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# Fostering CLSU-Student Entrepreneurship through Production and Marketing of Chocolate-Flavored Goat Milk

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## Abstract

The study evaluated the financial viability and market acceptability of chocolate-flavored goat milk as a micro-sale, technology-based enterprise operated by student entrepreneurs under a university-supported enterprise program (DOST-DATBED). Twelve fourth-year BS Agriculture students specializing in small ruminant production were provided with seed capital, access to the university-based milk processing laboratory, and a two-day training on goat milk processing, quality control, and basic enterprise management. Market acceptability was assessed through consumer-oriented sensory evaluation involving 100 respondents who rated product attributes using a 9-point hedonic scale and expressed willingness to pay (WTP) through a 5-point purchase intent scale. Profitability was evaluated using cost and return analysis based on production records over the five-month period. Results showed high consumer acceptance, with mean sensory scores ranging from 8.45 to 8.66, and 85–86% of respondents expressing willingness to pay for both the 500 ml and 1 L package sizes. A total of 650 L and 670 L of chocolate-flavored goat milk were produced and marketed by the two groups, generating net incomes of PhP 30,970.66 (ROI: 61.29%) and PhP 28,017.60 (ROI: 51.61%), respectively. The findings demonstrate that student-managed goat milk processing is financially viable and can serve as a university-supported platform for enhancing entrepreneurial competencies while promoting wider utilization of CLSU-developed dairy goat technologies.

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## Introduction

Goat milk is characterized as a functional food due to its rich nutritional profile and health-promoting benefits. Milk from dairy goats offers several nutritional advantages over bovine milk, including higher digestibility due to lower lactose content, smaller fat globules, and a higher proportion of medium-chain fatty acids. Goat milk also contains a distinct protein profile characterized by lower levels of the allergenic  $\alpha$ s1-casein and higher  $\beta$ -casein content (Mishra *et al.*, 2026), as well as higher amounts of micronutrients such as calcium, potassium, magnesium, and vitamin A (Wang *et al.*, 2018). Studies on locally produced

goat milk have further demonstrated favorable fatty acid composition and nutritional indices, reinforcing its value as a functional food in the Philippine context (Bondoc *et al.*, 2023). A number of research reports have confirmed that goat's milk and its components possess a range of unique functional and therapeutic properties including neuroprotective effects, anti-carcinogenic effect, antidiabetic activity, anti-inflammatory, antioxidative, and anti-atherogenic effects (Alkaisy *et al.*, 2023; Singh *et al.*, 2022). Globally, these characteristics make goat milk a valuable source of human nutrition across generations.

Goat milk consistently ranks as the third most produced milk in the Philippines, following cow and buffalo milk. Goat milk enterprise is a developing industry with a growing market potential; however, local production currently meets only a small fraction of the overall dairy goat milk demand (Alo *et al.*, 2018). This limited supply makes goat milk a specialized or niche market in the country. This situation is further compounded by the public apprehension about the sensory characteristics of goat milk, particularly its commonly perceived 'goaty' flavor. This perception negatively affects the mass-market adoption and value proposition of goat milk, despite its perceived nutritional benefits.

To date, various goat milk products have been developed by the Central Luzon State University-Small Ruminant Center (CLSU-SRC) to popularize the consumption of goat milk and increase market acceptance of goat milk-based products. Among these developed technologies is the chocolate-flavored goat milk, a flavored beverage made using goat milk as its base ingredient. Chocolate flavoring is added to enhance palatability and appeal across age groups.

Globally, in many universities, complex entrepreneurial ecosystems exist where students become aware of the option to start a business (Buchnik *et al.*, 2018), generate new knowledge, and commercialize it through spin-off and start-up programs (Audretsch *et al.* 2019). In this context, students are encouraged and prepared to pursue self-employment and job-creation (Rembiasz, 2017). Goat milk processing has strong potential as an enterprise since only a few ventures are currently operating in the business. Hence, with the technology in place, the CLSU-SRC through the Department of Science and Technology - Academe Technology-Based Enterprise Development (DOST-DATBED) program opened an avenue for students to engage in a micro-sale technology-based project, utilizing chocolate-flavored goat milk. This initiative served as a platform for industry-academic collaboration in developing students' entrepreneurial mindset and competencies, an initiative that may serve as a foundation for students to become future entrepreneurs. This study contributes to the growing body of literature on experiential entrepreneurship and technology-based enterprise development in agricultural systems.

The transfer of this developed technology not only provides income-generating opportunities while driving demand and expanding markets for goat milk products, creating a ripple effect in the dairy industry, as its presence on market shelves supports the viability and scalability of goat milk processing as an enterprise.

