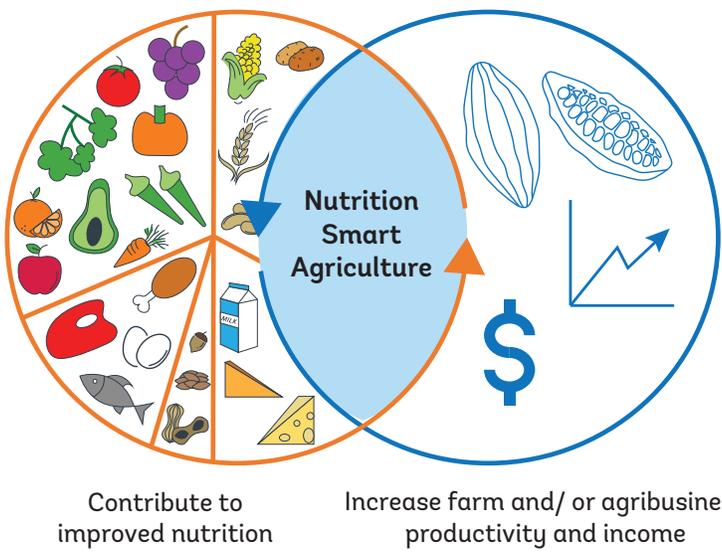


Nutrition Smart Agriculture in Haiti

Nutrition Smart Agriculture (NSmartAg) aims to simultaneously improve agriculture incomes and nutrition outcomes through agriculture interventions. NSmartAg practices and technologies contribute to address local nutrition issues and increase farm and/or agribusiness productivity and income (Figure 1). It is a building block of food systems that promote healthy people, a healthy planet, and healthy economies.

Figure 1: Nutrition Smart Agriculture has two aims



Actions taken in the agricultural sector impact people’s nutrition—it’s where decisions are made on what and how much to produce, as well as the techniques that can be used to boost a food’s nutritional content. Not leveraging the agriculture sector to contribute to nutrition outcomes is a missed opportunity. Agriculture and food production have been shown to be key drivers of nutrition outcomes. Failing to act on nutrition has staggeringly high economic and social costs for countries and the negative effects of poor nutrition can span entire lives and generations. Human capital—the sum total of a population’s health, nutrition, skills, knowledge and experience—is estimated to account for over two thirds of total global wealth [1], and 10–30% of the cross-country differences in gross domestic product (GDP) per capita can be linked to variations in human capital [2]. Malnutrition is intrinsically connected to human capital as undernutrition contributes to 45% of child mortality, and stunting is known to be associated with lost productivity and earnings in adulthood.

- Malnutrition is an underlying cause of death of up to 33% of children under five years of age in Haiti. Chronic malnutrition is present throughout the country and affecting nearly 22% of children under five. It is also more prevalent in rural than in urban settings.
- Vitamin A, iron, folic acid, iodine and zinc are considered to be the priority micronutrient deficiencies affecting Haitians, particularly children, as well as pregnant and lactating women.
- The agriculture sector plays a significant role in the Haitian economy, accounting for about 20% of GDP and providing nearly 50% of employment. While the sector is an important source of food for the population, it is currently unable to cover the increasing demand.
- The EAT-Lancet Commission’s planetary health plate was applied to identify the major food groups that contribute to production and consumption of nutrient intake in Haiti. The results reveal that consumption of all major food groups, except for starchy vegetables, grains and red meat, falls below the recommended EAT-Lancet Commission’s planetary health thresholds. Also, the production of almost all food groups falls short of providing for that intake. Only the production of starchy vegetables exceeds the planetary health boundary levels, as set by the EAT-Lancet Commission.
- A set of NSmartAg practices were identified in the North, Northeast, South and West regions in Haiti for selected food groups at the primary and postharvest/processing levels.
- Investments in food safety regulations and infrastructure development are required in order to create a favorable environment for agri-food enterprise development in general, and NSmartAg in particular.



Financial support for this work was provided by the Government of Japan through the Japan Trust Fund for Scaling Up Nutrition.

Adding all these up, the global economic cost of malnutrition is estimated to be US\$3 trillion [3]. The prevalence and costs of overweight/obesity are also rising even in low- and middle-income countries where over 70% of the 2 billion overweight/obese people live today [4]. The total economic impact of obesity is estimated to be US\$2 trillion a year, or 2.8% of world GDP [5].

NSmartAg technologies and practices are those focused on primary production, and/or agri-food processing and distribution, i.e., where farmers and agribusinesses make decisions on what and how to produce. NSmartAg supports the overall Nutrition Sensitive Agriculture agenda across all the food system (Figure 2).

Existing NSmartAg technologies and practices are available to farmers and agribusiness in Haiti, but their adoption has been incipient. There is thus an opportunity for these NSmartAg technologies and/or practices to be supported by agriculture public policies and programs, expanding their adoption.

This country profile provides a snapshot of NSmartAg technologies and practices across the country and identifies entry points for their adoption for improved outcomes for farmers and agro-entrepreneurs.

NATIONAL CONTEXT

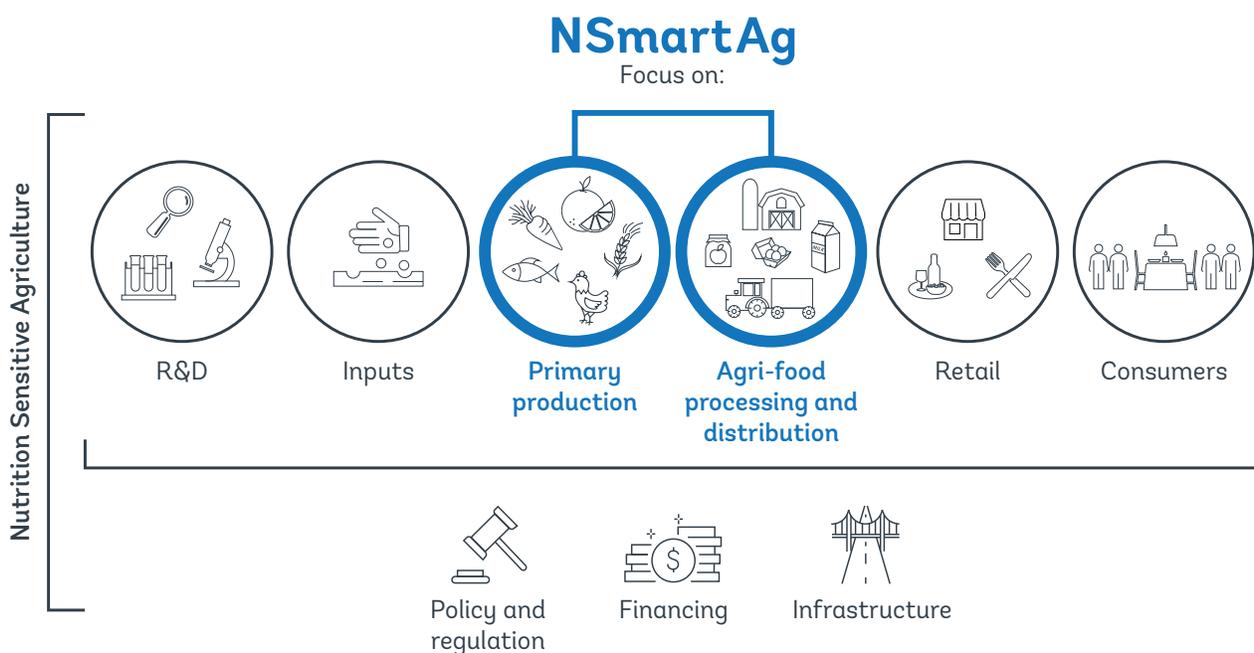
KEY FACTS ON MALNUTRITION

Malnutrition is an underlying cause of 33% of under-5 deaths in Haiti [6]. Stunting, a manifestation of chronic malnutrition, affected nearly 22% of children under the age of five in 2019. The highest rates of chronic malnutrition are recorded in the departments of the North (27.1%) and Southeast (25.7%). Stunting among children is higher in rural areas with 23.9%, compared to 18% in urban areas. Among the country's children aged six to 59 months, 6% suffer from acute malnutrition, with 2.1% severely malnourished [7].

In terms of adult nutrition, the 2016–2017 national survey shows that an average of 10.7% of adult women (15–49 years old) are underweight, with 11.5% in rural areas and 9.8% in urban areas. At the same time, 31.7% of the adult women are either overweight or obese, with 20.5% overweight (BMI ≥ 25 kg/m²) and 11.2% obese (BMI ≥ 30 kg/m²); the prevalence rate of adult women who are either overweight or obese is higher in urban areas (37.7%) than in rural areas (26.3%) [8].

Anemia is a serious public health concern for Haiti. Women of reproductive age are particularly affected by anemia with a rate of nearly 49% in 2017 [8]. The percentage of women

Figure 2: Nutrition Sensitive Agriculture and NSmartAg



suffering from anemia appears to be lower in rural areas, with 45.6%, than in urban areas, with 52.4%. In addition, children are even more affected by anemia with a prevalence rate of 66% nationwide and 67.2% in rural areas. There is no strong evidence explaining the higher prevalence of anemia in women seen in urban areas compared to rural areas while stunting prevalence is lower and overweight/obesity rates are higher in urban areas. One often-cited study speculates that one of the reasons may be different dietary patterns between urban and rural populations affecting the quality of diet. According to this study, whereas urban populations have better access to purchased energy-dense staples such as rice or cornmeal, rural populations are more likely to seasonally access micronutrient-dense fruits and vegetables such as mangoes or leafy green vegetables at low cost. Among rural women, lower-income status was associated with a substantial reduction in the risk of anemia. The food consumed by rural poor (i.e., certain low-cost fruits and vegetables rich in micronutrients), are stigmatized and rejected by those with a higher wealth index, which in turn favors the diet of the rural poor with higher iron, vitamin C, and provitamin A content [9].

While there is no recent national level zinc deficiency prevalence data, it has been globally suggested that zinc deficiency is closely associated with child stunting, and that stunting rates at or above 20% should be indicative of having a population-level zinc deficiency problem among children under five years of age [8]. An MSPP/UNICEF survey carried out in 2005 indicated that about 32% of children between six and 59 months were directly affected by vitamin A deficiency. The proportion of children with vitamin A deficiency was estimated at 33.69% in rural areas, 32.24% in the metropolitan area and 29.21% in other urban areas [10].

Although there is no recent data on the consequences of malnutrition, in 2010 it was estimated that **malnutrition may cost the Haitian economy around US\$1.26 billion between 2013 and 2022, a loss of 16% of its GDP** [11]. Of these economic losses, US\$959 million is due to chronic malnutrition (stunting) and US\$206 million from iron deficiency anemia.

Map 1 presents the key malnutrition indicators in Haiti.

