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Integration of ANP and TOPSIS Methods in Prioritizing Sales Strategies for Frozen Food Products

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ABSTRACT

This research is about determining the best marketing strategy In Frozen Food Products. This Company is a food industry in the form of nuggets, sausages, batagor, empek-empek, meatballs, burgers, and risoles. For the next few years, the Company will be in a growth phase position, which is at the stage of development of increasing sales. Therefore, it is necessary to do mentoring and evaluation to increase sales. Still, the problems that often occur in the Company are: cannot market products in the modern market and hotels and marketing strategies that are less effective in increasing sales results. This certainly has an impact on achieving sales targets. Based on these problems, an assessment and selection of the best strategy is carried out the best design that will be chosen and maintained by the Company in increasing sales at IKM X. Based on the processing of the ANP Method and using Superdecision Software, the weight of product criteria is obtained into selected criteria with a percentage weight of 27.06%. Using the TOPSIS method, the top priority of the new marketing alternative for frozen food products that match the product criteria is the taste according to consumer taste because it has the most significant preference value of 0.8891.

Keywords: Froozeen Food, ANP (Analytical Network Process), Technique for Order Preference by Similarity to Ideal Solution (TOPSIS)

INTRODUCTION

One of the businesses of processing food into practical food is processed frozen food, better known as frozen food. This type of processed food can be consumed by all groups, ranging from children and adults to elderly parents. In addition, processed frozen food is also easy and practical to support the lifestyle of people who increasingly need effective and efficient everything [1][2].

The products produced by IKM X are various processed frozen foods derived from broiler chicken meat and tuna. The products include nuggets, sausages, batagor, empek-empek, meatballs, burgers and risoles [3]. One of the advantages of IKM X frozen food products is that it has 17 variations of processed frozen food derived from processed chicken and tuna meat and does not use flavoring, coloring, or preservatives. This gives IKM X its advantages over other competing products [4].

Looking at product sales history data in the last 27 months, the owner of IKM X is optimistic that sales of frozen food products for the next few years are in the position of the growth phase, which is at the stage of development of increasing sales [5]. Therefore, IKM X wants to develop the frozen food business by adding product variations and targeting modern markets. Therefore, a marketing strategy is needed to achieve this target so that frozen food products can continue to grow and increase from the target to be achieved [6].

In addition to the market potential, which is considered quite promising, the production machine capacity used by IKM X is quite significant because the production machine used by IKM X is a frozen food production machine with a large-scale production capacity. Seeing the market potential that is considered quite promising, it is necessary to market frozen food products to increase product sales results [7] further. The number of potential competitors for frozen food products now gives the Company the best marketing strategy to grow and expand the market to achieve the planned target. Currently, the Company markets products only through social media; therefore, it is necessary to select this marketing strategy to determine which method is feasible for marketing the frozen food product. The ultimate goal is to find a suitable marketing strategy to increase sales results and increase the Company's business development [8].

Marketing strategies are selected to meet consumers' needs, wants, and demands because this will be a competitive advantage for the Company against the products developed. This competitive advantage will make an optimal contribution to the Company. Looking at the Company's strengths and weaknesses from here becomes the basis for strategic thinking in developing the product. Also measured our strengths and weaknesses so that in the end, this product can achieve the right target because of its advantages that are not found in its competitors [9].

The obstacles experienced by the Company in developing its business and marketing products more broadly are still unable to market products in the modern market and hotels due to the incomplete MPOM licensing [10]. The Company's business development is a policy that needs to be carefully considered. With the study of this marketing strategy, an investment picture and future business projections can be obtained [11]. This marketing strategy is one step in determining the best alternative to be chosen so that the marketing techniques carried out by the Company are correctly on target and can compete. Therefore, several marketing designs will be selected for the Company by applying the Multi Criteria Decision Making (MCDM) method. The method to be adopted in this study is the integration of the Analytic Network Process (ANP) used to determine the weight of interconnected marketing criteria to form a network. The Technique for Order Preference by Similarity to Ideal Solution (TOPSIS) TOPSIS has the principle that the selected alternative must have the closest distance from the positive ideal solution and the farthest from the negative ideal solution from a geometric point of view using distance Euclidean to determine the relative proximity of an alternative to the optimal solution [12]. In the TOPSIS method, the most optimal option is the one closest to the positive ideal solution and the one farthest from the negative ideal solution. Therefore, TOPSIS was chosen as the best alternative selection method of criteria [11].

