



MINISTRY OF AGRICULTURE AND ANIMAL RESOURCES

Nutrition Sensitive Agriculture Mainstreaming Guideline

Planning for Wealth

May 2020

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Acronyms & Abbreviations

CFSVA	Comprehensive Food Security Vulnerability Analysis
CIP	Crop Intensification Program
DDS	Dietary Diversity Score
DRI	Dietary Reference Intake
EICV	Enquête Intégrale sur le Conditions de Vie de ménage
FAO	Food and Agriculture Organization (United Nations)
ICN	International Conference on Nutrition
IYCF	Infant and Young Child Feeding
KG	Kitchen Gardens
LUCP	Land Use Consolidation Programme
MAD	Minimum Acceptable Diet
MDD	Minimum Dietary Diversity
MIGEPROF	Ministry of Gender and Family Promotion
MINAGRI	Ministry of Agriculture and Animal Resources
MINALOC	Ministry of Local Government
MINEDUC	Ministry of Education
MINISANTE	Ministry of Health
NDF	Nutrient Dense Foods
NECDP	National Early Child Development Programme
NSA	Nutrition Sensitive Agriculture
PSTA	Plan Strategique pour Transformation du secteur Agricole. Strategic Plan for the Transformation of Agriculture in Rwanda
PUFA	Poly Unsaturated Fatty Acids
SBCC	Social Behaviour Change Communication
WASH	Water, Sanitation and Hygiene

Foreword

In Rwanda, 70% of population lives in rural areas, primarily engaged in agricultural activities. Thus the agriculture sector plays quite significant roles in the society by providing the majority of its citizens with means to satisfy their food, nutritional and financial needs for their livelihoods.

The government of Rwanda has made massive efforts to address challenges in food security and economic growth through, for instance, delivering effective support services to agriculture sector. These efforts resulted in remarkable production and productivity improvement, development of agricultural value chains, viable private sector, creation of job opportunities and increased income and trade of farm produce, all of which have contributed to the overall growth and development of the country. Nonetheless, as much progress was not observed in the nutrition status of Rwandan people despite the efforts by relevant stakeholders, thus malnutrition and diet-related health problems remain critical issues at both national and household levels. It is, in this context, of paramount importance to introduce the nutrition-centered approach that has potential to dramatically improve the situation.

Nutrition Sensitive Agriculture Mainstream Guideline aims at providing guidance on mainstreaming nutrition aspects in planning and implementation of policies and interventions in agricultural and food security sector in Rwanda. This is to enhance the nutrition impacts of all the on-going and upcoming agricultural related programmes and projects and the guideline is meant for not only the government institutions, but also for development partners, donors, NGOs, private sector, research institutions and all the stakeholders concerning agriculture and food security in Rwanda.

I wish to take this occasion to express my sincere appreciation to all agriculture sector partners and stakeholders for their support and valuable contributions to the development process of this guideline. I look forward to seeing agriculture give greater nutritional impacts on Rwandan society as a result of utilization of this guideline.

Thank you.

Jean Claude MUSABYIMANA
Permanent Secretary



Rwandan farmers link their agricultural activities with their food requirements and nutritional needs. They rely on agriculture for their livelihoods as well as their direct source of daily food. The purpose of this operational guidance document is to build on what farming households do intuitively by integrating nutrition sensitivity into policies, programmes and plans.

Key approaches

- 1. Seasonal and or chronic dietary gaps and related health problems should be one of the drivers for agriculture supply chain upgrading.*
- 2. Value chain interventions need to first use a “do no harm” framework to ensure existing cropping systems and their corresponding dietary diversity as well as gender roles are valued, preserved and improved.*
- 3. Agriculture project resources have to be programmed to meet both nutrition and income goals.*

The present guideline document introduces nutrition sensitive agriculture (NSA) and its importance to achieving food and nutrition security. The steps of NSA approach are provided in Annex 1 and 8. The guideline provides an overview of existing nutrient gaps at national level, for specific nutrients (proteins, Vitamin A and Iron), taking into consideration the potential general impact of estimated nutrients supply projected in the PSTA 4. The guideline also provides a framework in the chapter four, for identification of Nutrition Dense Foods (NDF) through three stages; 1) identification of nutrition issue, 2) listing-up of potential commodity for nutrition improvement, 3) feasibility assessment of the production of listed commodities. The document provides a systematic guidance for the designing, execution and monitoring of nutrition-sensitive agriculture programs including four key indicators that serve as NSA programming principles, important interventions for mainstreaming nutrition into agriculture investments, as well as NSA entry points for current MINAGRI Programmes. Attached Annexes contain valuable checklists that will help ensuring the integration of NSA at every stage of the process including meaningful indicators.

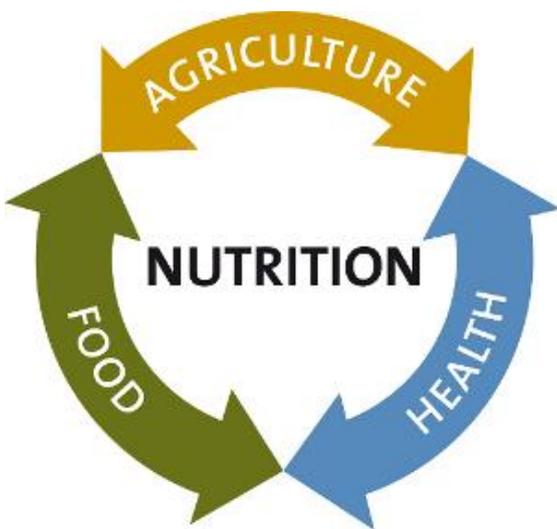
1 Introduction

Agriculture remains the backbone of Rwanda's economy, but the government of Rwanda through the Vision 2020,¹ the long-term development plan, intends to reduce agriculture's contribution to GDP from the current 31% to 24%. The agriculture sector employs 58% of the labour force, earns 60% of the foreign exchange, provides 75% of raw materials for the agro-processing industry and generates about 45% of the government revenue. In the last 19 years since 2000, the average annual growth of the agricultural sector has more than doubled the growth of the population with an average of 5.0% annual growth. Productivity of smallholder farmers has improved mostly due to the introduction and dissemination of modern agricultural technologies. Productivity and production for a number of crops have sharply increased because of scaled-up of public investments in the Crop-Intensification Programme comprising Land Use Consolidation Programme (LUCP), subsidies on fertilizers and seeds, and other public interventions to promote production of priority crops, which consequently improved rural incomes. The above achievements were through implementation of government national policies, strategies, plans and programmes toward agriculture development and food security, and these home grown policies and initiatives have contributed to significant improvement in access to services and human development indicators.

Despite the tremendous achievements made by the country as described above, the problem of food and nutrition security remains the main health and development issue for the Country. According to CFSVA-2018, the prevalence of stunting among the children of 6-59 months old is 35%, while that of wasting and underweight is 2% and 12.6% respectively. Micronutrients deficiency for Iron is also at 36.5% for children between 6-59 months old and 19% for women of reproductive age. Approximately 65% of food consumed at households is purchased in the market. Most of the food expenditure is due to cereals. Overall, economic access to food has improved; households spending on food represented a smaller share of total food spending in 2018 as compared to 2015. However, one third of the Rwandan households borrowed food or purchased food on credit in the month before the CFSVA-2018 survey. Physical access to market remains an issue in some areas with steep geographic terrain, like the Western Congo Nile Crest, especially during the rainy season. According to CFSVA – 2018 infant and young child feeding (IYCF)

practices remain inadequate: about 17 percent of children achieved the minimum acceptable diet (MAD) based on dietary diversity and meal frequency. Rwandan children of 6-23 months old ate an average of three food groups per day twice a day, meaning that at least one more food group and at least one more feeding time per day is needed to achieve MAD.

The main food security challenge for Rwanda's smallholder farming families is the optimal use of their limited resources of farmland and family labour to avoid hunger. The main food security challenges for government include ways to deliver effective services to farming families 'at risk' for the growth of agriculture



¹ Vision 2050 has been drafted and expected to be launched by the end of 2020

economy and improvement of farm livelihoods, among others, while also addressing serious diet-related health problems that can be observed at both national and household levels. Nutrition-sensitive agriculture (NSA) is a win-win approach to contribute to both the increase wealth and the improvement of health condition of the Rwandan population (Annex 6). How can governments address issues of availability, access, utilization and resilience at the same time and in a mutually supportive manner? How can they further enable the private sector with risk reduction measures aimed at supporting them to improve the agriculture productivity while simultaneously improving food safety and quality (Annex 9) (e.g. fortification, reduction of post-harvest loss, etc.)?

Among the factors contributing to under-nutrition in Rwanda are dependency on rain-fed agriculture and subsistence farming, the low educational status of most farming households, land scarcity with average household having 0.5 Ha, land degradation, soil infertility, the lack of gender sensitivity represented by low participation and benefit of women from agriculture technologies and interventions. Rwanda's female farmers face multiple challenges such as inadequate access to extension services, inputs, and other technologies as well as the competition with household responsibilities over time and resource allocation that hinder their productivity. Differences in both the levels of productive factors used and the returns that these factors generate drive the country's gender gap to a substantial degree.