KEY FACTS ON FOOD PRODUCTION

Haiti covers a geographic area of 27,500 km², with more than 60% considered mountainous and nearly 39% arable land. Agriculture has always played a key role in the country's economy given that more than one million small family farmers are producing food on an average area of less than 1.5 ha [12]. The agricultural sector accounts for about 20% of the gross domestic product (GDP) [13] and employs more than 50% of the active labor force [14]. The sector provides food, energy (i.e., charcoal) and building materials. The agro-processing sector, although not very developed in Haiti, employs 5% of the active workforce.

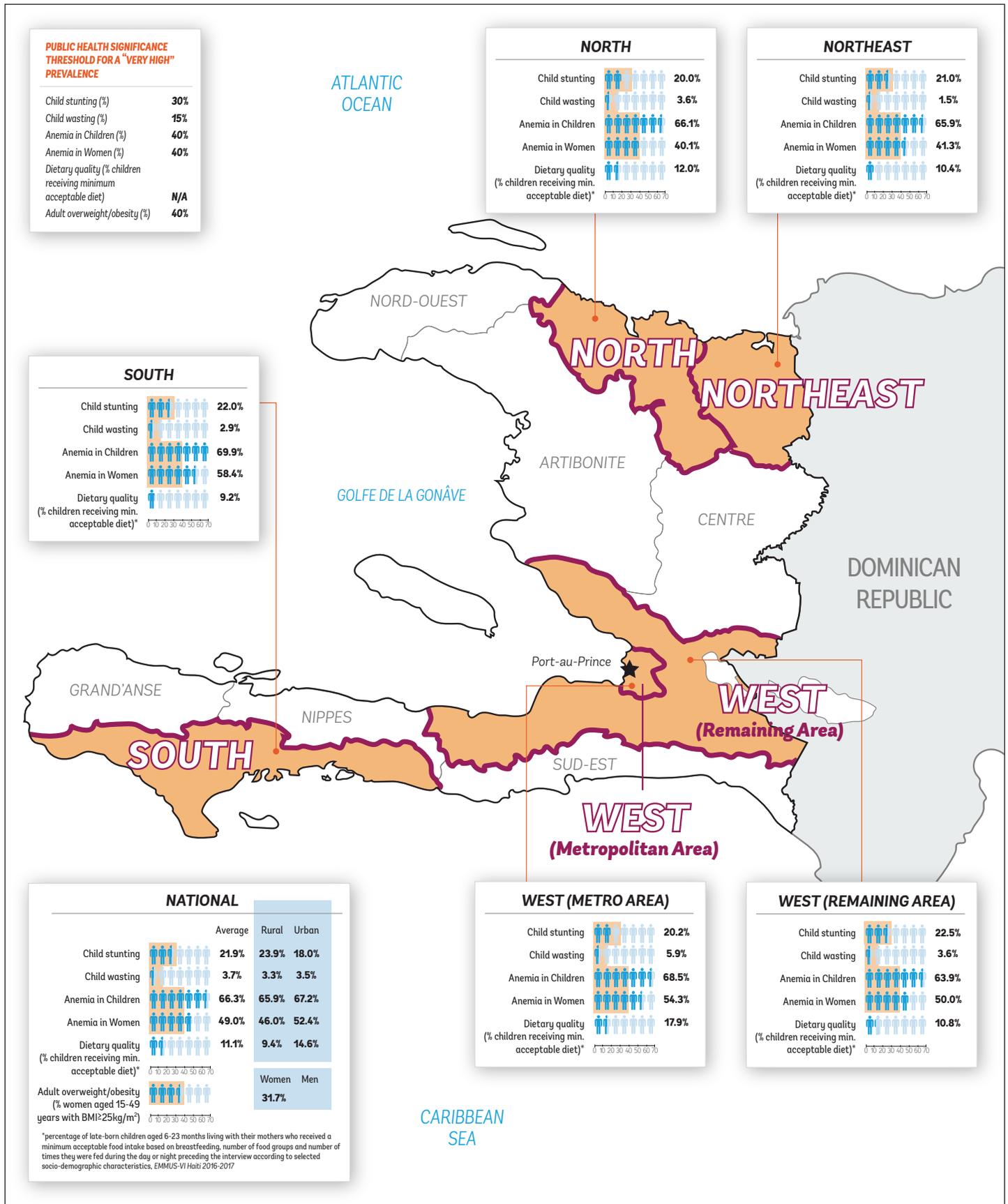
Despite the country's agricultural potential, Haiti is highly dependent on international markets for its food security. Between 2014 and 2017, Haiti imported nearly six million tons of food. The most important food import items are cereal, accounting for more than 63% of total imports (Graph 1). These imported products include rice, wheat and wheat flour [15]. Other main food imports are vegetable oil, sugar and chicken meat, which account for 12.52%, 10% and 5.3% of total food imports respectively, followed by legumes, fish, and milk.

Haiti's dependence on international markets is particularly marked for cereals, with rice coming in first. The share of imports in the overall supply of cereals in the country has increased considerably in recent years, from 61% in 2014 to 73% in 2017 (Chart 2). Similarly, the share of imports in the supply of rice increased from 78% in 2014 to 87% in 2017 [15].

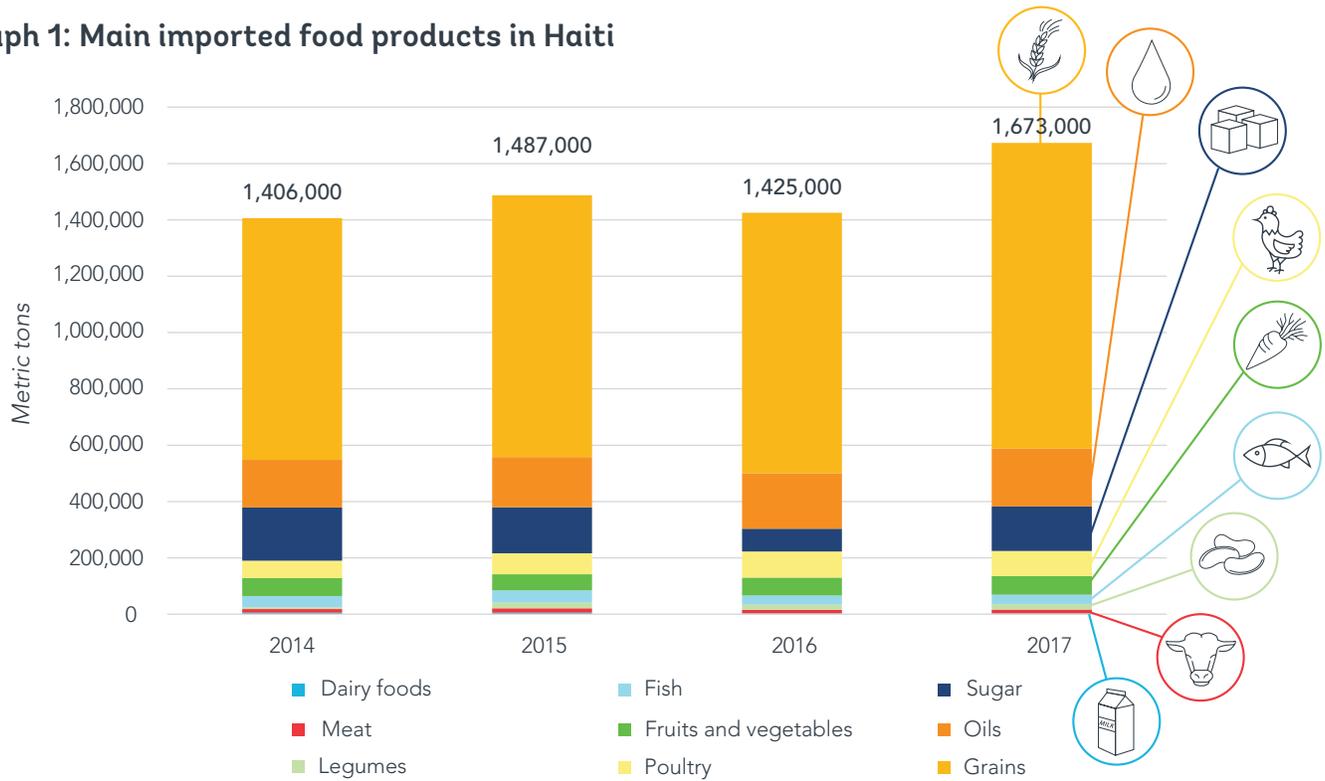
The country's food exports (mainly mangoes, cocoa and coffee) are not very important; while vetiver—used in essential oils and cosmetics—is recording a very fast increase of the exports share.

The trade balance deficit increased from US\$531 million in 1995 to more than US\$2.19 billion deficit in 2017 [13] (Graph 3). The 2007/08 global food price crisis highlighted Haiti's dependency on food imports and its vulnerability to fluctuations in international prices, which caused major food riots.

