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IMPLEMENTATION OF DECISION SUPPORT SYSTEM IN THE THREE PUTRA CASSAVA CRACKER INDUSTRY BASED ON SIMPLE ADDITIVE WEIGHTING

Salma Sadiah [a,1,*], Aprilla Aulia [b,2], Prelya Paskah Pergiwati [c,3]

[a,b,c] Universitas Nusa Putra, Jl. Raya Cibolang No.21 Cisaat Sukabumi 43152 Indonesia
[1]salma.saidah_si@nusaputra.ac.id*; [2] aprilla.aulia_si22@nusaputra.ac.id; [3]prelya.paskah_si22@nusaputra.ac.id
* Correspondence Author

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ABSTRACT

The Tiga Putra cassava cracker industry faces significant challenges related to the decline in production levels which negatively impact profitability and business continuity. This study aims to identify the factors causing the decline in production and propose the best solution using the Simple Additive Weighting (SAW) method. Five main criteria are set: production cost, production time, production quantity, customer orders, and weather. Four alternative solutions were identified: packaging innovation, digital marketing, forging partnerships, and oven manufacturing. Data was collected through interviews, direct observations, and literature studies. The results of the analysis showed that oven manufacturing was the best alternative with the highest score of 1.00, followed by establishing a partnership with a score of 0.93. The implementation of oven manufacturing is expected to significantly increase efficiency and productivity. This study also suggests gradual implementation, employee training, periodic monitoring, and adaptation to weather changes to optimize the production of Tiga Putra cassava crackers.

KEYWORD
UMKM,
Supplier,
Quality of Raw Materials,
Covid-19,

1. Introduction

The cassava cracker industry is one of the micro, small and medium enterprises (MSMEs) that are quite developed in Indonesia. MSMEs are the most strategic sector of the national economy and concern the livelihood of many people so that they become the backbone of the national economy" [1], [2], [3]. The cassava cracker industry has become one of the central sectors in the Indonesian economy. Cassava crackers are one of the most popular snack products and are in wide demand among the public [4]. Various variants of crackers offered by cracker entrepreneurs. Cracker entrepreneurs in Sukadamai Village, Cicantayan District, Sukabumi Regency are one of them. A business founded by a housewife who took the initiative to start her business to earn income even at home. Mrs. Sumarni named this industry three sons. Only with an initial capital of 190 thousand, Mrs. Sumarni's cassava cracker production can survive until now. Mrs. Sumarni's cassava cracker industry has been established for almost 15 years. In each production in a day, Mrs. Sumarni produces 10 kilos of cassava as raw materials for its manufacture, and annual production is produced according to the production factors of its manufacture.

Fig. 1. Growth of Cassava Cracker Production in the three-son industry

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However, in recent years, the three-son cassava cracker industry has faced significant challenges related to declining production levels that can negatively impact the profitability and continuity of the cassava cracker business. In Figure 1, in 2018, cassava cracker production grew by 90%, but the following year, there was a significant decline with a growth rate of only 60%. Although there was a slight increase in 2020 to 65%, the increase was still below the previous year's growth rate. The decline continued until 2021, where the growth rate only reached 70%. Although there was a slight increase in 2022 to 75%, production is still below the growth rate of 2018. In 2023, there is a more significant increase with a growth rate of 80%, but it still has not reached the initial growth rate. Finally, in 2024, the production growth rate remains at 80%, indicating production stabilization at a lower rate compared to previous years. From this analysis, it can be concluded that the production of cassava crackers in the three-son industry has experienced a decline in growth rate from year to year. The growth of cassava cracker production shows a downward trend year-over-year during the observed period.