METHOD

Data Collection

Data collection is the most critical step in the research process. Therefore, the data collected must be actual data from the Company under study. The data collection can use primary and secondary sources [13][14].

1. Primary Data

Primary data is data that is directly obtained from the first source. The primary data in this study is interview data on SAMARA IKM leaders and distributing questionnaires to 5 IKM X employees, technical (Purpusie Sampling) determined by researchers [15].

2. Secondary Data

Secondary data indirectly provides information to data collectors, such as company profiles, sales data, and marketing strategies in IKM X [16].

Data Processing

After the data is obtained, the next step is data processing. Here are the stages in data processing to measure supplier performance, namely [17]:

1. ANP Calculation

After the desired data is sufficient, data processing is carried out. At this stage, the data collected from interviews with marketing experts resulted in a pairwise comparison for the weight of the ANP score. The steps in working on the ANP method are [18]:

a. Building network design marketing criteria

In this step, what needs to be emphasized is that the definition of the problem that will be the object of research must be clear. Criteria and subcriteria are selected based on torming brains. Then, create clusters from these criteria and subcriteria to form a network (network) [19].

b. Forming a matrix in pairs

ANP assumes that decision-makers must compare interests between all elements for each level in pairs. The comparison is transformed into matrix A. The aim value represents the relative importance of the ingredients in the i-th row to the elements in the j-th column. e.g., aij [20].

c. Calculate the average weight of criteria and subcriteria

If the pairwise comparison is complete, then calculate the eigenvector. The eigenvector is the priority weight of a matrix, which is then used to prepare supermatrices [21].

d. Calculating partial weights and ratios

That consistency ratio should be 10 percent or less. If the value is more than 10 percent, then the assessment of the decision data should be corrected. By comparing CI and RI, a benchmark is obtained to determine a matrix's consistency level, called the consistency ratio [22].

e. Building a supermatrix

The supermatrix is processed using super decisions software version 2.0.8, including the geometric mean of each criterion and subcriterion. Flow Char Data Processing is shown in Figure 1.

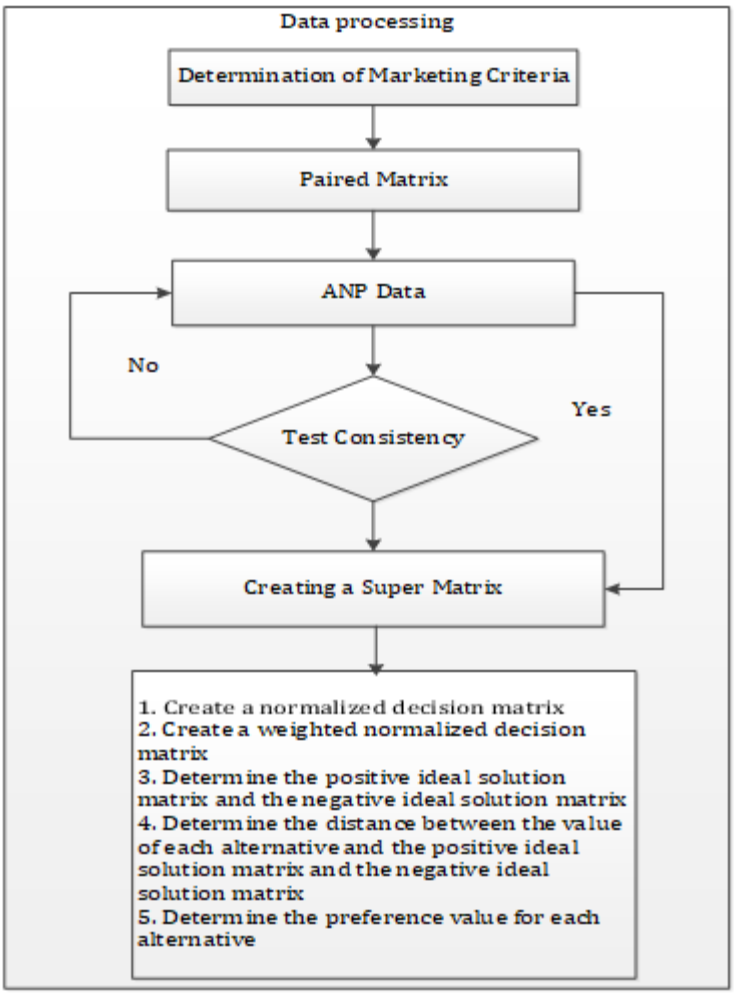


Figure 1. Data Processing Flow Chart

RESULTS

Calculating the Average Weighting of Analytical Network Process (ANP) Criteria

Calculate each criterion's average score based on the respondents' assessments' overall results. The geometric mean for criteria A (Product) with B (Place).

