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VALUE ADDED ANALYSIS AND DEVELOPMENT STRATEGY OF CANNED TRADITIONAL FOOD VEGETABLE CANDLE (*Saccharum edule*)

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ABSTRACT

Vegetable candle (sayur lilin in Indonesia) (*Saccharum edule*) is a traditional food typical of North Maluku, which is processed from sugarcane flowers and cooked using coconut milk. The application of canning technology acts as an effective preservation method to increase the shelf life of products while ensuring food safety. This research aims to analyze added value and formulate the right development strategy for the canned vegetable candle industry. This study uses SWOT analysisand value-added analysis with the Hayami approach. A study of the data revealed that canned vegetable candles had a 70.57% enhanced value ratio. The internal conditions of the business were in the moderate category, while the external environment showed strong conditions. Based on the IE matrix, the canned vegetable business is in Quadrant II with a growth and building strategy position. Thus, the best options for development are market entry tactics, market development, and product development. The SWOT analysis and added value results also indicate that canned veggies have a lot of room for growth. Recommended strategies include promotion through social media, product socialization, collaboration with relevant stakeholders and local governments, and adaptation of recipes to increase product competitiveness.

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INTRODUCTION

This plant, which is also known as the local candle, has an edible stem and is often processed into various regional dishes. Vegetable candle is known to have a sweet taste and chewy texture, making it a popular choice in various dishes, especially as a complement to rice or the main ingredient in vegetable-based dishes (Pentury et al, 2017). As one of the natural riches typical of North Maluku, the Vegetable candle not only has high nutritional value, but also has economic potential that can support the welfare of the local community. Its abundant presence in coastal and mountainous areas provides a great opportunity to be developed as a processed food product with commercial value, both locally and nationally. Furthermore, because vegetable candles may thrive in a variety of soil types and tropical climes, they may potentially be a more environmentally responsible food option.

Vegetable candle or sugarcane flower is part of the Poales family (Sukmawani et al., 2021) and one of the Saccharum species (Saraswati et al., 2011). The flower head, which is contained within the sheaths, is what is edible. The head flower is either yellow or white in hue. Previous study reported that sugarcane flower had moisture 87.59% - 91.76%, ash 1.40% - 1.56%, fat 0.25% - 0.67%, protein 3.20% - 4.21%, and carbohydrate 3.34% - 6.32% (Wijayanti & Fara, 2021). The concentration of fatty acids was 0.44%, with palmitic acid having the greatest concentration (0.16%). Sugarcane flower did not have total sugar content, but it had 5.11% starch (Kuncari, 2017). Sugarcane blossom has antipyretic and lactation-promoting qualities in addition to its nutritional advantages. It contains the following beneficial chemicals: 66.46±0.71 total phenols, 0.78±0.04 total anthocyanin, 1.77±0.23 beta carotene, 2.83±0.03 total carotenoids, 1.05±0.02 caffeic acid, 0.16±0.00 ferulic acid, 0.44±0.01 mg/100g quercetin, and 4.17±0.13 mg/100g chlorogenic acid (Andarwulan et al., 2012). Vegetable candles are typically sold in plastic bags by local vendors at the market. As a result, the vegetable candle's shelf life was shortened. The shelf life of vegetable candles packaged in plastic bags is shorter than twenty-four hours. If stored in a refrigerator, it can have a longer shelf life. None of the local vendors of vegetable candles have sold their goods outside of North Maluku. One of the traditional cuisines that might be marketed nationally is vegetable candles. However, it is difficult to distribute the vegetable candle outside of North Maluku due to its short shelf life and unusable packaging.

Food packaging is one of the important values in the food industry, which will provide attractiveness to food products (Wang et al., 2023). Attractive packaging will become the main medium in marketing food products and can maintain the taste of the product and also have a longer shelf life (Becker et al., 2011). It is useful because it includes information about the food, protects it, and facilitates its distribution (Vasile & Baican, 2021). There is a wide variety of packaging materials, such as plastic, glass, paper, metal, board, or a combination (Otto et al., 2021). However, due to its price, accessibility, and durability, plastic-based packaging continues to be the most widely used (Mukheed & Alisha, 2020) Food loss or waste within the supply chain could result from inadequate packing, which should safeguard the food during distribution (Wohner et al., 2019). Plastic packaging is controversial (Ruippo et al., 2023). Practical single-use packaging is plastic; however, in modern life, it will have consequences for the environment with a large amount of plastic waste, which cannot be processed or decomposed by the environment (Müller & Süßbauer, 2022).