The PSTA 4, approved by the Cabinet of Rwanda as the main strategic implementation document of the Ministry of Agriculture and Animal Resources (MINAGRI) up to 2024, is the guiding document for this NSA guideline. Considering the fact that 70% of Rwandans live in rural areas and are primarily engaged in agricultural activities, it is critical to initiate and strengthen NSA in the country. This guideline aims at mainstreaming NSA into the agriculture sector while acting as a complementary document to the implementation of PSTA 4. The guideline has focused on estimating the national dietary gaps, based on existing data for agriculture production at national level.

Operationalization of NSA guideline requires coordination across various ministries from the government and non-governmental level. However, at the intra-ministry coordination level, the technical staff and others at various levels of the Ministries should be equipped with thorough knowledge of nutrition for the successful implementation of NSA.

2 Nutrition Sensitive Agriculture and Food Security

2.1 Concept of Undernutrition and Food Insecurity

Nutrition Sensitive Agriculture (NSA) is defined as a “*food-based approach to agricultural development that puts nutritionally rich foods, dietary diversity, and food fortification at the heart of overcoming malnutrition and micronutrient deficiencies.*”² Nutrition is closely related to the quantity and quality of food consumed, there is, therefore, an obvious link between agriculture and human health especially in terms of nutrition as most of food items are produced by various agriculture activities. NSA entails the concept to view potential investments and activities in agriculture sector through a nutrition lens. In practical terms, this NSA concept brings up questions of (i) investing in specific crop or livestock value chains; and the potential impact (positive and negative) on the nutritional quality, (ii) the nutritional value of respective commodity throughout the entire cycle including production and post-harvest; and (iii) the avoidance of the nutrient loss along the supply chain and result in optimizing vitamins, minerals, starch, dietary fibre, or protein quality. (See Annex 3 for an example of an NSA approach for beans)

When it comes to NSA, the concept of **Food Security** also needs to be revisited. “*Food security exists when all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life. The four pillars of food security are availability, access, utilization and stability. The nutritional dimension is integral to the concept of food security and to the work of CFS (CFS Reform Document 2009).*”³ A food security framework entails the nutrition perspective. Thus, it is used to gauge the potential nutritional impact of a proposed investment. Food security, which includes a continuous supply of a variety of high-quality foods, especially dietary diversity while considering nutrition dense foods, can be accomplished through building resilient pathways or pillars of availability, access to affordable foods, utilization and stability (see the definition above).

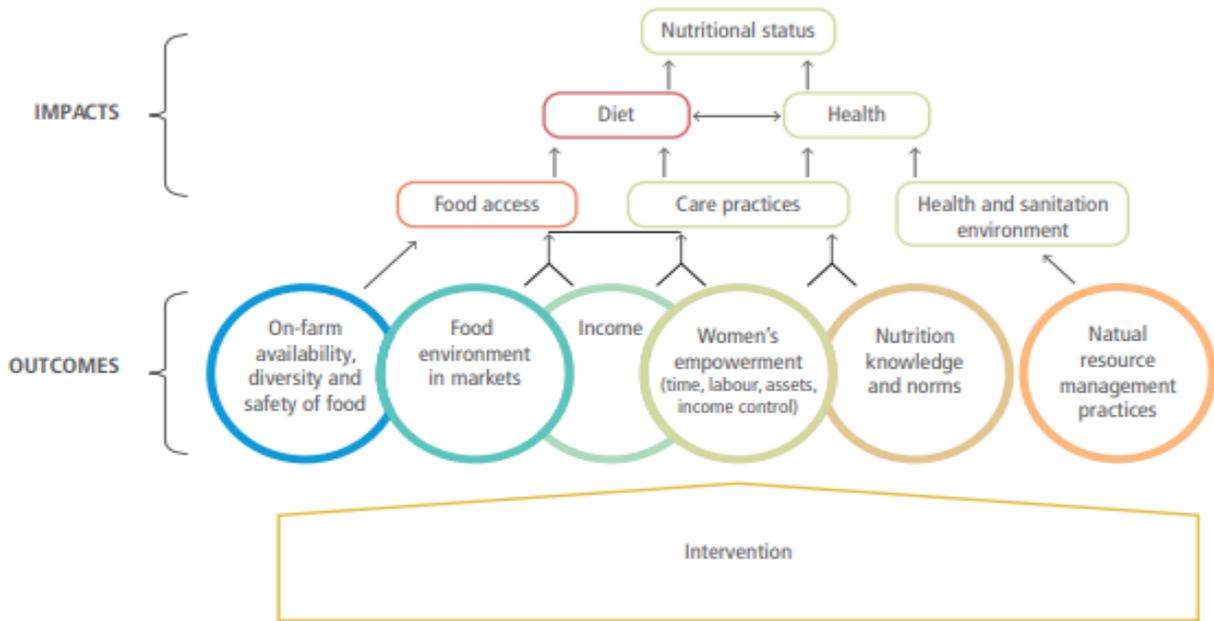
NSA takes into consideration these four aspects (availability, access to affordable foods, utilisation/consumption and stability) to determine the viability and importance of the investments through looking at how the investment will impact each one of them and in turn impact overall food security of the farming household as well as the larger population. Indicators designed to reflect the impact of these four pathways are also part of NSA. The key programming principles are listed as a checklist, in the following section, to ensure nutrition sensitivity that has been fully integrated into the decision-making process. For an overview of the impact pathways that were identified in the FAO Compendium of indicators for Nutrition-Sensitive Agriculture, see the below figure 1 from that document.

It is important to know that the food consumption is a direct factor influencing nutrition status, while other factors such as inadequate access to food, inadequate care and health environment are regarded as underlying causes of malnutrition (See Figure 2) and they are also important contributing factors determining the nutrition status. Rwanda continues to experience high levels of undernutrition according to a recent survey⁴ in areas with high agriculture production (Eastern province), while areas with relatively minimal agriculture production and urban areas have relatively reduced levels of under-nutrition.

² Source: [Second International Conference on Nutrition \(ICN2\) 2014](#)

³ Source: [Global Strategic Framework for Food Security & Nutrition \(GFS\)](#)