Respondent 1 : 4

Respondent 2 : 6

Respondent 3 : 5

Respondent 4 : 5

Respondent 5 : 6

Then, the geometric average is

$= \sqrt[5]{4x6x5x5x6}$

= 5.1435

The geometric average of each marketing technique criterion can be shown in Table 1.

Table 1. Average Geometry Criteria of Marketing Techniques

Code	Products (A)	Place (B)	Promotion (C)	Price (D)	People (E)	Physical Evidence (F)
A	1	5.143	2.408	1.084	4.317	3.728
B	0.1944	1	0.221	0.254	0.242	0.211
C	0.4152	4.514	1	3,159	2.701	2.550
D	0.9221	3.936	0.316	1	2.930	3.981
E	0.2316	4.129	0.016	0,341	1	2.459
F	0.2682	4.723	0.028	0,251	0.406	1
Sum	3.0315	23.446	3.990	6,090	11.598	13.93

Calculation of Persian Weight and Matrix Consistency

Calculation of Partial Weights and Consistency of Matrices Between Criteria

The calculation of partial weight is carried out to obtain a weight value that will be used to determine the relative value of a criterion and other criteria or alternatives. The consistency of the matrix is calculated to see whether the answers given by experts or respondents are judged consistent or inconsistent. The calculation of the consistency ratio uses the following formulas:

1. Consistency ratio calculation

= (breaking average calculation matrix) x (weight vector of each row)

2. Vector consistency calculation

= (consistency ratio / partial weight of each row)

3. Average entries ($\lambda\, maks$)

$$\lambda\, maks = \frac{\sum_{i=1}^{n} Vector\ Consistency}{\text{n}}$$

4. Consistency Index (CI)

$$CI = \frac{\lambda \text{ maks} - \text{n}}{n-1}$$

5. Consistency Ratio (CR)

$$CR = \frac{\text{CI}}{Random\ Consistency\ Index}$$

Table 2. Random Consistency Index

N	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
RI	0	0	0.58	1	1.1	1.2	1.3	1.4	1.5	1.5

Next, calculate the consistency ratio by multiplying the average value matrix against the weight that has been obtained. An example of calculating CR on line A with weights is as follows: Consistency ratio calculation = [(1x 0.32843) + (5.1435 x 0.04001) + (2.4082 x 0.25249 ..... + (3.728 x 0.07417)] = 4.9373. This calculation is carried out on each row so that a recapitulation can be seen in Table 3.

Table 3. Consistency Ratio Results

	A	B	C	D	E	F	Weight	CR
A	1	5.1435	2.408	1.084	4.317	3.728	0.328	1.863
B	0.194	1	0.221	0.254	0.242	0,211	0.04	0.275
C	0.415	4.514	1	3.159	2.701	2.550	0.252	1.786
D	0.922	3.936	0.316	1	2.930	3.981	0.209	1.560
E	0.231	4.129	0.016	0.341	1	2.459	0.096	0.921
F	0.268	4.723	0.028	0.251	0.406	1	0.074	0.820

Table 4. CR Calculation Recapitulation

Element	N	CI	RI	CR	Information
Criterion	7	0,606	1,24	0,05	Consistent
Product	3	0,457	0,58	0,078	Consistent
Place	3	0,00259	0,58	0,0045	Consistent
Promotion	3	0,0026	0,58	0,0046	Consistent
Price	3	0,0541	0,58	0,0932	Consistent
Browse	3	0,0523	0,58	0,090	Consistent
Physical Evidence	3	0,0099	0,58	0,017	Consistent

Compiling an Analytical Network Process (ANP) Supermatrix

The data processing process to collect a supermatrix with Superdecision software is as follows:

1. Make a comparison model against the criteria to be compared.
2. Compare one criterion with another
3. After all the criteria are compared, fill in the values obtained from the distribution of questionnaires.

