Youth Engagement in Transforming the Food System to Address Malnutrition in the Philippines

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ABSTRACT

Unless the Philippine food system is made more resilient, the aspirations of *AmBisyon Natin* 2040 will remain elusive, hindering the country's ability to achieve inclusive growth, eradicate poverty, and ensure the well-being of all Filipinos. Focused on the youth, this paper brings together three related issues: (1) how can the youth be encouraged to devote their careers to agriculture? (2) How do poor quality diets compromise the cognitive abilities of young people? and (3) How can nutrition concerns be incorporated into agricultural policies? Early exposure to agricultural concepts can inspire young people to pursue careers in agriculture, ensuring a steady influx of leaders and professionals equipped to tackle the challenges within the food system. This approach not only secures the future of the agriculture sector but also promotes innovation and resilience in food production and distribution.

One in two preschoolers in the lowest wealth quintile in the Philippines are stunted, while only one in eight in the highest wealth quintile are stunted. Children who are stunted are not reaching the full potential of their cognitive development. The dietary quality of mothers before pregnancy, during pregnancy, and during breastfeeding improves markedly with income and so is associated with the better heights of their children. In the long term, agricultural productivity must be improved with a particular focus on increasing the incomes of the poor. Increasing household income is the most sustainable way to improve dietary quality. In the shorter term, there are two broad strategies to link Philippine agriculture to nutrition by adding more minerals and vitamins to the food supply: (1) by increasing the density of minerals and vitamins in food staples, a strategy referred to as "biofortification," and (2) by lowering the prices of nutritious nonstaple food such as vegetables, fruits, pulses, fish, and meat through improved productivity that results in rapid supply increases.

Keywords: food system, youth, education, malnutrition, dietary quality, agricultural policy
JEL codes: I15, I25, Q18

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INTRODUCTION

The Philippines' *AmBisyon Natin* 2040 describes how all Filipinos aspire and envision how their life should be by 2040. This vision is for all Filipinos to be healthy, well nourished so that they are productive and are able to contribute to the Philippine economy, and the country's progress (NEDA 2017). This is the quality of life the youth today should be able to look forward to in their adult life. The food system will have a major role in meeting *AmBisyon Natin* 2040 in less than 20 years.

However, the current food system has been impacted by shocks that have greatly affected food accessibility and availability and diet quality, especially of vulnerable groups, such as young children and young adults. When restrictions were imposed in 2020 due to the onset of the COVID-19 pandemic, more households became food insecure and hungry (FNRI 2021). The impact of these shocks on the food systems today will be a huge part of the lives of future generations. Unless the food system is made more resilient, the aspirations of *AmBisyon Natin* 2040 will remain elusive, hindering the ability to achieve inclusive growth, eradicate poverty, and ensure the well-being of all Filipinos.

Focused on the youth, this paper brings together three related issues: (1) How can the youth be encouraged to devote their careers to agriculture? (2) How do poor quality diets compromise the cognitive abilities of young people? and (3) How can nutrition concerns be incorporated into agricultural policies?

To set the scene, there has been much progress in making food more available to address food insecurity, much to the credit of efforts to boost the agriculture sector. However, hunger remains to be a major problem alongside the double burden of malnutrition, which continues to exist due to the many challenges and shocks on the food system.

In 2015, the United Nations adopted the 2030 Agenda as a commitment to the Sustainable Development Goals (SDGs). While SDG 2 (ending hunger) and SDG 3 (good health and well-being) are directly linked to nutrition, achieving all the other SDGs will have an impact on food security and the global nutrition situation whether it is through ending poverty, environmental conservation, gender equality, peace and prosperity, and economic growth, among others (UN 2021).

To achieve the SDGs in 2030, the Food and Agriculture Organization recommends a food system approach to addressing nutrition problems through nutrition-sensitive interventions. These include increasing the production of fruits and vegetables, investing in transport and cold-chain infrastructure to reduce food loss, food reformulation laws, regulations for retail and food service chains, food labeling policies, and legislation to ensure institutional procurement from local smallholder farmers, where possible (FAO n.d.).

The UN Decade of Action on Nutrition 2016–25 will be monitoring countries committed to achieving the SDGs and nutrition-related targets through their action plans and food and nutrition policies. It is therefore imperative that countries' development plans incorporate nutrition-sensitive interventions, especially in agricultural development, which has shown significant effect on reducing the prevalence of stunting, increased food production, and energy supply (Mbuya et al. 2021). With this as goal, engaging our youth today as future experts and leaders will play an essential role in transforming the national food system, beginning with the agriculture sector, to achieve the SDG targets and improve the food security situation of the Philippines.

What Is the Food System?

How far back in the value chain do we think about where and how food is produced, how it is prepared, up to the time it is consumed? Perhaps we think as far back as the kitchen, or maybe the market or at a food service provider where food is procured. The food system is a simple concept with very complex components. It is a system of where, what, who, and how we (the people) are nourished. Experts describe a food system as a

system that "gathers all the elements (environment, people, inputs, processes, infrastructures, institutions, etc.) and activities that relate to the production, processing, distribution, preparation, and consumption of food, and the output of these activities, including socio-economic and environmental outcomes" (HLPE 2017).

Agriculture plays a crucial role in a country's economy, but more importantly, in sustaining its food supply. In the Philippines, a steady decline in agricultural production has been reported and is relatively lower than neighboring countries such as Indonesia, Thailand, Malaysia, and Vietnam (Brown, Decena, and Ebora 2018). The Philippines has yet to reach the same level of economic growth and development achieved by other Asian countries, where agriculture has significantly contributed to household food security. According to the national nutrition surveys of the Food Nutrition Research Institute (FNRI), farming households in the Philippines remain the most food insecure (FNRI 2021). While progressive economies, including those of China and Japan, followed an agriculture-led industrialization pathway that facilitated their industrialization and economic transformation, much focus has been given to services and manufacturing in the Philippines, as agriculture continues to be a small part of its gross domestic product (i.e., GDP) (Briones and Felipe 2013).

Support for agriculture will be crucial as the country grapples with severe calamities. The Philippines has experienced the worst super typhoons, earthquakes, and volcanic eruptions. One cannot separate agriculture from the issues concerning the environment. While these are two distinct disciplines, their science is very closely related and cannot be treated separately. In the wake of the Taal volcanic eruption in 2020, losses in agriculture reached PHP 578 million (Simeon 2020). This means loss in the country's food production, income for farmers, and an increase in food prices in the market, therefore limiting food access to families, especially those who are already experiencing financial constraints. When Mt. Pinatubo erupted, damage to crop, livestock, and fisheries was estimated at PHP 1.4 billion. Overall damage from the Mt. Pinatubo eruption impacted livelihood, social services, infrastructure, trade, and natural resources for more than a decade. While our mindset is on financial losses in agriculture, we should also think about the impact of agricultural losses to the consumer in terms of losses in calories and micronutrients from food losses. While food loss is costly in a financial way, the Filipino population are deprived of the calories and micronutrients that could have been consumed to meet the daily needs and requirements to prevent all forms of malnutrition.

