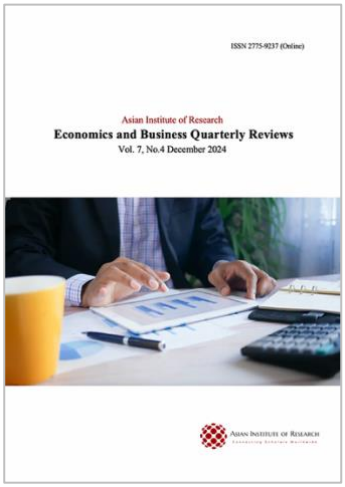

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Analyzing the Economic Impact of Ingredient Costs and Efficiency Ratios on Small-Business Coffee Sustainability in Battambang, Cambodia

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Abstract
This research explores how ingredient costs and efficiency ratios affect the sustainability of small coffee businesses in Battambang, Cambodia. By examining ingredient usage patterns, cost impacts, and economic efficiency, the study aims to find strategies to improve financial sustainability. Data were gathered from 80 coffee shop owners through surveys and interviews. Regression analysis was used to investigate the relationship between various cost factors and coffee income. The results show that ingredient costs, equipment costs, and operational expenses significantly affect coffee income. Costs for coffee beans, ice, plastic items, and straws positively impact income, while the cost of ice buckets has a negative effect. Additionally, the price of coffee sold is crucial for revenue generation. The study concludes that by optimizing ingredient use, managing costs efficiently, and implementing strategic pricing, small coffee businesses in Battambang can improve their financial sustainability and support the local economy.

Keywords: Economic Impact, Ingredient Costs, Efficiency Ratios, Small-Business Coffee, Battambang, Cambodia

1. Introduction

Battambang, a picturesque city in northwestern Cambodia, is celebrated for its rich cultural heritage and also its growing coffee culture. This third-largest city in Cambodia has a total population of 987,400 (Chhay, 2019; Darith & Eav, 2024). Small coffee businesses in Battambang are thriving, blending traditional Cambodian hospitality with modern coffee trends. These local cafes often source their beans from nearby regions, ensuring fresh and high-quality brews. Each coffee shop has its own unique charm, from cozy, rustic settings to chic, modern spaces, making them ideal spots for both locals and tourists to relax and enjoy a cup of coffee (MOP, 2022; 6wresearch, 2024).

The economic impact of these small coffee businesses is substantial. They contribute to the local economy by creating jobs, supporting local farmers, and attracting tourists. Also, millions of jobs around the world are supported by the coffee industry, which gives small-scale farmers employment and income (Sachs et al., 2019). By sourcing coffee beans locally, these businesses help sustain agricultural communities and promote sustainable farming practices. Additionally, the growth of the coffee industry in Battambang has spurred the development of related sectors, such as hospitality and retail, further enhancing the city's economic landscape. According to Sokly & Mardy (2023), Cambodia's coffee industry has the potential to significantly improve the economy of the country and society. The coffee industry could contribute to reducing poverty and improving the livelihoods of rural communities. Likewise, small coffee businesses in Battambang play a vital role in driving economic growth and fostering community development.

Small coffee businesses in Battambang, Cambodia, face numerous challenges in maintaining profitability while delivering high-quality products. A key driver of financial sustainability in these businesses is the precise management of ingredients used in coffee preparation. By applying ingredient usage in detail, business owners can better understand the cost associated with each drink. This helps them monitor the consumption of coffee beans, milk, sweeteners, syrups, and other essential ingredients (Smith & Wilson, 2020).

The analysis of ingredient costs is essential for identifying operational inefficiencies and implementing specific measures to reduce costs (Jones & Taylor, 2019). For small coffee businesses, this can involve everything from refining recipes to choosing locally sourced ingredients to reduce transportation expenses (Chin & Sok, 2018). Understanding the costs of ingredients is crucial for finding ways to improve how a business operates and reduce expenses (Adams, 2021).

In Battambang, where small businesses contribute significantly to the local economy, applying such analytics can be transformative. By understanding both local market conditions and consumer preferences, small coffee shop owners can fine-tune their offerings, pricing strategies, and inventory management to maximize profitability (Phan & Bopha, 2022).