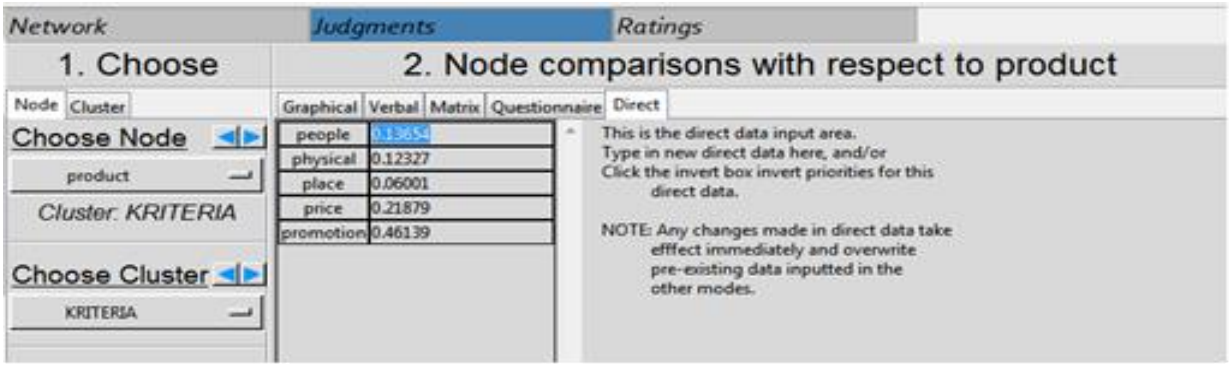


Figure 2. Direct Cluster "KRITERIA" result from "Product" Node

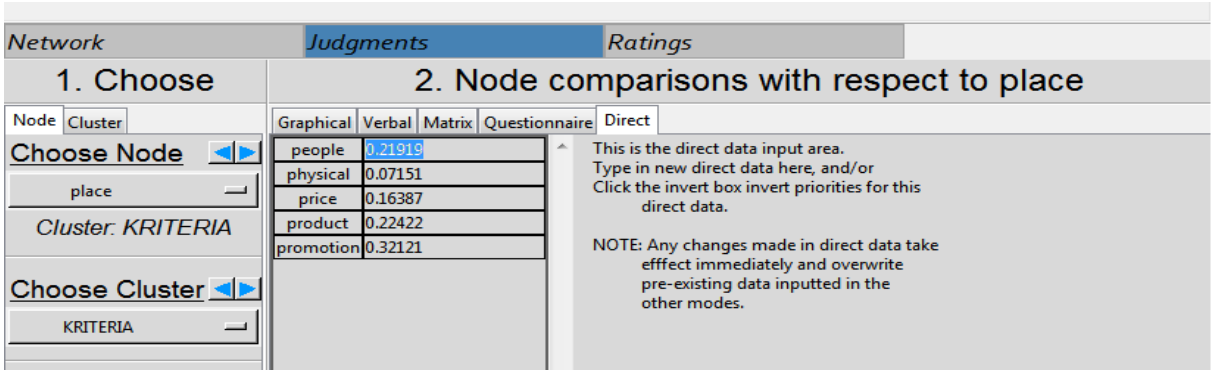


Figure 3. Direct Cluster "KRITERIA" Results from "Place" Node