Why Does the Food System Need Transformation?

The nutrition situation in the Philippines reflects how well the food system is able to nourish the population. Before the pandemic, the prevalence of stunting (i.e., low height for age) among children under five years old in the Philippines was at 33 percent, higher than other ASEAN[1] countries such as Thailand (11%) and in South Asia like Sri Lanka (17%). The prevalence of stunting in the Philippines is similar to that in low-income (poorer) countries such as Lao PDR and Bangladesh and some countries in Africa (Ulep 2019; Mbuya et al. 2021). In 2020, when the pandemic started, more families and households became more food insecure due to loss of jobs or inability to work (FNRI 2020c). Prolonged food insecurity could lead to more malnourished children and young adults.

The pandemic is not the only event that has disrupted our food system. Extreme weather, such as super typhoons, volcanic eruptions, earthquakes, and even armed conflicts, like what happened in Marawi a few years back, can bring about different levels of disruptions to the food system, making many households become less food secure.

Because there has also been much destruction to our environment, it is imperative to transform our food system into a more sustainable, resilient, equitable, and nutrition-sensitive one (UN 2021).

1 Association of Southeast Asian Nations

This means caring for our environment to make it more productive with healthy soil, cleaner air, and ample supply of clean water. As we sustain a healthy environment, it is necessary to take into account what food is being produced (both quality and quantity), how food is produced, where it is being produced, and who are producing our food. All these comprise our food system.

Aside from the shocks that affect access to food, we should also be mindful of the quality of food that is being produced in our food system. Filipinos have shifted away from their traditional foods, which play an important role in the Filipino diet (Besa 2021). In 2000, over 2,000 national and multinational fast-food chains were operating in the Philippines with around 60 million regular patrons. At that time, the total population of the Philippines was 75.3 million (PSA 2020). In 2014, less Filipinos were buying fresh food from the supermarket compared to 2012. The reason for this was that Filipinos were cooking less and eating out more and preferred convenience food and fast food (Gavilan 2014). In 2018, around 46 percent of Filipinos consumed fast food one to three times a week (Statista 2021). While food may be more accessible to consumers, the quality may not necessarily conform to a healthy diet. Food choices of Filipinos have been greatly influenced by convenience, flavor, and price, with less consideration for nutritional quality. And that has been a common profile of eating habits, which has become the basis of consumer demand. Making good food choices that is good for the environment and good for one's health can help transform the food system.

YOUTH ENGAGEMENT IN AGRICULTURE

Education Curriculum

Education plays a crucial role in shaping the future of a nation and in transforming its food system. An informed and educated population is essential for understanding the multifaceted aspects of the food system. This ensures a collective effort toward achieving food sustainability. Engaging the youth in agricultural education during their formative years is vital. Early exposure to agricultural concepts can inspire young people to pursue careers in agriculture, ensuring a steady influx of leaders and professionals equipped to tackle the challenges in the food system. This approach not only secures the future of the agriculture sector but also promotes innovation and resilience in food production and distribution.

In recent years, the Philippine education system has undergone significant reforms, aimed at enhancing the quality of education. These changes include the implementation of the K-12 program, which aligns the country's education system with global practice and aims to produce more competent graduates. Despite these efforts, the country still faces an education crisis characterized by issues such as overcrowded classrooms, lack of resources, mass promotion, lack of proper assessment, and insufficient teacher training and support. Additionally, the situation is exacerbated by high rates of malnutrition and unemployment, which further impact students' ability to learn effectively and access educational opportunities (PBEd 2023).

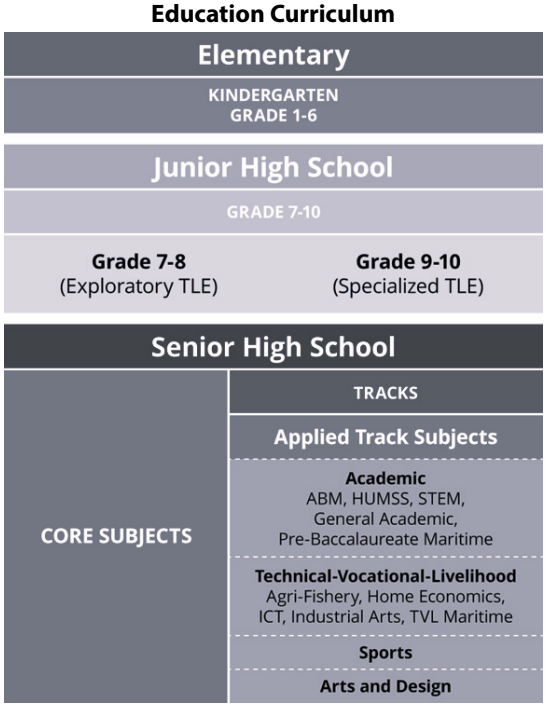
The current K-12 curriculum began in 2012 with the passage of the Enhanced Basic Education Act (Republic Act 10533). It mandates the addition of two years to the basic education program, extending it from a 10-year to a 12-year program. The act mandates a curriculum that is inclusive, learner-centered, and focusing on the holistic development of students. This curriculum also aimed to help the Philippine education system align with global education standards and improve the global competitiveness of Filipino students.

The K-12 curriculum was initiated through a phased implementation. During school year (SY) 2012–13, the Universal Kindergarten was rolled out, making kindergarten mandatory for all children. During SY 2013–14, the new curriculum for Grade 1 and Grade 7 (the first year of junior high school) was introduced. Then the new curriculum was progressively introduced to the higher grades each subsequent year. In SY 2016–17, Grade 11 was introduced, marking the start of senior high school, and in SY 2017–18,

Grade 12 was introduced, completing the K-12 implementation. Figure 1 shows the composition of the K-12 basic education curriculum, which includes a mandatory year for kindergarten education, six years of primary education (elementary), four years of secondary education (junior high school), and two additional years of specialized upper secondary education (senior high school) (DepEd 2024a).