⁴ CFSVA-2018



Source: Herforth and Ballard, 2016.⁴

Fig 1: Simplified impact pathway framework of investment projects

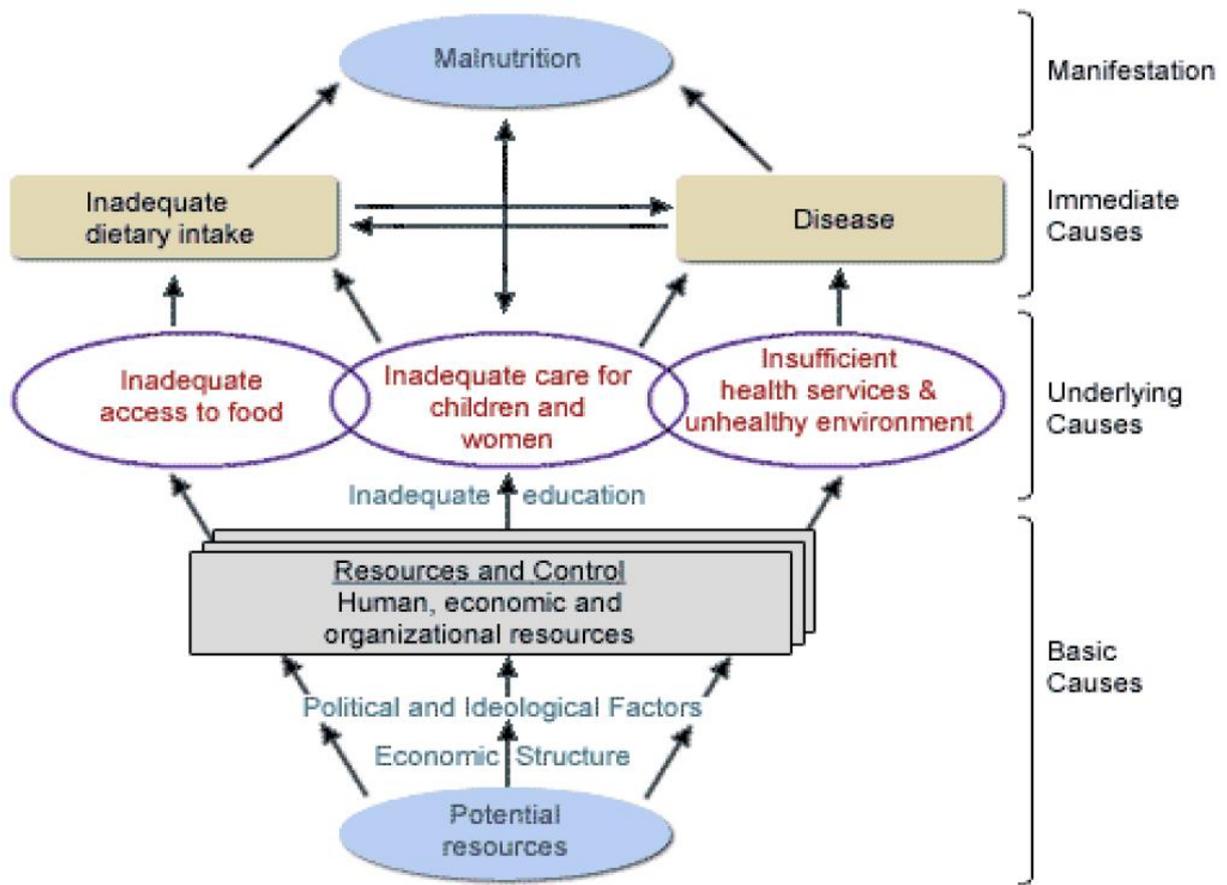


Fig 2: Various causes and factors contributing to malnutrition

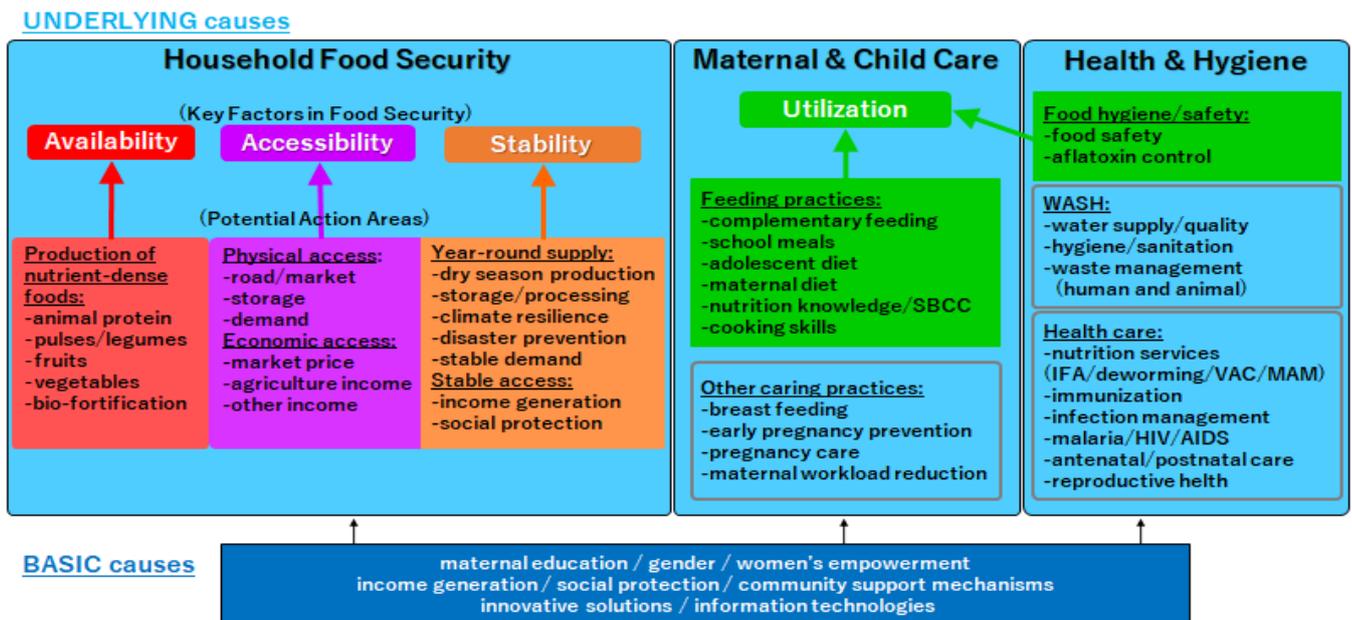


Fig 3: Basic and underlying causes of malnutrition

Nutrition Dense Food (NDF): is defined as a “set of food commodities that are nutrient dense (rich in macro and/or micronutrients such as protein, vitamin C, vitamin A/ pro-vitamin A, folic acid, iron, iodine). NDFs help meeting daily nutrition requirement and are in line with food preference of target population, while affordability and availability of those commodities to be secured year round for target group”.

All these factors are dependent on local specific contexts such as nutrition situation, socio-economic status of target population and agro-ecological environment. For this reason, NDF needs to be identified at each locality (district / community or even lower level), and this NSA guideline can be used as a tool to help identification of locally specific NDF.

Potential area of improvement in dietary related intervention through NDF:

Currently, one of the key concepts of dietary guidance is “dietary diversity”. Dietary diversity has been effectively contributing nutrition improvement as it can be understood and interventions for it can be implemented easily and sustainably. Also the dietary diversity will help improve micronutrient status which is important nutrition indicator. However, its contribution to address specific nutritional issue is limited because the concept misses some “quantitative” aspect. The below figure shows correlation between diet related habit and stunting using the country level data gathered from DHS and FAOSTAT (85 countries, 1985-2017). The left figure shows relationship between stunting rate (Y-axis) and implementation rate of dietary diversity (4+ food group). The right figure shows relationship between stunting rate (Y-axis) and protein supply per capita (g/day/capita). Each dot represents one country at certain year. It shows the negative correlation between “dietary diversity” and “stunting rate”, while also showing that “protein supply per capita” has much stronger negative correlation with “stunting rate”. This is the potential area where food and agriculture can make additional contribution in nutrition improvement through improving availability, accessibility and utilization of NDF (in this particular case, protein rich food).

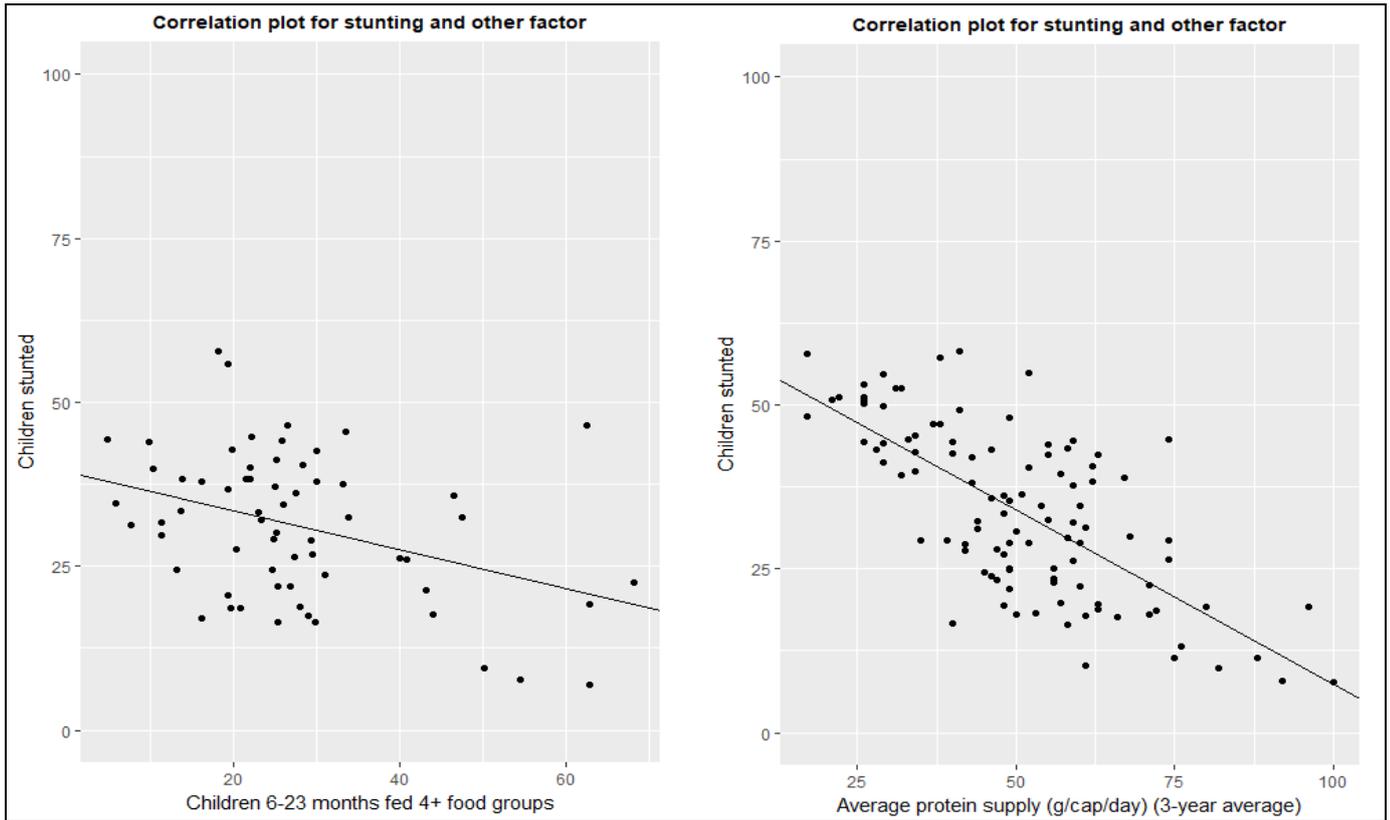


Figure 4: Correlation of stunting and a few factors (food diversity and protein supply)

2.2 Overall Nutrition Status of Rwanda

Analysis under four components of the food security

Since the consensus is reached by the international community concerning the four components of the food security (availability, accessibility, utilization and stability, refer to the section 2.1), this guideline will be in line with these components to review the status of Rwanda and in setting monitoring indicators.