This study aimed to evaluate the financial viability and market acceptability of chocolate-flavored goat milk as a student-managed, technology-based micro-enterprise under a university-supported setting. Specifically, it assessed consumer acceptability and willingness to pay for the product, as well as the profitability of enterprise operations over a five-month implementation period. By situating goat milk processing within an experiential entrepreneurship framework, the study provides empirical evidence on how university-developed dairy goat technologies can be translated into small-scale commercial applications while enhancing students' entrepreneurial competencies.

## Materials and Methods

### Selection of Student Entrepreneur

Two groups of student entrepreneurs, each composed of six individuals ( $n = 12$ ), participated in the enterprise implementation. The participants were fourth-year BS Agriculture students specializing in small ruminant production and were selected to align the enterprise intervention with their academic training. Participant eligibility was based on predefined criteria, including official enrollment during the project period, completion of a two-day training on goat milk processing and milk quality evaluation, demonstrated willingness to participate, and formal commitment through submission of required documentation and a signed memorandum of agreement. This selection approach ensured that participants possessed both the technical preparedness and commitment necessary for enterprise implementation.

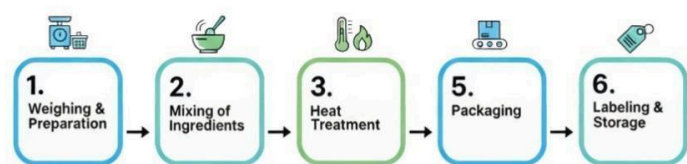
Each student group was provided with seed capital amounting to PhP 60,000.00 to support enterprise operations over five months. The capital was interest-free and repayable after the completion of operations. While a faculty adviser provided technical guidance and oversight to ensure adherence to approved procedures and budgets, operational and financial management decisions were independently handled by the student entrepreneurs. This structure allowed the study to examine student-managed enterprise performance under minimal supervisory intervention.

### Capacity Building

Prior to enterprise implementation, participants underwent a two-day capacity-building program designed to standardize technical competence and ensure product quality consistency. The training focused on goat milk processing procedures, quality control principles, and basic

enterprise management to minimize process-related variability during production. The training was facilitated by the technology developers, including a food technologist and a marketing specialist. The first day of the training focused on the introduction of the technology on chocolate-flavored goat milk, its process, and the resulting product. This was supplemented with a lecture on Good Manufacturing Practices to ensure the products were prepared hygienically and were of good quality.

The second day of the training focused on the actual production of chocolate-flavored goat milk, starting from the preparation of raw materials to packaging and storage. The necessity of following the standard operating procedure (SOP) was reinforced through repetitive processing to maintain product consistency in taste and texture across different batches of their products. Specific activities for producing chocolate-flavored goat milk are presented in Figure 1. In addition, a marketing specialist discussed basic bookkeeping and financial management along with the market potential of goat milk processing as an enterprise to strengthen student's entrepreneurial competencies.



**Figure 1.** Process flow of producing chocolate-flavored goat milk

The training component served to establish a common operational baseline among participants, thereby allowing subsequent enterprise performance to be attributed primarily to market response and managerial execution rather than differences in technical proficiency. The standardized process flow ensured consistency in product quality across production batches, which is essential for reliable assessment of consumer acceptability and enterprise performance.

### Production and Marketing

The processing of the product was scheduled bi-weekly or every 14 days but included flexibility to adjust the processing frequency based on product demand. The CLSU-SRC milk processing laboratory served as the production and processing area of the student entrepreneurs including the use of all necessary materials and equipment. The produced chocolate-flavored goat milk was introduced and marketed in the university's mainstream market and showcased at various exhibits both within and outside the university. Free sample marketing and social media were used as promotional activities.

The majority of the products were marketed at retailer outlets and canteens inside the university. Subsequently, it was directly marketed to consumers, composed of students, faculty, staff, and visitors. A make-to-order production strategy was implemented for retailers. A set of guidelines were implemented with retail partners to efficiently manage operations in terms of ordering and maintaining product quality.

### Data Gathering and Analysis

A total of 100 respondents were randomly selected to determine the market acceptability of the chocolate-flavored goat milk. The market analysis focused on consumer-oriented sensory evaluation of overall product acceptability and assessment of consumers' willingness to pay based on its package size. Detailed evaluation of the specific product attributes and other product tests had already been conducted during product development.