One of the highlights of the K-12 curriculum is the introduction of specialized tracks in the senior high school. The senior high school curriculum offers academic, technical-vocational, sports, and arts tracks, allowing students to choose a path that aligns with their interests and career aspirations. Under this curriculum, agriculture and fishery topics are classified under the Technical-Vocational-Livelihood (TVL) track. Moreover, in the K-12 curriculum, agriculture and fishery subjects are collectively termed as Agri-Fishery Arts (AFA) and grouped with other subjects in the TVL track such as Home Economics (HE), Information Communication Technology (ICT), Industrial Arts, and TVL Maritime.

Figure 1. Composition of the K-12 Basic Education Curriculum



Source: DepEd (2024a)

For the junior high school, the agriculture and fishery topics are classified under the Technology and Livelihood Education (TLE) subjects, which are taken as exploratory TLE during grades 7 to 8 and as specialized TLE during grades 9 to 10. The TLE subject has the same component specializations with the TVL track, which are AFA, HE, ICT, Industrial Arts, and TVL Maritime.

Although the K-12 curriculum engages students in the fields of agriculture and fisheries, several factors need to be further examined and reevaluated to ensure that students develop a proper perception and appreciation of these subjects. One major issue affecting student engagement in agri-fishery subjects is the lack of proper training and expertise among teachers. There are instances where teachers assigned to TLE subjects do not have the appropriate educational background to teach specialized topics such as agriculture and fisheries. When teachers lack the necessary training and expertise, they may not effectively convey the essence of the subject and are more likely to perpetuate misconceptions. Another concern is the lack of adequate resources and facilities in schools to support the activities required for achieving the learning competencies in agri-fishery subjects. Often, the delivery of these topics relies solely on pictures and video presentations, while practical activities are frequently omitted due to limited resources and teacher expertise.

Furthermore, it is essential to recognize that agriculture and fisheries should not only be categorized under TLE and the TVL track. Agriculture is not only a vocation; it is also a science connected to high-paying and highly skilled jobs. The integration of agri-fishery education should reflect its scientific foundations and its role in various advanced fields such as agribusiness, agricultural engineering, biotechnology, and environmental science. By treating agriculture and fisheries solely as vocational subjects, we risk undermining their importance and failing to highlight the potential career opportunities that exist beyond traditional farming and fishing. This perception limits students' understanding of the

breadth and depth of the field, which includes high-tech innovations, sustainable practices, global health, and global market dynamics.

Despite the benefits of the K-12 curriculum, the program has faced challenges, including resistance from some sectors, funding issues, and the need for extensive teacher training and curriculum development. In 2023, twelve years after the initial implementation of the K-12 curriculum, the Department of Education (DepEd) introduced the MATATAG curriculum, which aims to enhance the K-10 educational framework. This aims to decongest the existing curriculum, focusing on essential competencies and emphasizing foundational skills in literacy and numeracy. The K-10 MATATAG[2] curriculum is named for its focus on creating a strong and resilient foundation in basic education from kindergarten to Grade 10. Meanwhile, the senior high school curriculum is yet to be revised.

The MATATAG curriculum aims to address several issues in the K-12 curriculum. It decongests the curriculum content by reducing subject coverage by 70 percent, allowing for a more concentrated and effective approach to teaching fundamental skills, such as literacy and numeracy. This reduction seeks to alleviate overcrowded curricula and enables educators to dedicate more time and resources to essential subjects, thereby improving the quality of education and student comprehension. The MATATAG curriculum will be implemented in phases from SY 2024–25 to SY 2027–28. The integration schedule is as follows: in SY the 2024–25, it will begin with Kindergarten, Grade 1, Grade 4, and Grade 7. In SY 2025–26, it will extend to Grade 2, Grade 5, and Grade 8. In SY 2026–27, it will cover Grade 3, Grade 6, and Grade 9. Finally, in SY 2027–28, it will include Grade 10. This phased approach ensures a gradual and manageable transition for both students and educators, facilitating a smoother adaptation to the new curriculum (DepEd 2024b).

With the impending revisions in the basic education curriculum, there is a golden opportunity to deepen the integration of agriculture and allied subjects. However, the challenge lies in streamlining the curriculum, while combating the prevailing perception of agriculture as merely "vocational" or "supplementary." This mindset risks relegating agriculture and its allied subjects to the sidelines, diminishing student engagement, and missing out on the chance for young learners to develop a genuine appreciation for agriculture early on.

To truly revolutionize our education system in support of a sustainable food system, we must first acknowledge the shortcomings within our current education system. Crucially, stakeholders such as the DepEd need to grasp the significance of bolstering agricultural education within the MATATAG curriculum. This acknowledgment sets the stage for meaningful reforms that prioritize the integration of agriculture and allied subjects throughout the basic education curriculum, ensuring that every student gains vital insight and appreciation in improving the agriculture industry and transforming the food system.

Perception of Youth toward Agriculture

A baseline survey conducted by the UP Rural High School in 2020 (Ardales et al.) with select schools offering agriculture subjects in Laguna province showed mixed perceptions among high school students, both negative and positive, about agriculture. Students perceive agriculture as "low paying," with farmers always disadvantaged by middlemen and traders. Although some students perceive agriculture as a good source of income, and may provide good employment opportunities, students still opt to pursue non-agriculture courses such as medicine, accounting, business courses, and communication, as some examples.

The perceptions of high school students in 2020 did not change much since the time of study conducted by Manalo and van de Fliert (2012), where they enumerated negative perceptions toward agriculture among the youth, including "anti-beauty," a "difficult task to perform," and "not so glamorous venture."

2 Filipino word for "strong" or "resilient"

Another study conducted by Secretario (2021) revealed derogatory statements about agriculture such as, "agriculture as a poor man's profession and dirty work," "agriculture is just planting," "agriculture is a degree for those who are not smart enough," and "agriculture is not a lucrative form of livelihood or occupation."

There is also a lack of awareness among students of the socioeconomic aspects of agriculture. While we focus on promoting science and technology, students need to be more educated on the role of agriculture in the economy, food security, trade and politics, and the like (Geza et al 2021).

Farming families have much influence on youth perceptions as farming is unable to lift the family out of poverty. For this reason, farming parents tend to encourage their children into a more lucrative profession (AFA 2015; Geza et al. 2021). Negative perception among the youth may also be influenced by the minimal involvement of the youth in agricultural activities (Geza et al 2021).

Role of Youth in the Food System

In 2020, the age group from 10 to 19 years comprised more than half of the Philippine population of 109 million (indexmundi 2021). With this huge share in the population, the youth can have much influence on the national food system. This age group has the chance and responsibility to make themselves better nourished and healthy by demanding for more fruits and vegetables and other food products that are readily available, affordable, and safe to eat.

