopo Nyono   | 5               | 4                | -                    | 9     |
|    | Total                  | 8               | 11               | 15                   | 34    |

Source: Data Processing

Table 4. Total Losses Customers from culinary-i to culinary-j

| No | Name of culinary       | Ambon Meatballs | Malang Meatballs | Sopo Nyono Meatballs | Total |
|----|------------------------|-----------------|------------------|----------------------|-------|
| 1  | Meatballs Ambon        | -               | 3                | 5                    | 8     |
| 2  | Meatballs Malang       | 7               | -                | 4                    | 11    |
| 3  | Meatballs Sopo Nyono   | 10              | 5                | -                    | 15    |
|    | Total                  | 17              | 8                | 9                    | 34    |

Source: Data Processing

Table 5. Meatballs culinary Customers Transfer Pattern from culinary-i to culinary-j

| No | Name of culinary       | Ambon Meatballs | Malang Meatballs | Sopo Nyono Meatballs | Total Previous |
|----|------------------------|-----------------|------------------|----------------------|----------------|
| 1  | Meatballs Ambon        | 53              | 3                | 5                    | 61             |
| 2  | Meatballs Malang       | 7               | 36               | 4                    | 47             |
| 3  | Meatballs Sopo Nyono   | 10              | 5                | 44                   | 59             |
|    | Total Now              | 70              | 44               | 53                   | 167            |

Source: Data Processing Results

In Table 5 it is used to calculate the value of transition opportunities for baso culinary customers, that is:

$$
P = \begin{bmatrix}
53 & 3 & 5 \\
61 & 61 & 61 \\
7 & 36 & 4 \\
47 & 47 & 47 \\
10 & 5 & 44 \\
59 & 59 & 59
\end{bmatrix}

P = \begin{bmatrix}
0.8696 & 0.0492 & 0.0820 \\
0.1489 & 0.7660 & 0.0851 \\
0.1695 & 0.0847 & 0.7458
\end{bmatrix}

Table 6. Culinary Customer Transition Opportunity Value

| No | From Culinary Customers | To Culinary Customers |
|----|-------------------------|-----------------------|
|    |                         | Ambon Meatballs | Malang Meatballs | Sopo Nyono Meatballs |
| 1  | Meatballs Ambon         | 0.8689           | 0.0492           | 0.0820               |
| 2  | Meatballs Malang        | 0.1489           | 0.7660           | 0.0851               |
| 3  | Meatballs Sopo Nyono    | 0.1695           | 0.0847           | 0.7458               |
|    | Opportunities for each Culinary |             |          |                     |
|    |                         | 0.4192           | 0.2635           | 0.3174               |

Source: Data Processing Results
Then calculate the market share of each baso culinary in period I in order to be able to predict the period in the future by multiplying the transition opportunity matrix with the previous market share. The following is the calculation of market share and customer predictions in the future period.

Market share of each meatball culinary in period I (February)
- Ambon Meatballs: \( \frac{61}{167} = 0.3652 = 37\% \)
- Malang Meatballs: \( \frac{47}{167} = 0.2814 = 28\% \)
- Sopo Nyono Meatballs: \( \frac{59}{167} = 0.3532 = 35\% \)

Market Share Periode II (March)

\[
\text{Market Share II} = \begin{bmatrix} 0.3652 & 0.2814 & 0.3532 \end{bmatrix} \times \begin{bmatrix} 0.8696 & 0.0492 & 0.0820 \\ 0.1489 & 0.7660 & 0.0851 \\ 0.1695 & 0.0847 & 0.7458 \end{bmatrix}
= \begin{bmatrix} 0.4191 & 0.2634 & 0.3173 \end{bmatrix}
= \begin{bmatrix} 42\% & 26\% & 32\% \end{bmatrix}
\]

In the calculation of the third market period and so on, it can be calculated as above by multiplying the transition opportunity matrix with the previous market share to get steady state results. In other words, the results of the calculation of the market share on the condition of the transition probability matrix have reached a certain period of time in a fixed state. The following is the result of the calculation of the market share for each period until the value has not changed or is in a fixed state as shown in Table 7.

| No | Period    | Ambon Meatballs | Malang Meatballs | Sopo Nyono Meatballs |
|----|-----------|-----------------|------------------|----------------------|
| 1  | February  | 37\%            | 28\%             | 35\%                 |
| 2  | March     | 42\%            | 26\%             | 32\%                 |
| 3  | April     | 46\%            | 25\%             | 29\%                 |
| 4  | May       | 48\%            | 24\%             | 28\%                 |
| 5  | Juny      | 50\%            | 23\%             | 27\%                 |
| 6  | July      | 52\%            | 22\%             | 26\%                 |
| 7  | August    | 53\%            | 22\%             | 26\%                 |
| 8  | September | 53\%            | 21\%             | 25\%                 |
| 9  | October   | 54\%            | 21\%             | 25\%                 |
| 10 | November  | 54\%            | 21\%             | 25\%                 |
| 11 | December  | 54\%            | 21\%             | 25\%                 |

Source: Data Processing Results

5. Conclusion

The conclusion obtained from the markov chain method is that the Markov chain can predict the opportunity for moving customers of the three meatballs culinary with the value of the opportunity for moving customers of meatball culinary for Ambon Meatballs is 0.42, Sopo Nyono Meatballs is 0.32 and finally in Malang Meatballs is 0.26. Ambon Meatballs culinary have the largest market share.
among other meatball culinary. In the 10th period in November 2021 it reached a balance point with the percentage for Ambon Meatballs is 54%, in the second place Sopo Nyono Meatballs is 25% and the lowest is Malang Meatballs 21%.

In this research, the restriction of respondents is make specifically for direct customers. Suggestions for the future researchers is to be able to do the same analysis without neglecting direct customer involvement or not.

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