A formal survey using a structured questionnaire was conducted to evaluate consumer acceptance and willingness to pay (WTP). Each respondent was served 20 ml of chocolate-flavored goat milk, consistent with the standard practice for single-product sensory evaluation (Civille et al., 2024). A 9-point hedonic scale was used to assess overall acceptability, with verbal descriptors ranging from "dislike extremely" (1) to "like extremely" (9). WTP was measured using a 5-point purchase intent scale with verbal descriptors ranging from "definitely will not buy" (1) to "definitely will buy" (5).

The data gathered were encoded and organized using MS Excel (2010). Descriptive statistical analysis was employed to summarize consumer responses, including frequency distribution and percentage for categorical variables, and mean and standard deviation for sensory acceptability ratings. Consumer acceptability was evaluated using a 9-point hedonic scale, while willingness to pay was assessed using a 5-point purchase intent scale. Pearson's correlation coefficient was used to examine the association among sensory attributes and overall acceptability. Financial performance of the enterprise was assessed using cost and return analysis based on documented production and sales records.

Information such as inputs used, cost of inputs, volume of production, volume sold, and sales were documented to analyze the profitability of the business to measure the amount of return of producing chocolate-flavored goat milk relative to the investment cost.

## Results and Discussion

### Market Assessment

The market survey was conducted inside the university, which served as the mainstream market of the student entrepreneurs. Demographic characteristics of the respondents show that 70% were female, while men contributed the remaining 30%. The majority of the respondents (72%) were young adults aged 17-30 years old, who were mostly students. About 18% of the respondents were employees of the university, and 10% were visitors. Notably, about 78% of the respondents consume dairy milk products (Table 1).

**Table 1.** Sociodemographic profile of respondents (n=100)

Variable	Frequency (f)	Percentage (%)
Gender		
Male	30	30
Female	70	70
Marital Status		
Single	86	86
Married	14	14
Divorce	0	0
Widow	0	0
Age Group		
Child (0-16)	5	5
Young Adults (17-30)	72	72
Middle-aged Adults (31-45)	8	8
Old-aged Adults (Above 45)	15	15
Educational Attainment (Highest degree earned)		
Elementary	0	0
Graduate		
High School Graduate	72	72
Vocational Course	3	3
College Graduate	25	25
Employment		
Government Employee	18	18
Private Employee	7	7
Self Employed	3	3
Unemployed	0	0
Students	72	72
Consume dairy milk products	78	78

The results of the sensory analysis for the chocolate-flavored goat milk indicate high consumer acceptance across all attributes with a mean score ranging from 8.45 to 8.66 (Table 2). All mean scores were consistently high, indicating strong consumer preference for the chocolate-flavored goat milk across evaluated attributes. The overall acceptability mean score of 8.62 further confirms the chocolate-flavored goat milk strong sensory appeal and market potential. Generally, chocolate-flavored goat milk is consistently preferred by all the respondents.

**Table 2.** Consumer perceptions on chocolate-flavored goat milk

Attributes	Mean	Std Dev.	t-value	p-value
Aroma	8.59	1.11	32.31	<0.001
Taste	8.61	1.07	33.67	<0.001
Mouthfeel	8.45	1.30	26.28	<0.001
Color	8.66	1.01	36.34	<0.001
Overall acceptability	8.62	1.09	33.22	<0.001

*t-values and p-values are presented for reference only*

Statistical analyses were used to describe patterns and relationships in consumer responses rather than to establish hypothesis-driven inference. All attributes exhibited strong positive associations with one another, with correlation coefficients ranging from  $r = 0.90$  to  $0.99$ , reflecting the integrated nature of sensory perception during product evaluation. (Table 3). The strongest relationship is observed between aroma and taste ( $r = 0.992$ ). Aroma and taste are closely related attributes; taste and aroma interactions occur each time we eat or drink (Noble, 1996). Moreover, overall acceptability consistently shows high correlations with all individual attributes ( $r > 0.92$ ), indicating that each attribute is strongly associated with overall consumer preference for the product.

**Table 3.** Correlation analysis between different sensory attributes and overall acceptability of chocolate-flavored goat milk

Attributes	Color		Mouthfeel		Aroma		Taste		Overall Acceptability	
	Coefficient	p-value	Coefficient	p-value	Coefficient	p-value	Coefficient	p-value	Coefficient	p-value
<b>Color</b>	1.00000		0.90638	<0.001	0.97542	<0.001	0.97038	<0.001	0.98543	<0.001
<b>Mouthfeel</b>	0.90638	<0.001	1.00000		0.94892	<0.001	0.94049	<0.001	0.92207	<0.001
<b>Aroma</b>	0.97542	<0.001	0.94892	<0.001	1.00000		0.99232	<0.001	0.98805	<0.001
<b>Taste</b>	0.97038	<0.001	0.94049	<0.001	0.99232	<0.001	1.00000		0.98721	<0.001
<b>Overall acceptability</b>	0.98543	<0.001	0.92207	<0.001	0.98805	<0.001	0.98721	<0.001	1.00000	