Fifteen to 20 years from now, today's youth will be professionals. Our present day is a good time to invest in our future professionals. They will be faced with the long-term impacts of the current shocks on our food system, which has already caused much devastation to livestock, fisheries, and food crops. That is the challenge of the youth today, because they will be the caretakers of our future food system.

However, negative perceptions on agriculture among the youth must be corrected to enable better engagement in agriculture. Studies have identified strategies to encourage youth engagement in agriculture through incorporation of youth aspirations in agriculture, capacity building, and the development of rural infrastructure, improving the image of agriculture, and the engagement of youth in policy processes (Geza et al. 2021).

PRESCHOOLER STUNTING IS ASSOCIATED WITH COMPROMISED COGNITIVE ABILITY: WHAT ARE THE UNDERLYING CAUSES?

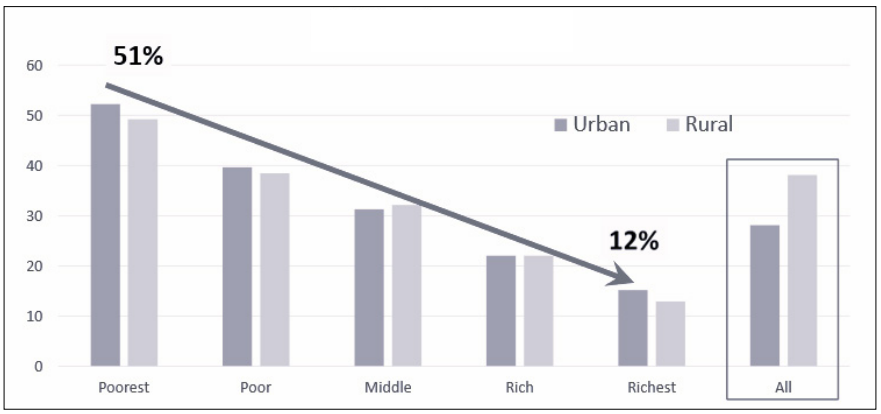
Children who are stunted or are considered short, underweight, or wasted or are considered skinny and thin, as well as those who are overweight or obese are not reaching the full potential of their development, both physical and cognitive. Therefore, they may have difficulties in learning and may eventually affect their capabilities to become productive citizens (Felix 2021).

Although prevalence of stunting decreased from 33.4 percent in 2015 to 29.6 percent in 2018–19 (at 0.95 percent per year), this reduction falls short of the needed 2.7 percent reduction per year to meet the SDG 2 (zero hunger) in 2030 as well as the PPAN[3] target of 21.4 percent by 2022. In the same manner, prevalence in wasting was reduced from 7.1 percent in 2015 to 5.7 percent in 2018–19 or a 0.35 percent reduction per year. However, the country's prevalence in wasting must be reduced by 0.51 percent per year to meet the SDG 2 target by 2030. On the other hand, the country is likely to meet the PPAN target of 5 percent prevalence of wasting by 2022 (Agdeppa 2021).

This section explores the underlying causes of stunting in the Philippines so that food systems remedies may be put in place, which will allow Philippine citizens to reach their full cognitive and therefore productive potential. It should be understood that stunting is largely a result of low income coupled with high food prices and is the primary driver of poor-quality diets, as shown in Figure 2 and tables 1 and 2.

3 Philippine Plan of Action for Nutrition

Figure 2. Prevalence of preschooler stunting by wealth quintile



Source: DOST-FNRI (2016)

Table 1. Per capita energy intake per day averaged for poorest and poor wealth quintiles (1&2) and rich and richest wealth quintiles (4&5) and percentage differences between quintiles by food group for 2013, 2015, and 2018

Food Group	Energy Intakes (Ave 2013/15/18)				% Difference Across Wealth Quintiles	
	Rural		Urban			
	Ave 1&2	Ave 4&5	Ave 1&2	Ave 4&5	Rural	Urban
Energy-Giving Foods						
Corn and corn products	128.9	14.0	59.6	9.9	-89.1	-83.3
Rice and rice products	1,077.4	1,034.9	1,002.5	911.2	-3.9	-9.1
Other cereal products	104.3	171.9	1,44.8	212.6	64.8	46.8
Starchy roots and tubers	17.1	12.3	8.2	14.4	-28.1	74.4
Sugars and syrups	42.7	43.4	31.7	36.3	1.7	14.4
Fats and oils	101.8	134.1	89.0	129.3	31.8	45.3
Body-Building Foods						
Dried fish	12.1	7.1	7.7	5.2	-40.8	-32.9
Processed fish	12.1	9.1	11.2	9.1	-24.7	-18.4
Fresh fish	33.3	51.4	35.0	44.3	54.3	26.6
Crustaceans and mollusks	3.9	6.4	3.7	5.6	66.3	48.8
Eggs	19.3	30.9	22.3	29.0	60.6	29.6
Organ meat	2.6	6.4	4.6	7.6	152.5	65.9
Processed meat	14.1	53.1	31.0	66.7	275.5	115.2
Milk and milk products	13.4	38.8	17.4	39.7	188.6	128.2
Fresh meat	44.5	150.5	68.5	166.3	238.4	142.8
Poultry	14.7	47.8	22.5	56.5	225.5	151.4
Dried beans and nuts	17.4	20.2	15.6	18.6	16.5	19.5
Body-Regulating Foods						
Green leafy vegetables	10.2	6.6	6.7	5.1	-35.4	-23.7
Yellow vegetables	6.8	5.9	4.8	5.1	-13.9	6.2

Continued on next page

Table 1 continued

Food Group	Energy Intakes (Ave 2013/15/18)				% Difference Across Wealth Quintiles	
	Rural		Urban			
	Ave 1&2	Ave 4&5	Ave 1&2	Ave 4&5	Rural	Urban
Other vegetables	23.7	25.1	17.0	21.5	6.1	26.6
Other fruits	17.5	29.3	14.6	27.0	67.6	84.4
Vitamin C-rich fruits	2.7	6.0	2.4	5.9	127.2	143.2
Miscellaneous Foods	38.1	52.2	49.3	61.6	37.2	25.0

Source: Angeles-Agdeppa et al. (2024)

Table 2. Calories purchased per peso averaged for poorest and poor wealth quintiles (1&2) and rich and richest wealth quintiles (4&5) by food group for 2013, 2015, and 2018