The study aims to analyze the economic impact of ingredient usage patterns, identify cost-saving opportunities to enhance financial sustainability in coffee operations, and assess the cost impact of key ingredients on overall profitability to advise strategic choices in Battambang, Cambodia. This analysis seeks to convince coffee shop owners to be well-prepared and knowledgeable about the elements influencing their business in order to mitigate potential threats.

2. Methods

2.1 Sampling and Data Collection

Table 1 illustrates small coffee businesses in Battambang, Cambodia, with a sample of 80 coffee shop owners selected for a survey. The sample was chosen using a non-random sampling method that combined purposive and convenience sampling. coffee shop owners were selected based on specific criteria such as size, location, and operational experience, while convenience sampling ensured participation from accessible and willing participants. A closed-ended questionnaire was used to collect quantitative data on various aspects of their income and expenses, allowing for standardized data collection and comparison across businesses. Additionally, open-ended questionnaires and semi-structured interviews were conducted with coffee shop owners or managers to gain insights into how they perceive and manage risks related to financial sustainability in small-business coffee preparation. The average age of owners ranged from 20 to 39 years, with an overall average of 31 years. Sale periods varied, with some cafés operating for as little as 1 year and others for up to 5.5 years. The average experience of coffee shop owners ranged from 1.7 to 5.5 years, with an overall average of 3.1 years. This data provides valuable insights into the demographics and operational characteristics of small-business coffee shop owners in the province.

Table 1: Sample Size and General Information of Small-Business Coffee Shop Owners.

Province	District	Sampling Size		Gender (%)		Mean (Years)		
		N	%	Male	Female	Age	Sale Period	Experiences
Battambang	Aek Phnum	6	7.5	17	83	28	1.3	2.0
	Banan	4	5.0	25	75	30	2.1	2.3
	Battambang	51	63.8	20	80	33	3.0	3.4
	Bavel	2	2.5	0	100	24	1.0	2.0
	Moung Ruessei	2	2.5	0	100	39	2.5	5.5
	Phnom Proek	1	1.3	0	100	30	2.0	5.0
	Rotonak Mondol	2	2.5	50	50	20	2.0	2.0
	Samlout	1	1.3	0	100	24	2.0	3.0
	Sangkae	5	6.3	0	100	27	3.6	1.7
	Thma Koul	6	7.5	17	83	31	2.2	3.5
	Total	80	100	14	66	31	2.7	3.1

2.2 Model and Data Analysis

All data in this research were analyzed using STATA software version 17 for data generation, regression, and analysis. Following the econometric approaches outlined by Jeffrey (2009), Siek et al. (2017), Darith & Eav (2024), Siek et al. (2024a), and Stock (2015), empirical analysis models were applied to investigate the income regression of small business coffee. These models assess the impact of coffee income, as the dependent variable, on a range of independent variables related to costs such as coffee beans (Incred_Seed), ice (Incred_ice), fresh milk (Incred_fresmil), condensed milk (Incred_Condensed), coconut (Incred_Coconut), cup items (Equip_cup), plastic items (Equip_plastic), straw items (Equip_straw), ice bucket price (Pri_IceBucket), refrigerator price (Pri_Refrigerat), shop rental cost (Pri_Location), staff salaries (Salary_staff), water usage (Water_use), electricity usage (Eletric_use), machine usage (Machin_use), and sales coffee price (Pri_Coffee). Here, β_0, β_1, β_2, ..., β_{16} represent coefficients estimating the impact of each variable on income, while u_i denotes the error term accounting for unobserved factors affecting income. This study employed multiple linear regression models to analyze how various expense factors impact the ingredient costs of small coffee businesses in Battambang, Cambodia. The general form of the regression equation is as follows:

$$\begin{aligned} \boldsymbol{Income} = {} & \boldsymbol{\beta_0} + \boldsymbol{\beta_1}.Incred\_Seed + \boldsymbol{\beta_2}.Incred\_ice + \boldsymbol{\beta_3}.Incred\_fresmil + \boldsymbol{\beta_4}.Incred\_Condensed \\ & + \boldsymbol{\beta_5}.Incred\_Coconut + \boldsymbol{\beta_6}.Equip\_cup + \boldsymbol{\beta_7}.Equip\_plastic + \boldsymbol{\beta_8}.Equip\_straw \\ & + \boldsymbol{\beta_9}.Pri\_IceBucket + \boldsymbol{\beta_{10}}.Pri\_Refrigerat + \boldsymbol{\beta_{11}}.Pri\_Location + \boldsymbol{\beta_{12}}.Salary\_staff \\ & + \boldsymbol{\beta_{13}}.Water\_use + \boldsymbol{\beta_{14}}.Eletric\_use + \boldsymbol{\beta_{15}}.Machin\_use + \boldsymbol{\beta_{16}}.Pri\_Coffee + u_i. \end{aligned}$$