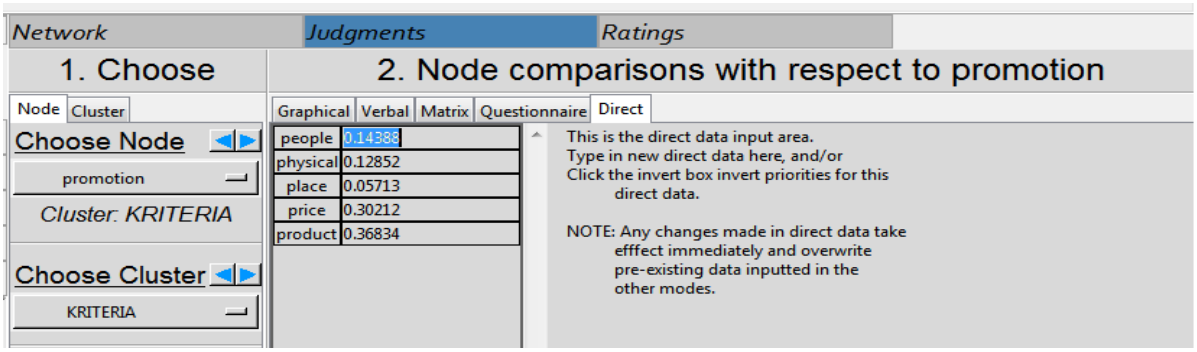
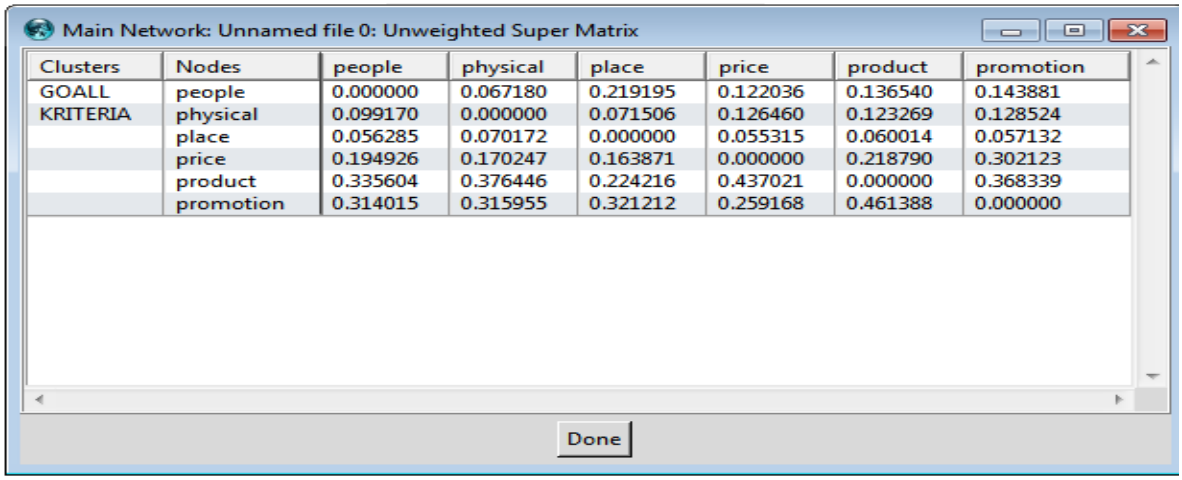


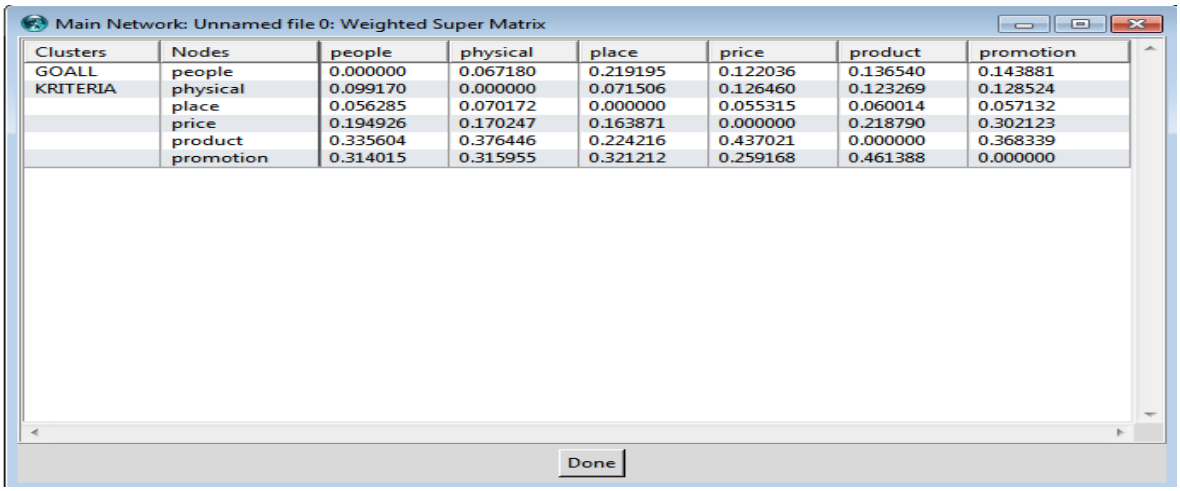
Figure 4. Direct Cluster "KRITERIA" Results from "Promotion" Node

