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Selection Government Food Programs using Analytical Hierarchy Process

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Abstract*: Population growth is phenomenon in every country, it is directly proportional to the level of food consumption. Indonesia is ranked 4th as the country with the largest population. With the management of a good food security system, expected to meet the food needs of the community, both in quality and nutrition. The Jakarta provincial government, in this case makes a cheap food program that is subsidized so that it can be reached mainly by people with low income. but in the distribution process, there is still quite a lot of food that is not appropriate, so it becomes a problem raised by the author. by using the Analytcal Hierarchy Proccess method, the application of the AHP method in categorizing food feasibility is expected to help officers in sorting appropriate food consumption properly, effectively and efficiently. This study indicates the most priority freshness criteria in choosing appropriate food with a weight value of 0.409, in follow naturally with a weight value of 0.264, while the third and fourth criteria that affect the taste with a value of 0.187 and a good product with a weight value of 0.141.

***Keywords*: AHP, Appropriate food, Distribution, Product quality, Subsidies.**

I. INTRODUCTION

Indonesia is one of the most populous countries in the world after the People's Republic of China, India and United States where is Indonesia's population is 237,641,326 people in 2010 and projected to reach 261,890, 900 people in 2017[1]. Along with population growth that is quite fast, it is related to the needs of each individual, one of which is food needs. Food is the most basic human need. Fulfillment of food sufficiency is at the core of food security, it is indicated by the availability of sufficient food, in terms of quality, safe for consumption, various types, nutritious, equitable, affordable prices, and does not conflict with the religion, beliefs and culture of the community, be able to live healthy, active and productive sustainably[2]. Food security is closely correlated with poverty that is in a straight line with purchasing power, which has an impact on the lack of quality of food that is suitable for consumption[3]. The Jakarta government as a policy maker in this case is the need for food that is suitable for consumption for the society. The Jakarta City Government has a subsidized food program as a solution to the problem of the need for consumable, quality and nutritious food. This cheap food program is distributed in collaboration with PD Pasar Jaya as a distribution provider, and the Food Station as its supplier. When food items are sent to a distribution location, from the observations that the authors make, officers at the distribution location receive large quantities of goods and it takes a lot of time to manually sort out which items are suitable to be distributed to the beneficiaries, and which are not appropriate.

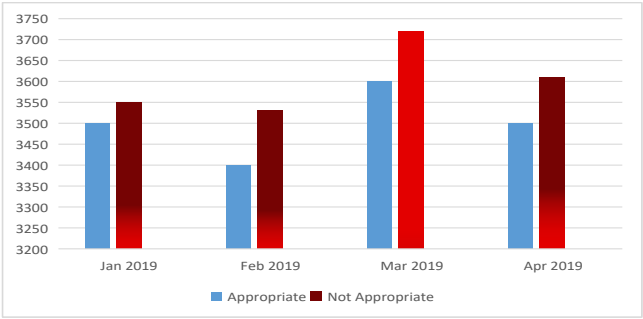

Fig. 1 Data about approriate food and not appropriate food

Based on the data above, in the last 4 months the items with not appropriate categories were more than those in the decent category, there were a number of factors why there were more items with appropriate categories, because when sorting was found, items with damaged packaging, expiration dates a brief and consistent change in the contents of the item. with the existence of the phenomenon of the problem, making the author interested in raising the issue into a study. and it is expected that with the research carried out, produce a solution for the relevant officers in conducting proper food sorting using a better method.

A. Research Problem

Based on the problems described in the background, the problems can be formulated as follows: How can the Analytical Hierarchy Process Algorithm determine the appropriate food category? How to design a management information system to improve food distribution services?

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B. Limitation Research

Based on the formulation of the above problem, the limitation of the problem in this study is that the author only discusses, how to use the AHP algorithm, so that a system to help officers in the field can determine appropriate food categories with several criteria and alternatives.

C. Object and Benefits

The objectives to be achieved in this study are make it easy for warehouse staff officers to determine which foods are worth distributing. This research is expected to provide benefits for the parties concerned as follows, for Authors, apply the fields of knowledge that have been obtained during the lecture, get experience and lessons in identifying problems around and analyze them to find the best solution. for the DKI Provincial Government, this research is expected to be one of the benchmarks to improve services for the community receiving the subsidy assistance program, especially in the food sector.