Food Group	Calories Per Peso (Ave 2013/15/18)			
	Rural		Urban	
	Ave 1&2	Ave 4&5	Ave 1&2	Ave 4&5
Energy-Giving Foods				
Corn and corn products	93.6	36.3	80.7	31.7
Rice and rice products	77.4	72.8	73.9	64.8
Other cereal products	32.0	27.7	33.5	26.1
Starchy roots and tubers	38.9	16.8	22.7	13.2
Sugars and syrups	43.0	26.6	34.3	21.0
Fats and oils	88.4	70.6	68.0	53.5
Body-Building Foods				
Dried fish	9.8	9.7	9.6	9.9
Processed fish	10.5	10.2	10.0	10.3
Fresh fish	5.8	4.9	5.3	4.5
Crustaceans and mollusks	5.7	4.0	5.5	3.4
Eggs	11.7	12.3	12.0	11.7
Organ meat	7.9	8.3	10.3	8.0
Processed meat	16.1	13.5	17.5	14.4
Poultry	8.2	7.4	8.2	7.6
Dried beans and nuts	30.4	20.5	24.6	18.8
Body-Regulating Foods				
Green leafy vegetables	7.3	5.7	6.2	4.2
Yellow vegetables	12.8	7.9	8.9	5.9
Other vegetables	7.2	5.2	5.7	4.4
Other fruits	24.8	16.0	19.3	13.4
Vitamin C-rich fruits	7.8	5.7	5.5	4.9
Miscellaneous Foods	10.9	10.3	11.6	10.2

Source: Angeles-Agdeppa et al. (2024)

Table 1 shows a clear preference for fresh fish, animal products, and fruits, the consumption of which increases most rapidly with income. Indeed, fish and animal products are the foods densest in bioavailable minerals and vitamins. Fruits do not constitute a large proportion of the food budget.

As shown in Table 2, rice is one of the least expensive sources of calories in the diet. Rice consumption does not vary by income group; rice is as plentiful in low-income households as in high-income households (this pattern for food staple consumption to remain constant with income was noted 30 years ago, for example in Bouis, Haddad, and Kennedy 1992).

Tables 3 and 4 suggest a mechanism for improvements in preschooler stunting as income increases—that is, through better dietary quality of mothers before and during pregnancy. In both tables, the columns colored in blue (all ages averaged together) show a similar pattern as in Figure 1. Disaggregating by age, in both tables, the pattern of improvements in stunting with income remains more or less constant from 12–23 months to 48–59 months. In both tables, the income effect is already established at 0–11 months (on average, infants are six months old for this age group). In both tables, stunting worsens for all income groups moving from 0–11 months to 12–23 months, but the monotonic income pattern remains intact.

Table 3. Preschooler height-for-age z-scores by age and by wealth for the Philippines, 2013

Income/ Agel		Age in Months					All Ages
		0–11	12–23	24–35	36–47	48–59	
Wealth Quintile	1	-0.72	-1.89	-2.13	-2.11	-1.99	-1.80
	2	-0.63	-1.43	-1.84	-1.89	-1.65	-1.51
	3	-0.65	-1.33	-1.55	-1.49	-1.54	-1.33
	4	-0.49	-1.11	-1.10	-1.17	-1.08	-0.99
	5	-0.24	-0.74	-0.74	-0.69	-0.63	-0.61
All		-0.56	-1.37	-1.55	-1.57	-1.45	-1.32

Table 4. Preschooler height-for-age z-scores by age and by income, Bukidnon Province, 1984–85

Income/ Agel		Age in Months					All Ages
		0–11	12–23	24–35	36–47	48–59	
Wealth Quintile	1	-2.80	-2.75	-2.62	-2.44	-2.69	-2.57
	2	-1.24	-2.37	-2.26	-2.30	-2.46	-2.22
	3	-1.20	-2.03	-2.04	-2.13	-2.17	-2.02
	4	-0.91	-1.97	-1.86	-2.28	-2.30	-2.02
	5	-0.82	-1.88	-1.76	-1.94	-1.91	-1.80
All		-1.31	-2.24	-2.15	-2.24	-2.34	-2.16

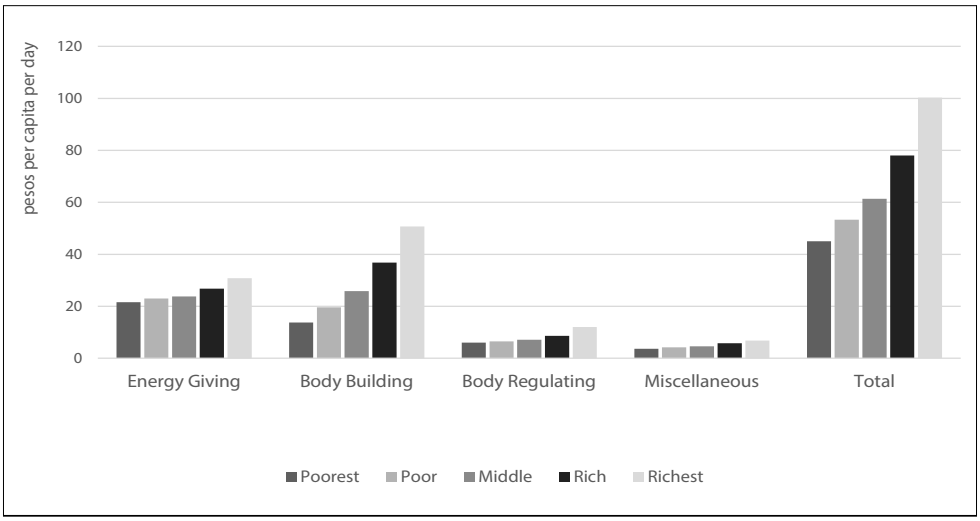
Consistent with tables 1 and 2, Figure 3 shows that Filipinos focus on spending for fish and meat consumption as income increases. Given this pattern of spending, it is useful to note that rice actually provides a high proportion of mineral and vitamin intake, as shown in Table 5.

While milled rice is not dense in minerals and vitamins, the large amounts of rice consumed multiplied by mineral and vitamin densities give the results shown in Table 5. This is not widely understood. The only mineral or vitamin for which vegetables and fruits provide a high percentage is vitamin C.

Because fish and meat provide large amounts of minerals and vitamins, intakes of these minerals and vitamins increase with income and nutritional status is associated with income, as shown in figures 4 and 5. Thus, a viable hypothesis is that improved dietary quality of mothers before and during pregnancy may account for the steady (although slow) decline in stunting over time, as shown in Figure 6.