Map 1: Key malnutrition indicators

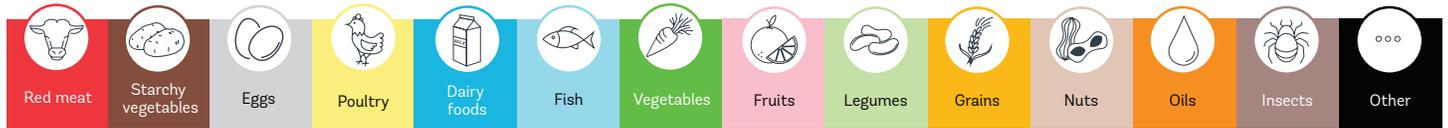


Graph 1: Main imported food products in Haiti

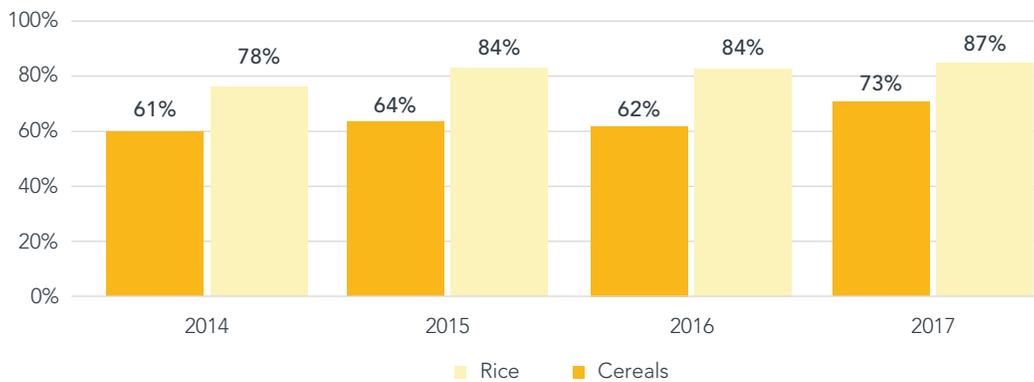


Source: FAOSTAT

Key

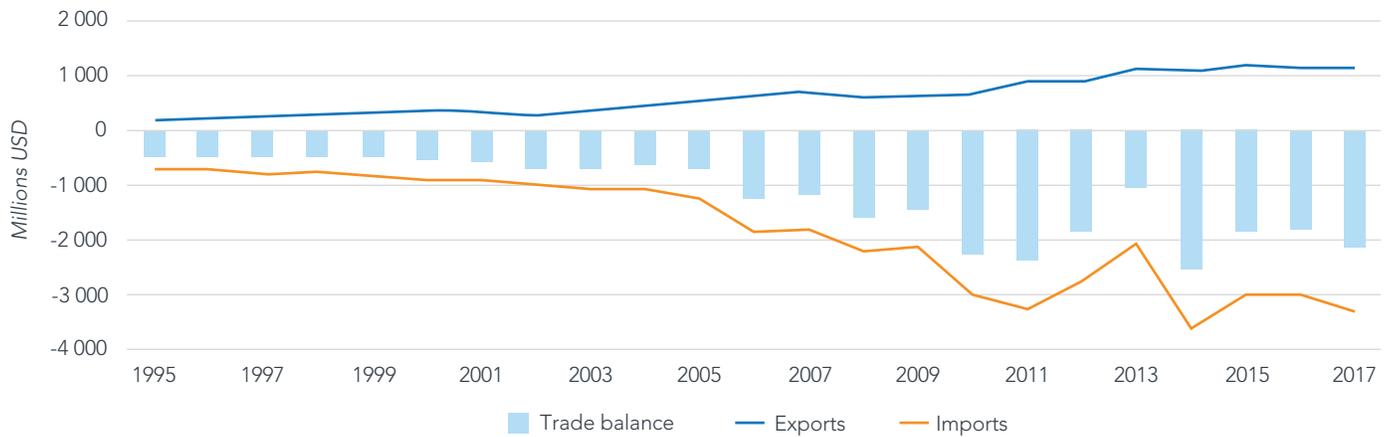


Graph 2: Import dependency (Import/Domestic supply quantity)



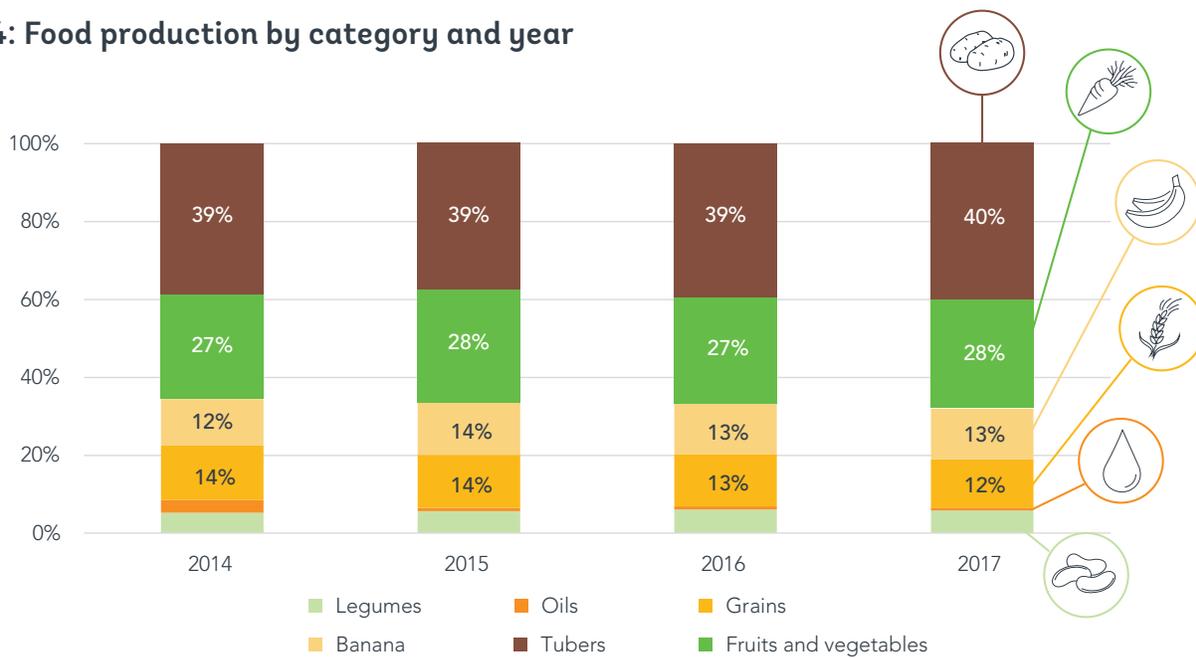
Source: FAOSTAT

Graph 3: Trade Balance



Source: The Observatory of Economic Complexity

Graph 4: Food production by category and year



Source: FAOSTAT

There are no recent or accurate agricultural production aggregates for Haiti. For recent years, the latest available data of food production show a general downward trend going from more than four million metric tons in 2014 to less than that in 2017. In 2017 the main food groups produced were tubers, banana, other fruits and vegetables, and cereals representing respectively 40%, 13%, 28% and 12% of food production. Tubers, mainly sweet potato, cassava and yam, are produced in relatively large quantities throughout the country. Vulnerability to natural disasters and climate change has been cited as a reason behind poor agricultural production (Box 1).

The total animal population has been stable during 2014–2017 with an average of 10 million heads of cattle per year. Livestock production has also been stable across the period

(Graph 5). Poultry represents more than half of the total animal production composed of goats (19%), cattle (14%) and pigs (10%). These animal species are found in all regions of the country. Approximately 23% of the poultry produced in Haiti comes from the West and 10% from the South department. The West accounts for 25% of the goat population, and the Northwest for 12%. Cattle production is the highest in the West with 23%, and the South accounts for 10%. The West accounts for 29% of the pig population and the South for 11%. Apart from these livestock products, a number of households in the coastal areas are engaged in fishing. In 2016, the latest year for which data are available, the volume of fishery products is estimated at 17,730 metric tons. There is also a production of about 18 million eggs per year in the country, i.e., 45% of national consumption.

Box 1: On vulnerability

The people and land of Haiti are vulnerable to natural disasters, and as the impacts of climate change escalate, vulnerability is projected to increase. High mountains characterize the landscape of the country. Poor farming practices have depleted the soil capital and undermined the productive capacity of the land. Arable land is eroding and topsoil concludes into the sea. Natural factors (such as drought, wind, rain) and manmade factors (such as deforestation) are causing land erosion and add to the vulnerability of the agriculture sector.

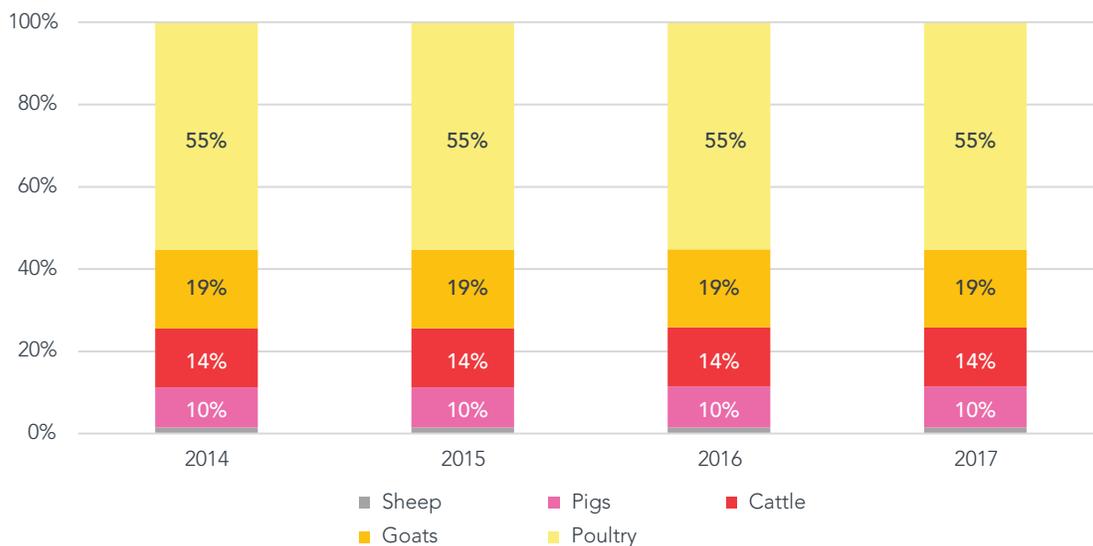
Climate change has had a direct impact on soil fertility, exacerbating the vulnerability of farmers, whose income level depends on rainfall [16]. Farmers have the highest poverty headcount at 71%, with almost 76% of workers in rural areas not earning enough to stay out of poverty [17]. High poverty levels combined with a very low level of land ownership and a lack of social safety nets have pushed farmers to practice deforestation as a coping mechanism—planting more annual crops—for a faster return on investment and usually more robust/resilient crops at the expense of more nutritious choices. These phenomena combined with erratic and heavy rains have worsened erosion and loss of fertile topsoil [16].

On average, each disaster costs two percent of GDP per year and significantly affects the agriculture sector¹. Indicatively, in 2012, agricultural production narrowed by 1.3 percent after a series of climatic shocks [18].

Other types of shocks, such as the earthquake in 2010, have also harmed the agricultural sector.

Notably, the large quantities of food aid imported to respond quickly to these crises have had unintended negative impacts on Haitian agriculture. Prices dropped precipitously low in local markets: increasing poverty, discouraging investments, and exacerbating the vicious cycle of deforestation and erosion described above, as well as contributing to rural-urban migration [16], [17]. These natural shocks aggravate the situation of the agricultural sector, which has been weakened since the early 1980s by the structural adjustment and liberalization of foreign trade policies applied in the country [20], [21].

Graph 5: Livestock population



Source: FAOSTAT

¹ The Post Disaster Needs Assessment (PDNA) report done in February 2017 following Hurricane Matthew mentioned an average of 50% of damages and losses concentrated in the agriculture sector between 1971 and 2014.

Fruits and vegetables are produced in relatively large quantities in Haiti depending on the season and production area, registering in 2017 more than one million metric tons; mangoes accounting for 86% of the total. Bananas are present everywhere in Haiti with a dominance of plantain and fig banana varieties. Banana production has been estimated at two million metric tons between 2014 and 2017, or 13% of global food production. Plantain bananas grow mainly in irrigated and humid lowland areas account for 47% of banana production compared to 53% for fig bananas. In 2017 cereal production was estimated at 484,000 metric tons from which maize accounts for more than half and rice almost a third of the total. Legumes, which are part of the daily diet of the majority of Haiti's population, account for only six percent of the total food production, mainly composed of beans, pigeon peas and "pois inconnu" (niébé-vigna, *Vigna unguiculata*).