II. STUDY LITERATURE

A. Distribution

Distribution is the process of delivering good or service from producer to consumer and user, when and where the goods or services are needed[4]. According to[5] distribution as interdependent organizations that are included in the process that makes product or service available to use or consumption. the main functions of the distribution include: Transportation, Sales, Purchases, Storage, Standardization of quality standards for goods, Risk takers[6].

B. Subsidies

Subsidies are payments by the government to companies or communities with the aim that subsidies can encourage higher production / consumption or encourage prices to be more affordable[7]. According to WTO subsidies are defined as direct funds transfers including potential transfers such as collateral loans, lost income, government goods and services such as public infrastructure or purchases of other goods by government, and specific subsidies from the government. then subsidies become an alternative political policy to transfer a portion of funds from one community group to another[8].

C. Product quality

Product quality is a characteristic of products or services that has the ability to meet customer needs[9]. Product quality is the ability of the product to demonstrate its function, including overall durability, reliability, accuracy, ease of operation and product improvement and other product attributes[10]. According to [11] Wendy van Rijswijk Quality words are more often defined in terms of "taste", "good product", "natural" and "freshness".

D. Services

Service is the provision of services by the government, private parties under the government, or private parties to the community, with or even without payment to meet the need and interest of the community[12]. Service is a sequence of activities that occur in direct interaction with people or machines physically and provide customer satisfaction[13]. Service is any activity that is profitable in an association that offers satisfaction even though the results are not physically bound to a product[14].

E. Previous Study

The following are some of the results of research that have been done by discussing the same problems regarding AHP. The first, Previous study conducted by Mulia Sulistiyono with the research title "Sistem Penunjang Keputusan Untuk Seleksi Calon Guru Menggunakan Analytical Hierarchy Process (AHP)"[15], This research discusses the use of the AHP method for selecting candidates for vocational teacher candidates with 4 criteria. result of research, Microteaching is the first priority criterion in determining teacher candidates with a percentage of 40.79%. then followed by CPI criteria with a percentage of 39.64%, academic potential test 11.35% and teaching experience 8.22%. The second study is Saefuddin with the title "Sistem Pendukung Keputusan untuk penilaian kinerja pegawai menggunakan metode Analytical Hierarchy Proccess"[16], this research discusses regarding the problems of the performance appraisal process carried out still using manual methods so that the assessment can be subjective, and the assessment becomes slow and inaccurate. So the employee performance appraisal decision support system was designed using the Analytical Hierarchy Process. The results of this research show the system built was able to provide the results of calculations automatically, according to the calculation manually. Then the third study E. Darmanto conducted research with the title “Penerapan Metode AHP (Analytical Hierarchy Process) Untuk Menentukan Kualitas Gula Tumbu”[17], in the research discussed the use of AHP to determine the quality of tumbu sugar with the stages of problem definition, making hierarchies with general objectives, then determining alternative criteria and choices. the next step is to create a paired comparison matrix, normalize the data, calculate the eigenvalue vector and test its consistency, calculate the eigenvectors of each paired comparison matrix, test the consistency of hierarchy. If it does not meet CR <0.100, the calculation must be repeated. The results of this research are calculations using the AHP (Analytic Hierarchy Process) method faster than manual calculations so that it can be more efficient and the accuracy of the data is almost perfect. Information is important for companies, especially in the field of service[18], to support decision-making activities, in addition to operational data, analysis is also needed to explore the potential of existing information, it also requires clear and easy-to-understand information according to the needs in decision making[19]. then with conditions that have been explained from the above problems, the author makes the problem as a research, how to do proper and improper food sorting by using the AHP method to determine food feasibility. Feasibility is determined by several criteria and supporting factors, eligibility is divided into 3 categories, the first is good, average and less.

III. METHODOLOGY

A. Research Step

The first step that the author does is determine the topic wants to do for research by looking for the phenomenon of problems that exist in unresolved fields. in the second step determine the formulation of the problem,

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the third step is to conduct a literature review obtained through previous research books and journals. in the fourth step, the author studies the research that has been done before and then compared with the research that will be conducted. then after learning from the literature study, the fifth step is to make direct observations in the field to find out how the business process is currently running. in the sixth step which is conducting a literature study related to research to understand the theoretical basis and also the methods used to support this research. the seventh step of conducting direct interviews with officers in the field regarding the process of determining and sorting appropriate food categories. The eighth step is to make a questionnaire to obtain data from respondents about food feasibility. the ninth step analyzes the data obtained by the SWOT analysis method. In the tenth step, the author analyzes and designs information systems based on existing problems and based on the results of the SWOT Analysis with the aim of solving the problem. eleven design steps use UML and the AHP method to determine the appropriate food category. and the final step is to make conclusions and suggestions about the research conducted.

