Assessment Study

The Economic Cost of Integrated School Gardening in School Feeding Program

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Contents

Executive Summary

This study evaluates the expenditure of schools on the School Feeding Program (SFP) using a mixed-methods approach to assess both economic and nutritional dimensions. The research investigates the effectiveness of various implementation models, including those led by the State and the World Food Programme (WFP). Data was collected through key informant interviews and analysis of secondary data from governmental and educational sources, providing a comprehensive view of the program's costs and nutritional impact.

The study for the academic year 2022-2023 revealed that the average annual cost per beneficiary/student in the sampled schools was approximately USD 44.35. A comparison of expenses among different types of schools showed that state-run schools had the lowest annual cost per beneficiary at USD 38.90, primarily focusing their budget on food consumption. In contrast, WFP-run schools had the highest cost at USD 55.24, with significant investments in building facilities and infrastructure.

Using the SEEM nutrition approach, it was found that recurring costs, including food consumption, labor, utilities, and administrative costs, accounted for 66.94% of total expenses, while non-recurring costs, such as capital, equipment, and other costs, accounted for 33.05%. The highest expenses were for food consumption (57%), followed by capital costs (20%), and labor costs. The average annual cost per pupil was approximately USD 42.10, with food costs averaging USD 22.98 per student, highlighting the program's focus on providing nutritious meals.

The cost to prepare each breakfast was USD 0.14 for state-run schools and USD 0.15 for WFP-run schools, both cost-efficient compared to the subsidy of USD 0.195 per student. However, the bidding process for food suppliers often results in lower bids, raising concerns about food quality. The study also highlighted the benefits of school-grown gardening, such as reducing expenses and promoting interaction and nutrient-dense meals. For example, "Wat Run" primary school generated USD 600-900 per year from selling vegetables. Schools expressed willingness to promote gardening with incentives and technical support.

However, the average caloric intake per breakfast was 228.82 kcal, below the recommended 360 kcal – benchmark for moderate active children. Whilst the intake of protein, carbohydrates, fats, and essential vitamins also did not meet recommended levels, which leads to insufficient nutrition consumption – potentially affecting students' physical and cognitive development.

The government and stakeholders working on this program or are interested in promoting this program should consider improving meals by increasing portion sizes to meet the requirement of at least 20-25% of the total daily energy intake, recommended 360 kcal for moderate active or 400-500 kcal for hyperactive. Additionally, they should also create consistent guidelines for specific dishes to ensure well-balanced meals for students, providing sufficient macro and micronutrients. Besides, scaling up school grown plantation to support the program is worth investing where it could get some potential revenue for the school to reduce additional expenses. Therefore, promoting the cultivation crops vitamin-dense vegetables around the campus could be capitalized, while providing technical support on crop cultivation should be considered such as interventions on techniques to help crop withstand the severe environment and especially the irrigation supports.

List of Figures

List of Tables

I. Introduction

What is a School Meal Program? School meal programs provide nutritious meals to students, addressing child nutrition, health, and academic performance. These programs vary globally to meet local needs. For example, the U.S. National School Lunch Program (NSLP) offers balanced, low-cost or free lunches, serving 29.6 million children daily in 2019. Japan's "Kyu-shoku"[1] program emphasizes nutrition and food education, using local ingredients and involving students in meal service. European countries like France and Finland focus on high-quality, balanced meals, with Finland offering free school meals since 1948. In developing countries, programs often combat malnutrition and boost school attendance, with the World Food Programme (WFP) supporting many initiatives. For example, India's Mid-Day Meal Scheme, one of the largest, reaches over 120 million children, improving nutrition and school attendance, (Government of India, 2020).

Importance of Nutrition for School-Age Children Nutrition is crucial for children's growth, health, and academic performance. Well-balanced meals support cognitive development, physical growth, and a strong immune system. Programs like the NSLP ensure children receive necessary nutrients, improving dietary intake and academic outcomes. School meal programs in developing countries enhance nutrition and education. They can be implemented through direct food provision or cash transfers. For example, Nepal provides midday meals to over 600,000 children. Research focuses on cost efficiency, with studies showing varying costs per beneficiary, (FRAC, 209). School gardens promote sustainable growth and cost savings, offsetting up to 25% of food expenses. Hunger and malnutrition hinder educational goals. School feeding programs improve school attendance, cognitive function, and educational achievement. They often target the poorest children and complement other nutrition programs. Effective management requires community participation, better teaching quality, and improved infrastructure.

The school meal program in Cambodia began in 1999, initially providing daily on-site cooked breakfasts to over half a million primary school children. The program transitioned from canned fish to meals with vegetables, meat, and grains, encouraging school attendance and concentration. WFP Cambodia procures most commodities locally, benefiting the domestic market and local farmers. In 2009, WFP delivered over 27,000 metric tons of food across Cambodia, with 8,000 metric tons for school feeding, consisted of rice, canned fish, and vegetable oil. The program involves multiple stakeholders, including the Royal Government of Cambodia, World Bank, ADB, UNICEF, and private sponsors. Additional support includes school equipment, uniforms, latrines, safe drinking water, and nutritional education. De-worming tablets and vegetable seeds for school gardens are also provided.

In 2014, the new phase of the school meal program was initiated, where the government began to broaden its effort to transition from wholly WFP-led school feeding program to nationally managed

[1] The Society of Nutrition and Food Science. (2017). The history, current status, and future directions of the school lunch program in Japan. *Journal of Nutritional Science and Vitaminology, 76*(Supplement), S2–S5. Retrieved from https://www.jstage.jst.go.jp/article/eiyogakuzashi/76/Supplement/76_S2/_pdf

initiatives, which is known as “Cambodia’s Home-Grown School Feeding (HGSF)” program. This Breakfast is offered to primary schoolchildren from grades 1 to 6, and now includes kindergarten. This shift gained its popularity after the Cambodian government started taking greater ownership of the program. This national HGSF program was formally established in 2019, following the development of Cambodia School Feeding Policy and related strategies. This initiative as well is designed to improve child nutrition and bolster the local economy by engaging smallholder farmers. To this extent, over 270,000 students in ten provinces benefit from the program, with 553 schools receiving state support and 561 partnering with WFP. The Joint School Feeding Transition Strategy, launched in 2022, aims for the Ministry of Education to take over the program from WFP by 2028, focusing on local sourcing, food safety, and community empowerment, (WFP, 2022).

Ensuring sufficient nutrition during school years is crucial in developing regions. Various interventions, like providing free meals, aim to improve student attendance and academic performance. However, these interventions often face challenges such as high costs and insufficient budgets. Research on school meal programs often overlooks the financial dynamics at the school level, leading to incomplete pictures of their sustainability and effectiveness. This study aims to fill this gap by focusing on school-level expenditures and their impact on nutrition and education.

The Cambodian government recognizes the importance of school feeding programs, but current budget allocations remain doubtful if it is sufficient to provide adequate meal along with sufficient nutrition to the schoolchildren. Thereafter, this study aims to:

1. Assess key expenses of different modalities and their variations.
2. Evaluate the efficiency of the different modalities
3. Evaluate if meal in the modalities provide sufficient nutrients.
4. Explore ways to improve students' nutrition intake.
5. Investigate the potential of school-grown gardening to enhance nutrition and reduce costs.

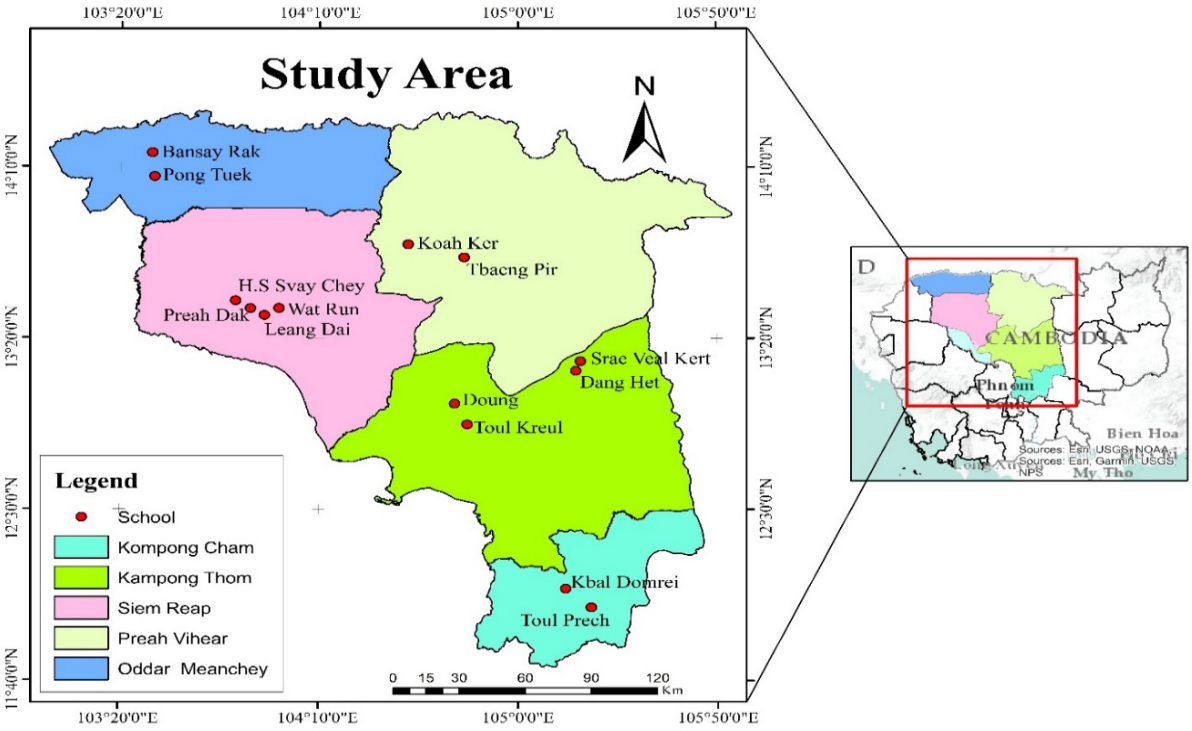
To answer the study aims, there are several key objectives to be addressed which include:

- Estimate the actual cost of the current school feeding program implementation
- Estimate the Cost Per Beneficiary, Cost Per Breakfast, and Cost Per Item contributed
- Estimate the level of nutrition intake of the schoolchildren receive from each breakfast
- Assess the related benefits and trade-offs of the implementation of the school grown gardening integrated in the school feeding program

II. Methodology

This study assesses school-level costs and nutritional intake for the school year 2022-2023. It aims to identify the true cost per student and evaluate weekly nutritional intake. Both primary and secondary data are collected.

Figure 1 Map of the Sampled Schools under State and WFP



Data Collection:

To achieve the goal of the study, there were two main sources of data to be collected which included:

a. ***Primary Data***: The data were collected from site visits, interviews, and surveys in selected provinces. Semi-structured survey questionnaire was conducted to capture all related expenditures at school level in AY 2022-2023 with the principle – where the costs involved recurring and non-recurring costs, deriving from SEEM approach to be fit in school level practice. While there were also interviews with school principals, cooks, and food suppliers also included, focusing on expenses, daily activities, and other related activities of the program as well as the implementation of the school grown gardening.

b. ***Secondary Data***: The data included literature reviews, financial records, budget spending, expense reports, and receipts from participating schools.

At the same time, to respond to the study's objectives, selected samples were used as case studies to understand cost differences among schools. This study tried not to generalize about the population but to portray a comprehensive view of the cost expenditures. Techniques from Stake (1995) and Yin (2018) were adapted, suggesting 10-15 case studies for robust results and interpretations.