► Availability

Simple assessment was conducted to estimate nutrition gap in Rwanda based on four sets of international standard data, Food Balance Sheet (FAO), Dietary Reference Intake (WHO), Food Composition Table for Western Africa (FAO), Rwanda EICV4, and two scientific paper to adjust those data (Colen 2018 for income elasticity and FAO 2011 for food loss and waste).⁵ Significant gap identified in Iron supply. Protein deficiency is also observed in the range of income quantile Q1 to Q3. Another key number is high level of dependency in carbohydrate among total calorie supply. 50% of dietary energy came from carbohydrate including potato, rice, banana, and cassava (FAOSTAT).

⁵ The similar analysis is made by WFP and NECDP with breakdown by different social groups (e.g. children under 2 year old, pregnant women, adolescent girls): *Fill the Nutrient Gap Study*

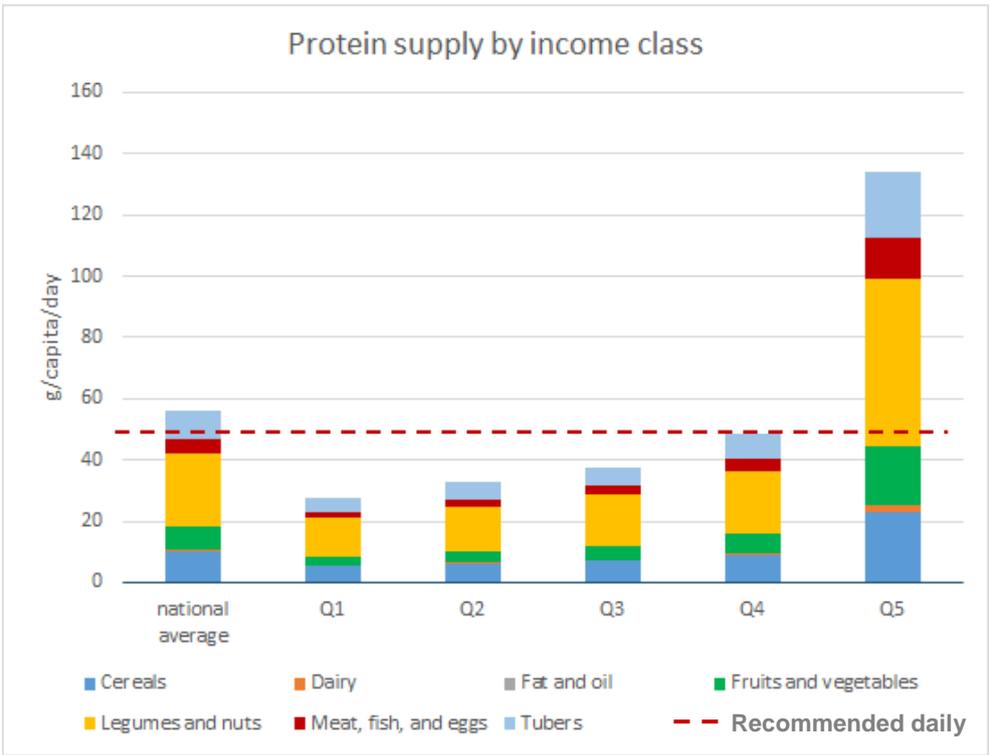


Fig 5: Protein demand/supply gap by income class

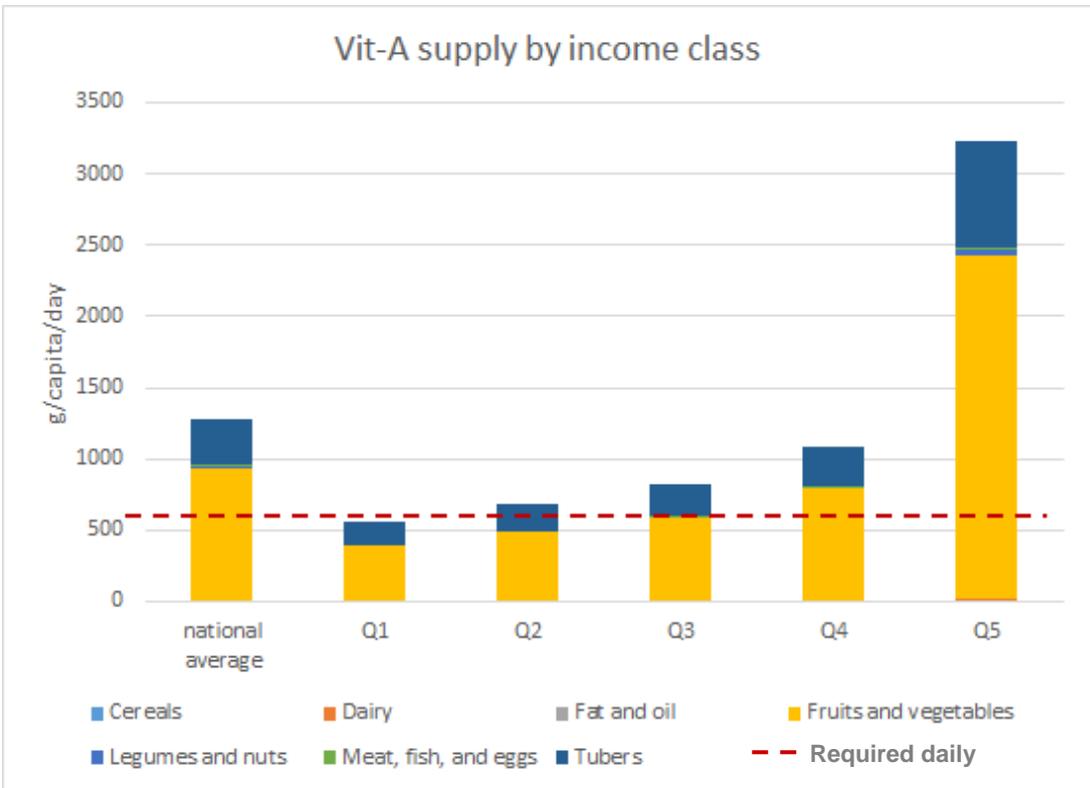


Fig 6: Vitamin-A demand/supply gap by income class

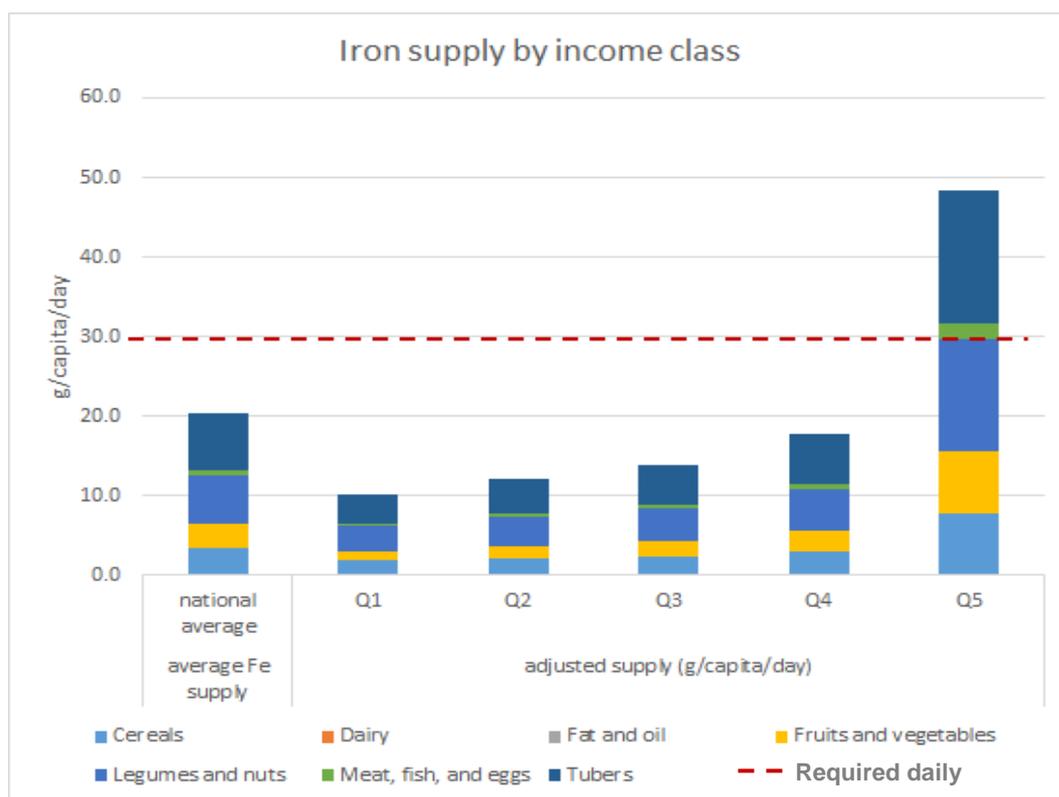


Fig 7: Iron demand/supply gap by income class

Table 1: Estimated National nutrient gap and potential impact of PSTA 4 in nutrient supply