Micronutrient deficiencies or the lack of certain micronutrients such as iron deficiency anemia, iodine deficiency disorder, vitamin A deficiency, and zinc deficiency pose serious threat to health. Micronutrient deficiencies also affect physical and mental development of children, and the overall health and well-being of individuals; in particular, the ability to prevent diseases. While

Figure 3. Food expenditures by wealth quintile by broad food group, Philippines



Source: DOST-FNRI (2016)

Table 5. Percent contribution of vegetables/ fruits, fish/meat, and milled rice to nutrient intakes of Filipinos, 2015

Nutrient	Vegetables and Fruits	Fish and Meat	Milled Rice
	45 Foods	71 Foods	A Single Food
Energy	3	17	59
Protein	3	48	40
Iron	15	30	33
Zinc	5	33	41
Calcium	16	48	20
Vitamin A	16	73	0
Vitamin C	75	7	0
Thiamine	9	31	39
Riboflavin	10	55	20
Niacin	5	40	45

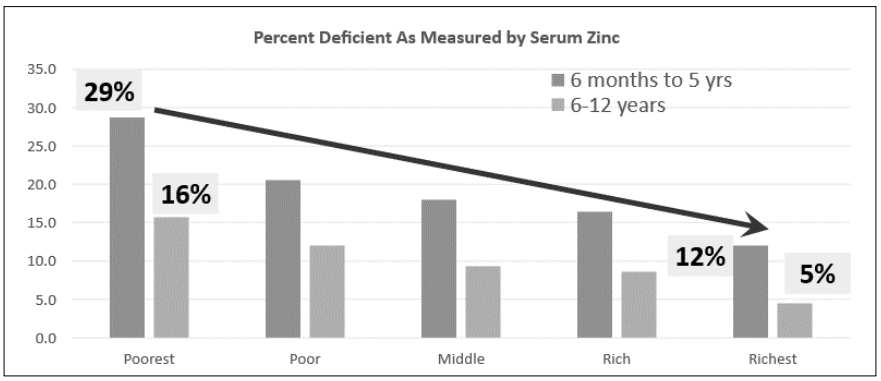
fruits and vegetables are the main sources of micronutrients, consumption by Filipinos is less than 60 grams per day for vegetables, and even lower for fruits at less than 30 grams per day for all age groups (WHO 2020).[4] In 2012, Gibson estimated micronutrient densities in the daily available food supply per capita were inadequately available based on data from the Philippine food balance sheet (Gibson and Cavalli-Sforza 2012).

The National Nutrition Council under the Department of Health formulated PPAN to address the country's nutrition problems and to ensure that all Filipinos are properly nourished.The different nutritional problems may be addressed through nutrition-specific and nutrition-sensitive programs.

Nutrition-specific programs are implemented as direct interventions to malnutrition. These programs include feeding practices and behaviors, food fortification, micronutrient supplementation, treatment of acute malnutrition, and dietary supplementation. On the other hand, nutrition sensitive programs are usually implemented as indirect interventions to malnutrition and primarily address other issue such as agriculture and food system, clean water and sanitation, education, women's empowerment, employment and social protection, healthcare, support for resilience, and community-led development (Fan, Yosef, and Pandya-Lorch 2019).

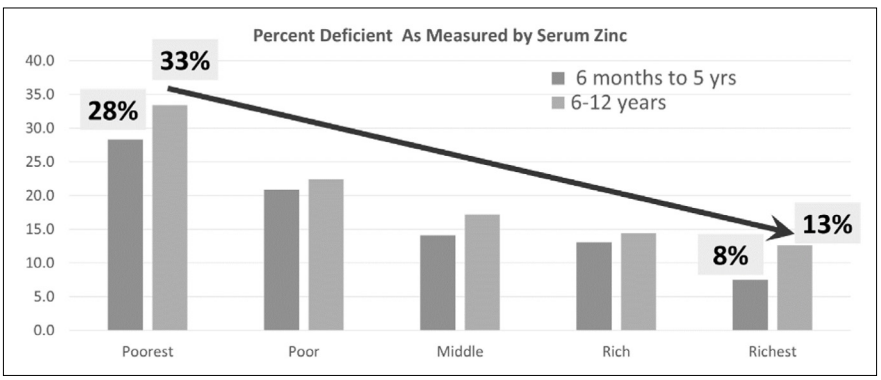
4 WHO recommends daily intake of 400 g of vegetables and fruits.

Figure 4. Prevalence of vitamin A deficiency among children <13 years of age by wealth quintile



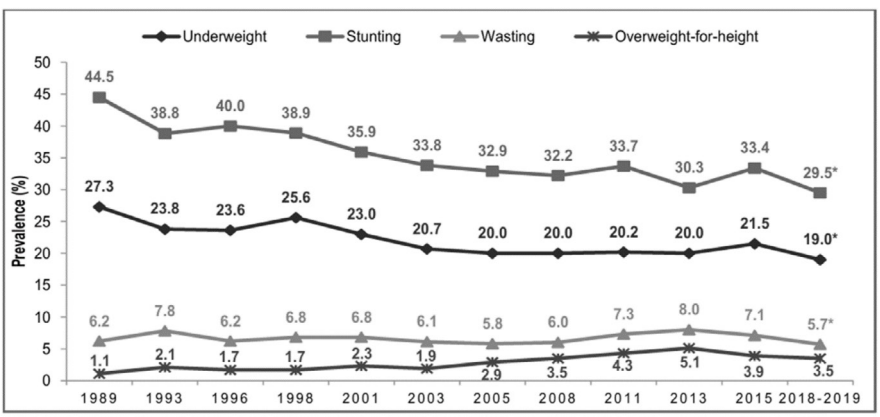
Source: DOST-FNRI (2015)

Figure 5. Prevalence of zinc deficiency among children <11 years of age by wealth quintile



Source: DOST-FNRI (2015)

Figure 6. Trends in the prevalence of malnutrition among children less than 5.0 years old (0 to 59 months), using WHO-CGS, Philippines, 1989–2015



Source: DOST-FNRI (2020a)

THE ROLE OF AGRICULTURE IN ADDRESSING MALNUTRITION IN THE PHILIPPINES

The agriculture sector is an important part of the national economic growth. While it provides employment and income to farmers, it is also responsible for ensuring that food is available and accessible to all Filipinos. Food that is produced on the farm and distributed in the markets where it is purchased could determine the diet of consumers. How food is acquired will depend on the consumers' purchasing power, food preference and eating habits, and other sociocultural factors, and will therefore impact the health and nutrition in the long run.