B. SWOT Analysis

SWOT analysis, a method based on logic that can maximize strengths and opportunities, but can simultaneously minimize weaknesses and threats[20]. With SWOT analysis allows companies to identify factors that influence both positive and negative from within and from outside the company. The key role of SWOT is to help to develop all the factors that can influence strategic planning and decision making[21].

C. UML (Unified Modelling Language)

According to [22] The UML method, a set of standard diagram techniques that provides a fairly rich graphical representation model of every system development project, from analysis to implementation.. The purpose of UML is to provide general vocabulary terms based on adequate object and diagramming techniques, complete enough to model the development of any system project, from analysis to design. There are four commonly used diagrams, namely the use-case diagram, class diagrams, activity diagrams and sequences.

D. AHP (Analytical Hierarchy Process)

AHP is one method to help set priorities of various choices using various criteria. Because of its multicriteria, AHP is widely used to prioritize[23]. AHP is done by structuring problems, identifying decision-making factors, measuring the importance of factors, a model to assist companies in making decisions[24]. There are 4 basic principles that are used to solve AHP problems, namely creating a hierarchy, evaluating criteria and alternatives, determining priorities, and measuring consistency[25].

AHP Formula Method :

CI = λ max-n / n-1 (1)
CR = CI / IR (2)

Description:
CI: Consistency Index
n: Many criteria
CR: Consistency Ratio
IR: Index Ratio

Table- I: Index Ratio

N	1	2	3	4	5	6	7	8	9	10
IR	0	0	5.8	0.9	1.12	1.24	1.32	1.41	1.45	1.49

Fig. 2 AHP Structure

IV. RESULT AND DISCUSSION

In this study, researchers used the AHP Method to determining appropriate food in Jakarta government food programs.

A. Preliminary

The results of identification using SWOT analysis, the outputs about the solutions to existing problems, and are expected to be solved by the design of this system.

Table- II: SWOT Analysis

SWOT	Strength	Weakness
	1. The Online Registration feature for food distribution is more practical 2. The distribution process becomes more structured with the existence of a system 3. Determining appropriate food is easier with the AHP method	1. Need to connect internet for access 2. System adjustments between users and officers
Opportunity	**SO**	**WO**
1. The system will encourage officers to improve performance so that goods are distributed more quickly.	Design a system with registration features without having to queue at the distribution location and make the distribution process simple.	Designing a computerized food distribution system and recording it in a database, minimizing the process that is still done manually by taking notes in the book.
Threat	**ST**	**WT**
1. Determination of appropriate food is still done manually so that the assessment is not objective.	Improve performance efficiency, and minimize invalid data input. Determination of eligibility with the AHP algorithm is more accurate, fast and objective.	Creating a multi-level security system so that both technical and non-technical threats can be anticipated.

The SWOT analysis tables above describe explains the food distribution process of subsidies, the results of the analysis produce opportunities to use information system as a system that can manage and improve the performance of the subsidized food distribution process, the system can then display food stock management, registration of food collection subsidies for recipients of assistance and the process of payment transactions and handover of goods. The hope with this system is to facilitate the recipients of assistance, without coming directly to the distribution location to register and make a payment transaction for taking goods.

B. Current business process analysis

In the below, explain the current business process about process flow that runs from the goods comes in the warehouse until distributed to the recipient of the assistance.