Commodity	Composition (per 100 g)			Increased supply (ton)	Nutrient supply		
	Protein	Vit-A	Iron		Protein	Vit-A	Iron
Beans, white, dried	22.1	14.9	5.7	126,368	27,965,237,861	18,849,892,970	7,224,330,984
Soya bean, combined varieties, dried	34.7	1.0	6.5	10,531	3,653,772,832	105,314,378	684,543,460
Sweet potato, yellow, raw	1.5	135.2	1.1	212,051	3,244,377,433	286,592,562,651	2,332,558,931
Carrot, raw	1.0	713.3	0.7	1,944	18,528,700	13,864,131,900	13,570,977
Groundnut, shelled, dried, raw	22.4	0.0	3.9	2,350	526,346,027	0	91,642,494
Milk, cow, whole, 3.5 % fat (includes	3.4	33.0	0.1	158,000	5,372,000,000	52,140,000,000	79,000,000
Beef, meat, 15-20 % fat, boneless,	18.4	16.0	2.9	4,667	858,666,667	746,666,667	135,333,333
Goat, meat, raw	17.5	0.0	2.4	2,333	408,333,333	0	55,222,222
Pork, meat, approx. 20 % fat, boiled	25.9	0.0	2.1	19,667	5,093,666,667	0	413,000,000
Egg, chicken, raw	12.6	160.0	1.8	3,333	420,000,000	5,333,333,333	60,000,000
Chicken, dark meat, flesh and skin, r	16.7	49.0	1.0	8,667	1,447,333,333	4,246,666,667	84,933,333
					0	0	0
					0	0	0
Total supply					49,008,262,852	381,878,568,566	11,174,135,734
Nutrient Gap					13,003,258,988	13,003,258,988	30,317,348,288
Supply/Demand(%)					377	2937	37

► **Accessibility**

Accessibility is composed of two main issues: physical accessibility (value chain infrastructure) and economic accessibility (food price and food purchasing power of consumer). Although the figures are available to capture the national level physical and economic accessibility, potential interventions to improve both accessibilities are rather broad and may be beyond the scope of NSA. Thus, in this guideline, indicators for accessibility and indicators for utilization (consumption score of NDF) are provided.

CFSVA⁶ showed the following table (Table2) for Season 2018A in beans and maize grains.

Table 2: Utilization of beans and maize grains Season 2018A

Food grains	Own consumption (%)	Kept for seeds (%)	Sold (%)	Given as gifts (%)	Spoilt (%)
Beans	74	10	12	3	1
Maize	73	4	19	3	1

Thus if food is available in the farm / kitchen garden, they are accessible to the family. The breakdown of the sales of beans (12%) and maize (19%) is indicated in the table below (Table: 3).

Table 3: Sales of beans and maize grains Season 2018A

Food grains	Traders in Sector markets (%)	Village markets (%)	Individual consumers / family / relatives (%)	Purchasers in the field (%)
Beans	40	24	10	0
Maize	26	22	18	17

According to CFSVA, the availability of beans and maize during the time of the survey was adequate or moderately adequate for the main markets in all districts, except for maize in Nyabihu and beans in Nyagatare, where a low availability was reported.

The country experienced economic pressures from inflation during the financial year 2016/2017 mainly emanating from the reduction in domestic food supply in all East African Community (EAC) countries affected by the drought. Consequently, headline inflation rose from 6.9 percent in July 2016 to 8.2 percent in February 2017. Prices of staple foods started to rise in 2016 due to global inflation and the drought, which affected the country and remained high through 2017; however, with regional trade for food supply and the Season 2018A production, there was a relative decline in the food price index despite it is remaining higher than the long-term average.

Markets fulfil an essential economic function and they contribute to the economy of the district. It is also a source of food for the rural subsistence farmers,⁷ and 65 % of households food

⁶ World Food Programme, (2018) Comprehensive Food Security & Vulnerability Analysis and Mapping (CFSVA)

needs are procured from the markets on average.⁸ According to the CFSVA 2018, 70% of households' food is procured in markets (even those households producing food themselves, i.e. farming households), making especially poor households very sensitive to food price fluctuations. Rwanda has 540 markets with 10,143 traders with at least one main market in each district. Nonetheless, the households physical access to market is still a critical challenge.⁵ In villages without a market, it takes 86 minutes on average to reach the nearest market with longer time taken in the districts of Rutsiro (145 minutes), Nyaruguru (122 minutes), Nyamasheke (111 minutes) and Kayonza (109 minutes) mainly due to the steep landscape, a lower road network coverage or poor road conditions. The main challenges related to access to food items, as reported by the communities, were the distance to markets, the unusually high food prices, and the high price for non-food items.

For households engaged in agriculture labour, their income in relation to food prices has significant impact on their ability to access food. Households relying on unskilled agriculture daily labour in rural areas have an average wage of RWF 752 per person per day with a minimum wage of RWF 500 and a maximum of RWF 2000. In February 2018, the terms of trade (wage/kg beans) was almost 2.5, meaning that with the average daily salary, one can purchase 2.5 kilograms of beans to feed a household. The share of the total budget spent on food can be used as a measure of economic vulnerability. The share of food expenditure decreases as the wealth of the household increases. Households in the very poor quintile spend, on average, 57 percent of their budget on food, while the wealthiest households spend only 36 percent. Agriculture daily labourers, unskilled labourers, and households living from external support or begging spend more than the half of their budget to buy food. Female-headed households also spend a larger share on food (50 percent) than male-headed (45 percent).

► Utilization

Food utilization is the intra-household use of the food they have access to and the individual's ability to absorb and use nutrients (a function of their health status and of the efficiency of food conversion by their body). The fewer crops a household cultivated during the first season, the more likely it is to be food insecure. Crops that household kept mostly for consumption were the main consumed cereals, roots and tubers as well as beans, and cooking banana. Apart from crops grown, 70% of all households in Rwanda own some type of livestock.⁹ A study undertaken by CRS revealed that produce from kitchen gardens were 'primarily consumed' at the household level, rather than those sold at markets. Furthermore, it is a useful source of income through the sale of surplus production.¹⁰ However, there is a need for creating increased awareness in the utilization of diverse range of crops to fulfil the nutritional requirements of the body. The 2018 CFSVA findings showed that majority (86%) of the decisions about agriculture expenses were managed by the head of household or by their spouse (14%).

⁷ MINICOM (2014) Market Infrastructure Master Plan

⁸ WFP, *Fill the Nutrition Gap Summary Report*, 2019

⁹ CAADP (2013)

¹⁰ Catholic Relief Services (2016) *To Consume or to Sell: A mixed-methods study on household utilization of home garden produce in Muhanga and Karongi Districts in Rwanda*

► **Stability**

One of the key aspirations of PSTA 4 is improving nutritional outcomes that will address a wide range of diet-related malnutrition, especially micronutrients and the prevalence of stunting in children. The country seeks to do more work and be committed towards low and stable prices for nutritious commodities. As one of its first lines of action, it aims to provide an efficient decentralized Strategic Grain Reserve (SGR) system that will serve as a resilient tactic against climate and market shocks.

According to CFSVA 2018,¹¹ 40 % of households reported having experienced at least one shock or an uncommon situation during the past 12 months that affected their access to food. They were weather in the form of drought, irregular rains, or prolonged dry spells, which mainly affected the Eastern and Southern Provinces. About two third of households reported having food access issues over the past 12 months prior to the survey and 40 % faced seasonal food access difficulties, which had doubled since 2012. Almost half of the households in *Ubudehe* 1 and low-income farmers reported seasonal food access issues. Season 2018A production were expected to be slightly higher than for Season 2017A. Household food stocks were, on average, sufficient for beans, maize, and cassava.

There are two main and distinct agricultural seasons across the country as well as a third season that occurs mainly in lowland marshland areas during the drier season:

- Season A starts in September and ends in February of the following calendar year, with the main harvest in December to February;
- Season B starts in March and ends in June of the same calendar year with main harvest in June-July;
- Season C starts in July and ends in September of the same calendar year with the harvest in September.