The high correlations observed among sensory attributes are expected in consumer hedonic evaluations, as attributes such as aroma, taste, mouthfeel, and color are perceptually interrelated and collectively influence overall liking. Rather than indicating redundancy, these strong associations reflect the integrated nature of sensory perception during product consumption. The consistently high correlation of individual attributes with overall acceptability underscores the contribution of each attribute to consumers' positive evaluation of the chocolate-flavored goat milk.

Results of the survey for the likelihood of buying the chocolate-flavored goat milk showed that 85% and 86% of the respondents are willing to pay PhP 65.00 and PhP 115.00 for half-liter and a liter of the milk product (Figure 2). This result is higher compared to the survey conducted by Orozco (2019) in Laguna, Philippines, where only 66% of the respondents were willing to buy a liter of goat milk product amounting to PhP 100-120 pesos. Findings demonstrate strong price acceptance within the campus-based market for both 500 ml and 1 liter package size. Additionally, some respondents have mentioned that the taste of the product is the most important factor they consider for buying the product. Over the years, WTP for dairy products has attracted the attention of researchers worldwide, Bai *et al.* 2013 as cited by Ngoulma(2015) reported that WTP of consumers in urban areas are very high for milk certified by the government, while a study by Jerop (2012) indicate that consumers are willing to pay an average of 38% above the current prevailing price for cows' milk, due to goats' milk perceived health benefits. The high level of purchase intention recorded in this study indicates strong market potential and a positive outlook for the product's commercial success.

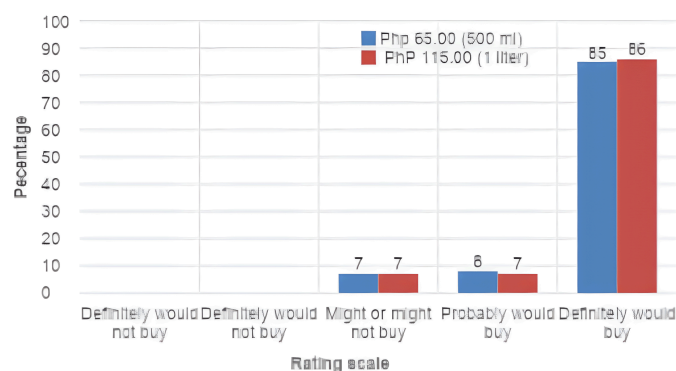


Figure 2. Consumers' willingness to pay

The high proportion of respondents indicating willingness to pay for both packaging sizes demonstrates favorable price acceptance within the campus-based

market, supporting the short-term commercial feasibility of the product under micro-enterprise conditions.

### Production and Marketing

Each group of the student entrepreneurs worked on a target production of 400 liters of chocolate-flavored goat milk over five months, equivalent to 40 liters per group of processing. Generally, a total of 195 liters (first group) and 201 liters (second group) of fresh goat milk were processed into chocolate-flavored goat milk. This corresponds to a total of 650 L and 670 L of chocolate-flavored goat milk processed and marketed, exceeding their target by 38.5% and 40.3%, respectively. These results indicate strong marketability and acceptance of goat milk-based products within the campus-based market.

This may be partly associated with the promotional and marketing strategies employed by the student entrepreneurs, which emphasized the nutritional benefits of goat milk. This is in agreement with the study of Orozco (2019), which revealed that nutritional content was the most important factor for consumers in buying goat milk products. Conversely, findings of Divarathne *et al.* (2025) revealed that despite health benefits, goat milk faces low demand in developing countries due to poor awareness and negative sensory perceptions. Hence, this initiative provides a healthier dairy alternative, increasing availability of value-added goat milk products in the community.

### Profitability of the Enterprise

According to Ridder and Van Der Sijde (2006), student entrepreneurs are individuals who are currently pursuing an academic course but are simultaneously running a business. The student entrepreneurs managed the entire operation of the enterprise, including finances. By taking ownership of the business, each student fostered accountability, built trust, and was able to make informed decisions when facing actual business challenges.

Throughout the five-month production period, the student entrepreneurs generated total sales of PhP 81,500.00 for the first group and PhP 82,300.00 for the second group from the processing and marketing of chocolate-flavored goat milk. The selling prices were based on computed production costs with mark-up rates of 60.42% for the 1-liter packaging and 55.69% for the 500-ml packaging. For the first group, total operating expenses amounted to PhP 50,529.34, resulting in a net income of PhP 30,970.66. Meanwhile, the second group incurred operating expenses of PhP 54,282.40, generating a net income of PhP 28,017.60, as summarized in Table 4.