2.3 Economic Formula

Starting a small coffee business in Battambang, Cambodia, is a promising venture. Understanding the formulas that apply to coffee shop profitability is crucial for assessing the business's financial health. The formulas for profitability and economic efficiency, as discussed by Siek (2011), Johnson (2021) and Darith et al. (2024b), provide detailed insights, as outlined below:

$$\boldsymbol{Profit} = Total\ Income - Total\ Expense \quad (1)$$

$$\boldsymbol{EE} = \frac{Total\ Income}{Total\ Expense} \quad (2)$$

Total Income: the formula calculates the total income generated per day from coffee sales. This income is determined by multiplying the average coffee price by the total number of coffee sales. Specifically, the income is calculated using the following formula:

$$\boldsymbol{Total\ Income} = (Pri\_s + Pri\_m + Pri\_l) / 3 \times (Ns\_sale + Nm\_sale + NL\_sale)$$

$= 4039.725 \times 64.675$

Total Income = **245,894 Riels** (approximate 61.47 US Dollars)

This formula provides a clear picture of the daily income, enabling business owners to assess performance and make informed decisions regarding pricing strategies, marketing efforts, and inventory management. Understanding these metrics is essential for evaluating the financial health of the coffee shop and planning for future growth. This analysis offers a comprehensive overview of the key variables and their descriptive statistics, along with the calculation of the final income generated from coffee sales. Furthermore, it is important to consider the total expenses incurred by the business, which are calculated as follows:

Total_expense = *Ingredient_All + Equi_All + Pri_IceBucket + Pri_Refrigerat + Pri_Location + Salary_staff + Water_use + Electric_use + Machine_use*

= *114,428 + 18,214 + 109 + 268 + 18,783 + 30,115 + 1,657 + 4,953 + 1,246*

Total_expense = **189,772 Riels** (approximate 47.44 US Dollars)

The total expense for the business is calculated by aggregating various cost components, including ingredients, equipment, ice buckets, refrigerators, location rental, staff salaries, and utility costs, resulting in a total of 189,772 Riels. This amount converts from Riels to US dollars, approximately 47.44 US Dollars.

3. Results

3.1 Descriptive Statistics of Total Income

The results in the following **Table 2** illustrated after conducting research and interviewing 80 coffee shop owners in Battambang, Cambodia. The descriptive statistics for various coffee-related variables that contribute to the generation of income. The variables included the number of different types of coffee sold (N_type), the number of sales for small (Ns_sal), medium (Nm_sal), and large (NL_sal) glass sizes, as well as the total number of coffee sales (N_total). Additionally, the table includes the prices for small (Pri_s), medium (Pri_m), and large (Pri_l) glass sizes, the average price of sales coffee (Pri_coffee), and the final income generated per day (Income).

The different types of coffee were sold at an average rate of about 3.45 cups per day with various flavors. The distribution of cup sizes showed that 30.46, 22.95, and 11.26 cups were sold for small, medium, and large glass sizes, respectively. The average prices for a small, medium, and large glass of coffee are 2980 Riels, 3899 Riels, and 5019 Riels, respectively, resulting in the general average coffee price of 4040 Riels per cup. This data on the coffee business's performance would help identify potential areas for improvement and efficiency.

