# Marketing Strategy Determination Using Markov Chain and Game Theory: A Case Study of Ready-to-Drink Tea Products

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**Abstract**

Decrease in the number of demand in the market and the transfer of consumers from the Nuu Green Tea brand to the Pucuk Harum Tea brand or vice versa is a result that can occur from market share competition. The calculation results obtained after doing manual calculations using the Markov chain method are the probability of transferring the subscription from each product a few times ago, at this time, and the time to come. For the time to come alone based on the steady state obtained is in the 10th year period. With the probability value of the movement from the shoot tea to Nuu Green Tea is 0.413 for a period some time ago and at this time, for other products transfer can be seen in Figure IV.6. For the value of the steady state in the 10th iteration with the mastery of the shoots of the market share of 0.4158 or 41.58% and Nuu Green Tea controlled the market share of 0.5841 or 58.41%. The calculation results that have been done manually and the use of application assistance can be concluded that the use of the maximin-minimax method produces an optimum solution, namely on X1 for row players (The Pucuk), and Y1 for column players (Nuu Green Tea). With a game value of 32. then the best marketing strategy used by Teh pucuk and Nuu Green Tea is the attribute 'flavor variant' by utilizing the flavor variant of the two can compete in the flavor variant.

**Keywords:** *packaged tea drinks, markov chain, game theory*

**Abstrak**

Penurunan jumlah permintaan di pasaran dan perpindahan konsumen dari merek Nuu Green Tea ke merek Teh Pucuk Harum atau sebaliknya merupakan akibat yang dapat terjadi dari persaingan pangsa pasar. Hasil perhitungan yang didapat setelah melakukan perhitungan manual dengan menggunakan metode Rantai Markov adalah didapatkan probabilitas perpindahan langganan dari masing-masing produk pada beberapa waktu yang lalu, saat ini, dan waktu yang akan datang. Untuk waktu yang akan datang sendiri berdasarkan steady state yang didapat adalah pada periode tahun ke-10. Dengan nilai probabilitas perpindahan dari Teh Pucuk ke Nuu Green Tea adalah 0.413 untuk periode beberapa waktu yang lalu dan saat ini, untuk perpindahan produk lainnya dapat dilihat pada gambar IV.6. Untuk nilai Steady State pada Iterasi ke 10 dengan penguasaan Teh Pucuk pangsa pasar sebesar 0,4158 atau 41,58% dan Nuu Green Tea menguasai pangsa pasar sebesar 0,5841 atau 58,41%. Hasil perhitungan yang telah dilakukan dengan manual dan penggunaan bantuan aplikasi dapat disimpulkan bahwa, penggunaan Metode Maximin-Minimax menghasilkan solusi optimum yakni pada X1 untuk pemain baris (Teh Pucuk), dan Y1 untuk pemain kolom (Nuu Green tea). Dengan nilai permainan sebesar 32. Maka strategi pemasaran terbaik yang digunakan oleh Teh Pucuk dan Nuu Green Tea yaitu atribut "Varian Rasa" dengan memanfaatkan varian rasa keduanya dapat bersaing dalam varian rasa.

**Kata Kunci:** *minuman teh dalam kemasan, rantai markov, game theory*

## 1. Introduction

In the highly competitive beverage industry, particularly in the ready-to-drink tea segment, companies are constantly seeking innovative marketing strategies to enhance their market share and customer loyalty [1]. The integration of advanced analytical methods such as Markov Chain and Game Theory provides a robust framework for understanding consumer behavior and optimizing marketing strategies [2]. Markov Chains allow for the modeling of customer transitions between different states of brand loyalty, while Game Theory offers insights into competitive interactions among firms[3]. This study aims to explore the application of these methodologies in determining effective marketing strategies for ready-to-drink tea products, thereby providing a comprehensive approach to decision-making in marketing [4].

Markov Chains are powerful tools for modeling consumer behavior, particularly in understanding transitions between different states of brand loyalty [5, 6]. By analyzing historical data, companies can predict future consumer behavior, identify key factors influencing customer retention, and assess the likelihood of brand switching [7, 8]. This predictive capability is essential for developing targeted marketing strategies that resonate with consumers and foster brand loyalty [9, 10]. For instance, a Markov Chain model can help a ready-to-drink tea company determine the probability of a consumer switching from one brand to another based on their previous purchasing behavior [11].

On the other hand, Game Theory offers valuable insights into the competitive landscape. It allows firms to analyze the strategic interactions between competitors, enabling them to anticipate rivals' actions and adjust their marketing strategies accordingly [12, 13]. In a market where multiple brands vie for consumer attention, understanding the competitive dynamics is crucial for success [14]. Game Theory can help companies identify optimal pricing strategies, promotional tactics, and product positioning that not only attract consumers but also effectively counter competitors' moves[15].