An illustration of the contribution of the main food groups produced in Haiti on providing the optimal nutrient intake to contribute to a healthy diet as defined by the EAT-Lancet Commission [21] reveals that the production of almost all

food groups falls short of providing for that intake (Figure 3). Only the production of starchy vegetables exceeds the planetary health boundary levels, as set by the EAT-Lancet Commission.²

KEY FACTS ON FOOD CONSUMPTION

As of 2012, almost 6.3 million Haitians could not meet their basic needs, and, among them, 2.5 million were living below the extreme poverty line, meaning that they could not even cover their food needs [17]. In 2019, it was estimated that about 1.2 million households were food insecure [22]. Box 2 highlights some elements of the Haitian food environment.

In addition, according to the Consolidated Food Security Indicator Approach (CARI),³ 50.7% of households are food insecure [22]. Out of these households, 38% are moderately food insecure, and 12.7% experience severe food insecurity, which is characterized by, among other things, a lack of access to food leading to poor nutrition (in quantity and quality). The highest percentages of food-insecure households were found in rural areas, particularly in the Northwest (82.7%) [22].

Figure 3: Main food groups produced and contributing to optimal nutrient intake

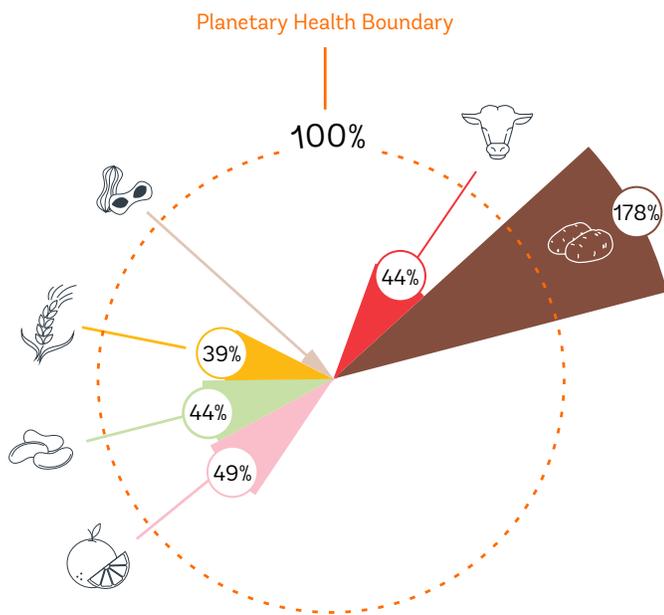
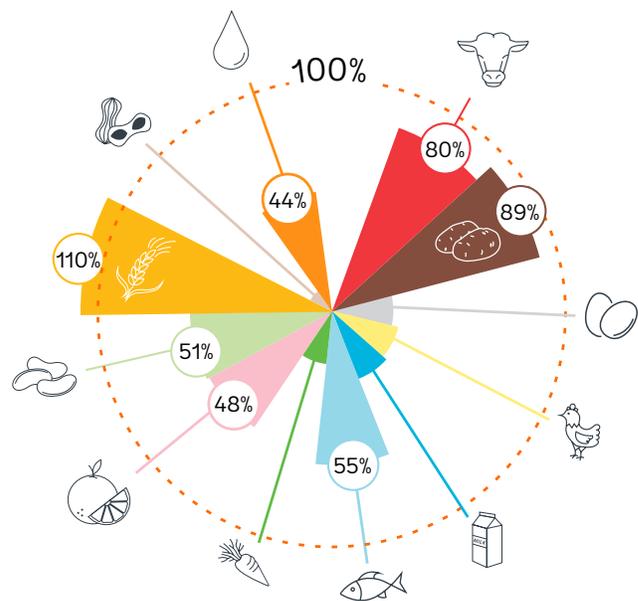


Figure 4: Main food groups consumed and contributing to optimal nutrient intake



2 The dotted line represents the production level of the entire country if all that is produced by the households is consumed locally (no exports or imports). This gives an idea of how far away the production of some key food products is from the "self-sufficiency" link representing the average healthy eating plate of that given population. This does not mean that self-sufficiency is being promoted, but it is an indication of an opportunity to increase production of certain foods that clearly show a deficit in terms of nutrient deficiencies of the local population.

3 CARI is a World Food Programme (WFP) method used to analyze and report the level of food insecurity within a population. Under the CARI approach, each surveyed household is classified into one of four food security categories. This classification is based on the household's current status of food security (using food consumption indicators) and their coping capacity (using indicators measuring economic vulnerability and asset depletion). More information is available here: <https://www.wfp.org/publications/consolidated-approach-reporting-indicators-food-security-cari-guidelines>.

Box 2: Food Environment in Haiti

Nearly 90% of Haitian households purchase their food at the market [22], where both local and imported food products can be found [23]. Poor households generally buy between 45% and 85% of their food at the market [24].

In 2019, the average monthly cost of a food basket composed of cereals, pulses, oil and sugar providing 1,870 kilocalories per person per day, has been estimated at US\$18.57 per person [25]. Although the cost is affordable to most people, it is worth noting that it is not a “nutritious” food basket.

Moreover, given households’ high dependency on the market and imported food products, they are highly vulnerable to inflation, exchange rate volatility and shocks of all kinds (socio-political unrest, adverse weather conditions) that can hamper food availability and access.

For local products, women known as *Madan Sara* perform vital logistical services in connecting local goods from the countryside to city markets. They travel to rural markets to purchase local goods and distribute or sell them in the city as wholesalers, or as retailers, reselling large stocks in smaller options [26].

Moreover, the Food Consumption Score (FCS)⁴ for Haitian households reveals that 51% of them experience inadequate food consumption—a situation that has remained almost unchanged since 2017. Of those households, 20% have poor food consumption, which means that their diet is deprived of animal protein, legumes, fruit or dairy products. The remaining 31% of households have limited food consumption which translates to a diet consisting of cereals and oil six days a week, and legumes and sugar about three days a week. Sixty percent of households with children under five do not enjoy adequate food consumption. In terms of frequency of consumption, households consume cereals, roots and oil almost every day. Pulses are consumed less than four days a week and sugar at most three days a week. Fruits, vegetables, meat and dairy products are consumed once or twice a week. Household Dietary Diversity Score (HDDS)⁵ findings show that about 67% of households consume from at least five food groups. At the national level, nearly 30% of households never consume vitamin A-rich foods, and more than 30% of households never consume iron-rich foods [22].

In the absence of food-based dietary guidelines (FBDGs) or recommendations for Haiti, the EAT-Lancet Commission’s planetary health plate was applied where a boundary marked by 100% represents the healthy eating plate, and the different food groups are mapped in terms of distance to the line⁶

(Figure 4). While Haiti has a food pyramid providing the recommended consumption by food type, the information could not be used in the analysis for this country profile for technical reasons. Instead, the EAT-Lancet Commission’s “planetary health base” has been applied (see Box 3). The consumption of all major food groups, except for starchy vegetables, grains and red meat, falls below the recommended EAT-Lancet Commission’s planetary health thresholds.

In Haiti, the review of national policies/strategies and other literature reveals that vitamin A, iron, folic acid, iodine and zinc are commonly referred to as problem key micronutrients to be addressed as part of national efforts (Box 4). In this analysis, protein, as an important macronutrient, was added because a deficiency in protein negatively affects physiological utilization of other important nutrients, such as iron. Deficiencies in these macronutrients are associated with compromised health and well-being of individuals, including growth failure in childhood and decreased immunity. Further, evidence suggests that protein intakes tend to fall significantly short of the recommended levels in many developing countries [27].

In this analysis, iodine, although an important micronutrient and highly relevant for great public health in Haiti (Box 5) was not examined, as iodine deficiency at population level

4 The FCS is an index that was developed by the World Food Programme (WFP), and is computed by grouping together the food items for which consumption was assessed over a seven-day recall period. WFP’s standard Food Consumption Groups include poor, borderline and acceptable. Acceptable consumption corresponds to a household’s diet that consists of daily consumption of starches, vegetables, oil, more pulses/beans/nuts as essential sources of vegetal protein (five days a week) to which are added three days a week of meat/fish consumption as a source of animal protein and three days a week of sugar; fruits and dairy products are rarely consumed.

5 HDDS consists of a simple count of the different food groups that a household has consumed in the last 24 hours. More information is available here: <https://www.fantaproject.org/monitoring-and-evaluation/household-dietary-diversity-score>.

6 As the EAT-Lancet’s boundary is not an endorsed tool to be used as a dietary reference/benchmark for any particular population groups, it is used only for an illustrative purpose, rather than to quantify deficiencies/excess against the 100% line. The consumption of all major food groups, except for starchy vegetables and red meat, falls below the recommended EAT-Lancet Commission’s planetary health thresholds.

Box 3: The Haitian food pyramid

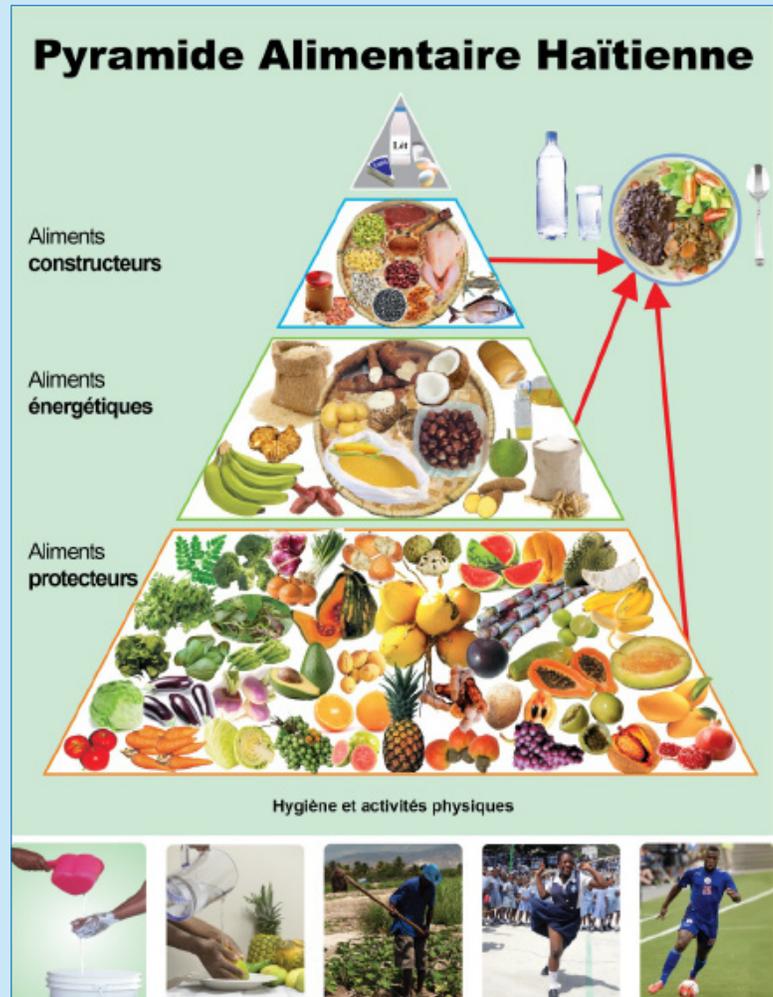
The Haitian food pyramid promotes healthy eating for Haitians and emphasizes the importance of combining a healthy and balanced diet with regular physical activity and hygienic practices.