Table 2: Descriptive Statistics of Coffee Variable for Generating Income

Variable	Definition	Units	Obs.	Mean		Std. Dev.	
				Riels	Dollars	Riels	Dollars
N_type	Number of coffee types sold	Cup/day	80	3.45		1.65	
Ns_sal	Number of sales of small glasses	Cup/day	80	30.46		31.85	
Nm_sal	Number of sales of medium glasses	Cup/day	80	22.95		29.35	
Nl_sal	Number of sales of large glasses	Cup/day	80	11.26		13.84	
N_total	Total number of coffee sales	Cup/day	80	64.68		38.58	
Pri_s	Price of sales coffee small glasses	Riel/cup	80	2980	0.75	1162	0.29
Pri_m	Price of sales coffee medium glasses	Riel/cup	80	3899	0.97	1498	0.374
Pri_l	Price of sales coffee large glasses	Riel/cup	80	5019	1.25	1747	0.437
Pri_coffee	The average price of sales coffee	Riel/cup	80	4040	1.01	2678	0.67
Income	The coffee income per day	Riel/day	80	245894	61.47	192997	48.25

Note: The Riel is the currency of Cambodia.

3.2 Descriptive Statistics of Total Expense

The **Table 3** presented provides a complete list of the descriptive statistics related to the daily ingredient usage and associated costs in a coffee preparation operation. This data contains how many ingredients were used, how much each one cost, and the daily expenses that followed. The table shows the ingredients used in coffee preparation: on average, 45.0 kilograms of ice, 8.34 cans of fresh milk, 7.65 cans of condensed milk, 2.56 coconuts, 1.18 kilograms of coffee beans, and 2.35 packs of coffee beans were consumed daily. These numbers represent the useful resource needs and consumption patterns involved in the coffee-making process.

In terms of the price per item of the coffee ingredients, the data showcases the unit-level costs for each component. The price of ice was 342 Riels (approximately $0.09 USD) per kilogram, the price of fresh milk was 3,100 Riels ($0.78 USD) per can, the price of condensed milk was 3,151 Riels ($0.79 USD) per can, the price of coconut was 2,350 Riels ($0.59 USD) per coconut, and the price of coffee beans was 32,413 Riels ($8.10 USD) per kilogram. The daily cost of each ingredient used in the coffee preparation process was also involved in the total expense. The data shows that the cost of coffee beans was 38,556 Riels ($9.64 USD) per day, the cost of ice was 15,016 Riels ($3.75 USD) per day, the cost of fresh milk was 26,626 Riels ($6.66 USD) per day, the cost of condensed milk was 23,868 Riels ($5.97 USD) per day, and the cost of coconut was 10,363 Riels ($2.59 USD) per day. The total cost of all ingredients combined amounted to 114,428 Riels ($28.61 USD) per day.

Table 3: Descriptive Statistics of Daily Ingredient Usage and Costs

Variable	Definition	Units	Obs.	Mean		Std. Dev.	
				Riels	Dollars	Riels	Dollars
Number of ingredients used in coffee preparation							
N_Ice	Number of ices	Kg/day	80	45.0		37.5	
N_Freshmilk	Number of fresh milks	Cans/day	80	8.34		8.93	
N_Condensed	Number of condensed milks	Cans/day	80	7.65		6.22	
N_Coconut	Number of coconuts	Coconut/day	80	2.56		3.72	
N_Seed_kg	Number of coffee beans	Kg/day	80	1.18		0.77	
N_Seed_pack	Number of coffee beans	Pack/day	80	2.35		1.53	
Price per item in the coffee ingredient							
Pri_Ice	Price of ice	Kg/riel	80	342	0.09	96	0.02
Pri_Freshmilk	Price of fresh milk	Cans/riel	80	3100	0.78	492	0.12
Pri_Condensed	Price of condensed milk	Cans/riel	80	3151	0.79	527	0.13
Pri_Coconut	Price of coconut	Coconut/riel	80	2350	0.59	2449	0.61
Pri_Seed	Price of coffee beans	Kg/riel	80	32413	8.10	10272	2.57
Cost of coffee ingredients used per day							
Incred_Seed	Cost of coffee beans	Kg/day	80	38556	9.64	30038	7.51
Incred_ice	Cost of ice	Kg/day	80	15016	3.75	12302	3.08
Incred_fresmil	Cost of fresh milk	Cans/day	80	26626	6.66	32318	8.08
Incred_Condensed	Cost of condensed milk	Cans/day	80	23868	5.97	19435	4.86
Incred_Coconut	Cost of coconut	Coconut/day	80	10363	2.59	14191	3.55
Incredient_All	Total cost of all ingredients	Riel/day	80	114428	28.61	75781	18.95

Note: The Riel is the currency of Cambodia.