It is inexpensive, but it leaves residue, and because of its short shelf life, improper packaging causes food waste (Ramakrishna, 2023).

Canned vegetables dominate 39.0% of the circulation in America compared to the consumption of frozen and fresh vegetables (Cash & Sinha, 2023). In addition to boiling, pickling, curing, and freezing, canning is one of the traditional methods of food preservation (Ariyamuthu et al., 2022). The process of canning fruit and vegetables requires good supervision to ensure food safety for consumers (Tomé et al., 2024). Hermetic packaging and a sterilizing procedure are necessary for the canning technique (Zheng et al., 2023). Hermetic packaging prevents germs, water, and air from penetrating the food. Hermetic packaging keeps food from spoiling and shields it from chemical changes like oxidation and water content loss (Widowati et al., 2021). Sterilization is an important process in canning (Deak & Mohácsi-Farkas, 2023). Enzymes and other biological materials are rendered inactive by it, and microbes are eradicated (Velbel et al., 2022). Food in cans has a long shelf life. In the store, it can endure for one to two years (Tokur & Korkmaz, 2019). Likewise, the length of sterilization will affect the characteristics and sensory characteristics of packaged rarang chicken (Handayani et al., 2023).

Vegetable candles are generally still consumed primarily by the public, with a relatively short shelf life. Apart from that, Vegetable candles are widely consumed by the community as a special menu, both for household consumption and for traditional ceremonies. A useful and efficient innovation that uses convenience technology to extend its shelf life is the vegetable candle in a can. A novel product that has never been made in North Maluku is canned vegetable candles. This study looked at the canned vegetable candle industry's development strategy and the vegetable candle's added value, a traditional meal in North Maluku, after it has been canned. It is anticipated that canned vegetable candles will boost their economic worth and, ideally, broaden their market beyond North Maluku.

RESEARCH METHOD

A descriptive qualitative approach is used in this study. It took place in the canned vegetable candle manufacturer, Universitas Khairun Production House. The Head of Production House Universitas Khairun and the staff members participated in this study as respondents. The Head of Production House Universitas Khairun and the staff were interviewed, and the manufacturing process of canned vegetable candles was observed in order to gather data.

Value Added Analysis

Value added was examined using Hayami's methodology (Hayami et al., 1987). Three variables made up the Hayami table: output, input, price, income, benefits, and reimbursement for production factor services.

Matrix of Internal Factor Evaluation (IFE) and External Factor Evaluation (EFE)

A technique for evaluating a company's internal status in terms of its strengths and weaknesses (S and W) is the IFE matrix. Unlike IFE, the EFE matrix is a tool for evaluating outside factors that impact the company. The company's opportunities

and threats (O and T) are assessed (Keller, 2016). Both techniques are used to gather data regarding the company's internal and external aspects for use in SWOT analysis and the Internal-External (IE) matrix, among other analyses.

Each factor must have a rating between 1 and 4 and a value between 0.0 (low relevance) and 1.0 (great importance). Significant strength is represented by number four in the IFE matrix, minor strength by number three, minor weakness by number two, and significant weakness by number one. The EFE matrix identifies a superior answer as number 4, an above-average response as number 3, an average response as number 2, and a poor reaction as number 1 (Leliga et al., 2019).

Table 1. Hayami Table for Value Analysis

No	Variable	Equation
I	**Output, Input, Price**	
A	Input (kg)	A
B	Output (kg)	B
C	Labor	C
D	Output Price (per 100 can)	D
E	Conversion Factor	$F = A/B$
F	Average Labor Wages	E
G	Labor Coefficient	$F = C/B$
II	**Revenue and Benefits**	
A	Raw Material Prices	H
B	Other Input Donation	I
C	Output Value	$J = D \times F$
D	a. Value Added	$K = J - H - I$
	b. Value Added Ratio	$L = K / J \times 100 \%$
E	a. Labor Income	$M = E \times G$
	b. Percentage of Labor Contribution	$N = M / K \times 100 \%$
F	a. Processing Advantages	$O = K - M$
	b. Profit Rate	$P = O / J \times 100 \%$
III	**Repayment for Production Factor Services**	
A	Profit Margin	$Q = J - H$
B	a. Labor Income	$R = M / Q \times 100 \%$
	b. Other Input Contributions	$S = I / Q \times 100 \%$
	c. The Advantage	$T = O / Q \times 100 \%$