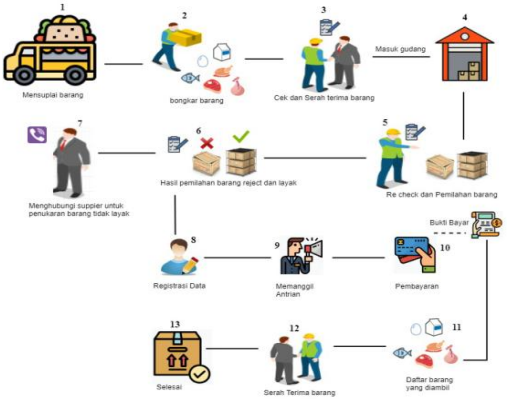

Fig. 3 Current business process

In the picture above, explain the flow that is currently running process of distributing goods to a warehouse in distribution site, the steps is First, the Transport of goods to the distribution location. The goods supply officer unloads the items that will be distributed to the warehouse. The process of checking the completeness number of items and handover between the supply officer and the head of the responsible (Admin) of the warehouse at the distribution location. The Items have been checked are entered into the warehouse. The officer then checks again for goods in warehouse, with the aim of sorting out items that are feasible and not feasible and then making a report to be handed over to the head in charge of the warehouse. The results of sorting appropriate and improper items. Head of the warehouse responsible (Admin) contact the supplier to exchange goods that are not feasible from the results of sorting with new items. The recipient of assistance came to the distribution site to register the queue, which was carried out by the recipient of the assistance, namely writing the name in the book provided. The recipient of the assistance waits to call on his name by the officer in the queue order written in the book. After being called, then the recipient of the assistance goes to the payment officer to make a payment transaction The recipient of assistance gets proof of payment from the officer who contains the items to be taken. Then the recipient of the assistance goes to the clerk to hand over the item and submit the receipt of payment receipt. Sending goods based on items selected and approved by the recipient of the assistance. Recipients of assistance get the items.

C. Information System Design

The design method used by the author is UML, the design flow including making usecase, activity diagram, sequence diagram, and class diagram.

1) Usecase diagram

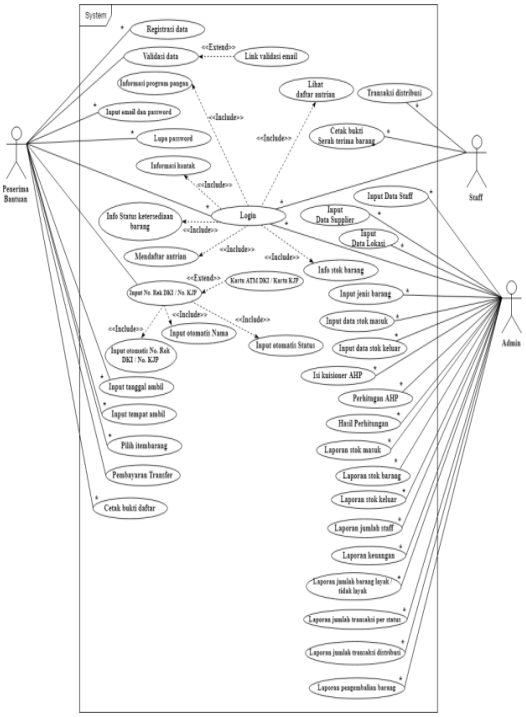

Fig. 4 Usecase diagram

In the use case above there are 3 actors involved in this process, namely Admin, Beneficiary and Staff, the design of this system is web-based and accessed through an internet connection.

2) Class diagram

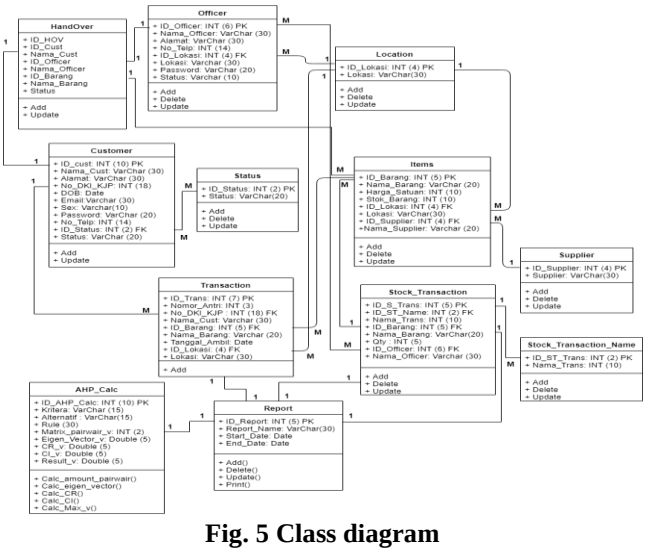

Fig. 5 Class diagram

In the picture above describes the description of class diagrams designed for Food Management Information Systems, class diagrams are also used as table designs that will be used in the system. In this system, there are 12 tables, which are: customer table, table officer, table location, supplier table, status_customer table, table items, hand over table, transaction table, stock_trans table, stock_trans_name table, report table, and AHP_Calc table. Each table has a relationship with other tables.

