Nutritional Analysis and Economic Viability of Fried Ube Noodles: A Comprehensive Study

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Abstract

Purpose of the Study: Ube has a significant production volume in Quirino Province, but it faces challenges in generating high profits due to limited post-harvest activities and low awareness of its nutritional composition. To address these issues, this comprehensive evaluation aims to examine the nutritional value, financial viability, and profitability of fried ube noodles.

Methodology: Ube-based products' nutritional value is analyzed using the IPO model and various methods such as the Biuret Method and Moisture Analyzer. The study also evaluates manufacturing costs and profitability using gross profit margin (GPM), net profit margin (NPM); and return on investment (RoI).

Main Findings: The analysis demonstrates that the product is profitable, with a GPM of 54.35%, NPM of 19.43%, and ROI of 24.11%. The 6 Ps study suggests various strategies, including awareness campaigns, involvement of health professionals, product diversification, collaborations with local farmers, research publication, patent opportunities, and lobbying for industry policies.

Implications: These strategies leverage the nutritional value of fried ube noodles to increase market visibility and support sustainable growth across People, Services, Products, Places & Partnerships, Publication, Patents, and Policy. The study provides fried ube noodle operators with comprehensive information for decision-making and strategic planning.

INTRODUCTION

Globally, snacks are highly sought-after products due to their convenience, diverse range, and superior quality (Katare & Anute, 2021). Additionally, their portability makes them easily transportable between different locations (Adejuwon et al., 2020). Snack food consumption is steadily rising due to urbanization and sociological trends (Bayomy & Alamri, 2022). Various types of snacks include pretzels, cookies, noodles, sticks, and biscuits (Chen et al., 2020). Noodles, which are primarily made from cereals, often lack essential amino acids such as tryptophan, threonine, and lysine (Cheng et al., 2021). Lysine deficiency affects the synthesis of proteins, hormones, enzymes (Puligundla & Lim, 2021; Fajri et al., 2017), and antibodies, which are vital for growth and bodily processes (Marudhadurai, 2020).

The noodles market is anticipated to reach a value of US$27.8 billion by 2026 with a compound annual growth rate (CAGR) of 4% (Obadi et al., 2022; Phong & Yenradee, 2020). Noodles are popular in Asian countries due to their convenient preparation and long shelf life (Andriana et al., 2021). In the Philippines, improving nutritional security, income, and employment through efficient food processing and value addition is crucial (Sasongko et al., 2020; Nawaz et al., 2021). Despite achieving self-sufficiency in grain production, agriculture faces challenges such as low returns, shrinking farm holdings, stagnant productivity, and inadequate research and extension support for secondary agriculture, including food processing and value addition (Elisabeth et al., 2020).

The Ube industry in Quirino province faces challenges with high post-harvest losses, resulting in low profits and a small share for farmers in consumer prices compared to other regions (Colpo et al., 2022; Susanto et al., 2023). Additionally, there is limited awareness of the nutritional contents, financial feasibility, and profitability associated with Ube production (Hussin et al., 2020). Extensive research on the nutritional composition and economic viability of Ube production is lacking (Ge et al., 2022; Tian, Wei, & Chen, 2022), and strategies to maximize profitability in this market segment have not been well investigated (Meenu et al., 2023). These gaps hinder well-informed decision-making and the optimization of economic and nutritional advantages of Ube.

Therefore, this study aims to develop fried Ube noodles and provide detailed information on their nutritional components and economic feasibility. The results will fill these gaps and offer crucial information for consumers, farmers, and

entrepreneurs. Understanding the nutritional composition of Ube noodles will help individuals make informed decisions about their diet.

Additionally, a comprehensive study of financial feasibility and profitability is essential for entrepreneurs interested in investing in or improving their position in the market. Furthermore, this research contributes to the promotion of sustainable business practices in the Ube noodle industry, ensuring economic growth and fostering healthier eating options. Thus, appropriate strategies are needed to increase farmer's income and awareness, sustain Ube productivity and profitability, and maintain the interest of farmers and their children in farming Ube commodities.

OBJECTIVES OF THE STUDY

Generally, this study intends to evaluate the nutritional composition and analyze the financial viability and profitability of fried ube noodles.

Specifically, the study aimed to:

1. Evaluate the nutritional composition of fried ube noodles in terms of nutritional values and proximate content.
2. Establish financial viability of fried ube noodles.
3. Analyze the profitability of fried ube noodles in terms of gross profit margin (GPM), net profit margin (NPM); and return on investment (RoI).
4. Propose strategies aligned on the 6 Ps project output (People Services, Products, Places & Partnerships, Publication, Patents and Policy).