After filling in the values of all nodes, a supermatrix value will be obtained. The importance of Super Mariks are shown in Figure 5 and Figure 6



Clusters	Nodes	people	physical	place	price	product	promotion
GOALL	people	0.000000	0.067180	0.219195	0.122036	0.136540	0.143881
KRITERIA	physical	0.099170	0.000000	0.071506	0.126460	0.123269	0.128524
	place	0.056285	0.070172	0.000000	0.055315	0.060014	0.057132
	price	0.194926	0.170247	0.163871	0.000000	0.218790	0.302123
	product	0.335604	0.376446	0.224216	0.437021	0.000000	0.368339
	promotion	0.314015	0.315955	0.321212	0.259168	0.461388	0.000000

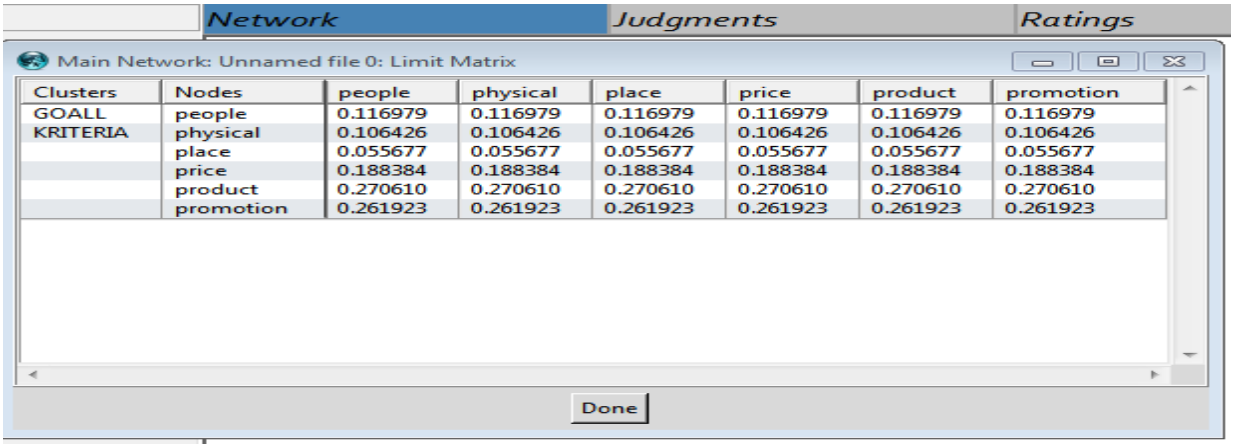
Figure 5. Unweighted Supermatrix



Clusters	Nodes	people	physical	place	price	product	promotion
GOALL	people	0.000000	0.067180	0.219195	0.122036	0.136540	0.143881
KRITERIA	physical	0.099170	0.000000	0.071506	0.126460	0.123269	0.128524
	place	0.056285	0.070172	0.000000	0.055315	0.060014	0.057132
	price	0.194926	0.170247	0.163871	0.000000	0.218790	0.302123
	product	0.335604	0.376446	0.224216	0.437021	0.000000	0.368339
	promotion	0.314015	0.315955	0.321212	0.259168	0.461388	0.000000

Figure 6. Weighted Supermatrix

The Weighted Supermatrix obtained is multiplied by the matrix itself in several iterations. This iteration aims to keep the weight of the supermatrix stable, meaning that the row values of each element become equal. When the consequences in each column have the same value, then the Limiting Supermatrix has been obtained.



Clusters	Nodes	people	physical	place	price	product	promotion
GOALL	people	0.116979	0.116979	0.116979	0.116979	0.116979	0.116979
KRITERIA	physical	0.106426	0.106426	0.106426	0.106426	0.106426	0.106426
	place	0.055677	0.055677	0.055677	0.055677	0.055677	0.055677
	price	0.188384	0.188384	0.188384	0.188384	0.188384	0.188384
	product	0.270610	0.270610	0.270610	0.270610	0.270610	0.270610
	promotion	0.261923	0.261923	0.261923	0.261923	0.261923	0.261923

Figure 7. Limiting Supermatrix

At the supermatrix's limit, each row's weight value is the same, meaning that the supermatrix is in a stable state. The weight value of the supermatrix that has the most significant percentage will be used as material in the calculation of TOPSIS as a basis for the weight of choosing the best marketing technique. From the results of ANP (supermatrix) processing, the best criteria are calculated by looking at the importance of goals against each measure. Then, the weight is ranked. The ranking of priority weights can be seen in Table 5.