It also recommends eating a wide variety of foods in optimal quantities. The following three food groups make up the pyramid: “Protective foods”: those that protect the body from infection, regulate satiety and aid digestion. They include fresh vegetables and fruits, and should be consumed in greater frequency and quantity; “Energy foods”: those that provide the body with the energy it needs to function, primarily through carbohydrates and fats; and “Building foods”: those that provide the body with proteins necessary for the growth and development of tissues and which are important for establishing and strengthening the immune system. It is, however, recommended to consume them in smaller quantities.

The Haitian food pyramid also recommends: 1) preparing food with little or no fat, sugar and salt; 2) use cooking methods that require little or no materials, such as baking, grilling or steaming. It is also possible to quickly sauté foods; 3) limit the consumption of foods rich in fat, sweet sauces and cubes of flavors rich in salt; 4) drink a lot of water regularly every day, 2 liters or 8 glasses of 8 ounces, particularly in hot weather or during physical activity. Sugar-free water quenches thirst without adding on calories. Consuming different foods in each group, makes it easier to get all the nutrients the body needs.

The NSmartAg analysis could have adopted the Haitian food pyramid if it were accompanied by quantitative recommendations of national nutritional guidelines based on food (FBDG) for a category of adult women or for all population groups of age/sex.

Source: Ministry of Public Health and Population (MSPP), Coordination Unit of the National Food and Nutrition Program (UCPNANU).



is usually addressed through non-agricultural solutions that are beyond the scope of this Country Profile⁷. Overweight and obesity are an emerging nutritional problem in Haiti and many other countries, yet evidence related to the impact of specific agriculture interventions on overweight/obesity is still limited. Malnutrition issues related to undernutrition

and micronutrient deficiencies are still more prevalent and receive policy and program attention. Specific interventions that directly try to address overweight and obesity issues therefore were not analyzed, while an “obesity lens”⁸ was applied in selecting the recommended menu of options.

7 MARNDR has a role in the production of raw salt that meets quality standards. Improving the quality of the raw salt is important for the subsequent process of fortifying it with iodine because it may affect the stability of iodine in the final product.

8 Foods high in sugar/oil/salt, ultra-processed foods and red meat that are known to contribute to overweight/obesity or diet-related non-communicable diseases, such as cardiovascular diseases, are not promoted.

Box 4: What are the consequences of deficiencies in iron, zinc, vitamin A, and folate?

Iron deficiency often causes anemia, which is a condition where the capacity of the blood to carry oxygen to the body's tissues is reduced, resulting in symptoms such as fatigue, weakness, dizziness and shortness of breath, among others. These physiological conditions also affect the overall health status, cognitive development in children and productivity in later life. Iron is found in both plant and animal sources, yet the bioavailability (i.e., the absorption rates in the body) of plant-sourced iron is much lower than the animal sourced one.

Zinc deficiency limits childhood growth and decreases resistance to infections as zinc is an important essential nutrient for cellular growth, cellular differentiation and metabolism. Zinc is found more commonly in animal-sourced food items while some plant sources, such as nuts, starchy vegetables and cereals contain zinc which has lower bioavailability.

Vitamin A deficiency may be exacerbated by high rates of infection, and greatly increases the risk that a child may die from diseases such as measles, diarrhea, and acute respiratory infections, and is the leading cause of childhood blindness. Vitamin A is an essential micronutrient that plays a key role in vision and immune response.

Folate deficiency is associated with abnormalities in both mother (anemia, peripheral neuropathy) and fetus (congenital abnormalities), including fetal neural tube defects that originate before the 4th week of gestation. Folate is most needed during the very first month of pregnancy when fetal brain and spinal cord development start. Since many women do not know they are pregnant during the first trimester, it is strongly recommended to ensure adequate consumption of folate-rich foods in daily life generally, even when individualized nutritional counseling is available.

Box 5: Insufficient iodine intake in Haiti

Iodine is an essential micronutrient that helps prevent the development of thyroid diseases in children and adults, and its deficiency puts children at risk of stunting, learning disabilities and even severe forms of cognitive impairment such as cretinism [8]. Studies have shown that iodine deficient children could have 15 points lower IQ than non-iodine deficient ones on average. Haitian national regulations require that 100% of salt for consumption be fortified with potassium iodate (KIO₃), however, between 2000 and 2016–2017, the percentage of households consuming iodized salt decreased significantly from 23% to 8% [8], [28].

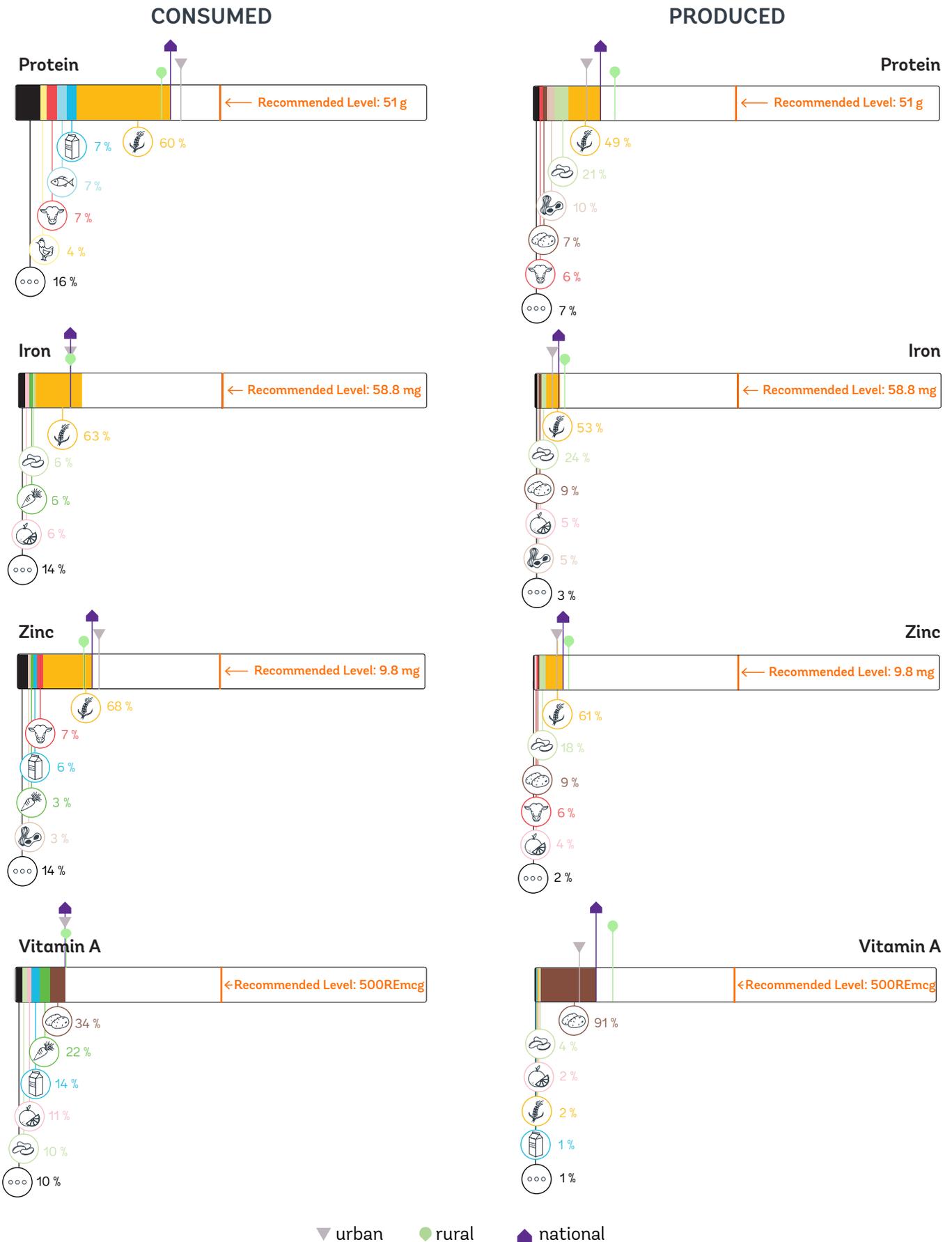
An analysis of available data [13] allows for the identification of major food sources that contribute to the production and consumption of these key nutrients in Haiti. The bar graphs in Figure 5 display the estimated average nutrient production and consumption levels,⁹ per day, per adult female equivalent,¹⁰ for the population of Haiti. For each graph, the estimated production or consumption level of each nutrient of interest is compared to the corresponding recommended intake level for the adult female category (center). The top five (5) food groups contributing to the intake and production are displayed as colored segments, sized according to their contribution. For example, the first bar graph in Figure 5

shows that 63% of the average iron consumption comes from the "cereals" food group, followed by 6% from the "pulses", "vegetables", and "fruits" categories. At the national level, both production and consumption of food sources for all five key nutrients fall significantly short of the recommended levels, except for the consumption of protein sources. Grains constitute the major food sources in terms of production and consumption for four of the key nutrients, i.e., protein, iron, vitamin A and zinc. Starchy vegetables play this role for vitamin A. Grains provide the major source for folate production, while pulses are the major source for its consumption of protein.

⁹ Bio-available and after losses average nutrients intake.

¹⁰ Special statistical measures were applied to compute an adult female equivalent, instead of per capita (see more detailed methodologies in the Supplementary Materials), as physiological nutrient requirements and individual dietary patterns are different by age/gender and women tend to be more vulnerable to nutrient deficiencies.

Figure 5: Food group sources for key nutrients (produced and consumed) at the national level



NUTRITION SMART AGRICULTURE TECHNOLOGIES AND PRACTICES

NSmartAg technologies and practices present opportunities for contributing towards a double objective: improving nutrition of the local population, while also increasing farm and/or agribusiness-level productivity or revenue. In combination, these are the drivers for agribusiness investments. For this profile, these practices were identified based on observation/evidence of what farmers and agribusinesses are engaged in.

Table 1 showcases NSmartAg practices that were identified for selected production systems/agro-ecological zones in the South, North, Northeast, and the West of Haiti,¹¹ and by prioritized food groups for the primary production and post-harvest/processing levels¹². The same analysis presented in Figures 3 and 4 was done at the department level (results shown in the Supplementary Materials), comparing the consumption and production levels by food group against the planetary health thresholds.