Sample Selection:

This study applied the purposive and stratified sampling technique by categorizing program types into State-run and WFP-run, and school-grown gardening and no school-grown gardening modalities. After defining the program types, random selection of the schools was made where in total there were about 14 schools selected from 5 provinces which included Kampong Cham, Kampong Thom, Preah Vihear, Oddar Meanchey, and Siem Reap province. In the 14 selected schools, they consisted of:

- There were 4 schools run by WFP.
- There were 10 schools run by the State.
- And 3 schools implemented school gardening, while 2 schools were under the state-run and 1 school was under WFP's monitoring.

Denoting that, the study aims to see if schools can capitalize on the benefits of school-grown gardening, with 3 schools successfully utilizing and even selling their produce.

Study Analyses:

The study employs the SEEM nutrition approach to evaluate both costing and nutrition aspects, aiming to provide a comprehensive understanding of school-level expenditures and their impact on student nutrition. In terms of the costing evaluation, the study shapes its focuses on school-level costs, including food, labor, utilities, capital, equipment, and maintenance, and other costs. Whereas Central-level costs cover program management, administrative expenses, support, and training will not be considered since there is no direct impact to the program's implementation. Additionally, the study also conducts nutritional analysis where it tries to examine the types of food consumed by the schoolchildren and their nutrient intake, comparing it with FAO guidelines.

School-Level Cost Analysis: To analyze the total expenditure of the targeted schools in the academic school year 2022-2023, both recurring and non-recurring costs are considered. These costs are categorized into five groups: Food Costs (FC), Labor Costs (LC), Running Costs (RC), Capital Costs (CC), and Other Costs (OC) – explained in the calculation below:

Calculation Formula:

$$\mathbf{C_T = FC_s + LC_s + RC_s + CC_s + OC_s}$$ where

- C_T: Total expenditure at the school-level in AY 2022-2023 (USD)
- FC_s: Total food consumption costs, includes all expenses on food, such as vegetables, grains, and meat, based on monthly purchasing orders and additional items bought by the school or community.

- LCs: Labor Costs, calculated by multiplying the average monthly salary or incentives of cooks by the number of months worked, including any in-kind incentives converted to monetary value.
- RC_s: Total running costs, Covers expenses on cooking materials, electricity, water, and administrative costs. Cooking material costs are based on monthly wood purchases, electricity costs on bulb usage, and water costs on pumping machine expenses.
- CC_s: Total capital costs that includes construction costs for kitchens and eating shelters, and equipment purchases. These are calculated using depreciation rates based on the Cambodian Tax Booklet (2018), where the rate is bound at 5% in average with the 10 years lifespan of the construction and 5 years lifespan for equipment.
- OC_s: Total other related costs, which refer to miscellaneous expenses such as construction of washing areas, cement floors, and school-grown gardening activities. These costs are considered non-recurring and include land preparation, irrigation, and equipment for cultivating crops.

Full-time Equivalence Analysis: With this regard, this analysis focuses on the time contribution from school-level actors, such as principals, warehouse keepers, finance staff, teachers, and cooks. The evaluation converts their time contribution into monthly working hours to determine the percentage of their working contribution to the program.

Cost Per Beneficiary: Ultimately, the goal of the study is to determine the cost per beneficiary in the targeted schools and its cost per item contributed to see their efficiency behaviors, which explains by the calculation as follows:

$$\mathbf{C_p = \sum C_T / S_n}$$ where

- C_p: Cost per beneficiary
- $\sum C_T$: Summation of the total cost expenditure
- S_n: Total Number of the students

Nutritional Intake Analysis: On the other sidelines, the study also takes a deeper look at the level of nutrition of the schoolchildren at each targeted school. The study tries to evaluate the nutritional intake based on the weekly food consumption pattern in schools, focusing on grains, vegetables, and meat. The analysis excludes other ingredients due to lack of records. The goal is to determine if the nutrition provided meets the required standards, using a budget of 780 riel per student. To perform the estimation, the study follows the below method:

- Calculate macro and micronutrients from the total amount of each food category.
- Use data from the Food Consumption Table for Cambodia (2013) for nutrient values per 100 grams.
- Focus on caloric intake, protein, carbohydrates, fat, calcium, iron, vitamins A, C, and D.
- Divide the total nutrient values by the average number of participating students each week.

After the estimation, the study will employ the analysis on both macro nutrition absorption and try to provide more details on micronutrition intakes as well. The results attained from the estimation will be compared with the minimum requirements from the "Development of Recommended Dietary Allowance and Food-Based Dietary for School-Aged Children in Cambodia" (2017) and USDA guidelines.

III. Findings and Implications

3.1. Costing and Cost Per Beneficiary

Table 1 below provides a detailed breakdown of the costs associated with the school feeding program (HGSFP) for the academic year 2022-2023 across 14 sampled schools. The total expenditure for the program was USD 198,307.47. The average cost per beneficiary (student) was USD 44.35. The majority of the costs (54.53%) are spent on food consumption, highlighting the primary focus of the program on providing meals. Labor costs are relatively low (8.14%), indicating efficient use of human resources. Running costs and equipment & maintenance costs are minimal, showing that operational expenses are kept under control. Construction costs are significant (22.45%), reflecting investments in infrastructure to support the program. Other costs account for nearly 10% of the total, covering various additional expenses. This detailed breakdown helps in understanding where the funds are allocated and highlights the importance of food consumption in the overall expenditure. It also provides insights into the efficiency and sustainability of the program.

Table 1. Average Share of the Cost Per Student of the Selected Schools in AY 2022-2023

Cost Item	Total cost for the 14 schools (USD)	Average cost per student (USD/yr)	Share of Cost (%)
Food Consumption	102,748.89	*22.98*	54.52
Labor	15,342.50	*3.43*	8.14
Running	14,660.21	*1.03*	2.30
Construction	42,301.58	*9.46*	22.45
Equipment & Maintenance	4,695.46	*1.05*	2.50
Other	18,728.88	*4.15*	9.94
Total	198,307.47	**44.35**	100

Source: Author's calculation from school interviews 2024

*Note: Total Number of the Student in the 14 schools is 4,471 students.

3.2. Cost Per Beneficiary Comparison in the Different Scenarios

This section examines the cost per beneficiary across different school meal program modalities: state-run, WFP-run, non-school-gardening, and school-gardening. Table 2 below shows the average cost per student and cost per making each breakfast in different modalities. Based on the annual performance report for 2021 by WFP, cost per beneficiary is an indicator to measure the average cost of delivering

assistance to tier 1 beneficiary. while the cost for making each breakfast or cost per breakfast refers to the amount of money that is needed to make one proper meal/breakfast per year-round. Additionally, the cost per breakfast is basically fully covered by subsidy provided by either state-run or WFP-run, with the current amount of 780 riel (USD 0.195). Overall, the state-run schools spent only USD 38.9 per student per year on average compared to WFP-run schools with the cost of USD 55.24 per student per year. At this particular sense, the difference in cost increase in WFP-run schools relatively resulted from the larger expenses on capital costs. The WFP-run schools have invested a lot in construction and facilities to help operate the program, making the overall expenditure rise.

However, looking at cost to make one breakfast/meal per day, it shows that state-run schools spend only USD 0.14 (KHR 587.8), whereas the WFP-run schools, in order to make one meal per day, need at least USD 0.15 (KHR 605.8). This illustrates that both cases are spent less compared to the amount of money supported by WFP and/or state – USD 0.195 per student. Interestingly, both modalities seem to be efficient in term of spending if we compared to the benchmark of the cash support for each student per day, while state-run schools could spend slightly economical than WFP-run schools with the USD 0.01 different compared to WFP's. Nonetheless, the expense on each meal for both state and WFP-run schools fully demonstrate the cost efficiency at all, meaning that if cost to subsidize is bound to a certain point, for example – USD 0.195 to meet the threshold of the amount of money for purchasing food, and they fail to reach that threshold, how could they even achieve cost saving while maintaining the quality of the food purchase? At this point, the issue is possibly related to the bidding procedure. During the bidding process, the food suppliers try to bid the least to get a permit to provide food supplies to school, and this could result in a loophole in meeting the requirement that each student gets – USD 0.195, doubting that the quality of food supplied is good enough. This constraint could also interpret that if the suppliers could have many schools in hand to supply, they could even get the supplies at a lower price compared to those who could only have a few. This would also trigger the gap in securing the quality of the supplies and their cost as well.

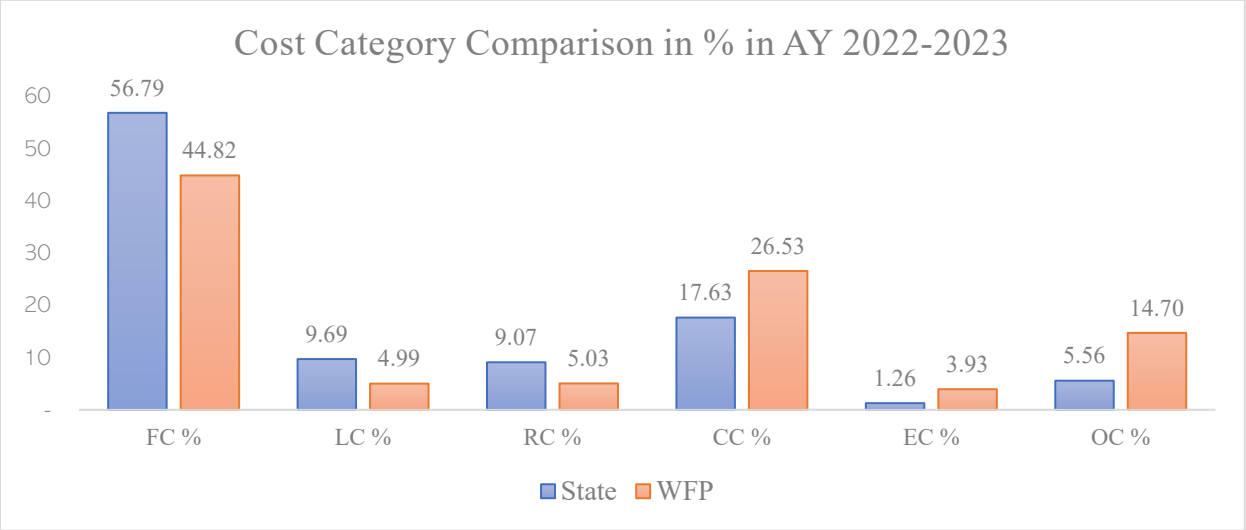
Table 2. Cost Per Beneficiary Comparison of the Different Modalities

Modalities	Cost Per Beneficiary (USD/yr)	Cost Per Breakfast Produced (USD/yr)	Cost Per Breakfast (USD/day)
State-run	38.9	29.39	0.14
WFP-run	55.24	30.29	0.15
Non-school-grown	40.95	28.55	0.14
School-grown	53.08	32.60	0.16

Source: Author's calculation from school interviews 2024

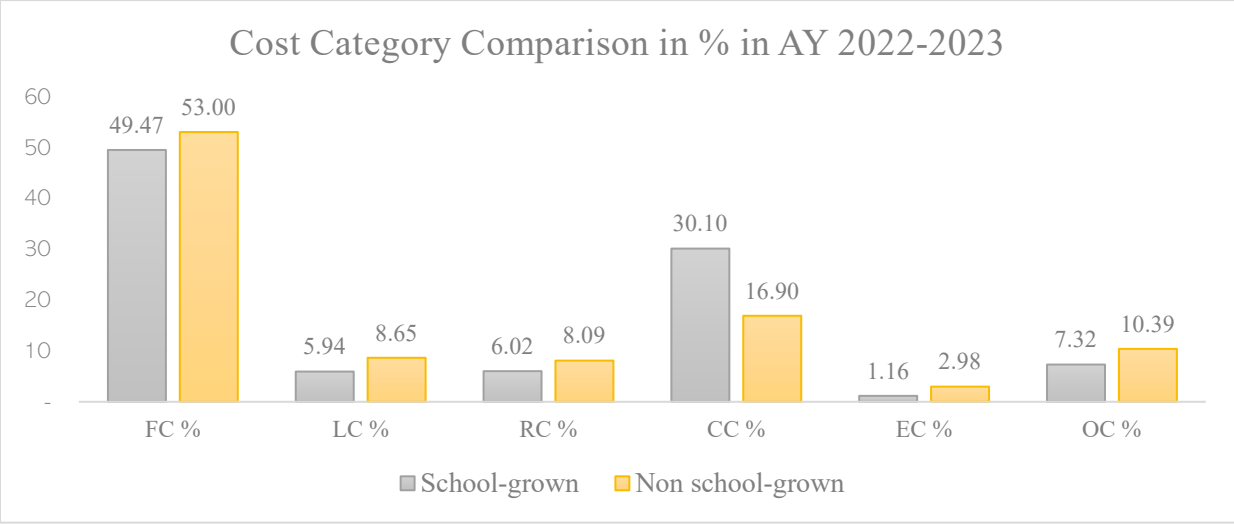
Figures 2 and 3 below illustrate the share of the input costs on the four modalities which include State-run vs WFP-run and School grown vs non School grown. State-run schools prioritize food costs, while WFP-run schools invest more in capital and other costs, indicating a focus on infrastructure and long-term program sustainability. While schools with gardening programs invest heavily in capital costs for gardening infrastructure, while non-gardening schools allocate more to food and labor costs. These figures highlight the different strategies and priorities in managing school feeding programs, reflecting the trade-offs between immediate food provision and long-term investments in program infrastructure and sustainability.