CONCEPTUAL FRAMEWORK

This section presents the conceptual framework for the study, utilizing the IPO model (Input, Process, and Output) to demonstrate the research interest. Brown's 1996 framework, also known as the IPO model, suggests that this model represents one end of a spectrum ranging from hierarchical to process-focused frameworks (Neely et al., 2000). The input component encompasses the developed product based on ube, specifically fried ube noodles. The process component involves analyzing the nutritional values (protein, lipid, fiber, carbohydrates, and metabolized energy [ME]) and proximate content (moisture and ash content) of the fried ube noodles.

Additionally, the financial viability analysis includes projected sales, cost of sales, total gross profit, other production costs, and total net profit. Moreover, profitability analysis is conducted using profitability ratios such as gross profit margin, net profit margin, and return on investment. Furthermore, the output component encompasses the overall results of the analysis, including proposed strategies for the 6Ps project output of fried ube noodles.

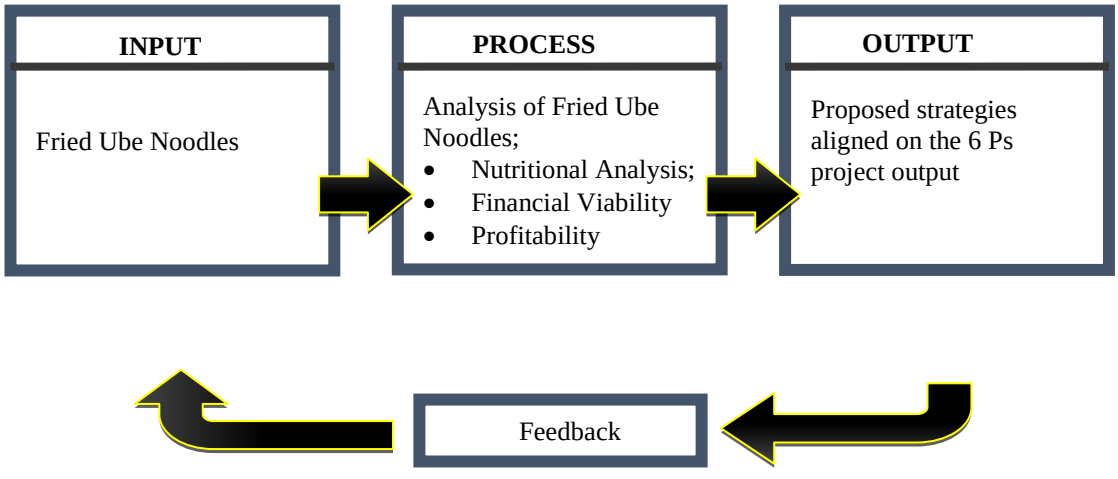

Figure 1: Research Paradigm (IPO)

RESEARCH METHODOLOGY

Nutritional Analysis

The study employed a pasta (noodles) procedure for preparing fried ube noodles, which underwent nutritional analysis as outlined in the following process. Furthermore, the study utilized various methods of chemical analysis, including the Biuret Method, Folch, Raghuramalu, Randive, and Moisture Analyzer. The Biuret Method is a chemical test used to determine the presence of peptide bonds in an analyte. It enables the estimation of protein content. When peptides are present, the copper (II) ion forms pale purple (or mauve) coordination complexes in an alkaline solution. The Folch method, a popular technique for lipid extraction from biological samples, utilizes a biphasic solvent system consisting of chloroform, methanol, and water in a volumetric ratio of 8:4:3 (v/v/v).

The Raghuramalu method was employed to determine the total fiber, carbohydrate, metabolized energy (ME), and ash content of the fried ube noodles. The Randive method estimates the metabolizable energy (ME) content of practical dry canine diets using the formula: metabolizable energy (MENRC, kcal/g) = 3.50 x crude protein + 8.46 x acid ether extract + 3.50 x nitrogen-free extract. This method, recommended by the National Research Council (NRC), assumes fixed digestibility for each nutrient. Additionally, the moisture analyzer was utilized to determine the water content through spectroscopic, chemical, conductivity, and thermogravimetric analysis.

Financial Analysis

Lastly, financial viability analysis was conducted to determine the overall production cost and projected profit. It served as a tool for devising profitability ratios.