In the absence of agriculture census and enterprise survey data in Haiti, both primary production and post-harvest/processing activities were identified through literature review, interviews, and field observations.¹³ Based on the department-level results, the food groups that are neither consumed nor produced optimally were selected for further analysis.¹⁴

The food groups that are only produced at negligible levels were excluded as they may not represent immediately exploitable business opportunities. Based on the selected food groups for each department, a list of food items to

be promoted for primary production was formulated. Once specific food groups are identified as being produced locally, and if overall production and productivity trends have been positive (in other words, if the product is not disappearing from the local production systems), then the food product appears in the NSmartAg menu of options. Additionally, at post-harvest food transformation/processing and handling level, field visits were undertaken to agro-entrepreneurs that handle such food groups in order to assess whether they engage in NSmartAg practices and/or technologies. The field survey intends to assess the degree to which the activity increases productivity or revenue, and the extent to which the key nutrients are maintained/preserved, without adding unhealthy ingredients (sugars, trans fat, etc.), or at least doing so only in acceptable quantities.

The food groups identified for each department were eggs, fruits, vegetables, pulses, dairy foods, fish, and nuts for the South; eggs, fish, dairy foods, vegetables, fruits, pulses, grains, nuts for the North; eggs, dairy foods, fish, vegetables, fruits, pulses, grains, nuts for the Northeast; and fish, pulses, fruits, vegetables, dairy foods, poultry, eggs, and nuts for the West.

The identification of food products/groups to promote does not imply a call to self-sufficiency. It simply constitutes an indication of an economically viable opportunity to increase production of certain foods that clearly show a deficit in terms of key nutrient deficiencies of the local population. Unless indicated otherwise, the practice or service is relevant for all the departments. Lastly, before integrating into a program/operation/project, this indicative (and not exhaustive) menu of options needs to be analyzed for cost/benefits to ensure that investment yields positive returns.

Table 1: Nutrition Smart Agriculture practices in Haiti

		NSmartAg		
Value Chain Segment	Practices and Technologies	Contribution to nutrition	Market potential	Where
PRODUCTION	Egg production	Addresses micronutrient deficiencies (mainly iron, zinc, vitamin A and folate); provides an additional source of protein consumption	Positive outlook for commercial viability of product; large market size (South) Positive outlook for commercial viability of product (West, Northeast, North)	South, Northeast, West, North
	Fish and crustaceans (shrimp)	Addresses micronutrient deficiencies (iron, zinc and some vitamin A), and provides an additional source of protein consumption	Positive outlook for commercial viability of product; large market size; stable market growth (crustaceans/shrimp, West) Positive outlook for commercial viability of product; large market size; expectation of market growth (tilapia, North)	South, North, Northeast, West

11 The selection criteria included diversity of agro-ecological zones, differences in nutritional status, production potential.

12 Annex IV of the supplementary documents provides an indicative list of case studies on smart farming technologies and practices for nutrition.

13 A list of companies was first established for the whole country by consulting several sources, and interviews with resource persons. Primary production activities were identified through literature review, the general census of agriculture carried out in 2009, and field observations.

14 See Annex II in Supplementary Material.

Value Chain Segment	Practices and Technologies	Contribution to nutrition	Market potential	Where
PRODUCTION	Poultry (chicken)	Addresses micronutrient deficiencies (iron, zinc and vitamin A), and provides an additional source of protein consumption	Positive outlook for commercial viability of product (South, North, Northeast) Positive outlook for commercial viability of product; expectation for market growth (West)	South, North, Northeast, West
	Pulses	Addresses micronutrient deficiencies (mainly iron, zinc and folate), and provides an additional source of protein consumption	Positive outlook for commercial viability of product	South, North, Northeast, West
	Fruits (citrus fruit, mango, banana fig, avocado, melon, guava)	Addresses micronutrient deficiencies (some iron, zinc, vitamin A and folate depending on the kind of fruit) and provides an additional source of protein consumption	Positive outlook for commercial viability of product	South, North, Northeast, West
	Fresh and raw cow's milk	Addresses micronutrient deficiencies (some iron, zinc, vitamin A and folate); provides an additional source of protein consumption	Positive outlook for commercial viability of product	South, North, Northeast, West
POST-HARVEST/PROCESSING	Akamil (AK1000) —(flour from cereals and pulses including beans)	Addresses micronutrient deficiencies (mainly iron, zinc and folate), and provides an additional source of protein consumption	Positive outlook for commercial viability of product; large market size; expectation of market growth	West, South, Northeast
	Production of peanut butter (peanut paste)—no sugar added; not spicy	Addresses micronutrient deficiencies (mainly iron, zinc and folate); provides an additional source of protein consumption	Positive outlook for commercial viability of product; large market size	West, South, Northeast,
	Grilled nuts	Addresses micronutrient deficiencies (mainly iron, zinc, and folate), and provides an additional source of protein consumption	Positive outlook for commercial viability of product; large market size; stable market growth (West, South, Northeast) Positive outlook for commercial viability of product; large market size; stable market growth (almonds, Northeast) Positive outlook for commercial viability of product; large market size (cashew nuts, North) Positive outlook for commercial viability of product; stable market growth (cashew nuts, South) Positive outlook for commercial viability of product; large market size (cashew nuts, Northeast) Positive outlook for commercial viability of product; large market size; expectation of market growth (cashew nuts, West)	West, South, Northeast
	Moringa leaves (dried and chopped)	Addresses micronutrient deficiencies (mainly iron, zinc, vitamin A and folate), and provides an additional source of protein consumption	Positive outlook for commercial viability of product; large market size; expectation of market growth	North
	Yoghurt (no sugar added)	Addresses micronutrient deficiencies (some iron, zinc, vitamin A, folate), and provides an additional source of protein consumption	Positive outlook for commercial viability of product; large market size (West) Positive outlook for commercial viability of product; large market size; expectation of market growth (Northeast) Positive outlook for commercial viability of product; large market size; expectation of market growth (North) Positive outlook for commercial viability of product; large market size; expectation of market growth (South)	South, North, Northeast, West

Value Chain Segment	Practices and Technologies	Contribution to nutrition	Market potential	Where
POST-HARVEST/PROCESSING	Sterilized milk (no sugar added)	Addresses micronutrient deficiencies (some zinc and vitamin A) and provides an additional source of protein consumption	Positive outlook for commercial viability of product; large market size; expectation of market growth	Northeast
	Pasteurized milk (no sugar added)	Addresses micronutrient deficiencies (some zinc and vitamin A); provides an additional source of protein consumption	Positive outlook for commercial viability of product; large market size; expectation of market growth	South
	Cheese	Addresses micronutrient deficiencies (zinc, vitamin A and some folate); provides an additional source of protein consumption	Positive outlook for commercial viability of product; large market size	West
	Dried fish	Addresses micronutrient deficiencies (mainly iron and some zinc, folate and vitamin A) and provides an additional source of protein consumption.	Positive outlook for commercial viability of product; large market size; expectation of market growth (Northeast) Positive outlook for commercial viability of product; expectation of market growth (South) Positive outlook for commercial viability of product; large market size; stable market growth (West)	Northeast, South, West
	Breadfruit flour (arbre véritable)	Addresses micronutrient deficiencies (some vitamin A and folate) and provides an additional source of protein consumption	Positive outlook for commercial viability of product; large market size; expectation of market growth	Northeast
	Dried fruit (such as mango and guava)	Addresses micronutrient deficiencies (some iron, zinc, vitamin A and folate depending on the kind of fruit) and provides an additional source of protein consumption	Positive outlook for commercial viability of product; large market size; expectation of market growth (mango, pineapple)	North
	Chicken meat	Addresses micronutrient deficiencies (iron, zinc and vitamin A), and provides an additional source of protein consumption	Positive outlook for commercial viability of product; large market size; expectation of market growth	West
	Fish meat (local either aquaculture or fishing)	Addresses micronutrient deficiencies (mainly iron and some zinc, vitamin A and folate depending on the kind of fish) and provides an additional source of protein consumption	Positive outlook for commercial viability of product; large market size; expectation of market growth (West) Positive outlook for commercial viability of product; large market size; stable market growth (South)	West, South

According to the data collected during the field survey, the agro-entrepreneurs, most of whom own a micro, small or medium enterprise (MSME) are optimistic for the commercial viability of their business due to the existence of general demand for their products. Most of them sell their products directly to consumers and retailers, who are located in both

rural and urban areas. The majority of owners of businesses active in NSmartAg activities are men. Although agro-entrepreneurs responded that they follow good hygiene and good manufacturing practices, they appeared to not know the country's food safety regulations. The majority of practices found is concentrated in food production.

Highlight 1: Akamil (AK1000)

Name of agribusiness: Parents' Association in Martino of the third communal section of Camp Perrin

Akamil is a mixture of cereals and pulses and mainly flour that contributes to boosting protein and micronutrient consumption, as well as energy. This Parents' Association makes AK1000 (out of own produced and purchased raw material in the market) and sells it directly to wholesalers, distributors and retailers in both rural and urban areas, making a profit in a relatively large and stable market.

Key considerations for further support:

A business plan and knowledge of food permits/certifications and/or food safety are lacking. The Association is interested in acquiring better equipment and access to packaging to increase production and also expand its customer base. It would also like to increase its storage capacity for both cereals and pulses.

Highlight 2: Dried fish

Name of agribusiness: Aquadev

AQUADEV is a foundation located in Grand Goâve in a seaside location called Petit Paradis. The structure offers a service of buying, selling and delivering fresh products and other processed products such as dried fish, ready to be sold to distributors, retailers and consumers located in urban and rural areas of the regions of Port-au-Prince and Goâve. Dried fish contributes to the intake of key micronutrients such as iron, Omega 3 and vitamin B₁₂. Aquadev believes that its product is viable in a growing market with some competitors in the region.

Key considerations for further support:

A business plan and knowledge of food and/or food safety permits/certifications are lacking. Support for the development of a business plan, information and training relating to food safety codes would be necessary to ensure the safety of fish consumers and promote the aspirations of this small business which wishes to continue to produce dried fish.

The company would like to acquire more efficient materials, equipment and packaging materials to increase its production and also to broaden its customer base, as the demand for quality fish products, including dried fish, is high. It would also like to make investments so as to increase its storage capacities.



Drying racks



Baliste (triggerfish) drying

INSTITUTIONS AND POLICIES THAT SUPPORT AGRICULTURE SOLUTIONS FOR NUTRITION

Since the 2000s, food and nutritional security have been a major concern for the Haitian Government. A set of policies and strategies has been adopted, particularly after the 2010 earthquake, to address malnutrition, increase food and nutrition security, and improve the performance of the agricultural sector.

In June 2012, the Republic of Haiti joined the Scaling Up Nutrition (SUN) Movement. The same year saw the establishment of a national strategic framework to fight hunger and malnutrition, known as ABA GRANGOU [29]. The framework was launched by the Executive Office and involved nine ministries, including the Ministry of Agriculture, Natural Resources and Rural Development (ministère de l’Agriculture, des Ressources Naturelles et du Développement Rural, MARNDR) and multiple stakeholder groups. A national-level Commission for the Fight Against Hunger and Malnutrition (Commission Nationale de Lutte Contre la Faim et la Malnutrition, COLFAM), had been set up to chaired by the First Lady, that provided strategic direction to the program.