Source: Hayami et al. (1987)

Matrix of Internal-External (IE)

The outcomes of the IFE and EFE matrix analyses are combined to generate the IE matrix. IFE and EFE scores are used to partition the IE matrix into nine quadrants. The IE matrix can be divided into three groups (David, 2015), namely:

Quadrant I, II, and IV: growth and build. Product creation, market penetration, and forward, backward, and horizontal integration are methods that work well for

these quadrants. Hold and maintain in quadrants III, V, and VII. Product development and market penetration are tactics that work well for these quadrants.

Harvest and divest in Quadrants VI, VIII, and IX. Revocation and retrenchment are methods that work well for these quadrants.

Table 2. IE Matrix

	IFE Total Weighted Score		
	Strong (3.00 to 4.00)	Average (2.00 to 2.99)	Weak (1.00 to 1.99)
EFE Total Weighted Score	High (3.00 to 4.00) — I	II	III
	Medium (2.00 to 2.99) — IV	V	VI
	Low (1.00 to 1.99) — VII	VIII	IX

Source: David (2015)

SWOT Analysis

Using both internal and external viewpoints, SWOT analysis can be used to identify a company's, organization's, strategy, individual, project, or business activity's strengths, weaknesses, opportunities, and threats (Quezada et al., 2019). While external perspective reveals the subject's prospects and threats, internal viewpoint highlights the subject's strengths and limitations (Agyekum et al., 2020). SWOT analysis is mostly used to assess the state of the business in order to make more strategic plans (Gurel & Tat, 2017). A comprehensive interview was conducted with the Head of Khairun University Production House and all employees to learn more about the benefits, drawbacks, prospects, and risks of the canned vegetable candle. SWOT analysis was used to create the growth strategy for the canned vegetable candle industry.

SWOT stands for opportunities, threats, weaknesses, and strengths. SWOT analysis is a technique used to identify suitable strategies for a company's development, according to Wang et al. (2024). Information regarding the benefits, drawbacks, opportunities, and risks of the canned vegetable candle sector was obtained from the interview and discussion with the chairman of Khairun University Production House.

RESULT AND DISCUSSION

Canned Vegetable Candle

There were two steps involved in making a canned vegetable candle. Making a veggie candle was the first step, and canning was the second. There were two steps in the process of creating a veggie candle. Preparing the sugarcane blooms was the first step. The sugarcane blossoms' heads were removed from their sheaths. After being cleaned with fresh water, it was steam-cooked for ten minutes. Making the coconut soup was the second step. Coconut cream, chilli, turmeric, lemongrass, ginger, bay leaf, garlic, shallot, caraway seeds, coriander seeds, candlenut, vegetable oil, sugar, salt, and chicken stock powder, were the components of coconut soup. Using a blender, spices were mashed until they were smooth. After that, the spice

mixture is sautéed for five minutes in heated vegetable oil. The fried spices were covered with coconut milk and stirred to create a soup. Finally, salt, sugar, and chicken stock powder were added to the coconut soup.

Table 3. Canned vegetable candles' added value

No	Variable	Equation	Value
I	Price, Input, and Output		
A	Input (kg)	A	10
B	Output (kg)	B	20
C	Labor	C	3
D	Factor of Conversion	D = A/B	2
E	Coefficient of Labor	E = C/B	0.3
F	Output Price (per 100 can)	F	1,971,900
G	Average Labor Wages	G	300,000
II	Income and Advantages		
A	Other Input Donation	I	630,000
B	Raw Material Prices	H	530,600
C	Output Value	J = D x F	3,943,800
D	1. Value Added	K = J - H – I	2,783,200
	2. The ratio of value added	L = K / J x 100 %	70.57
E	3. Labor Income	M = E x G	90,000
	4. Labor Contribution Percentage	N = M / K x 100 %	3.23
G	5. Benefits of Processing	O = K – M	2,693,200
	6. Profit Rate	P = O / J x 100 %	68.29
III	Payment for Services Provided by Production Factors		
A	Profit Margin	Q = J - H	3,413,200
B	1. Labor Income	R = M / Q x 100 %	2.64
	2. Additional Input Contributions	S = I / Q x 100 %	18.46
	3. The Advantage	T = O / Q x 100 %	78.91

The six-step canning procedure was based on an earlier approach (Dhuey et al. 2022). The filling process was the first step. The can was filled with coconut soup and boiled sugarcane flower heads. The can containing the vegetable candle was heated for fifteen minutes as part of the second exhausting procedure. The sealing process was the third phase. After the laborious procedure, the can was sealed right away. It can be tested to see if it was properly sealed. After that, the canned vegetable candle was sterilized for 30 minutes at 121 °C. The can was then immediately cooled in cold water following sterilization. Before it could be commercialized, a 50-day quarantine was the final step.