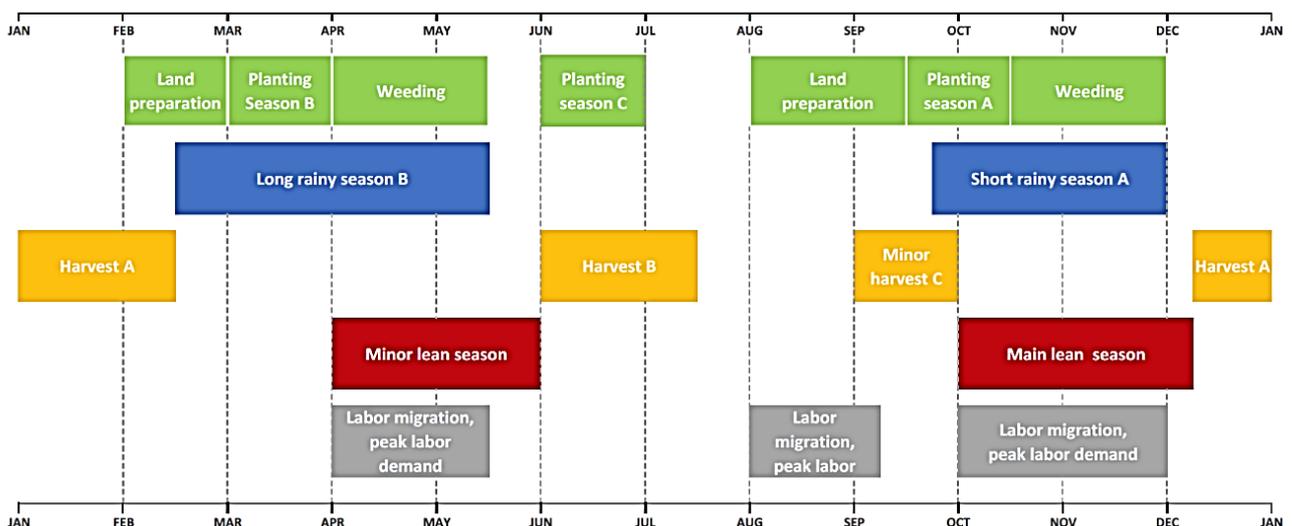


Fig 8: Seasonal agricultural calendar for Rwanda (FEWS NET)

¹¹ Comprehensive Food Security and Vulnerability Analysis (CFSVA) 2018

According to the Seasonal Agriculture Survey, Season 2018A, irrigation was practiced by 5% of small-scale farmers (holding less than 10 ha of agricultural land) and 18.5% of large-scale farmers (holding at least 10ha of agricultural land). Around 68% of small-scale farmers and 63.5% of large-scale farmers practiced anti-erosion activities. Nearly half of all large-scale farmers use improved seeds, fertilizers, and pesticides, while only a few small-scale farmers used these (Table 4).

Table 4 : Use of improved seeds, fertilizers and pesticides during Season 2018A

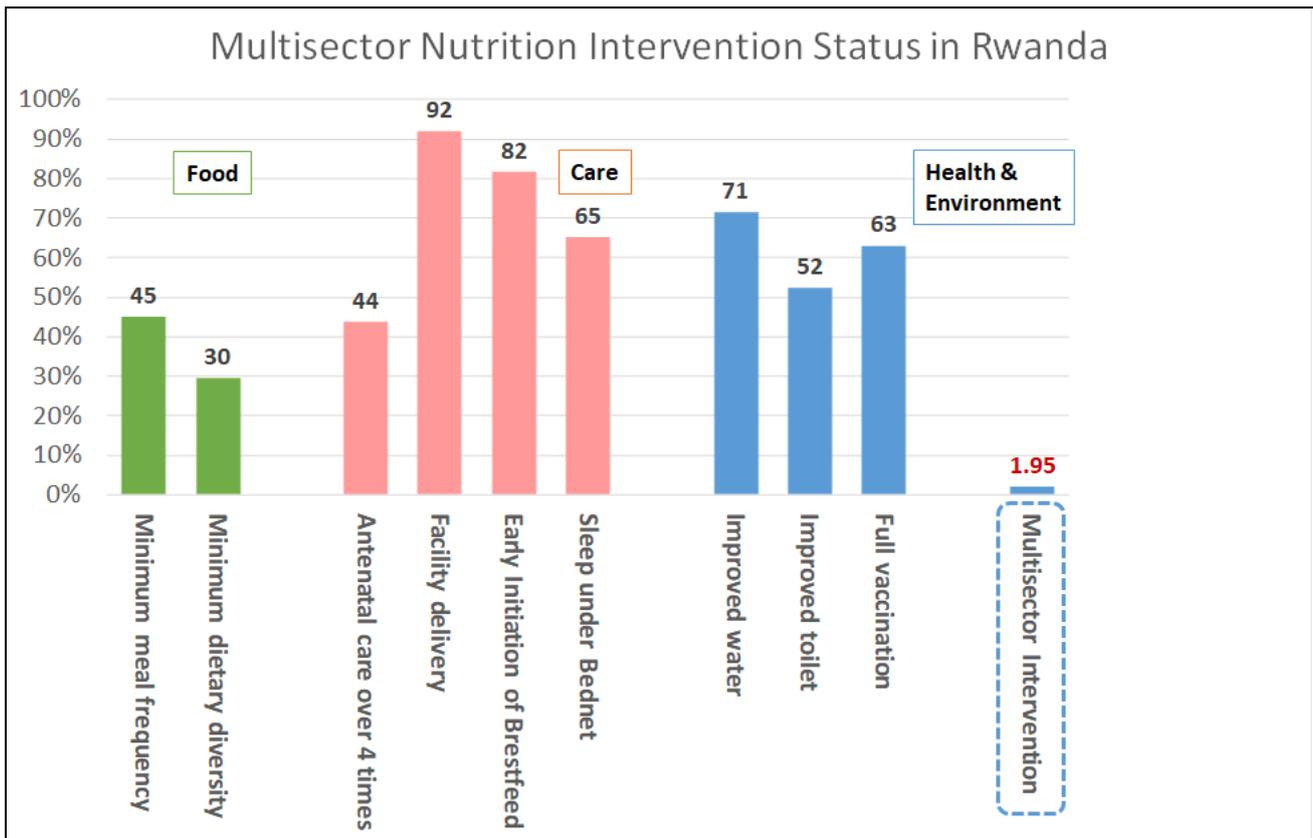
Use	Small-scale farmers (agri. land < 10ha)	Large-scale farmers (agri. land ≥ 10ha)
Improved seeds	11%	53.8%
Organic fertilizers	48.2%	50.8%
Inorganic fertilizers	24.8%	42.8%
Pesticides	19.5%	42.1%

The 2018 CFSVA findings showed that chemical inputs (pesticide or fertilizer) were not used for beans by (78%) of households and 51% for maize. Regarding soil conservation practices, households enhanced their land with terraces (67%) by agroforestry, and other soil and water conservation practices and 9% of agricultural households had part of their land irrigated.

Other characteristics in nutrition situation in Rwanda

► Status of multi-sectoral intervention

Nutrition improvement can only be achieved when all underlying causes are overcome for target beneficiaries as described in chapter 2.1. Multi-sector intervention status was analysed using DHS dataset in the below Figure 9 showing the share of households which receive appropriate government services in three subsectors, food, care, and health & environment. Nine indicators were selected as proxy for each three subsectors. The result shows that when it comes to single intervention, the share of households that receive the services ranges between 30 to 92%, while when it comes to combined interventions (receiving all services from three sectors) the share of household is just less than 2%. This figure implies that interventions from each sector are done independently without close coordination.



Source: DHS 2014, calculated by JICA mission for project formulation

Figure 9: Multi sector Nutrition Intervention Status in Rwanda

► **Agriculture productivity improvement not necessary contribute to nutrition**

CIAT reported the experience in Cyuve district, one of Rwanda’s most productive agricultural areas. As a result of government efforts for land consolidation, production of maize and wheat increased by 6-fold, and that of Irish potato and cassava has tripled in four years. Meanwhile, farmers’ income also has increased by 60% in Rwanda during the same period. Yet despite of all the effort and improvement, the stunting rate of Cyuve is still as high as 60%, at the unacceptable level.¹² This implies that mere agriculture productivity improvement and/or income increase do not necessary give an impact to nutrition improvement.