The use of Markov Chains in marketing enables businesses to predict future consumer behavior based on historical data, facilitating the identification of key factors that influence customer retention and brand switching [16]. On the other hand, Game Theory equips marketers with the tools to analyze competitive dynamics, allowing them to anticipate rivals' actions and adjust their strategies accordingly [17, 18]. By combining these two powerful analytical tools, this research seeks to develop a strategic framework that can guide marketing decisions in the ready-to-drink tea market [19]. According to Research [20] Non-cooperative game models are used to determine price strategies, promotions, and product innovations in the midst of market competition. Mixed-Strategy equilibrium strategies are often used to capture the uncertainty of competitors' behavior and consumer responses. By Research [21] Focusing explicitly on RTD tea, this empirical study surveys Indonesian consumers to test how Instagram-based marketing influences purchase intent. A SEM analysis shows that social media marketing activities (SMMA) significantly boost brand equity and e-WOM, which in turn raise consumers' purchase intentions for RTD tea In other words, stronger social-media engagement leads to higher brand equity and positive word-of-mouth, yielding greater sales. This work highlights the strategic importance of digital marketing in the competitive RTD tea market. According to Research [22] Against the Ready-to-Drink Tea Market, the study shows how innovative branding and promotional strategies can help a new RTD tea entrant stand out in a crowded market.

This paper will present a case study that illustrates the practical application of Markov Chain and Game Theory in formulating marketing strategies. The findings will contribute to the existing literature on marketing analytics and provide actionable insights for practitioners in the beverage industry.

## 2. Material and Methods
### *Conceptual Framework*

Consumer behavior by deciding on the purchase and management of purchasing goods is based on their perception. There are various factors, namely external factors (marketing, discounts, prices, product innovation) and internal factors such as cultural, psychological, and social.
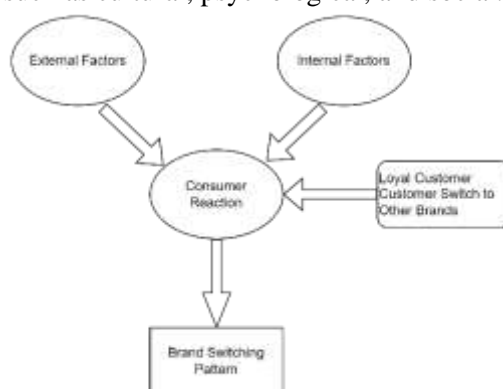


**Fig. 2**: Brand Switching Framework

### *Research Approach*

This study uses descriptive research by exploring and confirming the social entities that occur phenomena. In this study, it explains descriptive statistics without hypotheses, with the object used by customers who buy ready to drink (RTD) Tea products [23]. Brand products are from Mayora Group The

Pucuk, and ABC Nuu Green Tea. The sample used was 80 respondents using the Proportional Random Sampling Technique.

## 3. Results and Discussion

The characteristics of the respondents who filled out the questionnaire explained the socioeconomic situation and the characteristics of the respondents in detail. Described in **Table 1**. The following.

**Table 1**. Characteristics of Respondents.

| Description | Amount | Frequency (%) |
|---|---|---|
| Age Group | | |
| 15-18 | 30 | 0.3 |
| 19-25 | 20 | 0.2 |
| 26-35 | 16 | 0.16 |
| 36-40 | 15 | 0.15 |
| 41-50 | 12 | 0.12 |
| 51-55 | 4 | 0.04 |
| >55 | 3 | 0.03 |
| Amount | 100 | 100 |
| Education Status | | |
| JHS | 30 | 0.3 |
| SHS | 40 | 0.4 |
| Diploma | 20 | 0.2 |
| Bachelor | 10 | 0.1 |
| Amount | 100 | 100 |

This Data the highest respondent is 15-18 (30%) , and 19-25 (20%). The Highest Education status respondent is Senior High School (40%), and Junior High School (30%).

*Game Theory*

The game Theory method is to know the strategy of these two tea packaging products with 4 marketing attributes and know the best strategy. **Table 2** is atribut or variabels the game theory.

**Table 2**. Attributes or Variabel The Game Theory

| Game Attributes | Variable | |
|---|---|---|
| | Teh Pucuk | Nuu Green tea |
| Flavor Variants | X1 | Y1 |
| Price | X2 | Y2 |
| Size and Packaging Variants | X3 | Y3 |
| Brand | X4 | Y4 |

Determine the payoff matrix value of each game attribute from the two variables in this study on **Table 3**.

**Table 3**. Payoff Matrix Results of Teh Pucuk and Nuu Green tea Products

| | Y1 | Y2 | Y3 | Y4 |
|---|---|---|---|---|
| X1 | 32 | 75 | 124 | 146 |
| X2 | -68 | -25 | 24 | 46 |
| X3 | -113 | -70 | -21 | 1 |
| X4 | -130 | -87 | -38 | -16 |

Determine the maximin value (smallest value) of the row on player 1 (The Pucuk) and the minimax (largest value) of the column on player 2 (Nuu Green Tea). Finally, determine the saddle point in the payoff matrix which can be said to be a saddle point if the maximin value = the minimax value. In Table IV.6, it can be seen that the marketing strategy is X1 for player 1 (Teh Pucuk ), and the strategy is Y1 for player 2 (Nuu Green Tea) with a game value of 32. on **Table 4.**