Figure 2. The comparison on the Share of the Expenditures between State and WFP-run Schools



Source: Author's calculation from school interviews 2024

Figure 3. The comparison on the Share of the Expenditures between School-grown and non-school-grown School



Source: Author's calculation from school interviews 2024

3.3. Full-time Equivalence of the Key Performers at School-level

Full-time Equivalent (FTE) Analysis provides insights into the time dedication of key actors ensuring the sustainability and efficiency of the school feeding program. FTE analysis helps assess how much time each key actor dedicates to the program, ensuring smooth operation. At the same time, it helps provide better insights into the need for adequate staffing and resource allocation to maintain program efficiency. It even highlights the critical roles and time investments attained from various stakeholders to sustain the program.

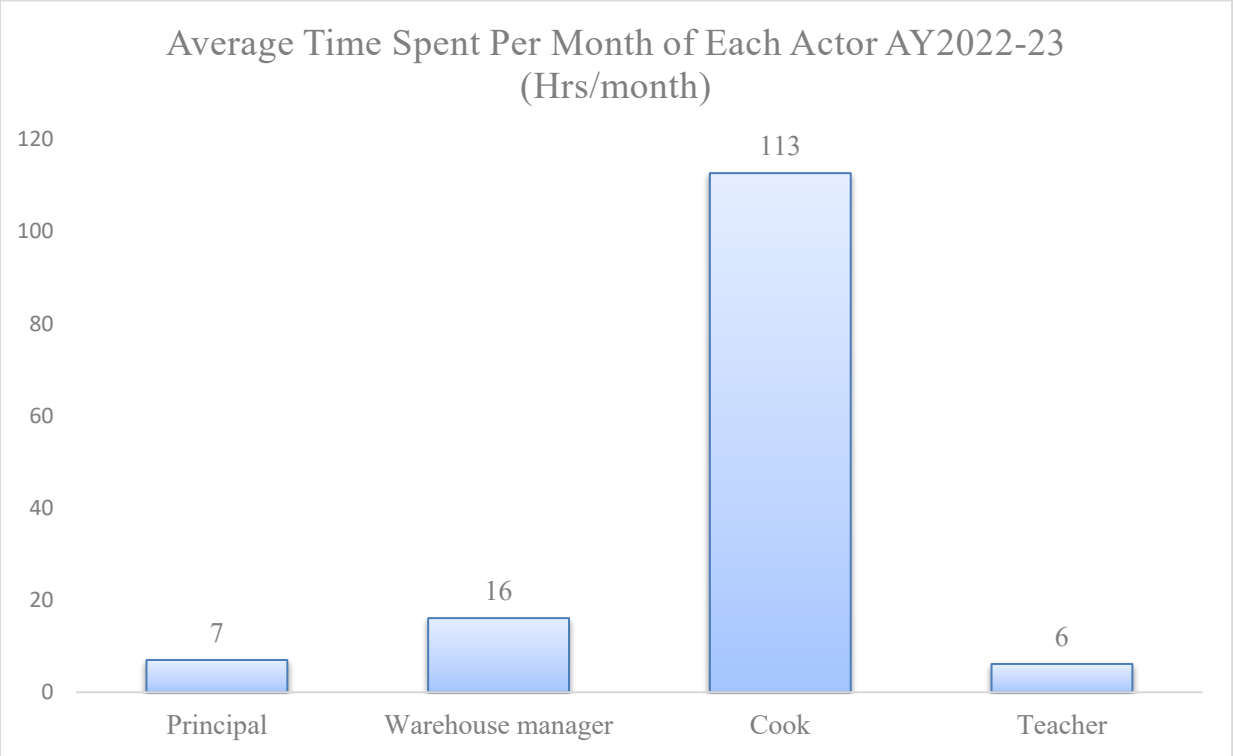
Anyway, this study analysis focuses on the contributions of several key stakeholders at the school level, including principals, warehouse keepers, finance staff, teachers, and cooks. This analysis underscores the importance of each stakeholder's contribution to the success of the school feeding program, ensuring that all aspects, from food supply management to meal preparation, are effectively handled.

The figure 4 below illustrates the key stakeholders, their roles, and their average time allocation:

a. ***Principals:*** Their roles include monitoring the overall implementation of the program, ensuring it aligns with school objectives and regulations. The principals oversee administrative duties, collaboration with key actors, and monitor program execution. They contribute most of their portion of their time to these tasks. On average, they spend about 7 hours per month.
b. ***Warehouse Keepers (often Vice Principals):*** Their main role is managing food supplies. Their main activities include receiving deliveries, maintaining inventory, ensuring safe storage, and timely distribution of food ingredients. Their role requires full attention to detail and efficient logistical management to ensure proper and smooth implementation. Adding to this, most of the time, they are involved with financial work that includes managing the budget, processing payments, and maintaining financial records to have a thorough balance and check with the food suppliers. This is also essential for ensuring financial sustainability and accountability. The warehouse keepers stand the second highest time allocation after the cook with the amount of 16 hours per month of their time allocation in this program.
c. ***Teachers:*** The teachers also play an important role in this program by supporting alongside their educational duties. They generally spend about 6 hours per month to help facilitate the program. The amount of time spent shares similar time allocation to the principals. They mainly help through taking student attendance, distributing meals, and managing classroom activities. On this behalf, their extra duties require careful time management to balance educational and feeding program responsibilities.
d. ***Cooks:*** Lastly, the major contributor to this breakfast program is the cooks who prepare and serve meals to the students. They need to ensure that the food is nutritious, safe, and appealing to schoolchildren. Noticeably, their substantial number of working hours were dedicated to meal preparation and service.

This highlights the significant disparity in time allocation, with cooks bearing the heaviest workload, while principals and teachers play supporting roles. The division of labor underscores the collaborative effort needed for the program but also points to the need for strategies to optimize time use, particularly for actors sharing multiple responsibilities.

Figure 4. Average Time Allocation of Each Actor in the Sampled Schools



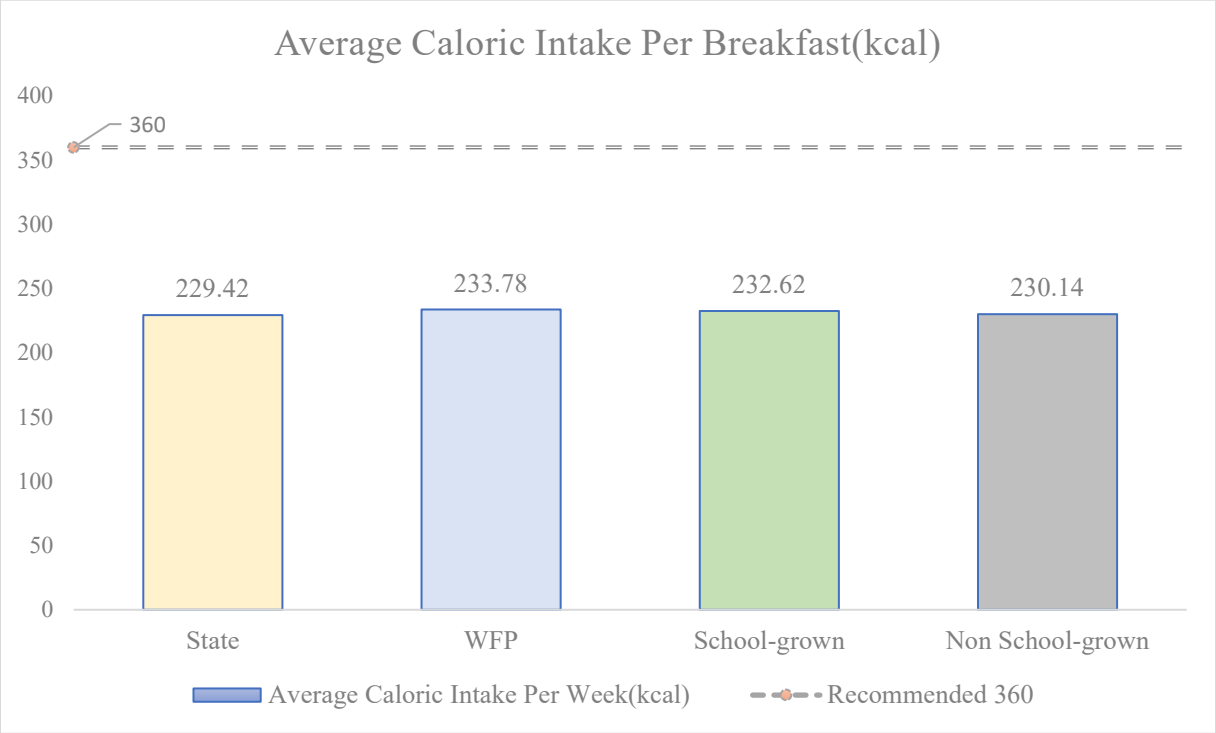
Source: Author's calculation from school interviews 2024

3.4. Nutritional Intake of the Schoolchildren in the Selected Schools

The School Feeding Program aims to improve the nutritional status of schoolchildren, enhancing their academic performance and reducing absenteeism. The study evaluated both macro and micronutrients in the meals provided to students in 14 schools.