Table 5. Priority Weight Ranking

Criterion	Weight	Percentage	Rank
A	0.2706	27.06%	**I**

B	0.0556	5.56%	**VI**
C	0.2619	26.19%	**II**
D	0.1883	18.83%	**III**
E	0.1169	11.69%	**IV**
F	0.1064	10.64%	**V**
Sum	1.0000	100.00%	

Table 5 shows that the criterion with the highest percentage is the Product criterion, meaning that the Product is the best choice according to expertise compared to other measures. From the Product criteria, 3 alternatives were obtained, and these three alternatives were distributed in pairs of comparison questionnaires again against the same expertise. The purpose of distributing this questionnaire is to determine the influence of existing alternatives on Product criteria with other criteria in the 6P marketing mix, and the results of the distribution of this alternative questionnaire will be carried out further calculations using the TOPSIS method to find out which alternative has the highest influence on all existing criteria. Options are chosen by obtaining which alternative has the closest value to the positive ideal solution and the farthest value to the negative perfect solution.

Calculating Technique for Order Preference by Similarity to an Ideal Solution (TOPSIS)
Matrix Normalization

TOPSIS requires an assessment rating of each alternative on each criterion. This rating is obtained from the value of the weight calculation that has been done. The weight assessment results of the entire analysis into a normalized matrix.

Table 6. Matrix Normalization

	A	**B**	**C**	**D**	**E**	**F**
C1	0.119	0.183	0,2623	0,4847	0,4474	0,3219
C2	0.741	0.202	0,5053	0,4095	0,2756	0,4856
C3	0.138	0.613	0,2324	0,1058	0,2771	0,1925

Normalization of Weighted Matrix

After the matrix is normalized, weighting the normalization is carried out in the following way.

$Y_{ij} = W_i R_{ij}$

Value is the weight value of alternative Product criteria. W_i The results from ANP data processing in Table 6 so:

W_i = (0.3284, 0.04, 0.2525, 0.209, 0.096, 0.0741)

$Y_{11} = W_i$ = (0.3284) X (R_{ij}0.1199) = 0.0394

$Y_{12} = W_i$ = (0.04) X (R_{ij}0.1833) = 0.0073

$Y_{13} = W_i$ = (0.2525) X (R_{ij}0.2623) = 0.0662

$Y_{14} = W_i$ = (0.209) X (R_{ij}0.4847) = 0.1013

$Y_{15} = W_i$ = (0.096) X (R_{ij}0.4474) = 0.0430

$Y_{16} = W_i$ = (0.0741) X (R_{ij}0.3219) = 0.02385

Each row above multiplication is performed, so a weighted normalized matrix is obtained.

Table 7. Weighted Normalized Matrix

	A	B	C	D	E	F
C1	0.0394	0.0073	0.0662	0.1013	0.0430	0.0239
C2	0.2434	0.0081	0.1276	0.0856	0.0265	0.0360
C3	0.0456	0.0246	0.0587	0.0221	0.0266	0.0143

Matrix of Positive and Negative Ideal Solutions

Positive ideal solution (A^+) and negative ideal solution (A^-) Are determined based on weighted assessments on a weighted normalized matrix (Y_{ij}). The ideal positive solution (A^+) can be calculated in the following way:

Y_1^+ = Max (0.0394, 0.2434, 0.0456)
= 0.2434

Y_2^+ = Max (0.0073, 0.0081, 0.0246)
= 0.0246

The above calculations are carried out on each column. A recapitulation of the positive ideal solution (A^+) can be seen from Table 8.

Table 9. Recapitulation of Positive Ideal Solutions (A^+)

	A	B	C	D	E	F
C1	0,0394	0,0073	0,0662	0,1013	0,043	0,0239
C2	0,2434	0,0081	0,1276	0,0856	0,0265	0,036
C3	0,0456	0,0246	0,0587	0,0221	0,0266	0,0143
Max	**0,2434**	**0,0246**	**0,1276**	**0,1013**	**0,043**	**0,036**

The negative ideal solution (A^-) can be calculated in the following way:

Y_1^- = Min (0.0394, 0.2434, 0.0456)
= 0.0394

Y_2^- = Min (0.0073, 0.0081, 0.0246)
= 0.0073

The above calculations are carried out on each column. A recapitulation of negative ideal solutions (A^-) can be seen from Table 10.