**Table 4**. Looking for maximin and minimax values in the payoff matrix

|        | Y1   | Y2   | Y3   | Y4   | Maximin |
|--------|------|------|------|------|---------|
| X1     | 32   | 75   | 124  | 146  | **32**  |
| X2     | -68  | -25  | 24   | 46   | -68     |
| X3     | -113 | -70  | -21  | 1    | -113    |
| X4     | -130 | -87  | -38  | -16  | -130    |
| Minimax| **32** | 75 | 124  | 146  |         |

*Markov Chain*

With the method of data collection using a questionnaire. And regarding the consumer movement of the two products and loyalty to the product using the Markov Chain Method are as follows:

**Table 5**. Customer Movement

| Brand | Initial Period Subscription Amount | Change during the period | | The number of current periods |
|-------|-----------------------------------|---------|-----------|-------------------------------|
|       |                                   | Move to | Moved from |                              |
| The Pucuk | 46 | 19 | 10 | 55 |
| *Nuu Green Tea* | 54 | 10 | 19 | 45 |
| Total | 100 | | | 100 |

Compiling transition probability matrix based on data from customers who consume packaged tea through questionnaire results at **Table 6**. Furthermore, compile a transition matrix from the results of consumer transfer from and to certain products in **Table 7**.

**Table 6**. Customer Movement

| Brand | Initial Period Subscription Amount | Additional brand | | Reduction of brands | | J The number of current periods |
|-------|-----------------------------------|------------|-------------------|----------|-------------------|---------------------------------|
|       |                                   | Teh Pucuk | Nuu Green Tea | Teh Pucuk | Nuu Green Tea |                             |
| The Pucuk | 46 | | 19 | 27 | 19 | 55 |
| *Nuu Green Tea* | 54 | 10 | | 10 | 24 | 45 |
| Total | 100 | | | | | 100 |

**Table 7**. Transition probability matrix

| From | To | | Total |
|------|-----------|---------------|-------|
|      | Teh Pucuk | Nuu Green Tea |       |
| Teh Pucuk | 0,587 | 0,413 | 1 |
| Nuu Green tea | 0,294 | 0,706 | 1 |

Determining Steady State Data to be used is the probability data from the transition until a steady state value is achieved by making row decisions and columns is from the same quadratic results as the row value and column in the previous matrix.

$$P = \begin{bmatrix} 0,587 & 0,413 \\ 0,294 & 0,706 \end{bmatrix}$$

$$P^2 = \begin{bmatrix} 0,587 & 0,413 \\ 0,294 & 0,706 \end{bmatrix} x \begin{bmatrix} 0,587 & 0,413 \\ 0,294 & 0,706 \end{bmatrix} = \begin{bmatrix} 0,466 & 0,534 \\ 0,380 & 0,619 \end{bmatrix}$$

$$P^{10} = \begin{bmatrix} 0,4158 & 0,5842 \\ 0,4158 & 0,5842 \end{bmatrix} x \begin{bmatrix} 0,4158 & 0,5842 \\ 0,4158 & 0,5842 \end{bmatrix} = \begin{bmatrix} 0,4158 & 0,5842 \\ 0,4158 & 0,5842 \end{bmatrix}$$

The condition has been steady state in iteration 10 with a probability value in the Teh Pucuk controlling market share of 0.4158 or 41.58% and Nuu Green Tea controls the market share of 0.5841 or 58.41%. That in the 1st, 2nd, and 3rd periods through calculations it can be seen that the increase in market share in the Nuu Green tea product is good in each period, while the teh Pucuk products have decreased the market share of each period as follows **Table 8**.

**Table 8**. Customer shift from each product

| | Counts Period 1 | Period 1 | Counts Period 2 | Period 2 | Counts Period 3 |
|---|---|---|---|---|---|
| Teh Pucuk | 46,25% | 58% | 42,95% | 50% | 41,98% |
| Nuu Green Tea | 53,75% | 43% | 57,05% | 50% | 58,02% |

## 4. Conclusion

Calculation results that have been done manually and the use of application assistance can be concluded that the use of the maximin-minimax method produces an optimum solution, namely X1 for row players (Teh Pucuk), and Y1 for column players (Nuu Green Tea). With a game value of 32. then the best marketing strategy used by Teh pucuk and Nuu Green Tea is the attribute 'flavor variant' by utilizing the flavor variant of the two can compete in the flavor variant.

The calculation results obtained after doing manual calculations using the Markov chain method are the probability of transferring the subscription from each product a few times ago, at this time, and the time to come. For the time to come alone based on the steady state obtained is in the 10th year period. With the probability value of the transfer from Teh Pucuk to Nuu Green Tea is 0.413 for a period some time ago and at this time, for the transfer of other products can be seen in Figure IV.6. For the steady state value in the 10th iteration with the mastery of Teh Pucuk of the market share of 0.4158 or 41.58% and Nuu Green Tea controlled the market share of 0.5841 or 58.41%.

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