Canned vegetable candles' added value

A technique for calculating the worth of producing something from basic components is value-added analysis. This analysis considers some aspects such as investment, profitability, and cash flow variables (Benzaghta et al., 2021). Value-

added analysis is based on economic profit. Profit is used to gauge how well a business is performing (Tortella & Brusco, 2003). The Hayami approach was employed to examine the value added of canned vegetable candle. This approach took into account revenue and benefits, output, input, and price, as well as reimbursement for production factor services (Hayami et al., 1987).

Value-added analysis was used to calculate the canned vegetable candle's economic worth. The results showed that canned vegetable candles had a respectable value added. The canned vegetable candle had a value addition of Rp 2783200 per hundred cans. 70.57% of canned vegetable candles had value added. A high value-added ratio (>70%) was assigned to it. A product with a value added ratio more than 50% can be developed (Jakub et al., 2015).

IFE Matrix of Canned Vegetable Candle

A technique for assessing a company's strengths and shortcomings based on internal management aspects is the IFE matrix (Wahyudin et al, 2024). Four strengths and three weaknesses were found in the canned vegetable candle made by Universitas Khairun Production House. While the canned vegetable candle's weaknesses were its drawbacks, its strengths were its advantages.

Table 4. Canned Vegetable Candle Internal Factor Evaluation (IFE) Matrix

No	Internal Strategy Factors	Value	Rating	Score (Value x Rating)
I	Strengths			
A	No one has canned any Candle made of vegetables	0.141	3	0.423
B	Quick and ready to eat	0.159	4	0.636
C	Long-term storage (1-2 years)	0.172	4	0.688
D	Distributable	0.122	3	0.366
	Total	0.594		2.113
II	Weaknesses			
A	The raw material is difficult to find	0.144	2	0.288
B	The locals are not familiar with canned traditional foods	0.123	2	0.246
C	Vegetable candles in plastic packaging cost less than those in cans	0.139	2	0.278
	Total	0.406		0.812
	Weighted Total	1.000		2.925

The canned vegetable candle's strength points received a total score of 2.113 and a total value of 0.594. The entire score for the canned vegetable candle's weaknesses was 0.406, which was less than the total score for its virtues, which was 0.812. The canned vegetable candle received an IFE weighted total score of 2.925. The vegetable candle fell under the average range of 2.00 to 2.99.

A technique for assessing opportunities and dangers based on a company's external influences is the EFE matrix. Threats represent negative elements, while

chances represent favorable ones. As part of the IE matrix analysis, it is computed in a manner akin to that of IFE (Amirshenava & Osanloo, 2022). Possibilities include: There were two threat points and three opportunity points for the canned vegetable candle's.

EFE Matrix of Canned Vegetable Candle

The results of the EFE Matrix analysis presented in Table 5 show a comprehensive picture of the external conditions affecting the organization. The identified opportunities and threat factors are then weighed and assessed resulting in a total score that reflects the extent to which the company is able to respond to the dynamics of the external environment.

Table 5. External Factor Evaluation (EFE) Matrix of Canned Vegetable Candle

No	Factors of External Strategy	Value	Rating	Score (Value x Rating)
I	Opportunities			
A	A longer shelf life expands the market	0.206	3	0.618
B	There are no competitors for the canned vegetable candle	0.187	3	0.561
C	Canned vegetable candles are used to promote traditional Indonesian cuisine	0.132	3	0.396
	Total	0.525		1.575
II	Threats			
A	To compete with another traditional canned food will be difficult	0.212	3	0.636
B	Distribution expenses for markets outside of North Maluku are high	0.263	3	0.789
	Total	0.475		1.425
	Weighted Total	1.000		3.000

Opportunity points of canned vegetable candle had a total value of 0.525 and a total score of 1.575. Opportunities have a higher total value and score than threat points for the canned vegetable candle. Its total score was 1.425, and its total value was 0.475. The overall EFE weighted score was 3.000. According to the EFE total weighted score, it falls into the high category (3.00–4.00).