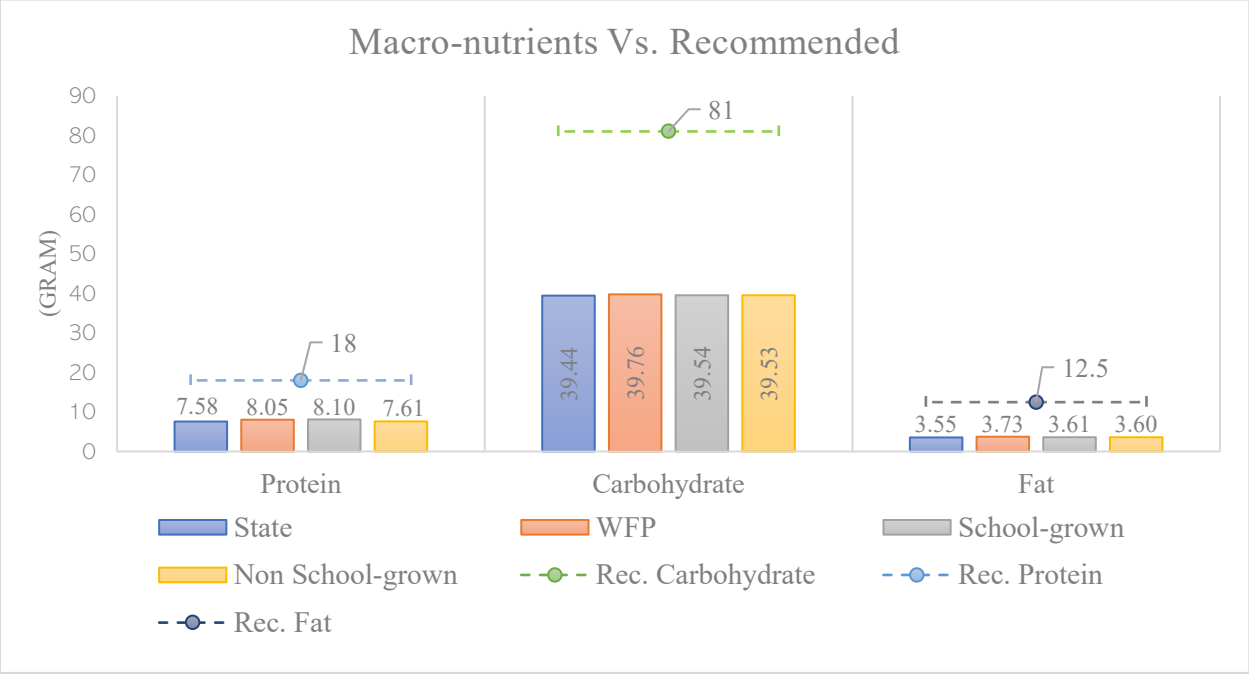
Figure 5 below shows that the current meals do not meet nutritional standards, which could lead to possible stress on nutrition insufficiency – affecting the long-term development growth of the students that might disrupt both cognitive and physical development. Insufficient caloric and nutrient intake can affect students' focus, energy levels, and academic performance. The average caloric intake per breakfast was around 230 kcal, which is below the recommended 360 kcal. All scenarios (state-run, WFP-run, school-grown gardening) showed insufficient caloric intake. WFP-run schools have the highest average caloric intake, but still below the recommended level. The slight differences in caloric intake among the scenarios indicate that none of the current meal programs provide sufficient calories to meet the recommended standards.

Figure 5 Comparison of Average Caloric Intake Per Breakfast



Source: Author's calculation from school interviews 2024

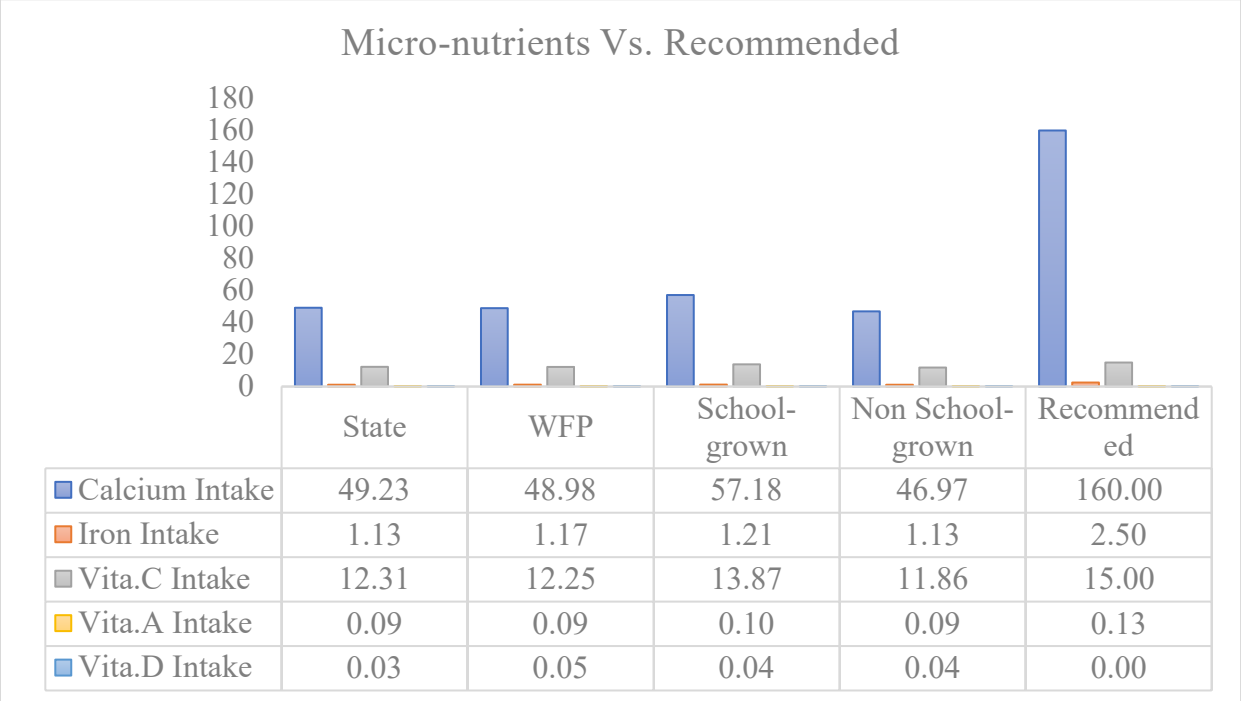
Figure 6. Comparison of Average Macro-nutrients Vs Recommended



Source: Author's calculation from school interviews 2024

Figure 6 shows the average daily macro-nutrient consumption per breakfast (protein, carbohydrates, and fat) across the four scenarios. All scenarios show insufficient intake of protein, carbohydrates, and fat compared to the recommended levels. The highest protein intake is in school-grown gardening schools, but it is still less than half of the recommended amount. Carbohydrate and fat intakes are also significantly below the recommended levels, indicating a need for more balanced meals.

Figure 7. Comparison of Average Macro-nutrients Vs Recommended



	State	WFP	School-grown	Non School-grown	Recommended
Calcium Intake	49.23	48.98	57.18	46.97	160.00
Iron Intake	1.13	1.17	1.21	1.13	2.50
Vita.C Intake	12.31	12.25	13.87	11.86	15.00
Vita.A Intake	0.09	0.09	0.10	0.09	0.13
Vita.D Intake	0.03	0.05	0.04	0.04	0.00

Source: Author's calculation from school interviews 2024

Figure 7 illustrates the average daily intake of key micro-nutrients (calcium, iron, vitamins A, C, and D) per breakfast across the four scenarios. Calcium and iron intakes are significantly below the recommended levels in all scenarios. Vitamin A and C intakes are closer to the recommended levels but still insufficient. Vitamin D intake exceeds the recommended level in all scenarios, indicating adequate provision of this nutrient.

Research indicates that breakfast helps schoolchildren maintain cognitive function, attention, and mood throughout the school day. However, whether a 300-kcal breakfast is sufficient to maintain focus and stave off hunger for 4 hours depends on factors such as the meal's nutritional quality, the child's age, metabolism, and activity levels.

A study published in the American Journal of Clinical Nutrition in 2005 found that children who skipped breakfast or ate a low-calorie meal performed worse on attention and memory tests than those who had a higher-quality breakfast with enough energy and nutrients. The study emphasized that nutritional composition is crucial; balanced meals with protein, fiber, and healthy fats promote longer-lasting satiety and consistent energy levels. Protein and fiber slow digestion, helping children

feel fuller for longer, while sugary or highly refined breakfasts can cause rapid spikes and drops in blood sugar, leading to hunger and loss of focus within a few hours.

Supporting this, research from the Journal of Nutrition and Frontiers in Human Neuroscience in 2013 found that children who ate breakfast performed better academically and had better mood regulation. However, if the meal lacked calories or nutrients, hunger could return in as little as 2-3 hours, especially in physically active children. The daily caloric needs of children aged 6 to 12 range from 1,400 to 2,200 kcal, depending on activity level. A 300-kcal breakfast typically meets 13-21% of daily energy requirements. While it provides immediate energy, some children may feel hungry before lunchtime, depending on their metabolism, activity level, and specific meals consumed. It was supported by Rampersaud et al. (2005) that those low-calorie meals or skipping breakfast altogether resulted in poor memory recall, weaker problem-solving skills, and shorter attention spans by late morning.

A 300-kcal breakfast can offer cognitive and energetic benefits, but its ability to sustain children for 4 hours depends on its nutritional quality. Balanced meals with more protein and fiber can delay hunger more effectively than meals high in sugar or refined carbohydrates. More substantial meals, containing 350-400 kcal, may help both focus and appetite control. The findings on average caloric intake, macro-nutrients, and micro-nutrients showed that children receiving roughly 228-230 kcal per breakfast, including 7.71 grams of protein, 39.53 grams of carbohydrates, and 3.6 grams of fat, are unlikely to maintain normal cognitive performance and stave off hunger for a full four hours. This breakfast accounts for only 10-15% of a 6- to 12-year-old child's daily energy intake (1,400-2,000 kcal). This amount of energy can provide short-term cognitive gains but is unlikely to sustain children over the next four hours. The low-calorie intake may lead to:

- ***Decreased energy levels:*** By mid-morning, children may experience hunger 2-3 hours after breakfast, feeling sluggish due to low energy, impacting attention, focus, and memory.
- ***Poor focus and academic performance:*** A lack of iron, vitamin A, and protein results in poor cognitive function. Iron deficiency can shorten attention spans and cause cognitive fatigue.
- ***Increased likelihood of hunger:*** Limited fat and protein intake may cause children to become hungry sooner, leading to irritation and decreased performance throughout the school day.
- ***Long-term effects:*** Inadequate calcium and somewhat sufficient vitamin D intake may disrupt bone formation over time. Without enough calcium, even with adequate vitamin D, the risk of weaker bones increases. Borderline iron intake and lower overall diet iron absorption can lead to iron-deficiency anemia over time, causing chronic fatigue, poor focus, and impaired academic performance.

The overall pattern of breakfast habits among the schoolchildren was insufficient to promote good physical and cognitive development. Caloric intake, along with moderate to low micronutrient levels, notably iron and calcium, likely leads to early hunger, reduced attention span, and poorer cognitive results. If this diet pattern continues over time, it may have serious consequences for bone health, immunity, and cognitive function.

3.5. Opportunities and Constraints

Challenges and Opportunities for Cooks and Suppliers

The findings revealed significant challenges and opportunities faced by cooks and suppliers in both State-run and WFP programs. Interviews provided insights into their views on the school feeding program and potential for expanding school gardening initiatives.

Challenges of the Cooks

Table 3: Comparison of Challenges of the Cooks in State-run & WFP-run

State-run	WFP
1. Inadequate infrastructure	1. Inadequate infrastructure
2. Insufficient Kitchen materials	2. Insufficient Kitchen materials
3. Waking up early	3. Waking up early
4. Delays in payment	

Cooks working in schools under both the State-run and WFP programs face several common challenges, including inadequate infrastructure, insufficient kitchen materials, and the necessity of waking up early. Additionally, cooks in State-run schools' experience delay in payment (Table 3).

Inadequate infrastructure: This is a significant issue, particularly in remote rural areas. Challenges include damaged roads, slippery conditions during the rainy season, and a lack of street lighting, making travel to school and access to resources difficult.

Insufficient kitchen materials: Many cooks reported a shortage of essential kitchen tools and ingredients, affecting their ability to perform effectively. For example, a cook from "Kbal Domrei School" in Kampong Cham mentioned difficulties such as wet wood during the rainy season and a lack of proper kitchen tools like ladles, pots, and pans.

Waking up early: Cooks often start their day between 3 and 4 a.m., adding to the physical demands of the job and contributing to overall strain.

Delays in payment: This issue is specific to State-run schools, with payment delays sometimes extending from one to two months, impacting the financial stability of cooks who rely on their salaries. A cook from Dang Het School in Kampong Thom stated, "We're supposed to be paid every month, but sometimes the payment doesn't come until the second week of the next month." These challenges collectively hinder the effectiveness of the school feeding program and place significant strain on the cooks, who play a crucial role in ensuring that students receive nutritious meals.