**Table 4.** Cost and return analysis of producing chocolate-flavored goat milk

Parameter	Value (PhP)	
	First group	Second group
<b>A. Sales</b>		
1 liter @ PhP 115/bottle	23,000.00	36,800.00
500ml @ PhP 65/bottle	58,500.00	45,500.00
<b>Total Sales</b>	<b>81,500.00</b>	<b>82,300.00</b>
<b>B. Operating Expense</b>		
Raw Materials		
Cocoa Powder	2,093.00	2,157.40
Skimmed milk	7,475.00	7,474.00
Stabilizer	126.75	211.00
Refined Sugar	2,925.99	3,015.00
Goat milk	19,500.00	20,100.00
Purified Water	1,835.00	1,889.00
Packaging		
1000 ml	2,200.00	3,520.00
500 ml	6,300.00	4,900.00
Stickers	3,300.00	3,060.00
Labor	1,200.00	2,000.00
Electricity	2,073.60	3,456.00
Gas	1,500.00	2,500.00
<b>Total Operating Expense</b>	<b>50,529.34</b>	<b>54,282.40</b>
<b>C. Net Income</b>	<b>30,970.66</b>	<b>28,017.60</b>
<b>D. ROI (%)</b>	<b>61.29</b>	<b>51.61</b>

Correspondingly, the student entrepreneurs were able to return the capital provided by the project, and each of them received a profit share of PhP 5,162.00 (first group) and PhP 4,670.00 (second group), respectively. Indeed, the student entrepreneurs demonstrated the financial viability of chocolate-flavored goat milk as a micro-sale, technology-based enterprise.

The market assessment was conducted primarily within a university-based setting, where the majority of respondents were students and university stakeholders. As such, consumer responses may reflect familiarity with the institutional context and exposure to goat milk advocacy activities, which could positively influence acceptability and purchase intention. While this environment is appropriate for evaluating enterprise feasibility under campus-based micro-sale conditions, the findings may not be directly generalizable to broader consumer markets. Future studies may consider extending market testing to non-campus populations to further assess consumer response under more heterogeneous market conditions.

## Conclusion

This study demonstrated that chocolate-flavored goat milk can be feasibly produced and marketed by student entrepreneurs within a structured, university-supported micro-enterprise model. Over the five-month implementation, the two student groups

achieved strong consumer acceptance, high willingness to pay, and positive financial returns, indicating that CLSU-developed goat milk technologies can be viably translated into small-scale commercial applications.

Beyond profitability, the initiative illustrates how technology-based enterprise programs can enhance students' practical competencies in food processing, quality control, financial management, and market engagement—skills that are increasingly relevant in agriculture and rural development contexts.

The outcomes suggest that integrating similar enterprise-oriented training into academic programs may strengthen students' entrepreneurial readiness while contributing to broader efforts to promote value-added dairy goat products in local communities. Future replications may explore expanded market segments, longer enterprise cycles, or additional product lines to further assess scalability and long-term viability.

## Ethical Statement

All respondents were given relevant information about the study to make a knowledgeable decision about participating in the survey. An informed consent to participate in the study was attached to the survey questionnaire. Participation in the research was voluntary, without coercion, and respondents had the right to refuse involvement at any time. All samples provided during the sensory evaluation were fresh, tested and safe for human consumption. All collected data and information were kept strictly confidential.

## Conflict of Interest Statement

The authors declare no conflict of interest related to the conduct and publication of this research. All procedures followed were in accordance with institutional and ethical standards, and there were no financial or personal relationships that could have influenced the outcomes of this study.

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## Declaration of Generative AI and AI-Assisted Technologies

During the preparation of this work, the authors utilized Google's AI assistance for grammar correction and conciseness. Following the use of this tool/service, the authors conducted a review and made necessary modifications, assuming full responsibility for the content of the publication.

## Data Availability

The data that support the findings of this study are available from the corresponding author upon reasonable request.

## Author Contributions

**LMDR:** Methodology, Formal Analysis, Validation, Data Curation, Writing - Original Draft, Writing - Review and Editing, Supervision, and Project administration; **EAO:** Conceptualization, Supervision, Project administration and Funding acquisition; **MEMO:** Conceptualization and Funding acquisition; **NADR:** Formal Analysis and Writing - Review and Editing; **PCOS:** Conceptualization and Methodology.

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