The provided **Table 4** presented the set of descriptive statistics on the daily usage and associated costs of various equipment items used in a business or operational context. The data encompassed the number of items used each day, the per-item prices, and the resultant daily costs for each equipment type. Regarding the number of equipment items used daily, the table indicated that on average, 98 plastic items, 70 straws, and 76 cups were consumed per day. The table suggested a relatively high volume of disposable item usage in the daily operations. When examining the price per item, the data revealed that the cost of a plastic item was 44 Riels (approximately $0.01 USD), a straw cost 49 Riels ($0.01 USD), and a cup cost 213 Riels ($0.05 USD). The prices provided details on

the particular costs related to each type of equipment. The daily cost expenses for each item used were then analyzed in detail. The data showed that the average daily cost for plastic items was 3,071 Riels ($0.77 USD), for straws was 3,141 Riels ($0.79 USD), and for cups was 12,002 Riels ($3.00 USD). The total cost of all items combined amounted to 18,214 Riels ($4.55 USD) per day. This complete list of the coffee shop's daily equipment usage and costs was the foundation for financial analysis and operational planning.

Table 4: Descriptive Statistics of Daily Equipment Usage and Costs

Variable	Definition	Units	Obs.	Mean		Std. Dev.	
				Riels	Dollars	Riels	Dollars
Number of equipment items used each day							
N_Plastic	Number of plastics used	Plastic/day	80	98		68	
N_Straw	Number of straws used	Straw/day	80	70		47	
N_Cup	Number of cups used	Cup/day	80	76		67	
Price per item in the coffee equipment							
Pri_Plastic	Cost in Riel for each plastic	Riel/plastic	80	44	0.01	21	0.01
Pri_Straw	Cost in Riel for each straw	Riel/straw	80	49	0.01	15	0.00
Pri_Cup	Cost in Riel for each cup	Riel/cup	80	213	0.05	161	0.04
Cost expense for each item used per day							
Equi_plastic	Cost of plastic items per day	Riel/plastic/day	80	3071	0.77	3003	0.75
Equi_straw	Cost of straw items per day	Riel/straw/day	80	3141	0.79	2062	0.52
Equi_cup	Cost of cup items per day	Riel/cup/day	80	12002	3.00	10367	2.59
Equi_All	Total cost of all items	Riel/cup/day	80	18214	4.55	12538	3.13

Note: The Riel is the currency of Cambodia.

The **Table 5** presented in detail of the descriptive statistics related to the operational costs incurred in the business. Each operational expense revealed the mean and standard deviation for examining the various cost components. Accordingly, the price of purchasing an ice bucket is 109 Riels ($0.03 USD) per day, while the price of a refrigerator is 268 Riels ($0.07 USD) per day. One ice bucket costs around $50, depending on its size. In a small business, an ice bucket and refrigerator can be used for an average of 5 years before it is damaged. Thus, to calculate the cost of use per day, the price of the ice bucket is divided by 5 years (which equals 1,825 days).

The cost of renting a shop or location amounts to 18,783 Riels ($4.70 USD) per day, highlighting one of the most significant operational costs. Usually, the cost of renting a shop or location is paid monthly. Therefore, for calculations, the monthly rent is divided by 30 days. In addition, the average daily salary of the entire staff is 30,115 Riels ($7.53 USD), and the cost of water usage is 1,657 Riels ($0.41 USD) per day. Electricity usage, a critical operational expense, is shown to cost 4,953 Riels ($1.24 USD) per day on average, with a standard deviation of 6,777 Riels ($1.69 USD), indicating that this cost category is subject to change. Lastly, the cost of machine usage, which averages 1,246 Riels ($0.31 USD) each day, is also included in the table. This underscores how necessary good equipment use is to maintain the efficiency of operation. Generally, one coffee machine can be used for an average of 10 years before it is damaged, according to the shop owners. As a result, to calculate the cost of use per day, divide the price of the coffee machine by 10 years (approximately 3,650 days).