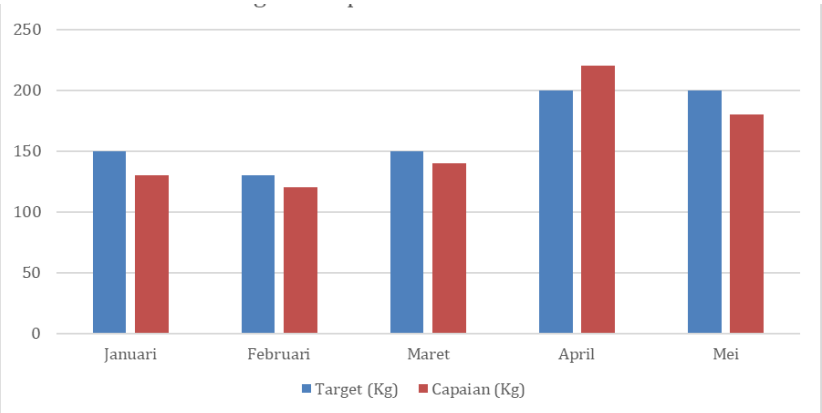

Fig. 2. Cassava Cracker Production Target & Achievement in the Last 5 Months

In addition, the data presented in figure 2 includes production targets and production achievements in the last 5 months. Data analysis shows that there is a significant variation in production achievement from month to month. In January and February, production did not reach the set target, with production achievement below the set target. Despite a slight increase in March, production still fell short of the expected target. However, in April, there was a significant increase in production achievements, where production targets were exceeded. Unfortunately, this increase did not continue into May, where production again fell below the target. The changes seen in the data indicate the need for an in-depth evaluation of the factors affecting production on a monthly basis and the development of strategies to improve production consistency in order to meet or even exceed the set targets.

The decline in the production rate of the three-son cassava cracker industry is caused by several main factors, based on a direct interview with Mrs. Sumarni as the owner of the three-son industry. First, unpredictable weather problems, such as high rainfall or cloudy weather, can hinder the drying process of crackers and disrupt the overall production process. Second, the increase in the price of raw materials, such as cassava, increases production costs and limits the ability of entrepreneurs to produce crackers in optimal quantities. Third, the difference in the price of raw materials in various regions can also be an obstacle in the production of cassava crackers, causing an imbalance in competition and affecting the competitiveness of entrepreneurs. Finally, the COVID-19 pandemic has had a significant impact on the industry, with restrictions on activities and a decline in demand during the pandemic affecting the production and sales rate of cassava crackers.

Several previous studies have discussed topics related to the cassava cracker industry and the factors that affect its production using the Simple Additive Weighting (SAW) method. Wardana and Restiana (2020) used the SAW method to develop a decision support system in selecting the best alternative for the development of starch cracker production influenced by weather factors. Another study analyzed the business and added value of cassava cracker agroindustry using the SAW method, identifying problems in the provision of raw materials, product quality, packaging, and product transportation costs [5]. Although these studies provide insights, there is still a research gap in terms of a comprehensive analysis of the factors that affect cassava cracker production and their influence on the efficiency and productivity of the industry in particular.

To overcome these problems, it is suggested that a management approach in increasing production and sales needs to be implemented. One of the solutions that can be implemented is to use a decision support system (SPK). SPK is an interactive and flexible computer-based information system to support decision-making in solving unstructured problems [6], [7]. By implementing SPK, it is hoped that cassava cracker MSME owners

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such as Tiga Putra Industry can make the right decisions in managing their businesses so that problems related to declining productivity can be overcome. Therefore, this research will develop a special decision support system for the Tiga Putra Cassava Cracker Industry in an effort to increase its productivity and propose the best solution for cassava cracker entrepreneurs. Through the analysis of production data, operational processes, and influencing external factors, this research will provide valuable insights to improve the efficiency and productivity of the cassava cracker industry. In this study, we used the Simple Additive Weighting (SAW) method to determine the best alternative based on several predetermined criteria. The SAW method is an effective decision-making technique in helping to evaluate alternative solutions based on multi-criteria assessment.

2. Literature Riview

2.1 Related Reaserch

Several previous studies have discussed topics related to the cassava cracker industry and the factors that affect its production.

• Wardana and Restiana (2020) used the Simple Additive Weighting (SAW) method to develop a decision support system in selecting the best alternative for the development of starch cracker production. This research focuses on the problem of declining cracker production which is influenced by weather factors [5].

Although these studies provide insight into the factors that affect cassava cracker production, there is still a research gap in terms of a comprehensive analysis of these factors and their impact on the efficiency and productivity of the cassava cracker industry in particular.

2.2 Thingking Framework

A framework of thinking is a structure or pattern used to structure and organize thoughts in a research or problem analysis. The framework helps to describe the relationship between the variables being studied and provides guidance in the research process [8], [9]. These diagrams help visualize the research flow from problem identification to conclusions and recommendations, ensuring all important steps are covered. The framework of the Decision Support System for Improvement in Cassava Cracker Production is as follows:

Fig. 3. Thinking Framework of the Decision Support System for Cassava Cracker Production

1. Cassava Cracker Production Problems: Identify three main problems in cassava cracker production.
2. Research Objectives: Set research objectives to address the problem.
3. Theoretical Foundation: Use the theory of SPK and cassava cracker production to support research.
4. Research Methodology: Plan and conduct research to collect and analyze data, as well as develop systems.
5. System Implementation: Design and test the decision support system.
6. Evaluation and Discussion: Evaluate the performance of the system and discuss the findings.
7. Conclusions and Recommendations: Make conclusions from the results of the research and provide recommendations.