Table 10. Recapitulation of negative Ideal Solutions (A^-)

	A	B	C	D	E	F
C1	0.0394	0.0073	0.0662	0.1013	0.0430	0.0239
C2	0.2434	0.0081	0.1276	0.0856	0.026	0.0360
C3	0.0456	0.0246	0.0587	0.0221	0.0266	0.0143
Min	**0.0394**	**0.0073**	**0.0587**	**0.0221**	**0.0265**	**0.0143**

Alternative Preference Value

The preference value for each alternative is calculated by the formula that can be seen below:

$$V_1 = \frac{D_1^-}{D_1^- + D_1^+}$$

Table 11. Order of Alternate Preference Values

Alternative	Preferences	Preference Value
Non-defective product quality	V_2	0.2773
Flavor Variants that have many choices	V_1	**0.8891**
Product packaging is neatly and attractively packaged.	V_3	0.0560

DISCUSSION

Alternative product quality that is not defective is in second place with a preference value of 0.2773. This alternative is done by rechecking the finished product before it is marketed and storing it in a cool place, for example, in the refrigerator, so that the Product lasts longer and does not get moldy quickly. The research results from [23] show that the sub-criteria with the highest weight for formulating alternative marketing strategies at Agronas Gizi Food is building relationships with consumers with an importance weight of 0.296. The marketing strategy priority at Agronas Gizi Food is to improve the quality of service to customers, with a score of 0.97. The results of the Research [24] also assessed each marketing strategy, and the TOPSIS method was used to determine the ranking of the best and most ideal marketing strategies implemented in the Company. Based on the ANP results obtained, five criteria are considered important in determining marketing strategies, and these criteria are the ability to relate to customers (0.423), Reputation and Competition (0.208), Human Resource Assets (0.142), Market Innovation Ability (0.140), and Managerial Ability (0.088). The results of the ranking show that the Differentiation strategy is the optimal marketing strategy.

The alternative taste corresponds to the first-position taste with a preference value of 0.8891. Taste according to taste shows that consumers who are not satisfied with the taste of a frozen food product will be disappointed and will not repurchase the frozen food product. In contrast, satisfied consumers will make continuous purchases. Taste is the main factor for consumers because taste is how consumers evaluate frozen food products and influence subsequent purchasing decisions. Each consumer is different, so each has other taste preferences. Alternatives include conducting direct surveys with consumers, distributing questionnaires online, and collecting taste demand data. Assess the best alternative by looking at the ideal distance between negative and positive points. The most considerable preference value calculated by the TOPSIS method is owned by advertising alternatives on social media with a preference value of 0.5008705. Therefore, making decisions that focus on promotional criteria through alternative advertising on social media is the right business strategy. It can increase sales figures, which was the research from [25]. [26] This research obtained the weight results for each criterion and sub-criteria: managerial ability of 0.15, ability to relate to customers of 0.54, reputation assets of 0.42, competition of 0.17, and market innovation ability of 0.4.

CONCLUSION

Alternative marketing strategies for IKM X frozen food products are based on the selection of criteria that become the framework for building marketing techniques, such as Marketing Mix or 6P. The 6Ps that form the basis of marketing strategies are Product, place, promotion, price, people, and physical evidence. All of these criteria have been analyzed, and each criterion has a subcriterion, where this subcriterion will be a guideline for determining marketing strategies for frozen food products. By calculating the comparison value in pairs with the ANP method and using Superdecision Software, the weight of the product criteria was obtained into selected criteria with a percentage weight of 27.06%. Using the TOPSIS method, the main priority of the new marketing alternative for

IKM X frozen food products that match the product criteria is the taste according to consumer taste because it has the most significant preference value of 0.8891.

Based on calculations, the alternative marketing strategy chosen is taste according to taste. Then, the marketing strategy proposals that can be given are Paying attention to the quality of raw materials to improve taste quality without eliminating the characteristics of IKM X, Conducting direct surveys to consumers, collecting product sales data from each distributor to see the sales trend of each taste, distribute questionnaires online by collecting taste interest data, Respondents who can be reached are not only those in the same area.

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