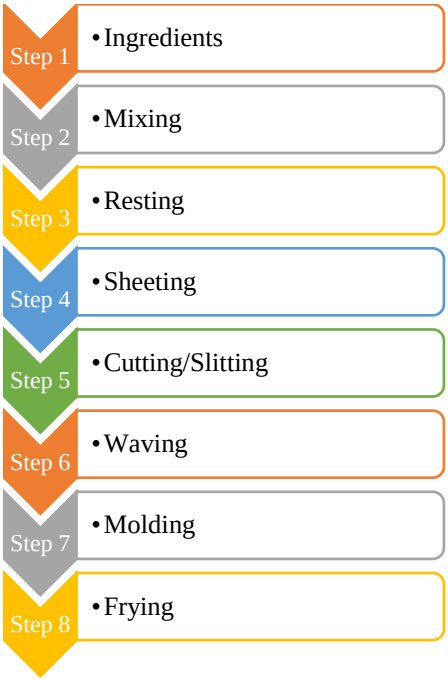

Figure 2: Preparation Process of Fried Ube Noodles

RESULTS AND DISCUSSION

The foregoing tables illustrate the results and interpretive discussions in the nutritional composition, financial viability, and profitability of fried ube noodles.

Nutritional Composition of Fried Ube Noodles

The nutritional analysis of fried Ube noodles reveals a diverse composition, showcasing significant amounts of essential elements. These noodles offer a nutritious option, being packed with vitamins, minerals, and antioxidants. Their unique blend of nutrients enhances the selection of a healthy diet, promoting overall health and well-being. The results of the nutritional composition analysis for fried Ube noodles, presented in Table 1, provide valuable insights into the potential health benefits and dietary implications of consuming this distinct culinary delicacy. By employing various analytical techniques such as the Biuret Method for total protein measurement, the Folch method for total lipid determination, and the Raghuramalu method for assessing total fiber and carbohydrate content, a comprehensive evaluation of the noodle's nutritional composition is ensured.

Table 1: Nutritional Composition of Fried Ube Noodles in terms of Nutritional Values

Sample Description	Method Employed	Result
Total Protein	Biuret Method	0.205 g in every 5g of the sample
Total Lipid	Folch	0.2842 g in every 1g of the sample
Total Fiber	Raghuramalu	0.7158 g in every 1g of the sample
Total Carbohydrate	Raghuramalu	74.18 g in every 100 g of the sample
Metabolized Energy (ME)	Randive	633.66 Kcal/100g of the sample

***Laboratory Service Analysis Report*

The study demonstrates that fried Ube noodles are a significant source of protein, containing 0.205 g per 5g of the sample. This aligns with other studies emphasizing the importance of consuming protein for maintaining muscle health and overall body functions (Herawati et al., 2020). The presence of 0.2842 g of lipids per 1g of the sample suggests a well-balanced fat composition, contributing to the overall energy density of the noodles (Lamy et al., 2022).

Moreover, the substantial amount of fiber, specifically 0.7158 g per 1g of the sample, underscores the potential digestive health benefits associated with consuming these noodles (Li et al., 2020; Li et al., 2022). The fried Ube noodles sample contains a significant amount of 74.18 g of total carbohydrates per 100 g, making it a considerable source of energy, consistent with research highlighting the role of carbohydrates as the primary energy generator (Pan et al., 2020).

The noodles' caloric density is highlighted by the metabolized energy value of 633.66 Kcal/100g, indicating that they are a satisfying and high-energy option for a diet (Phuyal et al., 2020). In summary, the findings of the nutritional analysis underscore the potential of fried Ube noodles to serve as a well-balanced and nourishing food choice, promoting both gustatory satisfaction and dietary well-being.

The results presented in Table 2, which outline the proximate composition of fried Ube noodles, provide valuable insights into their composition, specifically regarding moisture content and total ash. The moisture content, determined using a Moisture Analyzer, is found to be 24.80%. This finding holds significance as moisture content directly impacts the texture, shelf life, and overall quality of the noodles (Prerana & Anupama, 2020; Litaay et al., 2022). The moderate moisture level indicates a balanced combination of dryness and moisture, enhancing the taste and appeal of the noodles.