Opportunities of the Cooks

Table 4: Comparison of Opportunities of the Cooks in State-run & WFP-run

State-run	WFP
1. Contribute to their communities	1. Contribute to their communities
2. Receive leftover meals	2. Receive leftover meals
3. Avg. incentive of USD72.5	3. Avg. incentive of USD56.25

Source: Author's calculation from school interviews 2024

On the other hand, cooks working in both State-run and WFP programs reported similar opportunities, despite variations in incentives. Both groups emphasized their contributions to the community and the benefit of receiving leftover meals. Cooks in WFP-run schools typically receive an average incentive of USD 56.25, while those in State-run schools generally receive a slightly higher incentive of USD 72.5 (Table 4).

Contributing to their communities: Many cooks are inspired to support their communities and are motivated by having their grandchildren in the schools they serve.

Receiving leftover meals: Leftovers are valued by cooks in both programs. These are often taken home and used to feed animals, such as pigs, supplementing household resources.

Higher incentives in State-run programs*:* The slightly higher incentives for cooks in State-run programs are attributed to additional support from external sources, such as commune chiefs and non-governmental organizations, which assist with operations and provide motivation.

Challenges of Suppliers

Table 5: Comparison of Challenges of the Suppliers in State-run & WFP-run

State-run	WFP
1. Delays in payment (2 – 3 months)	1. Delays in payment (1 – 2 months)
2. Price fluctuation	2. Price fluctuation
3. Difficulties with transportation	3. Difficulties with transportation

Source: Author's calculation from school interviews 2024

Table 5 reveals that suppliers from both State-run and WFP-supported schools encounter similar challenges, though the severity often differs, particularly regarding payment delays.

Delays in payment: These significantly impact suppliers' operations, with many needing to borrow money to keep the program running. Suppliers in State-run programs reported delays of two to three months, sometimes leading to extreme measures like selling assets. For example, a supplier from a State-run school in Kampong Thom shared, "The payment delays usually last about two to three

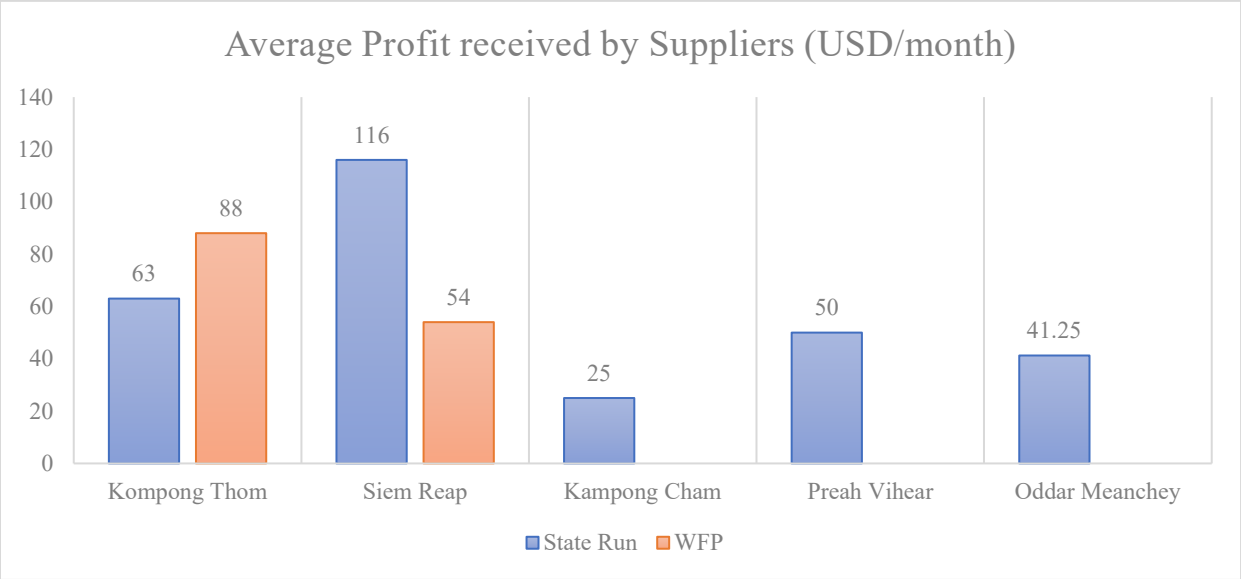
months. Once, it took so long that I had to sell a piece of my land to keep supporting the program." In contrast, WFP suppliers generally reported shorter delays of one to two months.

Price fluctuations: Suppliers face daily difficulties due to the lack of standardized pricing. A supplier from Tuol Prech School under the State-run program in Kampong Cham stated, "The price of goods changes when the weather is hot or when there is heavy rain, which impacts farmers and leads to fluctuations in market prices." Similarly, a supplier from Srae Veal Kert, a remote WFP-supported school in Kampong Thom, mentioned, "The price of goods changes because the community is no longer planting crops due to hot weather and water shortages. This leads to market price increases due to high demand and a lack of supply."

Transportation difficulties: Suppliers typically travel each morning to purchase goods from local markets or nearby communities to supply the schools. They often encounter issues such as damaged roads, long distances, and slippery conditions, particularly during the rainy season. These challenges disrupt their operations, leading to financial difficulties and operational inefficiencies in the school feeding program.

Opportunities of Suppliers

Figure 8. Comparison of the Benefits of Suppliers under State-run and WFP-run in the 5 Provinces



Source: Author's calculation from school interviews 2024

The above figure shows the primary benefit suppliers received per month from the school feeding program. The average profit among suppliers differs from province to province. In the 5 provinces, there are two provinces that have co-existed State-run and WFP-run schools – Kampong Thom and Siem Reap provinces. Suppliers in Kampong Thom show a slight difference in average profit, with WFP suppliers earning around USD 88 per month compared to USD 63 per month for those in State-run

programs. In contrast, suppliers in Siem Reap under State-run programs exhibit a significant difference, with an average profit of USD 116, more than double the USD 54 average profit of WFP suppliers. Additionally, looking at the other three provinces which are under the implementation of the state-run could earn profits ranging from USD 25-50 per month from supplying food for this program. Still, there are also differences that highlight notable variations in profit among suppliers, influenced by factors such as sourcing methods. Some suppliers buy from markets or nearby communities, while others use their own plantations to supply schools with crops like carrots, cabbages, and other varieties to save on costs. Price fluctuations also play a crucial role in provincial profit comparisons, as changes in price can significantly impact suppliers' profits depending on variations and seasonal changes.

While profit remains the primary incentive for suppliers in the school feeding program, many also experience other meaningful benefits. These non-financial opportunities are often tied to personal satisfaction and contributions to the community. Several suppliers mentioned feeling a sense of pride in supporting the well-being of local children by providing nutritious meals. This sense of community involvement fosters personal fulfillment, as their work directly benefits students and reduces the financial burden on families. A male supplier in Leang Dai school shared, *"It's rewarding to know that my efforts help children focus better in the class because they have a healthy breakfast."* Suppliers appreciate the flexibility of their role, which allows them to balance work and personal life. Since most supplier responsibilities involve only part-time work, one supplier from Svay Chek School in Siem Reap expressed appreciation, saying, *"I'm thankful for this opportunity because it doesn't require too much effort, and I only need to work for half a day."*

Perception of Cooks and Suppliers on School Feeding Program

Insights from key informant interviews show that cooks view the program positively and are happy to participate. They believe it helps reduce the financial burden on students' parents, which is particularly beneficial for struggling families. Additionally, they noted that students have more energy to study after eating meals. However, the cooks also requested more kitchen materials and proper tables for students, as many currently eat in classrooms. They also expressed the need for salary increases.

Similarly, suppliers see the school feeding program as valuable. Many of them, like the cooks, request the establishment of cafeterias to ensure proper sanitation and cleanliness for the students. Suppliers seem to enjoy their work, as it typically only requires a half-day commitment. A female supplier from Leang Dai school in Siem Reap, under the State-run program, shared her gratitude, stating, "I'm very happy and thankful to be able to work at this job because I don't need to immigrate to neighboring countries for work and can help my child study up to the third grade this year." Most suppliers mentioned their satisfaction in contributing to the well-being of young children by providing them with breakfast and supporting their families to reduce their child's expenses. Another supplier working for a school under WFP in Siem Reap remarked, *"I'm happy to gain some profit from this job and to help children eat good food, prosper, and improve their performance in class."*

Perception of Cooks and Suppliers on the Potentials of Scaling up School-grown Gardening

Currently, only three schools have implemented school-grown gardening programs: two in Siem Reap (Svay Chek School and Wat Run School) and one in Preah Vihear Province (Koh Keh School). Of these, only Wat Run School supplies crops to suppliers twice per month, while the other two schools manage only once per month. The limited number of school gardening programs means they cannot provide daily supplies, and the variety of crops is also insufficient. Consequently, most schools do not have gardening programs.

Interviews with cooks and suppliers working at schools without gardening programs revealed unanimous support for the idea that such programs were established. Suppliers showed interest in school gardening and indicated they would be willing to purchase crops from the schools, providing a profitable return. One supplier from Kampong Cham Province, who works under State-run schools, highlighted, “I think it’s a good idea because the school can grow crops, and I can buy them back from the school. However, the school would need someone to take care of the plants to ensure successful crop growth.” Some suppliers also noted that schools use only natural fertilizers, such as cow and chicken manure, which is a positive aspect as the crops are chemical-free.

The current implementation of school gardening in Cambodia is limited, as seen in a randomly selected sample of 14 schools, where only three are participating in such programs. Despite challenges like low production frequency and limited crop variety, there is significant interest from both cooks and suppliers in expanding these initiatives. Suppliers recognize potential economic benefits and are willing to support and purchase produce from school gardening. This suggests that scaling up school gardening could be a viable and beneficial initiative, provided that proper management and care for the crops are ensured.

3.6. Case Study on the Successful School-grown Gardening

School-grown plantations provide significant financial and educational benefits to schools, especially in resource-constrained environments. One well-known benefit is the ability to reduce the cost of school meals. Schools can economize on food purchases by producing their own vegetables, leveraging resources or funds for other essential needs or initiatives. According to findings, locally farmed vegetables can help students have more affordable and better lunch alternatives, improving both nutrition and budgetary efficiency (FAO, 2016).

Additionally, schools that produce more than they consume can earn extra money by selling excess vegetables in local markets or to other towns. This revenue can be reinvested in the school's infrastructure, teaching resources, or even additional garden extensions. For example, a school in rural Uganda saved around 20% on food expenditures by incorporating a school garden and reinvesting the savings in other school activities (Ssekabira, 2018).

In the context of the school-grown gardening scenario in this study, three schools had the potential to cultivate their own crops and sell the vegetables to food suppliers, which they practiced in the previous academic year 2022-2023. However, the earnings were not used to cover school expenses.

Instead, the money earned was used to support students and teachers, motivating them to continue the plantation practices. Notably, one of the three schools successfully supplied vegetables to suppliers throughout the year, selling vegetables one to two times per month. The variety of vegetables depended on the season, with the most common being morning glory, wax gourd, eggplant, and yard-long bean.

Since the average amount of vegetables sold depended on the season and the school could not recall the specific types of vegetables sold, the estimation was based on the specific vegetables sold last year and their quantities. The average price of the items was considered based on local prices. Table 7 illustrates the potential revenue that each school with school-grown gardening could earn.