¹² "Understanding Rwanda’s puzzling nutrition paradox" (2015), CIAT

3 Approaches of the Guidelines

3.1 Objectives

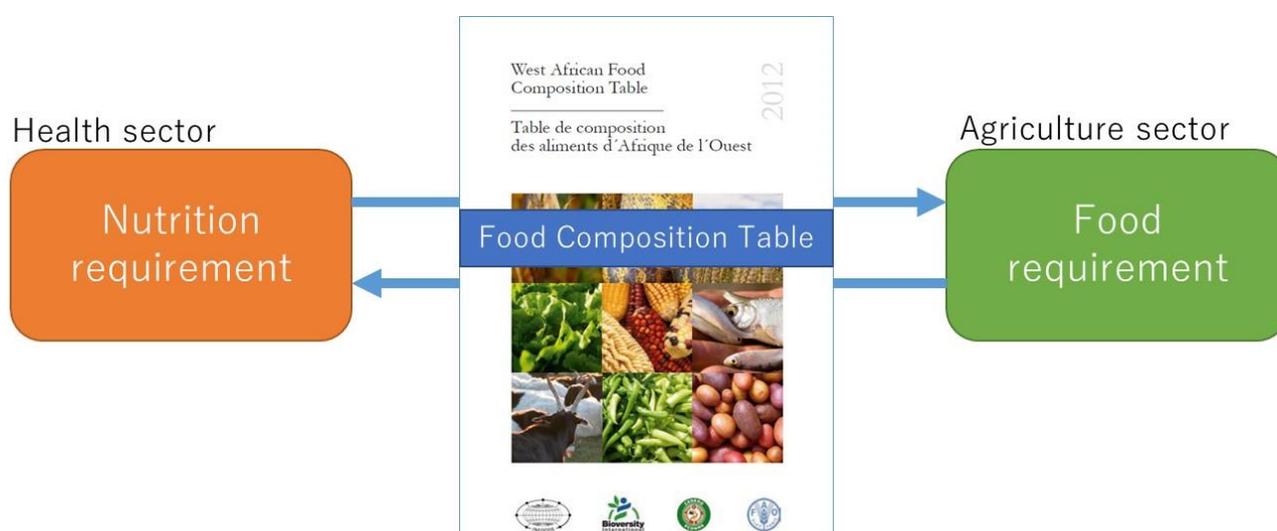
#	This document aims to provide guidance on:
1	Strengthening nutrition aspects of policies and strategies in agricultural and food security programmes and projects
2	Enhancing the nutrition impacts of existing/ ongoing agricultural related interventions
3	Ensuring the Design and implementation of agriculture and food system investments are nutrition sensitive

3.2 Identification of NDF

The three steps process of NDF identification are: 1) identification of nutrition issue, 2) listing-up of potential food commodities for nutrition improvement, 3) feasibility assessment of listed commodities.

The first step is the identification of most critical nutrition issue (e.g. Anaemia, Stunting, and Wasting) in target areas. This is important since each nutrition issue is caused by inadequacy of specific nutrients, and therefore preventive measures need to be determined accordingly per issue. In the second step, locally available commodities (including potential food commodities considering agro-ecological environment) are listed up from different food group (e.g. cereal, legume & beans, vegetable, animal products) as the potential solutions to nutrition issues specific to the target areas. In the third step, feasibility assessment is conducted based on four criteria (nutrient content - density, technical feasibility, social feasibility, economic feasibility). “Food composition table” and “Dietary Reference Intake (WHO)” will be the critical tools in this step to identify nutrient content for each commodity.

Figure 10: Enhanced communication between health sector and agriculture sector using food composition table



Assessment criteria

Category	Evaluation
1. Nutrition	<ul style="list-style-type: none"> ❑ Please refer to Food composition table <li style="color: red;">Wasting : Calorie (Staples) <li style="color: red;">Stunting: Protein (Legume, Meat, Dairy product, Fish product) <li style="color: red;">Anemia : Iron (Iron rich vegetable, Legume, animal product, Fish)
2. Technical feasibility	<ul style="list-style-type: none"> ❑ Agro-ecological Zone, Yield ❑ Required farm input ❑ Required infrastructure ❑ Required skill ❑ labor intensity ❑ Seasonal availability
3. Social feasibility	<ul style="list-style-type: none"> ❑ Dietary habit ❑ Food balance sheet
4. Economic feasibility	<ul style="list-style-type: none"> ❑ Investment cost ❑ Production cost ❑ Market price

Assessment tool for NDF

The screenshot shows the 'SNA Food Items Identification Tool.xlsx' spreadsheet. The workflow is as follows:

- 1) Specify region, nutrition, nutrient and target beneficiaries:** This step involves filling out the 'Commodity assessment table (1/4)' with fields for Country, Nutrition Issue Selected, and Target Beneficiaries (TB).
- 2) List up commodities:** This step involves listing commodities generally produced in the region / agro-ecology in the 'Commodity list' column.
- 3) Check nutrient content and DRI:** This step involves checking the 'Daily intake requirement' and 'Realistic?' columns for each commodity.
- 4) Primary screening:** This step involves checking the 'DRI is the daily intake requirement realistic?' and 'Consumption by TBs culturally accepted?' columns.
- 5) Feasibility assessment (technical, financial, stability):** This step involves checking the 'Technical requirement' (Infrastructure, Farm inputs, Skill, Sufficient service?), 'Initial investment', 'Recurrent cost', and 'Stability' columns.
- 6) Conclusion:** This step involves checking the 'Evaluation' column for results like 'Low hanging fruit', 'Option for the future', or 'Not feasible'.

3.3 Indicator Settings for NDF

One of the most critical limitations in designing the policy framework for NSA is the lack of macro level indicators. Most of the common indicators for agricultural development is based on the conventional idea of food security (e.g. calorie based food sufficiency (POU), staple based self-sufficiency rate) or economic contribution of agriculture (e.g. gross value added, export value). Although various international organizations are working to improve the situation in the nutrition sector through, for instance, “Fill the nutrient gap (WFP)” and GIFT (Global Individual Food consumption data Tool, FAO/WHO), a standardized information system for NSA is yet to be developed.

Nonetheless, the below indicators are adapted in this guideline:

▶ Availability

- Increased production of NDF at various levels, such as household, village, cell, district and national levels. Reduction of the post-harvest loss is another component covered under this indicator.

▶ Accessibility

- Physical distance to NDF markets and/or NDF production sites. NDF market price compared to the disposal income of target group. When NDF availability is increased, accessibility to NDF markets by consumers also tends to increase due to increased market supply of NDF that can also cause the reduction of NDF price.

▶ Utilization

- Increased consumption of NDF at different levels, especially at the household and individual levels (the food distribution among household member’s counts to a great degree). This is possible by awareness creation though campaign, information dissemination, training and advisory support and various extension activities to the target population, particularly to women.

▶ Stability

- Year-round assurance of above 3 indicators (Closure of seasonal and year-to-year gaps)

3.4 Identify Potential Area of NSA Contribution by Each Sub-Sector

	Availability	Accessibility	Utilization	Stability
Horticulture	+++	++	+	+
Irrigation	+++	++	+	+++
Post-Harvest	+++	++	++	++
Small livestock	+++	++	+	++
Kitchen Garden	++	++	++	++
Social Protection	+++	+++	+++	+++

+ – indicates existing; +++ – indicates maximum score

4 NSA Application into Sub-Sectors

4.1 Key Implementation Framework: Collaboration with Non-Agriculture Sector

As described in chapter 3.1., nutrition improvement can be achieved only when all three underlying causes of malnutrition are removed for target beneficiaries. In this sense, although this guideline is meant to be used for agriculture sector, it is critical that any NSA application design should consider first the harmonization of all activities with other sectors, especially health and social protection. In general, contribution of agriculture sector in nutrition improvement is limited to “food supply” (improvement of availability, accessibility and stability), and thus it would not have actual impact on nutrition on the ground unless “food supply” is linked with “food utilization”. There are already number of activities in Rwanda for “food utilization”, including nutrition education, dietary guidance, cooking demonstration. District/Sector government need to make effort to ensure all these activities overlap each other for the same target beneficiaries.

4.2 Horticulture

Horticulture encompasses fruits and vegetables. In Rwanda, these two crop groups are managed under the National Agriculture Export Board (NAEB) together with essential oils, coffee and tea. Fruits and vegetables play an important role in human nutrition and health, particularly as sources of vitamin C, thiamine, niacin, pyridoxine, folic acid, minerals such as Iron and calcium, dietary fibre, vegetable protein and bioactive compounds. In addition, the consumption of horticultural products reduces the risk of disease. In fact, the World Health Organization has identified low fruit and vegetable intake as a top risk factor for global mortality.¹³ Fruit and vegetable intake supply 16% of magnesium, 19% of iron and 9% of the calories (United States Department of Agriculture, 2000). Other vital nutrients supplied by fruits and vegetables include riboflavin, zinc, calcium, potassium and phosphorus. Some components of fruits and vegetables (phytochemicals) are strong antioxidants and modify the metabolic activation and detoxification of the body. β carotenes in plant based foods such as papaya, OFSP, dark green vegetables, mango, pumpkin, carrots are converted to vitamin A that is easily absorbed by the body. Vitamin A is absorbed in the presence of fat and is a potent antioxidant by protecting the body. Vitamin C, a vital nutrient, enhances iron absorption. It captures non-heme iron and stores it in a form that human body iron can more easily absorb. Recent levels of anaemia, (a result of Iron deficiency) in Rwanda are higher than the global standard norms. According to the 2015 survey,¹⁴ women and children with anaemia accounts for 19.2% and 36.5% respectively. Iron rich vegetables will therefore be a major source for affected vulnerable groups. Leafy vegetables like red and green amaranth, water spinach, drumstick leaves, are excellent sources of iron, beta-carotene (pro vitamin A), and folic acid. Ripe mango and papaya, carrot, orange-fleshed sweet potato and pumpkin contain high quantities of pro vitamin A whereas local citrus fruits as well as star fruit, jujube and guava provide vitamin C, good for enhancing absorption of iron from the diet. For instance, a combination of 1/4 cup pumpkin, 1/4 cup carrot and 1/2 cup of mango together supplies full RDA of vitamin A for a child under 5 years old.