Improving Agricultural Productivity

When agriculture is unable to produce the right amount and right type of food due to poor agricultural practices and poor environment, resulting in low and poor food production, it creates a vicious cycle of poverty due to low income, low food consumption, malnutrition, and decreased capacity to work due to poor health.

Compared to its ASEAN peers, the Philippines generally lags behind in agricultural production and productivity in key crops like rice, corn, coconut, sugar, coffee, mango and onions. Thus, it has had to rely on imports while lagging in exports, resulting in a negative trade balance.

While the Philippines lags in agricultural productivity in the ASEAN, the country's poverty is the highest in both rural and urban populations. Poverty has been a serious underlying cause of malnutrition in the Philippines (Javier 2021). To help improve agricultural productivity, and to be able to supply foods rich in vitamins and minerals to all Filipinos, the Philippines needs to change perceptions of agriculture exemplified in common folk songs like "planting rice is never fun," and "romanticizing tending a patch of vegetables and raising a few pigs and chickens in *bahay kubo*" (Javier 2021).

Knowledge is also limited about the encompassing nature of the field of agriculture, which not only includes food crops, but also livestock and aquaculture, and their multitude of environments and growing conditions. These environments are part of the food system that also include the multiple components of the supply chain, such as the supply and inputs for production, postharvest and food manufacturing, as well as marketing and distribution, which impact the consumers.

Everyone plays a role in improving Philippine agriculture through research, teaching, extension and development work, as well as regulation. Other fields of disciplines are also necessary to further develop agricultural productivity, such as finance, business management, sales and marketing, and logistics experts. More importantly, science and technology through scientific research, will help boost the agricultural productivity. While conventional technologies remain useful in improving crop varieties, new knowledge in genomics, nano science, and bioinformatics are now used to develop high-yielding and more resilient crop varieties. Similarly, social science is just as important to better understand the behavior, socioeconomics, and cultural aspects of food production (Javier 2021).

Improving the Amount of Minerals and Vitamins in the Food Supply

There are two broad strategies to link Philippine agriculture to nutrition by adding more minerals and vitamins to the food supply:

- By increasing the density of minerals and vitamins in food staples as the consumption of food staples remain constant; a strategy referred to as "biofortification."
- By increasing the quantity consumed of nutritious nonstaple foods such as vegetables, fruits, pulses, fish, and meat.

Biofortification

Mineral and vitamin density may be increased through conventional plant breeding, or by advanced crop development methods such as transgenics (popularly referred to as genetically modified organisms (GMOs) and gene editing.

The high mineral and vitamin density traits may be piggybacked with varieties that have superior agronomic traits and also higher yields. Superior agronomic performance makes adoption attractive to farmers, and higher yields mean that the biofortified food staples sell for the same price as nonbiofortified staples. The advantage of this strategy is that consumers could increase their mineral and vitamin intakes simply by substituting one-for-one biofortified rice (in the case of the Philippines) for nonbiofortified rice.

The best known biofortified crop in the Philippines is the Golden or *Malusog* (healthy) Rice, a GMO high in provitamin A, which was commercialized in the Philippines in 2022–24. However, a Philippine Court of Appeals ruling in April 2024 withdrew the biosafety permit for Golden Rice upon legal suits filed by NGO leaders. What had been legal, safe, and nutritious for two years (as determined by qualified Philippine scientists involved in the GMO regulatory system), is now deemed illegal and dangerous.

A dossier for a complementary GMO event high in zinc and iron (HIZR) is ready for submission to the Philippine regulatory system. Preliminary crosses have already been made between Golden Rice and the HIZR event to give a high-yielding 3-in-1 biofortified rice with high levels of provitamin A, zinc, **and** iron. Table 6 shows that the vitamin A intakes of the poor may potentially be doubled. For the entire Philippine population, zinc intakes may be more than doubled, and iron intakes increased by 25 percent.

Increased consumption of nutritious nonstaple foods

Table 1 shows clearly that Filipinos will eat more fresh fish, poultry, meat, and dairy products as their incomes increase. However, vegetable and fruit consumption has been declining over time (see figures 7 and 8).

Thus, a strategy of raising nonstaple food consumption—apart from rising household incomes—must be based on increased productivity of specific nonstaple foods. It will open the possibility of lower prices and/or nutrition education (behavior change), which will convince Filipinos to improve their innate preferences to consume more vegetables and fruits.

POLICY RECOMMENDATIONS

Engaging the Youth in Agriculture

Educators have a key role in promoting agriculture as a viable and versatile career option for high school students to take up agriculture and related sciences as their course in college (Manalo 2016). Based on an unpublished baseline survey conducted by the UP Rural High School (Ardales et al.) as part of their youth engagement program funded by the SFRT of SEARCA[5] in 2020, some

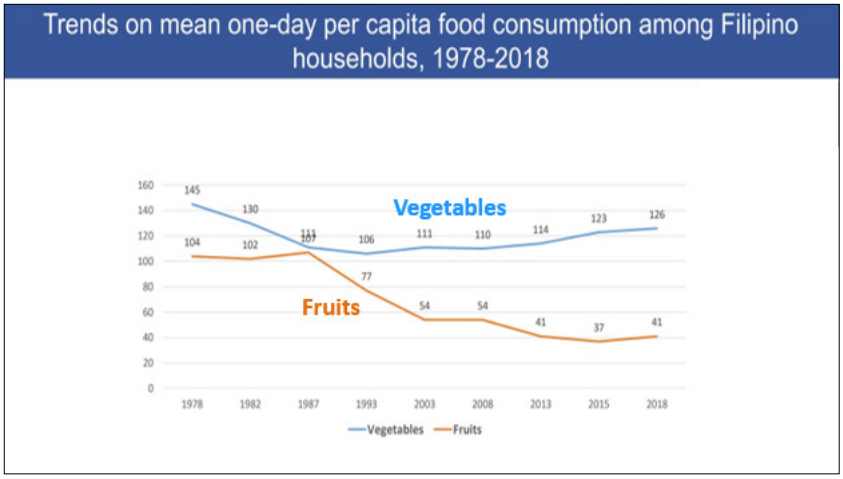
5 Seed Fund for Research and Training (SFRT) grant from the Southeast Asian Regional Center for Graduate Study and Research in Agriculture (SEARCA)

Table 6. Increased intake per capita per day of provitamin A, iron, and zinc in 3-in-one milled rice in the Philippines