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3. Methodology

3.1 Tools And Materials

1. Microsoft Excel

Microsoft Excel is a spreadsheet application program created and distributed by Microsoft Corporation for Microsoft Windows and Mac OS operating systems. The app is used for number processing (arithmetic) and has calculation and graphing features that make it very popular in various fields, including education and employment.

2. Microsoft Word

Microsoft Word is a word processor developed by Microsoft Corporation. This application is used to create, edit, and manage documents in the form of text, images, and multimedia. Microsoft Word is available in various versions, including for desktop (Windows and MacOS), mobile devices (iOS and Android), and online.

3.2 Data Collection

Data is collected through three methods, namely:

1. Interview

The interview was conducted by asking several questions to the owner of the cassava cracker industry 3 Putra. The industry is known as one of the leading producers of cassava crackers in the region, with a strong reputation for producing high-quality and innovative crackers.

2. Observation

Observations are made to directly examine the situation to ensure the accuracy of the data that has been collected. The purpose of this observation is to obtain valid data by directly observing the situation in the field.

3. Literature Studies

Literature studies are carried out by tracing and analyzing various written sources such as scientific journals and research reports related to cassava cracker production. The purpose of this study is to gather relevant information, understand best practices and innovations in the cassava cracker industry, and apply theories and concepts that can improve the efficiency and quality of production in the Tiga Putra Industry.

3.3 Simple Additive Weighting Method

Research Methodology that we apply in the process of analyzing the problem of cassava cracker production level using the SAW methodology (Simple Additive Weighting Method). The SAW method is one of the techniques in decision-making used to determine the best alternative based on several predetermined criteria [9], [10]. The basic principle of the SAW method is to calculate the weighted sum value of each predetermined criterion. So that the highest score indicates the best alternative. This assessment criterion is adjusted to the needs of the three sons industry. The calculation process in the SAW method involves normalizing the decision matrix (X) into a scale that can be compared between all alternatives. This is important so that each alternative can be assessed fairly based on the same criteria.

In general, the application of the SAW method in this study aims to facilitate a more objective and systematic decision-making process. By using this method, researchers can identify the best alternatives based on predetermined criteria, so that they can support companies or organizations in achieving their goals more effectively. The reliability of the SAW method in generating decisions based on multi-criteria assessments makes it a very useful tool in a wide range of application areas.

The steps in the SAW method are as follows:

• Step 1: Determining the Criteria of the Alternative

In this step, we identify the criteria that will be used to evaluate the alternatives. These criteria are anything that is relevant to the decision made, such as cost, quality, time, etc.

• Step 2: Give Weights to Each Criterion

After determining the criteria, the next step is to give weight to each criterion based on its level of importance.

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• Step 3: Creating a Matrix for Normalization

This step involves creating a decision matrix that contains the values of each alternative for each criterion. Once a decision matrix is created, the values in the matrix are normalized to be on the same scale.

• Step 4: Preferences

Once the normalization matrix is formed, the next step is to calculate the preference value for each alternative. This is done by multiplying the normalized value by the weight of each criterion, and then adding up the results. The formula for calculating the preference value is:

$Vi = \sum Wjrij \; n \; j=1$

Information:

Vi= as the Ranking for each alternative.

Wj= The weight value of each criterion.

Rij= Normalized performance rating value.

4. Result and discussion

4.1 Result

1. Analiysis Result

From the results of the analysis we obtained regarding the decision support system for cassava crackers for three sons, we get the following:

Table 1. Criteria table

Criteria Code	Criteria Provisions	Criteria Description
K1	**Production cost**	**cost**
K2	**Production time**	**cost**
K3	**Production quantity**	**Benefit**
K4	**Customer orders**	**Benefit**
K5	**Weather**	**benefit**

Table 1 explains some of the criteria in the production of cassava crackers that will be used to evaluate alternatives. These criteria are in the form of anything that is relevant to the decision taken

Table 2. Criterion weight value

Criterion Weight Value	
K1	**0.15**
K2	**0.05**
K3	**0.10**
K4	**0.25**
K5	**0.45**

In Table 2, explain the weight value of the criteria for each criterion based on its level of importance.