Table 2: Nutritional Composition of Fried Ube Noodles in terms of Proximate Content

Sample Description	Method Employed	Result
Moisture Content	Moisture Analyzer	24.80%
Total Ash	Raghuramalu	0.0151 g in every 1g of sample

***Laboratory Service Analysis Report*

Furthermore, the Raghuramalu technique reveals that the sample has a total ash concentration of 0.0151 g per 1g of the sample. The presence of ash content in food indicates its mineral composition and serves as a measure of inorganic residue (Son, 2020). The low ash concentration in Ube noodles indicates a minimal amount of mineral residue, consistent with the fact that noodles are typically not significant contributors of minerals in the diet (Xiong et al., 2021; Soncin Alfaro et al., 2022).

These findings hold importance for both consumers and food manufacturers. The moisture content reveals the textural characteristics of the noodles, ensuring consumer satisfaction, while the low ash content underscores the relatively low mineral contribution of the noodles to the overall diet. In summary, the proximate content analysis provides valuable information about the physical and mineral properties of fried Ube noodles. This study aids in understanding consumer preferences and improving production processes in the food industry.

Table 3 presents a comprehensive breakdown of the total expenses involved in the production of fried Ube noodles per kilogram, offering a detailed perspective on manufacturing costs. The subtotal of Php 95.80 is attributed to direct materials, which include Ube, iodized salt, All Purpose Flour (AFP), and packaging. A thorough breakdown of costs is vital for businesses seeking to optimize ingredient sourcing and streamline production processes (Obadi et al., 2022). Ube, as a fundamental component, significantly influences the overall material costs.

Financial Viability of Fried Ube Noodles

Table 3: Total Production Costs of Fried Ube Noodles per Kilo

Particulars	Quantity	Unit	Price	Total (Php)
Direct Materials:				
Ube	1	kilo	45	45.00
Salt (iodized)	8	grams	100/kl	.80
All Purpose Flour (AFP)	1	kilo	50	50.00
Packaging	11	pcs	5	55.00
Subtotal				**95.80**
Other Expenses:				
Direct Labor	45 mins.	Man/day	350	32.85
Utilities Expense				10.00
Miscellaneous/Contingency				50.00
Subtotal				**92.85**
Overall Total				**188.65**

Furthermore, additional costs such as labor, utilities, and miscellaneous/contingency charges amount to Php 92.85. Understanding the expenses associated with labor and utilities is crucial for enhancing production efficiency and maximizing profitability (Sasongko et al., 2020). By including miscellaneous expenses, the study acknowledges the importance of accounting for unexpected costs, thereby improving practical applicability.

The total production cost per kilogram is Php 188.65. The findings of this study have significant implications for both manufacturers and consumers. Manufacturers can utilize this information to develop pricing and cost management strategies, ensuring economic viability. It provides consumers with an understanding of the economic factors that impact

the retail price of fried Ube noodles. In conclusion, this cost analysis offers valuable economic insights for the overall study, guiding sustainable business strategies in the fried Ube noodle industry.

Table 4 presents a comprehensive breakdown of the total production costs of fried Ube noodles per day, offering a detailed overview of the financial implications associated with daily manufacturing. The direct materials, including Ube, iodized salt, All Purpose Flour (AFP), and packaging, amount to a subtotal of Php 1,206.40. This breakdown enables manufacturers to assess the daily expenditure on materials, facilitating efficient inventory management and procurement practices (Son, 2020; Tian, Wei, & Chen, 2022). Ube, as a significant component, has a substantial impact on the daily material costs.

Table 4: Total Production Costs of Fried Ube Noodles per Day

Particulars	Quantity	Unit	Price	Total (Php)
Direct Materials:				
Ube	8	kilo	45	360.00
Salt (iodized)	64	grams	100/kl	6.40
All Purpose Flour (AFP)	8	kilo	50	400.00
Packaging	88	pcs	5	440.00
Subtotal				**1,206.40**
Other Expenses:				
Direct Labor	1	Man/day	350	350.00
Utilities Expense				80.00
Miscellaneous/Contingency				400.00
Subtotal				**922.85**
Overall Total				**2,129.25**

Furthermore, other expenses such as direct labor, utilities, and miscellaneous/contingency costs contribute to a subtotal of Php 922.85. Understanding the daily costs of labor and utilities is crucial for operational planning and financial management (Zhang et al., 2023). The inclusion of miscellaneous expenses acknowledges the need to account for unforeseen daily costs, enhancing the practical applicability of the study.

The total daily production cost amounts to Php 2,129.25. This result holds profound implications for manufacturers, providing crucial insights into the daily economic aspects of producing fried Ube noodles. It assists in pricing strategies, profit forecasting, and ensuring business sustainability, offering valuable economic perspectives to the study and guiding informed decision-making within the fried Ube noodle industry.