D. User Interface Main Page

Fig. 6 Main page

E. Analytical Hierarchy Process Calculation

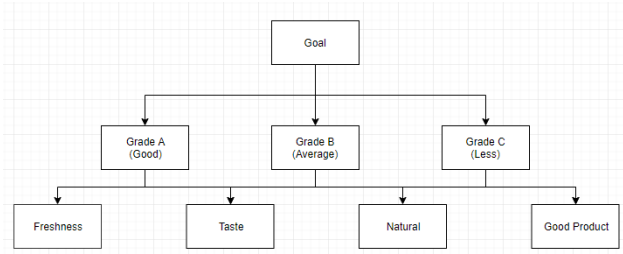

Fig. 7 AHP structure to determining appopriate food

The Structure AHP method above is a hierarchy of goal, alternatives and criteria for determining appropriate food. determine criteria and alternatives for appropriate food with 4 eligibility categories, as follows:

1. Freshness
2. Taste
3. Natural
4. Good product

And with 3 alternatives, namely:

1. Grade A (Good)
2. Grade B (Average)
3. Grade C (Less)

Table- III: Matrix pair wire comparison altenatives

Freshness	Grade A (Good)	Grade B (Average)	Grade C (Less)
Grade A (Good)	1	5	1
Grade B (Average)	1/5	1	3
Grade C (Less)	1	1/3	1
Σpriortization	2.2	6.333	5

Taste	Grade A (Good)	Grade B (Average)	Grade C (Less)
Grade A (Good)	1	3	1
Grade B (Average)	1/3	1	6
Grade C (Less)	1	1/6	1
Σpriortization	2.333	4.167	8

Natural	Grade A (Good)	Grade B (Average)	Grade C (Less)
Grade A (Good)	1	4	1
Grade B (Average)	1/4	1	4
Grade C (Less)	1	1/4	1
Σpriortization	2.25	5.25	6

Good Product	Grade A (Good)	Grade B (Average)	Grade C (Less)
Grade A (Good)	1	4	1
Grade B (Average)	1/4	1	5
Grade C (Less)	1	1/5	1
Σpriortization	2.25	5.20	7

Table- IV: Amount value of pair wire comparison

Criteria	Amount Value		
	Alternatives		
	Grade A (Good)	Grade B (Average)	Grade C (Less)
Freshness	2.2	6.333	5
Taste	2.333	4.167	8
Natural	2.25	5.25	6
Good product	2.25	5.20	7

Table- V: Matrix normalization alternatives

Freshness	Grade A (good)	Grade B (Average)	Grade C (Less)	Eigen Vector	λmax	CI	CR
Grade A (good)	0.455	0.789	0.200	0.481	4.03	0.01	0.011
Grade B (Average)	0.091	0.158	0.600	0.283			
Grade C (Less)	0.455	0.053	0.200	0.236			
Check	1.000	1.000	1.000	1.000			

Taste	Grade A (good)	Grade B (Average)	Grade C (Less)	Eigen Vector	λmax	CI	CR
Grade A (good)	0.429	0.720	0.125	0.425	4.15	0.05	0.054
Grade B (Average)	0.143	0.240	0.750	0.378			
Grade C (Less)	0.429	0.040	0.125	0.198			
Check	1.000	1.000	1.000	1.000			

Natural	Grade A (good)	Grade B (Average)	Grade C (Less)	Eigen Vector	λmax	CI	CR
Grade A (good)	0.444	0.762	0.167	0.458	4.04	0.01	0.015
Grade B (Average)	0.111	0.190	0.667	0.323			
Grade C (Less)	0.444	0.048	0.167	0.220			
Check	1.000	1.000	1.000	1.000			

Good Product	Grade A (good)	Grade B (Average)	Grade C (Less)	Eigen Vector	λmax	CI	CR
Grade A (good)	0.444	0.769	0.143	0.474	4.24	0.08	0.089
Grade B (Average)	0.111	0.192	0.714	0.306			
Grade C (Less)	0.444	0.038	0.143	0.209			
Check	1.000	1.000	1.000	1.000			