Table 5: Descriptive Statistics of Operational Costs

Variable	Definition	Units	Obs.	Mean		Std. Dev.	
				Riels	Dollars	Riels	Dollars
Pri_IceBucket	Price of purchasing an ice bucket	Riel/day	80	109	0.03	141	0.04
Pri_Refrigerat	Price of purchasing a refrigerator	Riel/day	80	268	0.07	455	0.11
Pri_Location	Cost of renting a shop or location	Riel/day	80	18783	4.70	16524	4.13
Salary_staff	Total staff salaries	Riel/day	80	30115	7.53	28114	7.03
Water_use	Cost of water usage	Riel/day	80	1657	0.41	2537	0.63
Eletric_use	Cost of electricity usage	Riel/day	80	4953	1.24	6777	1.69
Machin_use	Cost of machine usage	Riel/day	80	1246	0.31	2073	0.52

Note: The Riel is the currency of Cambodia.

3.3 Economic Efficiency

To assess the efficiency of the business, the Efficiency Ratio (EE) is calculated as:

EE = *Total Income / Total Expense*
= 245,894 Riels / 189,772 Riels
= **1.37 Riels**

The financial analysis of the coffee business offers essential details about its general profitability and economic efficiency. The daily income, calculated at 245,894 Riels, results from the average prices of small, medium, and large coffee cups multiplied by the total sales volume. In contrast, the total expenses amount to 189,772 Riels, which includes a variety of operational costs, including ingredients, equipment, utilities, and staff salaries. The business's robust Economic Efficiency (EE) of 1.37 signifies a healthy financial state. It generates approximately 37 Riel in net profit for every 100 Riel spent, clearly outperforming its costs and driving significant revenue growth. This evaluation of the business's income, expenses, and economic efficiency offers a complete picture of its financial health, demonstrating its capacity to generate profits while efficiently managing operational costs. The positive economic efficiency highlights the possibility for future growth and strategic investments, emphasizing the significance of consistently monitoring these metrics to maintain and improve profitability in a competitive marketplace.

So, the Profit can be calculated as:

Profit = *Total Income - Total Expense*
= 245,894 Riels - 189,772 Riels
= **56,122 Riels** (approximate 14.03 US Dollars)

In the context of financial analysis, profit is a crucial metric that reflects the financial health of an entity. In this case, the income is reported as 245,894.1 Riels, while total expenses amount to 189,772 Riels. By applying the profit formula, finding the profit of 56,122 Riels, indicates a positive financial outcome. This analysis shows that the entity is profitable, and that good financial management is essential for its continued success.'

3.4 Economic Impact of Small-Business Coffee

The regression model presented in **Table 6** examines the factors influencing the income of a small-business coffee operation. The dependent variable is the coffee income, and the independent variables include various cost and price components related to the coffee business. The analysis revealed that the cost of ice (Incred_ice) had a positive and highly significant coefficient at the 1% level ($\beta 2 = 0.0026$, $p < 0.01$). This indicated that for every unit increase in the cost of ice, coffee income rose by 2.638 units, assuming all other factors remained constant. This underscored the crucial impact of ice costs on the business's revenue.

Similarly, the cost of coconut (Incred_Coconut) had a positive and significant level at 10%, while the cost of plastic items (Equip_plastic) showed a significant level of 5%. This emphasized the need for the coffee business to manage these cost components effectively. Furthermore, the cost of straw items (Equip_straw) has a positive and highly significant level of 1%, indicating that higher straw item costs contribute to increased coffee income. Conversely, the price of an ice bucket (Pri_IceBucket) had a negative and marginally significant level at 10% (-0.0860), indicating that higher ice bucket prices were associated with a decrease in the coffee business's income. This result highlighted the importance of carefully monitoring and managing the pricing of complementary items, as they could substantially impact overall profitability. Notably, the price of sales coffee (Pri_Coffee) had a positive and highly significant level at 1% (0.0588). The increase in the price of coffee led to a substantial increase in coffee income.

The regression analysis showed a strong model fit, with an R-squared value of 0.924. As a result, the independent variables accounted for about 92.4% of the variation in the coffee business's income. The Root Mean Squared Error (Root MSE) of 59.746 further validated the model's predictive accuracy, reinforcing the reliability of the insights gained from this analysis. These results can be extremely useful for coffee business owners. By

recognizing the significance and direction of the key variables, they can devise strategies to optimize costs, manage pricing effectively, and ultimately boost the profitability and sustainability of their small coffee business.