Table 6: Estimation of the Potential Revenues from School-grown Gardening Schools

School	Management	Production Length	Times to Supply	Supplying Month	Avg. Quantity Selling (kg)	Total Revenue Per Year (USD)
Koh Keh	State-run	June-Oct	1	5	19	95-100
Svay Chek	State-run	Jan-Feb/May-June	2	1	22	40-60
Wat Run	WFP-run	Whole Year	2	10	30	600-900

Source: Author's calculation from school interviews 2024

"Wat Run," administered by the WFP, has the potential to earn the highest amount of money from selling vegetables, earning between USD 600-900 per year. This amount could cover other expenses, including spices, ingredients, incentives for cooks, warehouse keepers, and other activities. Meanwhile, the other two schools also had the potential to sell vegetables, but their supply was minimal due to weather and production length issues. Promoting school-grown plantations could help reduce expenses and generate revenue for schools. Additionally, the schools indicated that key factors contributing to successful gardening include irrigation systems, seedlings, weather, and techniques for nurturing vegetables. The three schools often spent money on land preparation, seedlings, and water for planting. Major problems encountered included harsh weather leading to crop failures. For example, in the cases of "Wat Run" and "Svay Chek," vegetables were flooded during the rainy season, resulting in crop failures. "Koh Keh" school faced topological constraints, making planting difficult during summer and prone to flooding during the rainy season. Therefore, they suggested technical interventions to help crops withstand adverse weather and land conditions.

3.7. Nutritional Intake Sensitivity

Nutritional input sensitivity refers to how variations in dietary patterns or food intake influence total nutrient and calorie consumption, especially regarding health implications. In school settings, understanding how changes to school meals, such as increasing portion sizes, might help schoolchildren meet nutritional standards is vital. It shows how small changes in portion sizes can

help children get closer to the recommended dietary allowances (RDAs) for calories and vitamins. For instance, increasing the quantity of breakfast by 10-20% could significantly increase caloric intake and essential nutrients, avoiding malnutrition and improving academic performance. This is supported by Hoyland, Dye, & Lawton (2009), who found that schoolchildren heavily reliant on school meals particularly require a large portion of their daily nutrition from these meals.

In this study, the sensitivity analysis mainly focused on overall caloric intake per meal. The proportions of the three main components—grain, meat, and vegetables—were key to the estimation. There were nine scenarios for increasing the size of the meal, with the baseline scenario set at 228.82 kcal per breakfast, the average calorie intake within the targeted schools. The three scenarios for increasing caloric intake were set to 320 kcal in scenario 1, 360 kcal in scenario 2, and the minimum requirement of 400 kcal per breakfast in scenario 3. The other six scenarios estimated the increase of only specific components, such as grain, meat, and vegetables.

Table 8 below illustrates the sensitivity of increasing meal sizes to meet the standard daily intake requirements.

- **Scenario 1 (320 kcal):** This represents a 39.8% increase in breakfast calories. It shows that a moderate increase helps move closer to standard, but additional adjustments might still be needed.

- **Scenario 2 (360 kcal):** This scenario, with a 57.3% increase, indicates that a more significant increase brings the intake closer to the standard with balanced proportions.

- **Scenario 3 (400 kcal):** This scenario, with a 74.8% increase, achieves the recommended intake but requires larger portions of each food group.

These scenarios suggest that even modest increases in portion sizes can substantially improve breakfast quality. To ensure well-balanced breakfasts that help students stay active and improve, increasing the size of the dish is necessary since the current practice does not guarantee improvement. Key stakeholders should consider various options for schools, such as consistent food menus that meet standard caloric intake and provide well-balanced nutrients, including essential macro and micro-nutrients (carbohydrates, fats, proteins, calcium, iron, vitamins A, C, and D).

Table 7: Sensitivity Analysis on Increasing Size of the Meal for Improving Nutritional Intake (Increase al Components)

Food Group	Scenario 0 (228.82 kcal)	Scenario 1 (320 kcal)	Scenario 2 (360 kcal)	Scenario 3 (400 kcal)
Rice (g)	115	160.77	180.90	201.02
Meat (g)	20	27.96	31.46	34.96
Vegetables (g)	50	69.90	78.65	87.96
Caloric Intake from Rice (kcal)	149.50	209.00	235.16	261.32

Caloric Intake from meat (kcal)	41.76	58.38	65.68	72.99
Caloric Intake from Vegetables (kcal)	29.82	41.70	46.91	52.13
Total Caloric Contribution	**221.09**	**309.08**	**347.77**	**386.46**
Remain Calories (kcal)	7.73	10.92	12.23	13.54

Table 9 below shows that increasing specific amounts of each food group (grain, meat, or vegetables) results in small increases in average caloric intake, which are still insufficient to meet the daily breakfast consumption requirement. Interestingly, increasing the amount of grain (rice) to the 360-kcal scenario implies that the average caloric intake per breakfast could reach 306 kcal, almost meeting the requirement of 300-400 kcal per breakfast. While increasing grain consumption can boost caloric intake, increasing vegetables could be more beneficial for overall nutrition. In short, increasing all food groups proportionally is more beneficial for providing both macro and micro-nutrients.

Table 8: Sensitivity Analysis on Increasing Size of Each Component

Food Group (g)	Sc.0 (kcal)	Sc.4 (kcal)	Sc.5 (kcal)	Sc.6 (kcal)	Sc.7 (kcal)	S.8 (kcal)	Sc.9 (kcal)
Rice	115	115	115	115	115	***160***	***180***
Meat	20	20	20	***27.96***	***31.46***	20	20
Vegetables	50	***69.9***	***78.65***	50	50	50	50
Cal. Rice	149.50	149.50	149.50	149.50	149.50	***209***	***235.16***
Cal. Meat	41.76	41.76	41.76	***58.38***	***65.69***	41.76	41.76
Cal. Veg	29.08	***41.69***	***46.91***	29.08	29.08	29.08	29.08
Total. Cal.	221.08	232.95	238.17	236.97	244.28	279.85	306
Remain Cal.	7.735	87.05	121.83	83.03	115.72	40.15	54

IV. Conclusions and Recommendations

The study investigated the costs incurred at both the school and central levels during the previous Academic Year (AY) 2022-2023 to execute the school feeding program. The assessment aimed to capture the true cost of expenses borne by both WFP-run and state-run schools. The analysis provided key insights into the financial and operational efficiencies of these initiatives, evaluating expenditures across various components such as food consumption, labor, utilities, administrative costs, capital, equipment, and other costs. Additionally, the study examined the nutritional intake of schoolchildren during the last academic year. The key outcomes of the study are summarized below:

- **Total Expenditures and Cost Drivers:** In the targeted schools, the cost drivers in recurring costs (food consumption, labor, utilities, and administrative costs) accounted for about 66.94% of total expenses, while non-recurring costs (capital, equipment, and other costs) accounted for 33.05%. Additionally, the highest expenses were for food consumption (57%), followed by capital costs (20%), labor costs, and other related costs.

- **Average Cost per Pupil:** Average Cost per Pupil: At the school level, the average annual cost per pupil was approximately USD 42.10. This cost encompasses various expenses, with the highest being food, which averaged USD 22.98 per student. The significant portion allocated to food highlights the program's focus on providing nutritious meals. Other costs included labor, running costs, capital costs, and equipment maintenance. The detailed breakdown of these expenses helps in understanding the financial allocation and efficiency of the school feeding program. Notably, the food cost per student was the highest, indicating that more than half of the total cost per pupil was dedicated to ensuring students received adequate nutrition.

- **Cost per Beneficiary and Cost per Breakfast Comparison:** State-run schools had the lowest cost per beneficiary at USD 38.90, while WFP-run schools had the highest at USD 55.24. State-run schools primarily allocated their budget to food consumption, whereas WFP-run schools invested more in building facilities and infrastructure to support the program. The cost to prepare each breakfast per day was USD 0.14 for state-run schools and USD 0.15 for WFP-run schools. Despite the slight difference of USD 0.01, both modalities were cost-efficient compared to the subsidy provided by the state or WFP, which was USD 0.195 (KHR 780) per student. However, the cost efficiency of each breakfast does not fully capture the overall cost dynamics. The bidding process for food suppliers often results in bids lower than the subsidy threshold of USD 0.195, raising concerns about the quality of the food provided. Suppliers tend to bid lower to secure contracts, which may compromise the quality of the goods supplied. This issue highlights a potential loophole in the expenditure process, where the focus on cost-saving could impact the nutritional quality of the meals provided to students.

- **Efficiency of School-grown Gardening:** The expenditure for school-grown gardening was relatively high, with the average cost per student at USD 53.08 per year. This increase in cost

was primarily due to the expenses associated with gardening activities, such as land preparation, irrigation, and purchasing seedlings. Despite these higher costs, school-grown gardening provided more effective nutritional intake compared to state-run schools. For example, schools with gardening programs were able to offer nutrient-dense meals, which included fresh vegetables like morning glory, wax gourd, eggplant, and yard-long bean. Additionally, the revenue generated from selling surplus vegetables, which ranged from USD 600 to 900 per year for some schools, helped support other school expenses and activities. This suggests that while the initial investment in school-grown gardening is higher, it can yield significant nutritional benefits and potentially reduce overall expenditure in the School Feeding Program (SFP) through improved food quality and additional revenue streams.

- **Full-time Equivalent Analysis:** The analysis revealed that cooks were the primary contributors to the school feeding program, dedicating nearly 113 hours per month to meal preparation. This significant time investment underscores the critical role cooks play in ensuring that students receive nutritious meals daily. The warehouse keeper or manager, responsible for managing food supplies and maintaining inventory, contributed 16 hours per month. Their role is essential for the smooth operation of the program, ensuring that ingredients are available and properly stored. Principals, who oversee the overall implementation and ensure the program aligns with school objectives, contributed 7 hours per month. This time allocation highlights the administrative and supervisory responsibilities principals have in supporting the program's success. Together, these roles demonstrate the collaborative effort required to sustain the school feeding program and ensure its efficiency and effectiveness.

- **Nutritional Intake:** The average caloric intake per breakfast was approximately 228.82 kcal, which is significantly below the recommended 360 kcal – applied benchmark for moderate active students. This shortfall indicates that the meals provided do not meet the necessary energy requirements for schoolchildren. Additionally, the analysis of macro and micronutrient consumption revealed that the average intake of protein, carbohydrates, fats, and essential vitamins and minerals did not reach the recommended levels of 20-25% of the total daily energy intake. This insufficiency suggests that the schoolchildren are not receiving adequate nutrition, which can lead to potential long-term physical and cognitive development issues. Insufficient caloric and nutrient intake can affect students' focus, energy levels, and academic performance, and may result in malnutrition, impaired cognitive and physical development, and other health problems over time.

4.1. Suggestions and Recommendations

Based on the findings, the following implications and recommendations are proposed:

Increase Budget for Food: Although the expenses for food were less than the planned budget, the government should consider increasing the budget to support the implementation. This is especially important for the bidding procedure, where a supportive mechanism should be in place to prevent food suppliers from bidding lower than the current subsidy (USD 0.195). Ensuring that the price and

quality of the food meet the set standards could be achieved by increasing the amount of individual consumption of each food item (meat, grain, and vegetables). Additionally, the cost per student should be increased to at least USD 0.26, reflecting the true cost of students' breakfast.

Additional Support for Schools: Provide financial support, technical support, and training. Schools need additional programs to support the feeding program, such as buying fruits for students, which can be costly. Incentives for warehouse keepers should also be considered, as they play a significant role in the program. Technical support is required to help schools better report documents, especially in areas with limited technology and service carriers.

Consistent Nutritional Guidelines: Despite the budget for food, there are still insufficiencies in macro and micronutrients. Line ministries and relevant stakeholders should set standard guidelines for meals to ensure students receive at least 20-25% of their daily energy intake, recommended for 360 kcal for moderate active students and/or roughly 400-500 kcal per breakfast for students who are hyperactive. Adjusting portion sizes and increasing vegetable intake should be considered, as vegetables are rich in vitamins essential for cognitive and physical development.

Promote School Gardening: As shown by the potential revenue from school-grown gardening, promoting this practice can reduce school expenses. Based on the sensitivity analysis, increasing the quantity of specific vegetables could be one way to ensure sufficient protein and vitamins for children. Schools could consider scaling up the gardening to support the program by capitalizing planting those crops with the varieties of nutrient-dense crops like moringa, amaranth, long yard beans, morning glory, broccoli, cauliflower, pumpkin, and carrots to ensure sufficient nutrients – full of vitamins which is good for student's growth. This should also consider the typology of the regions where they are suitable for these vegetables as well since some regions are not plausible for all types of vegetables at all. At the same time, it would be better if the school could grow additional fruit trees to support students' nutrition such as banana, papaya, and other fruit trees where they are easy growing. These kinds of interventions could also provide additional nutrients to students. Stakeholders should provide technical training on cultivating specific crops, support technological practices, and offer interventions to help crops withstand severe conditions, climate, and natural disasters. Ongoing assessments should ensure these interventions are effective.