In response to the new circumstances characterized by the global food crises of 2008 and the impact of the January 2010 earthquake, which exacerbated food insecurity in Haiti, the Government, with the support of technical and financial partners, updated in 2010 the PNSAN developed in 1996. This updated PNSAN covers the period 2010–2025, and is expected to be revised and adopted every three to five years. The vision expressed in this plan is to eradicate hunger by 2025 by meeting the food and nutritional needs of the population in both quantitative and qualitative terms. In 2018, the government developed the National Policy and Strategy for Food Sovereignty and Security and Nutrition in Haiti (PSNSSANH), whose aim is not only to reduce hunger and malnutrition, but also to seek the growth of the agriculture sector and agro-industry, which would reduce poverty, create jobs, stimulate the country’s economic growth, stimulate investment in the agro-food industry, and create sustainable communities. During the same year, a Departmental Food and Nutritional Security Plan was drawn up for each of the country’s 10 geographic departments. These different departmental plans should allow the operationalization the national plan in a decentralized way.

In 2013, the government adopted a National Strategy Nutrition Plan for the period 2013–2018 (Plan Stratégique National de Nutrition 2013-2018). This strategy was led by the Coordination Unit of the National Food and Nutrition Program (Unité de Coordination du Programme National d’Alimentation et de Nutrition, UCPNaNu) of the Ministry of Public Health and Population (MSPP)¹⁵. The plan focuses on preventative family nutrition through improving nutrition and health, particularly for children under five years of age, and pregnant and lactating women. This includes the promotion of adequate nutrition throughout the life cycle, calling specifically for an agriculture sector that promotes crops of high nutritional value that are known and accessible to the majority of the population, as well as small livestock to allow for access to nutrient rich food at low cost. This strategy has not been evaluated or updated since the end of its implementation period in 2018. Discussions have begun on developing a National Strategy Nutrition Plan for 2020–2025, but have been suspended given the disruption to normal government programming due to the Covid-19 crisis. In the meantime, the 2013–2018 strategy continues to provide the government’s framework for action on nutrition.

In the agricultural sector, the government has shown an interest in nutrition issues since the early 2000s. The MARNDR, with the technical support of FAO, has carried out the Special Programme for Food Security (PSSA) which was transformed in 2007 into the PNSAN. The PSSA developed a sweet potato production technique that has been very successful in improving productivity throughout the country. The program has also supported Haitian producers in breeding fish and chicken in several areas of the country. Although agricultural policies and strategies do not focus directly on nutrition, the results obtained through the PNSAN have played a role in defining policies in the agricultural sector.

In 2010, the Government of Haiti developed an agricultural development policy 2010–2025 (Politique de développement agricole) and a National Plan for Agricultural Investment (Plan National d’Investissement Agricole, PNIA) 2010–2016. The policy recognizes the need for a multisectoral approach to ensure food and nutrition security in the country. In fact, the documents call for the development of a multisectoral framework but falls short in making specific recommendations on how agriculture can improve nutrition. The PNIA casts the establishment of a strategic food stock program at the center of the sector’s response to food and nutrition insecurity, which reveals an important, but rather limited

15 The Coordination Unit of the National Nutrition Program (UCPNaNu) of the Ministry of Public Health and Population (MSPP) plays a determining role in facilitation and coordination, and is essential to all the initiatives underway in the country in nutrition. In particular, it promotes the agriculture approach to public health. One of the key pieces for the coordination of nutrition is the technical nutrition committee (CTN), a forum for exchanges between partners working in the field. A fundamental achievement is the development and popularization of the Haitian Food Pyramid with the contributions of the IHE and the financial support of USAID, following a broad national concertation.

aspect of nutrition security—the availability and access to food, regardless of its diversity and nutrient content.

The Haitian Parliament passed a law in February 2017 mandating the fortification of vegetable oil, wheat flour, and salt with micronutrients [30], specifically iodine for salt; iron, zinc, vitamin B, and folic acid for wheat flour; and vitamin A for edible oil. The Ministry of Public Health and

Population (MSPP) is responsible for food fortification (see Box 6) and collaborates with the MARNDR and the Ministry of Commerce and Industry.

Despite showing an organized institutional framework surrounding food safety, Haiti does not have food safety legislations in place, and legislation on labeling requirements is pending. Box 7 below provides a brief overview.

Box 6: Food fortification

Following the publication of the 2017 Food Fortification Law, the Ranfòse program Abitid Nitrisyon pou Fè Ogmante Sante (RANFOSE) was launched in 2017 by the MSPP to respond to micronutrient deficiency problems in Haiti through food fortification. The program works directly with the mills to manufacture wheat flour, iodized salt producers and importers of flour, edible vegetable oil and salt to enrich wheat flour, edible oil and salt, based on the recommendations of the MSPP. The companies and importers absorb all the additional fortification costs and RANFOSE provides them with technical assistance and a platform where they can obtain vitamins and minerals at a competitive price. Partners of the Americas and the Global Alliance for the Improvement of Nutrition (GAIN) implement this program funded by USAID, for a period of four years (2017–2021). Thanks to this collaboration, companies do not charge consumers for the cost of fortification, and enriched products aren't sold at higher prices. The publication of the implementing texts of the law on the fortification of micronutrient foods will allow all stakeholders to monitor its application.

Box 7: Food safety—current status

Three Ministries share responsibility for food safety in Haiti:

1. The Ministry of Commerce and Industry (ministère du Commerce et de l'Industrie, MCI), through the Directorate of Quality Control and Consumer Protection (Direction du Contrôle de la Qualité et de Protection du Consommateur, DCQPC), which is responsible for ensuring economic protection, consumer safety, and the fair functioning of markets by fighting against fraudulent practices—particularly those harmful to health—such as the falsification of foodstuffs, or the possession of products that are falsified or unfit for consumption. It ensures the control of quality and conformity of food products with standard requirements (technical specifications defined by the manufacturer, national and international standards, etc.), and the implementation and functioning of the national metrology system, on a sustainable basis. The Directorate houses the Codex Alimentarius National Contact Point (CCP).

MCI's Haitian Bureau of Standardization (Bureau Haïtien de Normalisation, BHN) is in charge of elaborating national technical standards on the quality of food products in collaboration with the sectors concerned and to contribute to their diffusion, to deliver signs of quality like label, brand, controlled origin, composition and nature of the product.

2. The Ministry of Agriculture, Natural Resources and Rural Development (ministère de l'Agriculture, des Ressources Naturelles et du Développement Rural, MARNDR) is responsible for developing inspection and control standards for products, establishments and processes throughout the food production phase, programming and coordinating the implementation of these technical standards in cooperation with the Minister of Public Health and Population (MSPP); protecting animals and plants against pests and disease. In November 1987, a presidential decree established the Department of Production and Food Safety (DGPSA) that oversees the Office of Animal Quarantine and Control of Fishing and Agricultural Products (DQCSPAP). The MARNDR manages the Veterinary and Quality Control Laboratory for Tamarind Food (LVCQAT), which allows it to carry out analyses to ensure the quality control of food intended for humans

Continued on the next page

and animals. The laboratory, which supports veterinary and food research, has become increasingly involved in the revitalization of agri-food companies regarding the standardization and health safety of food. There are plans to make it an Autonomous Institute in the future.¹⁶

3. The Ministry of Public Health and Population (MSPP), is responsible for regulating public health activities related to hygiene and food safety at the point of sale of foods of animal and vegetable origins intended for human consumption; developing the technical standards for the inspection and control of animal and plant products as well as derived products at the level of the centers or points of sale in conjunction with the MARNDR; identifying cases of food poisoning and zoonoses occurring in the country through active and passive surveillance, determining etiology and risk factors and, if possible, treating them. Through the Directorate for Health Promotion and Environmental Protection (Direction de la Promotion de la Santé et de Protection de l'Environnement, DPSPE), which designs and implements strategies to improve the overall health environment, MSPP dictates and promotes new health priorities in line with national, regional and global health developments.

Haiti has suffered many natural disasters that have further weakened an already fragile health system [31], most notably the earthquake and the cholera epidemic of 2010, and Hurricane Matthew in 2016. According to the World Food Programme [32] and USAID [33], two thirds of the Haitian population lack access to clean water and adequate sanitation, which in turn lead to increased foodborne diseases [34]. However, dire this situation may seem, it does represent an improvement in the public health services in the country, for before 2010, only 17% of the Haitian population had access to appropriate sanitation [35].

Since there is no domestic regulation on food additives, MSPP, MCI and MARNDR control the imports of additives for use in foodstuff based on international recommendation, including the Codex Alimentarius Commission (CAC). Legislation pertaining to pesticide residues has stalled in the Haitian Parliament since 2017 [36]. In the meantime, MSPP, MCI, along with the Ministry of Environment (MDE) control imports and maximum residue limits (MRLs) of pesticides and other contaminants based on a management plan for pests and pesticides (Plan De Gestion Des Pestes Et Des Pesticides, PGPP) of MARNDR prepared as part of the Strengthening of Agricultural Public Services Project (Projet de Renforcement des Services Publics Agricoles, RESEPAG), financed the World Bank. Requirements for foodstuff packaging and containers, and the quarantine and trade requirements of animal products, are regulated by Haitian standards.

Labeling requirements are established by the MCI's Department of Quality Control and Consumer Protection (DCQPC)¹⁷. Haiti has two official languages: French and Creole. However, with the proximity of the United States and Latin America, labels in English or Spanish are widespread in Haiti. Currently, there are no language requirements for product labels in the country. Legislation to protect consumers, which includes additional labeling requirements [37], is also pending in the Haitian Parliament [38].

The Government of Haiti is a Member of the Codex Alimentarius Commission (CAC) and, as such, established a national committee in the Bureau of Standards (BHN) in 2012 to organize and manage activities related to the standardization, certification, industrial metrology, promotion of quality, and provision of technical support to companies [38]. However, Haiti is not an active participant in Codex, and does not attend either the international committee meetings or the FAO/WHO Coordination Committee for Latin America and the Caribbean (CCLAC).

¹⁶ "Institut National de Diagnostic Vétérinaire et de Recherche sur les Aliments"

¹⁷ Current requirements include product name and composition, net weight or quantity, manufacturer's and importer's name and address, manufacturing and expiration dates, instructions for use and storage of the product, country of origin, batch identification number, product condition (e.g., frozen food).

The following table lists key actions led by the government in Haiti recognizing the role of agriculture sector interventions in addressing malnutrition and calling for such investments.