Table 6: The Regression Results of Small-Business Caffee Income as Dependent Variable

Variable	Definition	Coefficient		Std. Err.	T-Value	P-Value
Incred_Seed	Cost of coffee beans	β_1	0.0004	0.0003	1.370	0.174
Incred_ice	Cost of ice	β_2	0.0026***	0.0009	2.810	0.007
Incred_fresmil	Cost of fresh milk	β_3	0.0003	0.0003	0.850	0.400
Incred_Condensed	Cost of condensed milk	β_4	0.0000	0.0006	0.040	0.967
Incred_Coconut	Cost of coconut	β_5	0.0011*	0.0006	1.700	0.093
Equip_cup	Cost of cup items	β_6	0.0003	0.0009	0.330	0.742
Equip_plastic	Cost of plastic items	β_7	0.0106**	0.0041	2.570	0.013
Equip_straw	Cost of straw items	β_8	0.0288***	0.0046	6.220	0.000
Pri_IceBucket	Price of an ice bucket	β_9	-0.0860*	0.0548	-1.570	0.122
Pri_Refrigerat	Price of a refrigerator	β_{10}	0.0365*	0.0210	1.740	0.086
Pri_Location	Cost of renting a shop	β_{11}	-0.0003	0.0006	-0.490	0.626
Salary_staff	Total staff salaries	β_{12}	-0.0001	0.0004	-0.290	0.770
Water_use	Cost of water usage	β_{13}	0.0024	0.0042	0.560	0.577
Eletric_use	Cost of electricity usage	β_{14}	-0.0010	0.0017	-0.590	0.555
Machin_use	Cost of machine usage	β_{15}	-0.0022	0.0049	-0.450	0.656
Pri_Coffee	Price of sales coffee	β_{16}	0.0588***	0.0027	21.650	0.000
_cons	Constants	β_0	-179.5978***	20.2857	-8.850	0.000
Number of obs.	Number of observations		80.00			
Prob > F	Prob > F		0.000			
R-squared	R-squared		0.924			
Adj R-squared	Adj R-squared		0.904			
Root MSE	Root MSE		59.746			

Note**:** *10% level significant; **5% level significant; ***1% level significant

4. Discussion

Based on the findings, the significance of detailed ingredient analytics to ensure long-term financial sustainability was made obvious by the examination of ingredient usage and operating costs in Battambang coffee shops. It turned out from careful examination of daily ingredient use those changes in the price of necessary ingredients, consisting of milk, ice, and coffee beans, could have significant impacts on total profitability. Although the business generated a profit of 56,122 Riels ($14.03 USD), the Efficiency Ratio of 1.37 suggested that there was potential to enhance operational efficiency by implementing cost-saving measures. This finding corroborates existing literature that emphasizes the critical role of effective ingredient management in the food and beverage industry, where even marginal adjustments in ingredient utilization can result in significant financial gains (Kassim et al., 2014; Mekala & Viswanathan, 2017). Furthermore, the integration of data analytics tools can facilitate the ongoing monitoring of ingredient performance, enabling businesses to respond swiftly to evolving market dynamics and consumer preferences. As such, a strategic emphasis on ingredient analytics not only contributes to immediate profitability but also fosters long-term sustainability, ensuring the continued success of small coffee preparation businesses in Battambang within a competitive market (Biradar & Shabadi, 2017).

The examination of the factors influencing the income of small coffee businesses revealed that the costs of ice, coconut, and plastic supplies significantly impact revenue. Obviously, efficient cost management is crucial for the success of such businesses. Specifically, the cost of ice ($\beta2 = 0.0026$, $p < 0.01$) and coconut ($\beta5 = 0.0011$, $p < 0.10$) were positively correlated with coffee income. Thus, it seemed that increases in these costs led to higher coffee sales revenues. These findings align with previous research by Smith (2020), which indicated that operational costs directly impact the profitability of small businesses. Moreover, the price of sales coffee ($\beta16 = 0.0588$, $p < 0.01$)

emerges as a key driver of income, emphasizing the need for strategic pricing. This finding aligns with the idea that pricing strategies should adapt to market conditions and consumer demand to maximize revenue (Johnson & Lee, 2019). Conversely, the negative coefficient for the price of an ice bucket ($\beta 9 = -0.0860$, $p < 0.10$) indicated that higher prices for complementary products could negatively impact overall income, emphasizing the need for careful pricing strategies across all product lines.