Guidelines for Well-balanced Meals: The government or relevant stakeholders should create consistent guidelines for specific dishes to ensure well-balanced meals for students, providing sufficient macro and micronutrients.

Improve Sanitation and Accessibility: When scaling up, stakeholders should consider improving sanitation, accessibility, and school necessities. Needs vary by region; for example, areas lacking water accessibility may need wells or other water sources. Technical support should be provided for crop cultivation at schools.

4.2. Limitation of the Study

The current study covered the total expenditures for the school feeding program where both State and WFP were participating. Detailed data would be essential for a comprehensive analysis. However, several challenges during data collection made the study less rigid:

- ***Incomplete Data:*** There was a lack of documentation, including school enrollment numbers, attendance, dropouts, and students' weights and heights, which are crucial for nutritional outcomes analysis.

- ***Poor Data Management:*** At the school level, improper handling of files led to incomplete records on daily or monthly purchases of food ingredients, spices, and other expenses. Some calculations had to rely on estimates due to the lack of clear records.

- ***Difficulty in Obtaining Educational Outcomes:*** It was challenging to obtain information from local authorities and higher-ups, affecting the analysis of educational outcomes.

- ***Estimation Issues & Lack of Baseline Data:*** Utility consumption calculations were based on average estimates due to the absence of clear records. Price differences across regions also posed challenges, leading to the use of average prices for sampled schools. Without baseline data, it was difficult to conduct an impact evaluation to see how the intervention had changed over time. The baseline data involved information about the growth of the students including measurement, dropout rate, and other related data which are essential for nutritional impact evaluation. These challenges highlight the need for better data management and documentation to improve the accuracy and comprehensiveness of future studies.

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VI. Appendices

Table 9. Cost Per Beneficiary of Each School in AY 2022-2023

No.	School	Cost Per Beneficiary Pery Year (USD)	Cost Per Beneficiary Per Day (USD)	Cost Per Breakfast Produced Per Year (USD)	Cost Per Breakfast Produced Per Day (USD)
1	Tuol Prech	32.25	*0.16*	27.94	*0.14*
2	Kbal Domrei	20.57	*0.10*	14.32	*0.07*
3	Doung	35.01	*0.18*	34.83	*0.17*
4	Tuol Krerl	10.64	*0.52*	58.12	*0.29*
5	Bansay Reak	31.92	*0.16*	24.56	*0.12*
6	Pong Tuek	60.67	*0.30*	48.40	*0.24*
7	Koh Keh	51.85	*0.26*	28.36	*0.14*
8	Tbaeng Pii	46.92	*0.23*	46.15	*0.23*
9	Leang Dai	24.07	*0.12*	20.77	*0.10*
10	Svay Chek	46.96	*0.23*	28.47	*0.14*
11	Danghet	142.33	*0.71*	32.94	*0.16*
12	Srae Veal Kert	59.08	*0.3*	40.09	*0.20*
13	Preah Dak	31.75	*0.16*	20.72	*0.10*
14	Wat Run	62.73	*0.31*	40.59	*0.20*