Table 5 presents the income statement of fried Ube noodles per day, offering a comprehensive view of the economic landscape of the production process. The total sales amounted to Php 2,642.64, based on the sale of 88 pieces of fried Ube noodles at a price of Php 30.03 each. After deducting the cost of sales, which includes Ube, iodized salt, All Purpose Flour (AFP), and packaging, the gross profit margin stands at Php 1,436.24. This gross profit margin is essential for evaluating the product's profitability and understanding the economic viability of fried Ube noodles in the market (Cheng et al., 2021).

Table 5: Income Statement of Fried Ube Noodles per Day

Particulars		
Sales:		
88 pcs fried ube noodles X 30.03		2642.64
Less Cost of Sales:		
Direct Materials:		
Ube	360.00	
Salt (iodized)	6.40	
All Purpose Flour (AFP)	400.00	
Packaging	440.00	
Total of Cost of Sales		1,206.40
Gross Profit Margin		**1,436.24**
Less Other Expenses:		
Direct Labor	350.00	
Utilities Expense	80.00	
Miscellaneous/Contingency	400.00	
Total of Other Expenses		**922.85**
Net Profit		**513.39**

***Pricing use cost-plus pricing

Cost-Plus Pricing:

CPP = Total Variable Cost/Total Output X (1+mark-up amount)

CPP = 2,129.25/88 X (1+4.84)

CPP = 30.03

By subtracting other expenses, such as direct labor, utilities, and miscellaneous/contingency costs, a net profit of Php 513.39 is obtained. The application of cost-plus pricing principles, incorporating a mark-up of 4.84, validates the calculated selling price of Php 30.03 per piece. This pricing strategy is crucial for businesses to ensure profitability and sustainability in the competitive market (Katare & Anute, 2021).

These results hold significant implications for entrepreneurs and investors, providing insights into the financial viability and profitability of producing fried Ube noodles. It aids in strategic decision-making, pricing strategies, and overall business planning, contributing valuable economic perspectives to the study and guiding informed choices within the fried Ube noodle industry.

Profitability of Fried Ube Noodles

a. Gross Profit Margin (GPM)

$$GPM = \frac{Sale - Cost\ of\ Sales}{Sales} X100$$

$$GPM = \frac{2642.64 - 1,206.40}{2642.64} X100$$

GPM = 54.35%

The gross profit margin of the fried ube noodles is 54.35% which means that for every peso sale, the profit obtained is 54.34 centavos before deducting all expenses incurred in the operation.

b. Net Profit Margin (NPM)

$$NPM = \frac{Net\ Income}{Sales} X100$$

$$NPM = \frac{513.39}{2642.64} X100$$

NPM= 19.43%

The net profit margin of the fried ube noodles is 19.43%. This signifies that for every peso sale there is a net profit of 19.43.

c. Return on Investment (ROI)

$$ROI = \frac{Net\ Income}{Total\ Assets} X100$$

$$ROI = \frac{513.39}{2129.25} X100$$

ROI= 24.11%

The return on investment of the fried ube noodles is 24.11%. This indicates that there will be a return of 24.11 centavos for every peso invested.

Table 6 presents the profitability ratios of fried Ube noodles, offering key insights into the product's financial health and success. The Gross Profit Margin (GPM) of 54.35% represents the percentage of revenue retained after deducting the cost of goods sold, highlighting the strong financial performance of the product (Elisabeth et al., 2020). This high GPM indicates effective management of the production process, contributing positively to overall profitability.

Table 6: Profitability Ratios of Fried Ube Noodles

Particulars	Results
Gross Profit Margin (GPM)	54.35 %
Net Profit margin (NPM)	19.43 %
Return on Investment (ROI)	24.11 %

The Net Profit Margin (NPM) of 19.43% provides a glimpse into the portion of revenue that translates into profit after accounting for all expenses. This ratio reflects the product's efficiency in generating profit from sales, which is crucial for long-term sustainability (Lamy et al., 2022). The substantial NPM suggests effective cost management and a healthy bottom line.

Additionally, the Return on Investment (ROI) of 24.11% measures profitability in relation to the investment made. This ratio emphasizes the efficiency of the capital employed, demonstrating the potential for investors to gain returns on their investment in the production of fried Ube noodles (Litaay et al., 2022).