Nutrient	Increment Density (1)	Milled Rice Intake Per Day (2)	Increased Intake Per Day (3)	Base Intake Average Total Population (4)	Base Intake Poorest Quintile (5)
Provitamin A	+1	300 g	+300 RAE	518 RAE	334 RAE
Zinc	+31.6	300 g	+9.5 mg	9.0 mg	8.2 mg
Iron	+7.8	300 g	+2.3 mg	9.7 mg	8.4 mg

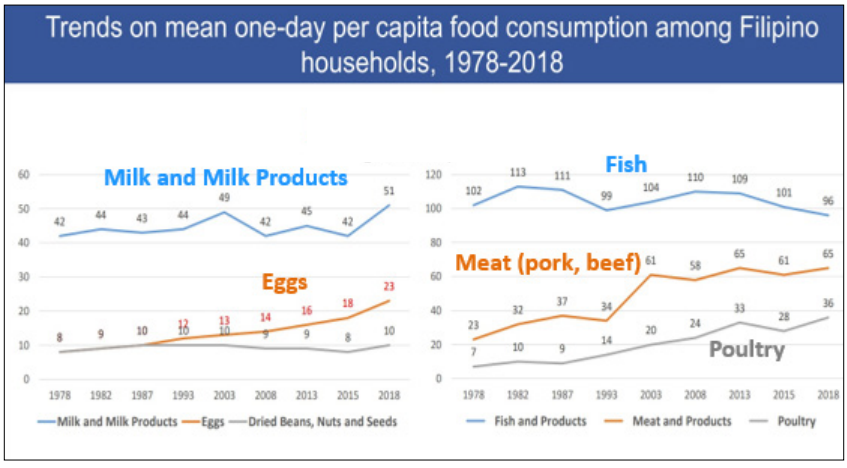
Source: Bouis (2024)
Notes: Provitamin A = RAE* per gram of milled rice before cooking; *(Retinol Activity Equivalents)
Iron and zinc = mg/kg (density); mg/day (intake)

Figure 7. Trends in vegetable and fruit consumption



Source: DOST-FNRI (2020b)

Figure 8. Trends in fish, meat, poultry, and dairy consumption



Source: DOST-FNRI (2020b)

students perceive agriculture as a good source of income and may provide good employment opportunities. However, students still opt to pursue non-agriculture courses such as medicine, accounting, business courses, and communication. There is also a lack of awareness among students of the socioeconomic aspects of agriculture. While much focus is on promoting science and technology, the education system can help make students more aware of the role of agriculture in the economy, food security, trade, and politics and the like. While farming parents discourage their children to pursue farming, parents may still be just as influential as educators. Parents may encourage their children to pursue courses in agriculture, if scholarships are available.

Schools recognize that agriculture may have a better advantage in student enrolment if it were under the academic track inasmuch as enrolment for the TVL track tends to be lower than the academic track. Not all schools that offer TVL include agriculture, and even if

it is offered, students tend to prefer information technology over agriculture. The reality is, there will be students who will not be able to go to university especially if their parents cannot provide the financial support and without access and availability of scholarships. The TVL track was put in place to allow students to acquire skills that will make them employable after senior high school. If provided with theoretical and practical skills in agriculture, students who opt to or are unable to pursue university degrees may venture into agri entrepreneurship ("agripreneurship"), which may be just as lucrative and profitable as other businesses or careers. Encouraging the youth into agripreneurship not only provides them a chance to earn but also contribute to the country's food production (Bairwa et al. 2014).

Some schools have plans to improve their agriculture courses by covering more topics such as crop and animal production, organic farming, machine operation and mechanization, and continue research from capstone activities, as well as expanding land area for planting and if necessary, converting practical activities to home-based activities. However, schools are bound to follow DepEd and TESDA[6] guidelines and regulations, which may not necessarily be accommodating to an expanded agriculture program. For example, modules may not be available, and national certification may not be granted to the school or student if the program is not covered by TESDA regulations.

DepEd's program *Gulayan sa Paaralan* (vegetable garden in the school) provides opportunities for students to engage in agriculture, if implemented successfully in accordance with Department of Agriculture Administrative Order No. 11 (Section 1) and DepEd Memorandum No. 58. The participation of students in the *Gulayan sa Paaralan* is included in the periodic grades as part of the HE and Livelihood Education (Inocian and Nuneza 2015). While the *Gulayan sa Paaralan* allows the youth to engage in agriculture, it was also found effective in promoting vegetable consumption for healthy lifestyles among teenage students (Baog et al. 2023).

To attract the youth to work in agriculture, many countries provide incentives, particularly to improve access to capital and land. The policies required go beyond incentive policies but should also include rural industrialization policy, through rural agro-industry development, innovation, investment, infrastructure, and strengthening agricultural institutions spanning upstream to downstream (Susilowati 2014).

The Asian Farmers' Association for Sustainable Rural Development identified five ways to promote agriculture among the youth. These include policy advocacy, alliance building among farmer organizations, young farmer exchange programs, partnerships among farmer organizations, and research and publication (AFA 2015). With the Magna Carta for Small Farmers (R.A. 7607), the government is mandated to conduct strategic research and extension initiatives that address the needs of small farmers. The Philippine Council for Agriculture, Aquatic and Natural Resources Research and Development in coordination with the Bureau of Agricultural Research, other government institutions, private research institutions, state universities and colleges, and farmers' organizations were identified to lead in strengthening the existing research and development system. Existing policies and the structure of the education system and its curriculum seem to limit students from learning more about agriculture, especially with few schools offering agriculture, or with teachers having limited skill and capacity to handle agriculture courses in high school. Agriculture is being offered under the TVL track where student enrolment is usually low, even though agriculture involves science and technology. Recommended monitoring and evaluation of existing programs such as *Gulayan sa Paaralan* by the DepEd may be useful in monitoring students' knowledge, attitudes, and behaviors toward agriculture, nutrition, and environment sustainability (Baog et al. 2023).

6 Technical Education and Skills Development Authority

Transforming the Philippine Food System

A food-based approach that puts nutritionally rich foods, dietary diversity, and biofortification at the forefront of agricultural development leads to increased production, sustainability and improved nutritional status.

To further expand agriculture-nutrition linkages, it is important to include agribusiness and marketing as part of the nutrition-sensitive agriculture that will give way to a nutrition-smart agriculture. This refers to a set of agricultural and agroprocessing technologies and practices that contribute to the improvement of nutrition through increasing farm and agribusiness level productivity, and vice versa. Farmers and agribusiness decide "what" and "how" to produce and "where" the agriculture sector designs and implements actions and policies to improve nutrition. All these aspects of nutrition-smart agriculture will lead to economic development by feeding the hungry, nourishing the body, and healing the sick.

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