Table 10. Cost Drivers in % of the 14 Schools in AY 2022-2023

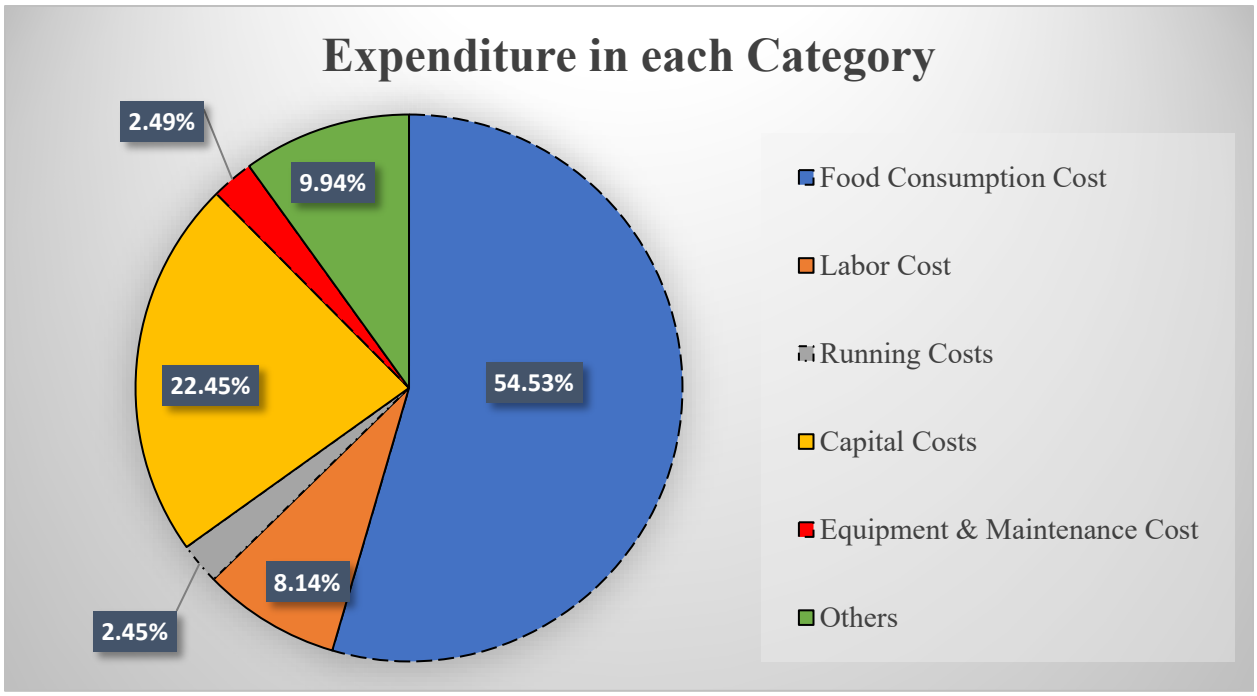


Figure 9. Cost Drivers of Each School Run by State AY 2022-2023

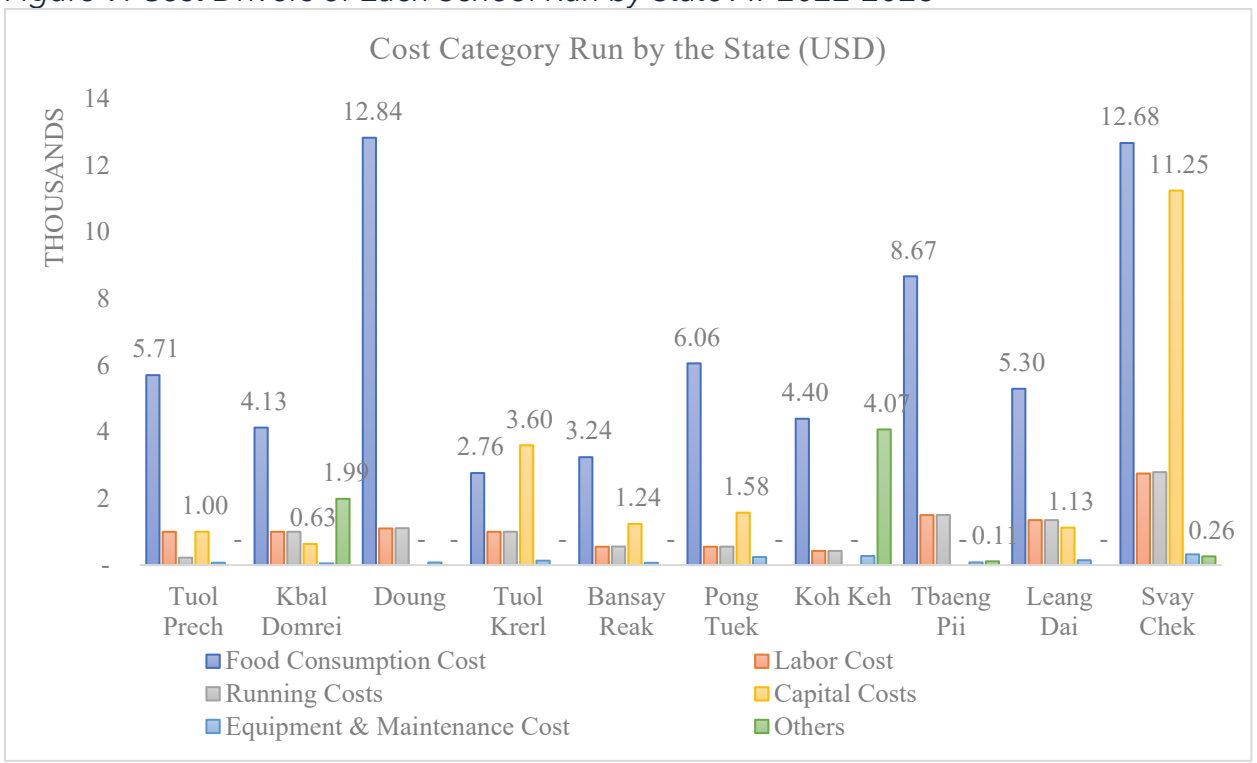


Figure 10. Cost Drivers of Each School Run by WFP in AY 2022-2023

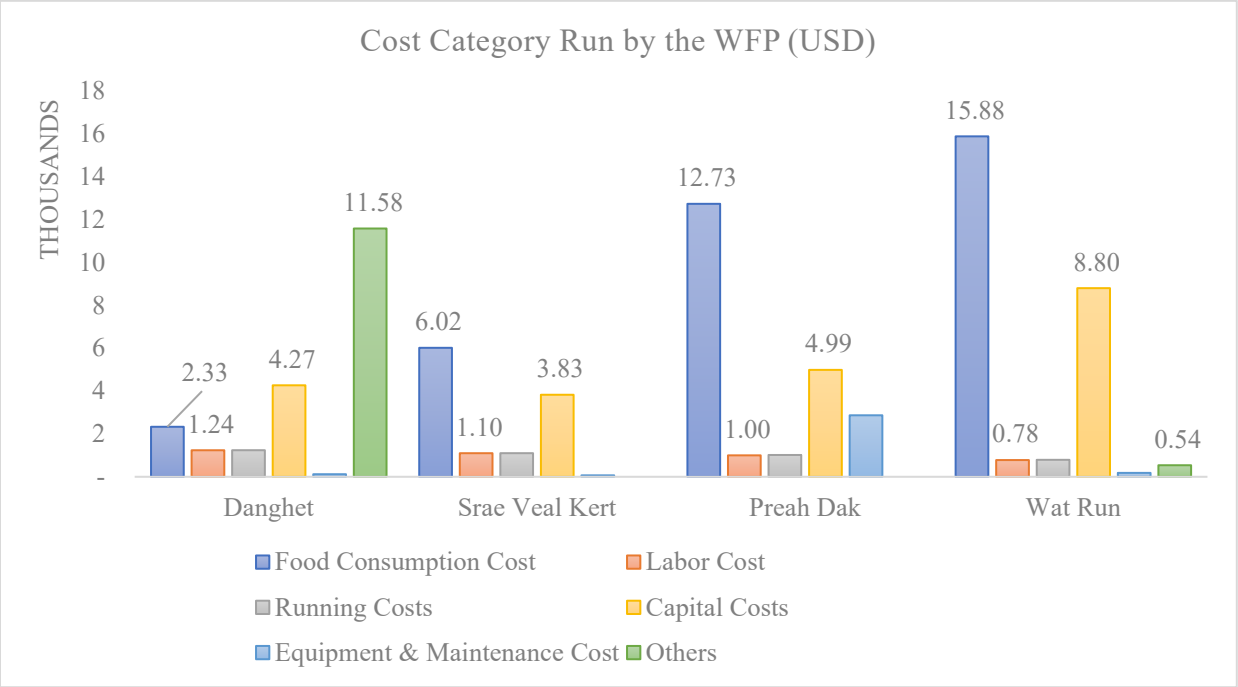


Figure 11. Average Caloric Intake Per Breakfast of Each School in AY 2022-2023

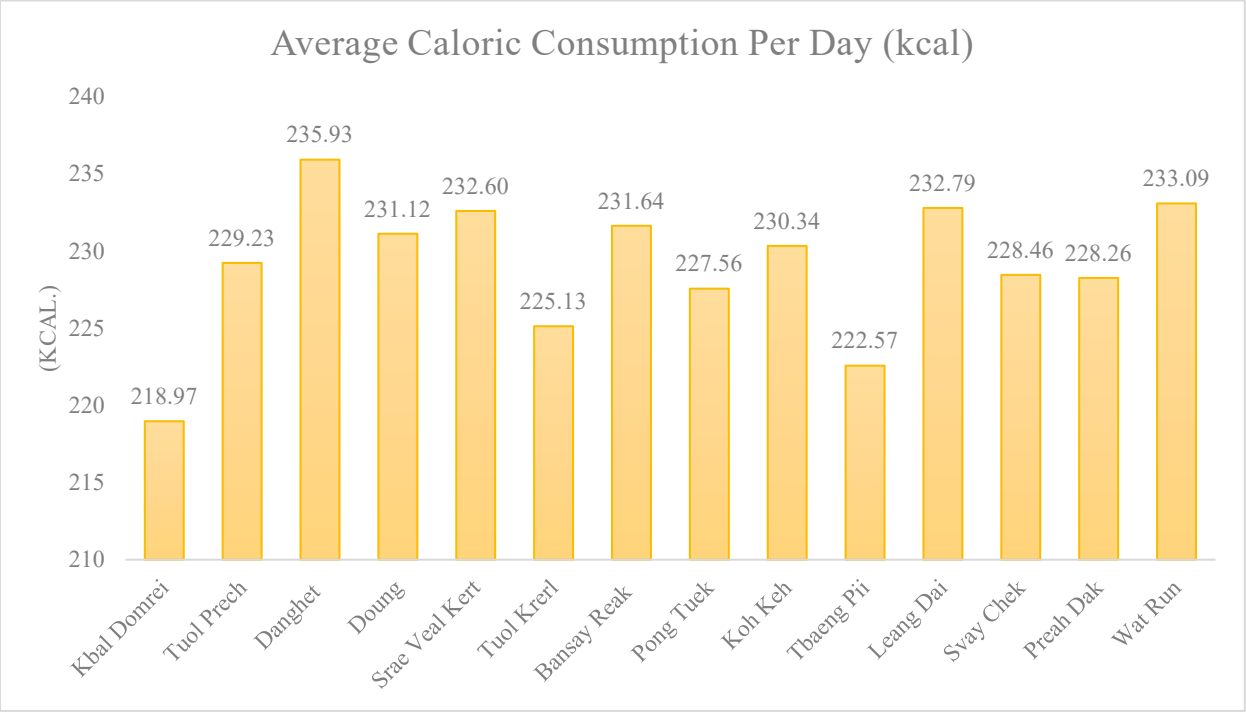


Figure 12. Summary of Average Macro-nutrients Consumption Per Breakfast of Each School

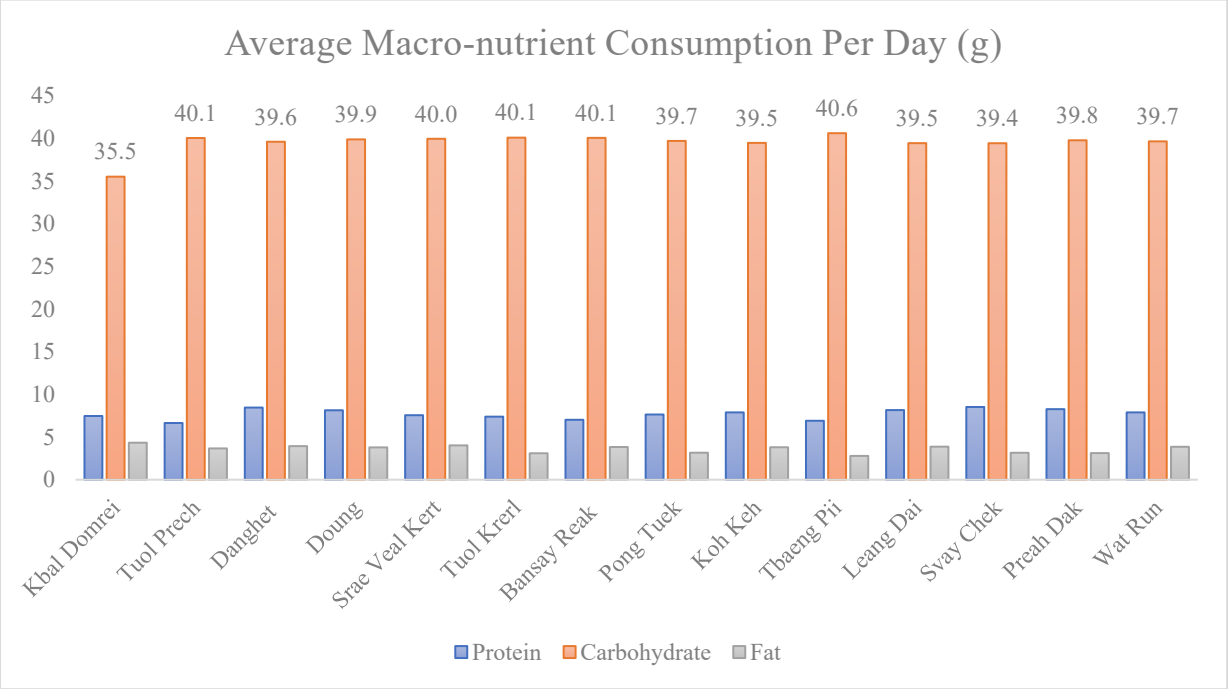
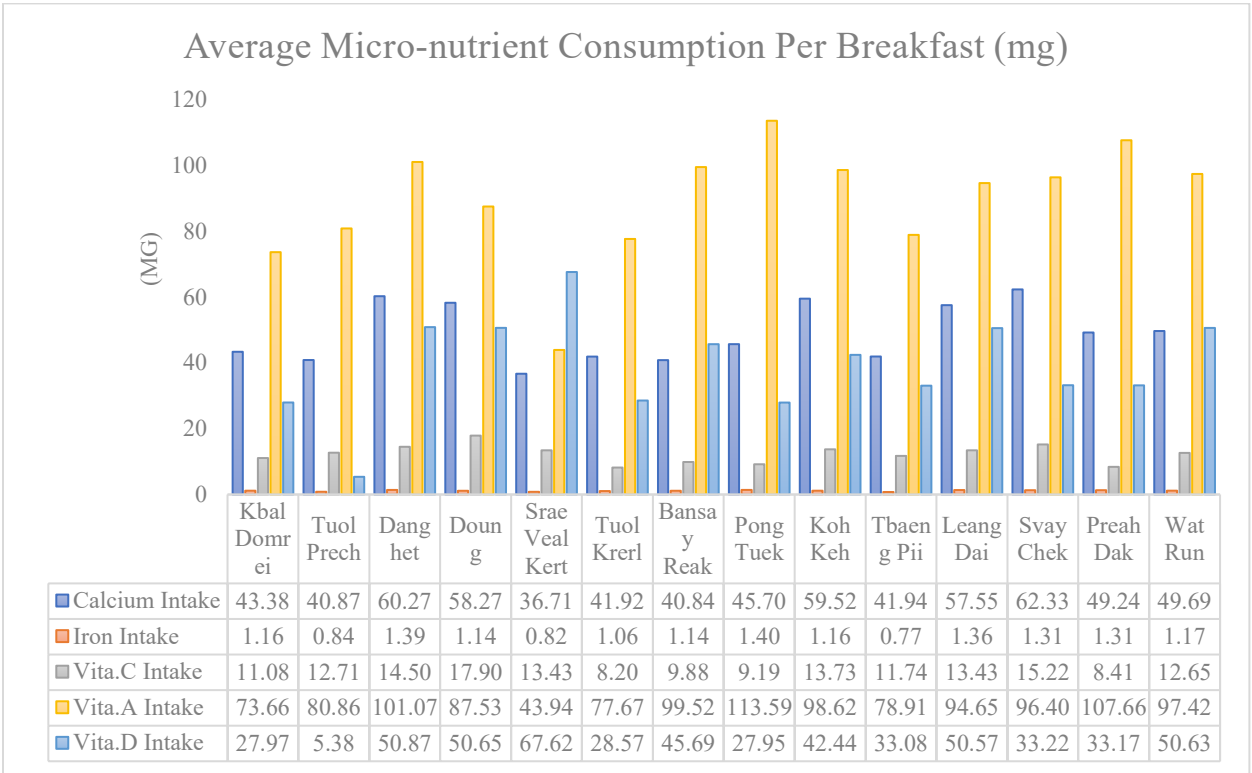


Figure 13. Summary of Average Micro-nutrients Consumption Per Breakfast of Each School



	Kbal Domrei	Tuol Prech	Danghet	Doung	Srae Veal Kert	Tuol Krerl	Bansay Reak	Pong Tuek	Koh Keh	Tbaeng Pii	Leang Dai	Svay Chek	Preah Dak	Wat Run
Calcium Intake	43.38	40.87	60.27	58.27	36.71	41.92	40.84	45.70	59.52	41.94	57.55	62.33	49.24	49.69
Iron Intake	1.16	0.84	1.39	1.14	0.82	1.06	1.14	1.40	1.16	0.77	1.36	1.31	1.31	1.17
Vita.C Intake	11.08	12.71	14.50	17.90	13.43	8.20	9.88	9.19	13.73	11.74	13.43	15.22	8.41	12.65
Vita.A Intake	73.66	80.86	101.07	87.53	43.94	77.67	99.52	113.59	98.62	78.91	94.65	96.40	107.66	97.42
Vita.D Intake	27.97	5.38	50.87	50.65	67.62	28.57	45.69	27.95	42.44	33.08	50.57	33.22	33.17	50.63

Figure 14. Link for Survey on Costing at School-level

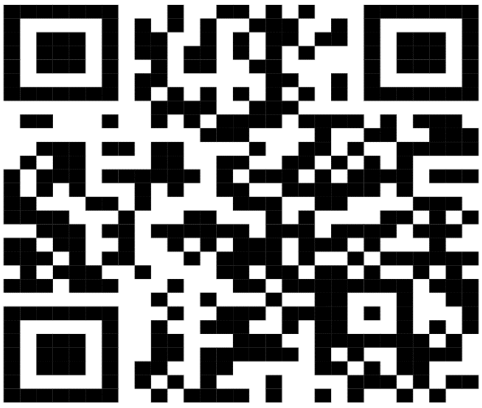


Figure 15. Link for KII of the Middleman on HGSFP

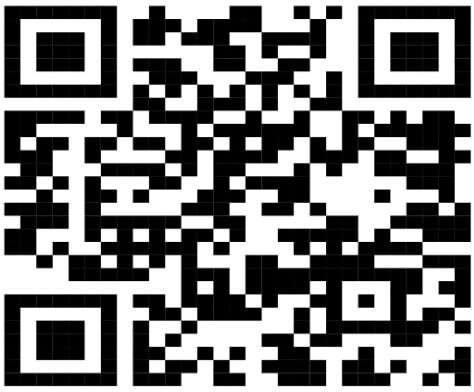


Figure 16. Link for KII of the Cook on HGSFP