Table 2: Key actions

2012 National Program to Fight Hunger and Malnutrition (Programme National de Lutte contre la Faim et la Malnutrition, ABA GRANGO)	<ul style="list-style-type: none"> Recognized the role of the agriculture sector in fighting malnutrition.
National Plan for Food and Nutrition Security (Plan National de Sécurité Alimentaire et Nutritionnelle, PNSAN) 2010–2025	<ul style="list-style-type: none"> Calls for eradicating hunger by 2025 by meeting the food and nutritional needs of the population in both quantitative and qualitative terms.
National Strategic Nutrition Plan 2013–2018 (Plan Stratégique National de Nutrition 2013-2018)	<ul style="list-style-type: none"> Advocated for the agriculture sector to contribute to the prevention of malnutrition through the promotion of adequate nutrition throughout the life cycle (specifically for crops of high nutritional value that are known and accessible to the majority of the population), and of small livestock to allow for access to nutrient rich food at low cost.
National food Sovereignty and Security and Nutrition Policy and Strategy in Haiti (Politique et Stratégie Nationales de Souveraineté et Sécurité Alimentaires et de Nutrition en Haïti (PSNSSANH)) (Primature 2018)	<ul style="list-style-type: none"> This document argues for the promotion of courtyard gardens, vegetable gardens, support for peri-urban agriculture and small farming.
2017 Law on Food Fortification in Micronutrients (Loi sur la Fortification des Aliments en Micronutriments)	<ul style="list-style-type: none"> Calls for food product companies to meet prescribed standards on fortification with micronutrients.

ONGOING AND PLANNED INTERVENTIONS LINKING AGRICULTURE AND NUTRITION

The purpose of this section is to present in a succinct fashion (Table 3) what Nutrition Smart Agriculture practices and technologies are supported where and by whom so that synergies, opportunities and gaps can be easily identified. Information is not exhaustive.

Table 3: Relevant Interventions

NSmartAg activity	Program Name (duration)	Development Partner	Target areas	Brief Description as related to NSmartAg
Primary production	Activation of the Contingency Emergency Response Component (CERC) of the Resilient Productive Landscape project (2018–2023)	World Bank	South	Direct production support in the South for fruits, vegetables, pulses (including peas, pigeon peas, beans, eggplant, spinach, tomato, mango, avocado, papaya, moringa, leek, cabbage, watermelon, carrot, pepper, citrus, coconut)
Menu of NsmartAg options	Strengthening of Agricultural Public Services Project (RESEPAG) II (2016–2021)	World Bank, Global Agriculture and Food Security Program (GAFSP)	North, Northeast, South	Support primary production and agricultural transformation through a voucher-based farmer subsidy scheme, and rural producers' organizations (OPR) through a matching grant scheme in fruits, vegetables, pulses, and fish.

NSmartAg activity	Program Name (duration)	Development Partner	Target areas	Brief Description as related to NSmartAg
Primary production	Technological Innovations Program for Agriculture and Agroforestry (PITAG) 2017–2023	International Development Bank (IDB), International Fund for Agricultural Development (IFAD)	North, Northeast, South	Direct financial support to farmers for the adoption of production technologies in fruits (such as mango, avocado, citrus)
Agricultural Production and Processing	Inclusive Agricultural Governance Support Program (PAGAI) 2017–2023	Swiss Cooperation	South	Support to production organizations in the development of agricultural services (production, processing, and marketing) in pulses (beans).
Primary production	National Program for the Development of Maritime Fisheries 2015–2020	IDB	South	Supply of equipment and technical assistance in fisheries

OUTLOOK FOR NUTRITION SMART AGRICULTURE IN HAITI

NSmartAg can be integrated in agriculture public policies and programs in Haiti.

Field surveys conducted among agribusinesses in the four departments of the country have highlighted the capacity of the latter to make food products available on the market. As an indication, agro-entrepreneurs in the selected departments called attention to investment opportunities in modern processing facilities and equipment for fruits, vegetables, nuts, dairy products and pulses, as well as appropriate storage facilities. In the South, Northeast and West regions, fish production and fishing are both profitable and promising entrepreneurial activities. Aquaculturists and fishermen point to the potential for improving production, conservation and processing through investments in fish ponds and the cold chain, respectively, and the installation of Fish Aggregating Devices (FADs, which reduce bycatch) and better fishing equipment. In the West, some poultry agro-entrepreneurs are considering increasing their production capacity by setting up their own incubators and other spaces to accommodate more broilers, and to find protein-rich feeds on the local market that can replace, even partially, the imported feed mix in the ration. Mini-dairy operators are planning to increase the number of dairy cows in the vicinity of their location. The agro-entrepreneurs who handle fruit and vegetables in the selected departments are very enthusiastic about acquiring more efficient technologies that will enable them to respond to the processing and preservation requirements of these foods. As for legumes and nuts, the agro-entrepreneurs are ready to invest in modern, high-performance equipment (mills, roasters), to increase their raw material storage capacity and to source different sizes of packaging from other companies in order to reach larger customer segments.

However, these agro-entrepreneurs face a series of constraints common to the development of the agricultural sector in the four departments of the country. In addition to energy, road and transport infrastructure problems, the constraints often revolve around accessing finance for processing equipment. In addition, improving knowledge, particularly about nutrition and food safety in enterprises, must also be considered in order to respond effectively to such constraints.

The integration of NSmartAg into programs, particularly for post-harvest and processing investments, will require a strong political will, as well as coherent global vision shared by all Haitian stakeholders leading to the implementation and enforcement of food safety standards (see Box 8). In addition, opportunities in NSmartAg can be identified in agricultural research and development such as fortification, value addition of traditional plants with high nutritional potential, training of agricultural advisory and extension services. This integration must be achieved by means of financial instruments capable of promoting NSmartAg practices and providing technical and financial support to agribusinesses that adopt/enhance these practices.

Finally, it would be important for the country to support a favorable environment for the development of agri-food enterprises (industrial, artisanal, family), and to create and implement infrastructure and standards that encourage the business climate in general and are conducive to NSmartAg in particular. Advocacy must continue to ensure that agriculture not only contributes to food security but also to improve nutrition. In ministries such as Agriculture, Public Health, Trade and Industry, and Education, nutrition expertise must be maintained and/or created and institutionalized so that NSmartAg practices are integrated into all projects and initiatives. In addition to these ministries, other institutions must also contribute/cooperate in informing, supporting and raising consumer awareness of the need for a diversified diet.

Box 8: Food safety—recommendations

Haiti has shown progress that stems from responses implemented after the 2010 earthquake and cholera epidemic [31]. For example, the United States' Center for Disease Control (CDC) worked with the Ministry of Public Health and Population (MSPP) to address how programs designed for their effects on health can improve preparedness for health security threats. But still, there is plenty of room for improvement. Two recommended areas that could bring significant improvements are to establish a “functioning, sustainable, self-correcting public health system” [31], as well as an updated and solid food safety regulatory framework.

For a public health system as defined within the seven public health impact goals established after the 2010 earthquake and cholera epidemic¹⁸, the MSPP worked with the CDC to expand laboratory capacity, as well as set up reportable disease surveillance systems, and a competency-based Field Epidemiology Training Program (FETP) mentored by the CDC, which continues to this day. This initiative has bolstered the national public health capacity to detect and monitor disease outbreaks, and use data to drive public health policy [31]. It has also made an important impact on food safety, as it builds human capacity, facilitates the detection and mapping of foodborne disease, thus enabling proper risk assessment and evidence-based prioritization.

Further gain could be achieved from scaling up work on the aforementioned seven impact goals. As the need for expanded public health services persists, MSPP and its partners should refine their prioritization process to use resources more efficiently given that international aid continues to decrease following the public health emergencies of 2010–2016. MSPP has shown proper foresight by shifting from emergency response mechanisms to long-term strategic plans [31], and all Haitians stand to gain from a solid and responsive public health system with a track record on disaster response.

National regulators should strive to harmonize with Codex Alimentarius Commission (CAC) Standards, and could work with regional partners (Caribbean, South and Central America) with whom the country has agreements in place, namely the CARICOM Regional Organization for Standards and Quality (CROSQ), the Panamerican Standards Commission (COPANT in Spanish), the Standards and Francophonie Network (Réseau Normalisation et Francophonie (RNF) in French), the Inter-American Metrology System (SIM in French), the American Society for Testing and Materials (ASTM), and the Dominican Institute for Quality (INDOCAL in Spanish) [36]. This process would avail Haiti with a legal and normative framework. In order to make better use of the resources made available by CAC, Haiti needs to increase its participation in the committee and CCLAC meetings, where it could use CAC resources, including receive support and funds through the Codex Trust Fund (CTF) [38]. The CTF supports countries in building strong and sustainable national Codex systems that allow them to participate fully and effectively in the work of Codex.

18 The seven public health impact goals for Haiti included: Eliminate vertical transmission of HIV; eliminate the threat of epidemic cholera; eliminate lymphatic filariasis; establish a functioning, sustainable, self-correcting public health system; reduce under-5 mortality rate from vaccine-preventable diseases by 35%; reduce maternal mortality by 30%; and reduce tuberculosis prevalence by 25%.

The Covid-19 crisis

The Covid-19 crisis is disrupting livelihoods and communities around the world. The pandemic poses a serious threat to food security and nutrition in developing countries. A majority of households are net food buyers and the poor spend most of their income on food. Experience from past pandemics and the 2007/08 world food price crisis highlight food security and nutrition as major concerns.

At the time of publication of this profile, the impact of Covid-19 on the food system in Haiti is not well known. Market data collected in March 2020 show an increase in food prices of more than 25% compared to the previous year in most of the markets across the country, showing general trends observed in the past few years. This rise in prices puts several departments in the country in the emergency phase of food insecurity [25]. This is coupled, among other things, with a decrease in purchasing power due to a slowdown of economic activities in Haiti but also in countries from which emigrants send remittances (mainly the USA and Canada), to the rise in prices of goods and services, and to the depreciation of the gourde against the US dollar.

Increases in the price of food, coupled with a decrease in the purchasing power of households—due to several economic activities closing because of the pandemic—reduce the consumption of food, in particular higher cost micronutrient-dense fruits and vegetables. This compromises the quality of diets and leads to malnutrition.

In turn, while malnutrition weakens the immune system, it increases the susceptibility to infections such as Covid-19. There are several specific micronutrients that play a critical role in strengthening the immune system, such as vitamin A and zinc, as well as others, such as iron and folate that help maintain its function. Deficiencies in these micronutrients are already causing problems in many low- and middle-income countries even at normal times even though they are found in a number of agricultural products produced in Haiti. Protein, one of the main macronutrients and represented in the food groups selected by this profile, plays a vital role in building and repairing body tissues and supports physiological utilization of other important nutrients, such as iron. An optimal consumption of protein in diet helps maintain the functioning of the immune system. Promoting NSmartAg technologies and practices, as well as broader nutrition-sensitive support is of great importance in the response to Covid-19 to contribute to the resilience of the most vulnerable populations [25].

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