Table- VI: Value of Eigen vector, λ-max, CI, CR, matrix normalization

Criteria	Alternatives			λmax	CI	CR
	Grade A	Grade B	Grade C			
	Eigen Vector	Eigen Vector	Eigen Vector			
Freshness	0.481	0.283	0.236	4.03	0.01	0.011
Taste	0.425	0.378	0.198	4.15	0.05	0.054
Natural	0.458	0.323	0.22	4.04	0.01	0.015
Good product	0.474	0.306	0.209	4.24	0.08	0.089

For all result λmax value criteria, if the value < 0.100 it's indicates consistence, because the value of Consistency Ratio < 10% (0.100).

Table- VII: Matrix Priortization Critera

Priortization Matrix	Freshness	Taste	Natural	Good Product
Freshness	1	2	2	3
Taste	1/2	1	1	1
Natural	1/2	2	1	2
Good Product	1/3	1	1/2	1
Σpriortization	2.333	6	4.25	7

Amount value of Freshness = 2.333
Amount value of Taste = 6
Amount value of Natural = 4.25
Amount value of Good Product = 7

Table- VIII: Matrix Priortization Normalisation Criteria

Criteria	Freshness	Taste	Natural	Good Product	Eigen Vector	λmax	CI	CR
Freshness	0.429	0.333	0.444	0.429	0.409	4.25	0.08	0.091
Taste	0.214	0.167	0.222	0.143	0.187			
Natural	0.214	0.333	0.222	0.286	0.264			
Good Product	0.143	0.167	0.111	0.143	0.141			
Check	1.000	1.000	1.000	1.000	1.000			

From the data in the table, the result in the below :
Eigen Vector of Freshness obtained from (0.429 + 0.333 + 0.444 + 0.429) / 4 = 0.409
Eigen Vector of Taste obtained from (0.214 + 0.167 + 0.222 + 0.143) / 4 = 0.187
Eigen Vector of Natural obtained from (0.214 + 0.333 + 0.222 + 0.286) / 4 = 0.264
Eigen Vector of Natural obtained from (0.143 + 0.167 + 0.111 + 0.143) / 4 = 0.141
λmax = (2.333 x 0.409) + (6 x 0.187) + (4.25 x 0.264) + (7 x 0.141) = 4.25
CI = λ maks-n / n-1 = 4.25 - 4 / 4 - 1 = 0.25 / 3 = 0.08
CR = CI / IR = 0.08 / 0.9 = 0.091

Table- IX: Overall Composite

Summary	Freshness		Taste		Natural		Good product		Final Score
	W	S	W	S	W	S	W	S	
Grade A	0.409	0.481	0.187	0.425	0.264	0.458	0.141	0.452	0.46
Grade B	0.409	0.283	0.187	0.378	0.264	0.323	0.141	0.339	0.319
Grade C	0.409	0.236	0.187	0.198	0.264	0.22	0.141	0.209	0.221

From the results of the assessment of alternative global priorities, the freshness criterion gets the highest weight value of 0.409, then the natural criteria with a weight value of 0.264, a taste criterion with a weight value of 0.187 then a good product with a weight value of 0.141, for alternatives, the top priority gets a value of 0.460, then medium priority 0.319, and the final priority is 0.221.

V. CONCLUSION

Analysis and design that has been done, it can be concluded that the following results, The design of a food management information system raises the phenomenon of problems that occur in cheap food programs of the Jakarta Provincial Government. The design uses a SWOT analysis to analyze the running system, from the analysis of the running system the output is an unresolved problem. UML and produce 6 Modules namely Registration Module, Stock Management Module, Goods distribution module, AHP Calculation Module, Master Module and Reporting Module. Calculations using the AHP algorithm that has been carried out, it produces ranking criteria for freshness criteria with the highest weighting value of 0.409, the second criterion that affects the assessment of the feasibility category is natural with a value of 0.264, while the third and fourth criteria affect the assessment of categories feasibility is a taste with a value of 0.187 and a good product (good product) with a weight of 0.141. for an alternative ranking grade A (Good) eligibility category gets a final score of 0.460, followed by grade B (Average) with a final value of 0.319 and Grade C (Less) with the final score of 0.221. These results indicate that the assessment of the food feasibility category the main criteria that are most considered are the freshness criteria and the most preferred alternative is the grade A (good) alternative.

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