IE Matrix of Canned Vegetable Candle

Internal-external matrix evaluation is the result of combining internal and external factor evaluation. The degree of vulnerability is reflected in the score. According to Aryee et al. (2024), the position in the IE matrix that results in the optimal strategy is the sustainable choice. The canned vegetable candle had an average (2.00-2.99) IFE total weighted score with a total score of 2.925 and a high (3.00-4.00) EFE total weighted score with a total score of 3.000, per previous study.

Table 6. Internal-External (IE) Vegetable Candle Canned Matrix

IFE Total Weighted Score

EFE Total Weighted Score		Strong (3.21 to 4.12)	Average (2.33 to 3.10)	Weak (1.26 to 2.01)
	High (4.00 to 4.56)	I	II	III
	Medium (2.25 to 3.10)	IV	V	VI
	Low (1.14 to 2.01)	VII	VIII	IX

Based on its IFE and EFE weighted total score, a canned vegetable candle was assigned to quadrant number II. The term "growth and build" is used to describe Quadrant II. An intensive approach or integrated strategy, such as product development, market expansion, and market penetration, would be advantageous for this company (Ogundipe et al., 2024).

SWOT analysis and canned vegetable candle development strategies

The supply of raw materials (sugarcane blossom), a lack of public marketing, rivalry from conventional canned foods, and the distribution chain were some of the challenges faced by canned vegetable candles. Applying strategies based on SWOT analysis included enlisting the help of the local government and relevant private sector, promoting online and offline, working with local farmers to ensure raw material supply, evaluating and developing master receipts, conducting market and distribution chain research, and evaluating the production process.

CONCLUSION

As a national cultural heritage, vegetable candles are one of the traditional foods from eastern Indonesia that must be preserved. Because of its genuine worth, vegetable candles are another possible food product to produce. Vegetable candles are now more convenient to distribute and have a longer shelf life thanks to innovations like canning. According to value-added analysis, the canned vegetable candle's value-added ratio was 70.57%, making development possible. The canned vegetable candle was classified as a growth and build business in quadrant II due to its strong EFE score and average IFE score. Planning solutions to grow the canned vegetable candle industry were presented using SWOT analysis. Product and market development, distribution chain assessment, online and offline advertising, and collaboration with the public sector, farmers, and local government were the suitable tactics to implement.

In order to determine the added value of a product that is widely accepted by consumers, more research on the degree of consumer acceptance of canned vegetable candles must be conducted by contrasting consumers who are accustomed to using them with those who are using them for the first time.

AUTHOR CONTRIBUTION STATEMENT

Author Contribution Statement: [Author 1]: Developed research concept, analyzed product problems, collected data, drafted initial manuscript; [Author 2]: Developed research roadmap, analyzed field data, drafted article; [Author 3]: Developed research method, analyzed data, interpreted data. [Author 4]: Analyzed data, compiled questionnaire results, calculated systematic SWOT analysis; [Author 5]: Developed ideal research concept, conducted interviews with respondents.

[Author 6]: Edited article, created research documentation, interpreted research data;
[Author 7]: Collected field data, analyzed in detail, submitted article to journal.

DECLARATION OF COMPETING INTEREST

There are no conflicts of interest pertaining to the production, analysis, or writing of this scientific publication, according to the authors. Every step of the study process was carried out independently and impartially, including planning, data collecting, analysis, preparation, and publication of the findings. No one's institutional, commercial, or personal interests had an impact on this study. Additionally, the authors affirm that there are no financial ties, unreported financing, or other types of payments that might affect how the study's findings and data are interpreted. As a result, the conclusions and suggestions made in this article accurately represent the outcomes of truthful, open, and ethically sound research.

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ETHIC STATEMENT

Since there were no medical procedures, human experiments, or therapies that would have put participants in danger physically, psychologically, or socially, ethics review and approval were not required for this study. Non-invasive interviews, broad, non-sensitive secondary data analysis, and observation were used to gather data. All steps of the research procedure were carried out in accordance with ethical research norms, such as scientific integrity, analytical objectivity, and data confidentiality. As a result, this project is classified as low-risk research and does not need formal ethical committee approval.

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