These profitability ratios collectively indicate the economic viability and financial success of fried Ube noodles, providing entrepreneurs and investors with valuable metrics for decision-making and strategic planning within the competitive food industry.

PROPOSE STRATEGIES ALIGNED ON THE 6 PS PROJECT OUTPUT

Based on the nutritional composition analysis and financial viability results of fried Ube noodles, several strategies can be proposed aligned with the 6 Ps: People Services, Products, Places & Partnerships, Publication, Patents, and Policy presented in the table below.

Table 7: Proposed strategies aligned on the 6 Ps project output

6Ps	Strategies
People Services:	• Launch awareness campaigns aimed at educating consumers about the nutritional benefits of fried Ube noodles, emphasizing its high protein content, balanced lipid profile, significant fiber content, and energy density. • Collaborate with nutritionists or health professionals to endorse fried Ube noodles as a healthy dietary option, specifically targeting health-conscious consumers.
Products:	• Introduce a variety of flavors and nutritional enhancements to the fried Ube noodles product line to cater to diverse consumer preferences and dietary needs. • Explore the possibility of creating a "health-focused" product line by incorporating functional ingredients known for their specific health benefits.
Places & Partnerships:	• Establish partnerships with local farmers or Ube producers to ensure a consistent supply of high-quality Ube, fostering community involvement and supporting local agriculture. • Collaborate with grocery stores, health food retailers, and online platforms to expand distribution channels, making the product more readily available to a wider audience.
Publication:	• Publish research articles or whitepapers that provide detailed information on the nutritional composition and health benefits of fried Ube noodles, positioning the product as a scientifically supported and nutritious food choice. • Engage with food bloggers and influencers to create content that highlights the unique features and culinary versatility of fried Ube noodles.
Patents:	• Explore the potential for patenting any unique processing methods or formulations used in creating fried Ube noodles, establishing a competitive advantage in the market. • Secure intellectual property rights for any innovative technologies or techniques employed in the production process.
Policy:	• Advocate for food industry policies that encourage the inclusion of nutritious ingredients in processed foods, promoting healthier product options for consumers. • Engage with regulatory bodies to establish quality standards for fried Ube noodles, ensuring transparent labeling and accurate representation of nutritional content.

These strategies aim to capitalize on the nutritional strengths of fried Ube noodles, enhance market visibility, and foster sustainable growth while addressing various aspects of the 6 Ps framework.

CONCLUSIONS AND FUTURE WORKS

In conclusion, the comprehensive analysis of the nutritional composition and financial viability of fried Ube noodles provides valuable insights into the potential health benefits, economic implications, and overall feasibility of introducing this culinary delicacy to the market. The nutritional analysis reveals that the noodles are a rich source of essential elements, offering significant amounts of protein, well-balanced lipids, substantial fiber, and a considerable energy density. These findings align with existing literature, highlighting the importance of protein consumption for muscle health and emphasizing the balanced fat composition that contributes to the overall energy density of the noodles.

Furthermore, the analysis underscores the potential digestive health advantages associated with the significant fiber content, positioning the noodles as a notable source of energy due to their high carbohydrate content. The caloric density further solidifies their position as a satisfying and high-energy dietary option. Collectively, the nutritional composition analysis positions fried Ube noodles as a balanced and nourishing choice, promoting both gustatory satisfaction and dietary well-being.

On the financial front, the cost analysis and profitability ratios offer crucial insights into the economic aspects of producing fried Ube noodles. The detailed breakdown of production costs per kilogram and per day provides manufacturers with essential information for optimizing ingredient sourcing, streamlining production processes, and ensuring economic viability. The income statement and profitability ratios, including Gross Profit Margin (GPM), Net Profit Margin (NPM), and Return on Investment (ROI), highlight the strong financial performance of the product. The high GPM suggests efficient management of the production process, while the NPM and ROI indicate effective cost management and the potential for investors to gain returns on their investment.

For future work, conducting consumer studies to assess the market acceptance of fried Ube noodles would be beneficial, considering taste preferences, cultural perceptions, and willingness to pay for a nutritious and economically viable product. Additionally, exploring sustainable sourcing practices for Ube and incorporating eco-friendly packaging could enhance the product's market appeal. Continuous research and development efforts can focus on further nutritional enhancements or alternative formulations to cater to specific dietary needs and preferences. Overall, this study serves as a foundation for informed decision-making in the fried Ube noodle industry, offering a blend of nutritional and economic perspectives for both consumers and manufacturers.

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