Following that, the high R-squared value of 0.924 explains that the model explains a significant portion of the variability in coffee income. Accordingly, the elements that have been found are important factors that influence financial performance. This result is in line with other research that points to the value of taking into consideration a variety of operational factors in order to fully understand the achievement of small businesses (Brown & Green, 2021).

To conclude, the knowledge gained from this research can aid small-business coffee operators in their decision-making. By focusing on cost reduction, strategic pricing, and continuous market research, operators can enhance their profitability and secure their business's future in a competitive industry.

5. Conclusions

This study examined the economic impact of ingredient costs and efficiency ratios on small-business coffee sustainability in Battambang, Cambodia. By examining these factors, daily ingredient consumption reveals key insights into resource allocation, with critical components such as ice, milk, and coffee beans playing substantial roles in overall expenses. Due to this, the operation generated a profit of 56,122 Riels (approximate $14.03 USD), highlighting its profitability. Moreover, the Efficiency Ratio of 1.37 suggests strong operational efficiency, as the business yields 37 Riel of net profit for every 100 Riel invested. Through a meticulous analysis of ingredient data, decision-makers may locate areas for cost savings and optimize ingredient usage, leading to improved financial results. This strategic focus not only contributes to immediate profitability but also fosters long-term sustainability in Battambang's competitive market. Consequently, integrating detailed ingredient analysis into operational practices is essential for promoting continuous development and strengthening the business's financial condition as well. According to these metrics, the business is not only performing well in its present market but is also in a strong position to grow and succeed in the future.

The detailed analysis of the factors influencing the income of small-business coffee operations through regression modeling was also gained from this study. The results uncovered several crucial suggestions that can inform strategic planning and managerial choices. Unexpectedly, the cost of ice, coconut, plastic items, and straws has a significant positive correlation with coffee income, emphasizing the importance of these inputs in generating revenue. However, to avoid negative effects on total profitability, pricing strategies for complementary products should be carefully considered, as seen by the negative coefficient for the price of an ice bucket. Along with that, the price of sales was found to have a highly significant positive coefficient, meaning that strategic pricing might have a major effect on the profitability of the business.

In conclusion, this study provides critical additional knowledge about the internal operations of small-scale coffee businesses. By prioritizing cost control and strategic pricing, business owners can be able to improve their financial health in an environment of competition. To further the understanding of the factors affecting coffee business profitability, future research could explore the influence of market trends and consumer preferences in more detail. Ultimately, this research contributes to the existing body of knowledge in small coffee business economics and provides beneficial tips for professionals in the coffee industry.

6. Recommendations

To enhance the financial sustainability of coffee operations in Battambang, Cambodia, several strategic recommendations can be implemented. Prioritizing regular monitoring of ingredient costs and usage will enable timely adjustments to purchase strategies, leading to more efficient expense management. Optimizing ingredient procurement, particularly through negotiating favorable pricing for bulk purchases of essential items like coffee beans and milk, can significantly reduce costs. Interestingly, training staff on efficient ingredient usage and waste

reduction practices can further contribute to cost savings. Investing in data analytics tools will facilitate detailed tracking of ingredient performance, supporting informed decision-making and trend identification. By carefully evaluating menu offerings and focusing on the most profitable items, total profitability can be enhanced. A feedback loop involving staff and customers can improve product quality and operational efficiency. Lastly, staying abreast of market trends will ensure the business remains competitive and responsive to consumer preferences. By implementing these strategies, coffee operations businesses can achieve greater financial sustainability and operational efficiency.

Plus, based on the findings of this study, additional recommendations are also proposed for small-business coffee operators. First, it is crucial to optimize costs related to ice, coconut, and plastic items, as these significantly impact revenue. Regularly reviewing supplier agreements and exploring alternative sourcing options can help minimize expenses. Implementing effective pricing strategies for coffee sales is important to maximizing income, taking into consideration market demand and customer willingness to pay. Monitoring the pricing of complementary products, such as ice bucket or refrigerator, is essential to ensure they do not negatively impact overall profitability. Last but not least, by conducting regular market research, operators can stay updated on market situation and implement new strategies to enhance profitability.

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