Table 3. Altermative Table

No	Alternative	Alternative Name
1	R1	**Packaging Innovation**
2	R2	**Digital Marketing**
3	R3	**Establishing Partnerships**
4	R4	**Oven Manufacturing**

In Table 3, we explain alternatives that can be used as a solution to the problem of cassava cracker production.

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Table 4. Alternative Vlaues

Alternatif	K1	K2	K3	K4	K5
R1	80	70	65	75	**40**
R2	78	75	70	80	**50**
R3	89	87	85	89	**80**
R4	95	85	95	90	**90**

In table 4, we explain the alternative values of the various criteria

a. Determining The Normalized Matrix

The data obtained for each criterion needs to be normalized so that it can be directly compared. Normalization is done by changing the data values to a range between 0 and 1, where 0 indicates the worst performance and 1 indicates the best performance.

Table 5. Maximum Value of each Criterion

Maximum Value of Each Criterion	
K1	**95**
K2	**87**
K3	**95**
K4	**90**
K5	**90**

Table 5, Describes the maximum value of the results of each criterion

Table 6. Normalization Results

Normalization Results					
	K1	**K2**	**K3**	**K4**	**K5**
R1	0.84	0.80	0.68	0.83	**0.44**
R2	0.82	0.90	0.74	0.89	**0.56**
R3	0.94	1.02	0.89	0.99	**0.89**
R4	1.00	1.09	1.00	1.00	**1.00**

Table 6, describes the final results of normalized data

b. Calcuating Final Preferences

In the final preference result, the normalized data is multiplied by the criterion weight value. Then each alternative is calculated.

Table 7. Final Preference Results

	Preference					Result
	K1	K2	K3	K4	K5	
V1	0.13	0.04	0.07	0.21	0.20	**0.64**
V2	0.12	0.04	0.07	0.22	0.25	**0.71**
V3	0.14	0.05	0.09	0.25	0.40	**0.93**
V4	0.15	0.05	0.10	0.25	0.45	**1.00**

4.2 Discussion

As a result of the analysis of the decision support system for the production of Tiga Putra cassava crackers, five main criteria have been determined, namely production cost (K1), production time (K2), production quantity (K3), customer orders (K4), and weather (K5). Each criterion is weighted based on its level of importance, with weather (K5) having the highest weight of 0.45, indicating how important this factor is in the decision-making process, while production time (K2) has the lowest weight of 0.05. Four alternative solutions were identified as

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steps to address production problems, namely packaging innovation (R1), digital marketing (R2), establishing partnerships (R3), and oven manufacturing (R4). Performance assessments of each alternative against all five criteria were conducted, which showed variations in the efficiency and effectiveness of each solution. The data normalization process is carried out to change the original value to a range between 0 and 1, so that the comparison between the alternatives becomes fairer. The normalization results showed that oven manufacturing (R4) had the best performance in all criteria, followed by establishing a partnership (R3). The final step is to calculate the final preference by multiplying the normalized value by the criterion weight. The final preference score explains that oven manufacturing (R4) is the optimal solution with the highest score of 1.00, followed by establishing a partnership (R3) with a score of 0.93.

Based on the results of the research and conclusions that have been presented, several suggestions can be put forward to increase the production of cassava crackers in the Tiga Putra industry. In order for the implementation of oven manufacturing to be carried out gradually, it starts with a small scale to evaluate its effectiveness. Training of employees on the use and maintenance of new ovens is also important to ensure optimal operation. Although oven manufacturing is the main solution, it is still necessary to consider the application of other alternatives such as establishing partnerships as a supporting strategy. Periodic monitoring and evaluation of production performance after the implementation of the oven is very necessary. Further research focusing on optimizing the use of ovens, including aspects of energy efficiency and improving product quality, is also recommended. Given that weather has the highest weight in the criteria, the development of adaptation strategies to weather changes is important. Product and packaging innovation, collaboration with external parties such as educational institutions or research institutions, improvement of supply chain management, and digitization of several aspects of business processes also need to be considered to improve operational efficiency and competitiveness of Tiga Putra industry in the market.

5. Conclusion

Based on the results of the analysis using the Simple Additive Weighting (SAW) method, making an oven (R4) is the best alternative to increase the production of Tiga Putra cassava crackers. Not only do these alternatives show the best performance in terms of cost, time, production volume, customer orders, and weather, but they are also expected to significantly improve efficiency and productivity. The results of data normalization were carried out to change the values of criteria and alternatives into a comparable scale. Thus, the V4 alternative was identified as the best option with the highest score of 1.00, indicating that the alternative has the most optimal performance based on the criteria that have been set in the cassava cracker production evaluation.

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