¹³ FAO/WHO (2004) Fruit & Vegetables for Health Report of a Joint FAO/WHO Workshop, 1-3 September, 2004, Kobe, Japan

¹⁴ RDHS – 2015. Rwanda Demographic Health Survey – 2015.

Ultimately, there is no doubt about the benefits of investments in horticulture production to improve the national and household nutrition status, and its multiple positive effects on other dimensions of well-being make it a vital avenue for development work in this sector.

4.2.1 Potential Area of Contribution

The increased consumption of horticulture products can lead to the intake of micro nutrients due to the nutritional features of fruits, vegetables and nuts as mentioned in the previous section. Through NAEB, Rwanda is in the process of establishing a mid-term strategy for the increased production of fruits and vegetables for export, in a complementary approach to the national kitchen garden program projects for increased production of fruits and vegetables for home consumption and partially for sale to local markets.

In the households where the members grow horticulture products in their farm or backyard garden, the availability and producers' accessibility to vegetables and fruits are increased. In addition, Regions and communities where farmers grow and sell horticultural crops have greater access to fruits and vegetables for purchase. As more fruits and vegetables enter the market, prices may decrease—which can make these nutritious crops more available and more enticing to shoppers.

Horticulture covers quite a wide range of crops and Rwanda is fortunate to have a plethora of vegetables and fruits available throughout the year. This is because producers can find several crops that are cultivable in their soil and climate conditions, as well as in different times of year, especially utilizing cropping season C, supplements both season A and B, with swamp reclamation and irrigation. Therefore, promotion of horticulture contributes to not only food availability but also food utilization, particularly dietary diversity that has been conventionally used as a proxy for the nutritional adequacy of a diet, in combination with the nutritional Behaviour Change Communication (BCC) under the mandate of NECDP that can influence the food consumption choices, food preparation and hygiene practices

In addition, horticulture production can increase the disposal income of farm households, as some horticulture products are high-value crops. Horticulture production can generate decent income from even the small plots of farmland, and horticulture producers tend to have higher earning than cereal producers. In this regard, promotion of horticulture can also contribute to the food accessibility through increased income.

Another feature of horticulture is the major player in its production. Women make up a majority of horticultural farmers in Rwanda and they are often responsible for feeding their household members, especially children. Horticulture production can provide women with more food options at home both through better availability of horticulture crops and better accessibility due to the increased income. As women tend to spend the available financial resources more on improving the health of family members, in comparison to men, horticulture's potential contribution to nutrition improvement is obvious especially on children. It is, however, important to note that the increased horticulture production has a risk to deprive time from women and increase burden by overloading women engaged in horticulture. The potential risks and benefits need to be carefully balanced in making policy and planning interventions.

Specific fruits and/or vegetables can be used to target particular nutrient deficiencies—for example, orange-fleshed sweet potatoes are effective for alleviating Vitamin A deficiencies. Perhaps more importantly, these whole foods also provide an array of phytonutrients and antioxidants that have a variety of beneficial health impacts. The nutrition-rich fruits and vegetables provides necessary micronutrients to human body that cannot be obtained from staple grains, meat or dairy. Therefore,

some nutrition issues can be addressed effectively through promoting the production and consumption of horticultural products that can help filling the nutrient gaps in specific target areas.

4.2.2 Potential Intervention Options

In the context of NSA, it is necessary to strategically plan the production and consumption of horticultural crops to overcome nutrition challenges specific to the localities. With promoted production, the locals would have better access to horticultural products that are rich in deficient nutrient in the area. Identification and production of NDF should be placed at the centre of interventions, as it contributes to the availability and accessibility of nutrient rich food commodities.

At the production side, horticulture production can be promoted through interventions to enhance the usage of agricultural inputs such as quality seeds, fertilizer and pesticides. The options include subsidy, seed multiplication and distribution, research and development, and provision of extension services, among others. Promotion of bio-fortified horticulture crops is an effective intervention to address specific nutrition issue. Another option is the promotion of kitchen garden that will be covered more in details at the later part of this document. In addition, any interventions to increase farmer's access to production assets such as land and water are effective. Water aspect will be elaborated further in the following section.

Post-harvest handling and processing components will be covered at the later part of this document.

In the marketing and distribution, the value chain integration, introduction of quality control and standard measures, grading, development of cold chain for perishable products and other market and transport infrastructures are potential interventions. Especially, minimizing the nutrition loss along the whole value chain is important, and the training and campaigning to food handlers (e.g. vendors, transporters) in this regard could be effective.

For longer-term use and sustainability, food production needs to be linked with local initiatives. For instance, developing community-based processing ventures and their successful operation can increase year-round availability of food, thereby directly contribute to reducing the negative impacts during the lean season on overall food security in the localities. By working with women's groups, the ventures can also provide important opportunities for their income generation and economic empowerment.

In addition, horticultural interventions combined with extensive nutrition education offer a long-term, food-based strategy to control and eliminate micronutrient deficiencies. Among the effective interventions for nutrition education are, food preparation techniques, cooking demonstrations, dietary counselling, where participants actively engage in and learn about appropriate food preparation methods to reduce nutrient losses, appropriate food combinations for improved nutritive value. Proper hygiene and sanitary practices of hand washing are also an important part of these sessions.

Finally, the preparation of horticulture-based complementary foods for children under the age of 2 should be promoted. This intervention contributes to the nutrition improvement through better food utilization, proper maternal and childcare as well as proper sanitary and hygiene practices.

4.2.3 Enabling Environment.

The government of Rwanda, through MINAGRI and NAEB, has developed a seven-year strategic plan for horticulture development in perfect line with the PSTA 4 through to 2024. The strategic plan largely addresses the productivity part of horticulture, while its focus remains on export that

requires good quality produce that has received gentle and appropriate handling right from the farm to the market including use of appropriate containers and affordable cool storage techniques.

Rwanda has proximity channels for agriculture extension through employing the Farmer Field Schools (FFS) approach and farmer promoters. It helps providing necessary technical and advisory support to horticulture producers, thus contribute to the promotion of horticulture production.

Rwanda's relatively small land size and high population density makes possible the relatively higher accessibility to markets by both producers and consumers. This is a significant advantage for promotion of horticulture in both marketing and consumption, because some of horticultural crops are perishable and can be damaged by long transport distance.

4.3 Irrigation.

Irrigation reduces the climate risk in farming, thus stabilizing the economic base of farm households. It encourages farmers to increase their investments on land and related farming activities for increased land productivity and crop intensification. It also encourages farmers to introduce new technologies and/or produce high-value crops for market-oriented farming. Irrigation is a key to increase crop yields, especially in arid and semi-arid areas. The most critical challenge in irrigation and NSA is the integration of nutrition concept into crop planning process in irrigation schemes. As irrigation usually require relatively large investment compared with other agricultural programs, the primary criteria for the commodity selection in irrigation schemes is often "profitability", or "national level food security", that usually means staple production. Even when farmer recognize the importance of NDF for nutrition improvement, they tend not to produce NDF except for household consumption, unless its value chain is well developed and market outlet is established. So, promotion of NDF production in irrigation schemes needs to be combined with "market creation for NDF" through various activities such as nutrition campaign, nutrition education, subsidy, establishing regulations to promote nutritious food and school feeding program, among others

These features of irrigation farming have a lot of potential to contribute to nutrition improvement of the target population as described in the following section.

4.3.1 Potential Area of Contribution.

With the utilization of irrigation equipment and facilities, farmers are able to produce various food crops even during the dry seasons. Irrigation farming, therefore, definitely contributes to the food and nutrition stability as it closes seasonal food gaps for both producer households as well as local markets. Irrigation farming also increases the resilience of farmers against climate shocks, thus contributes to improve year-to-year stability of farming production.

Development of irrigation infrastructure can trigger the increase of food production and productivity (as farmers under irrigated conditions tend to use more modern inputs, compared with farmers in rain-fed condition),¹⁵ and result in improved food availability and accessibility.

Through irrigation farming, farm households tend to generate higher and stable income, thus their accessibility to food is also likely to increase as their purchasing power is increased. Horticultural crops are likely to be grown in the irrigated plots 9-38% more than in non-irrigated plots. In line with

¹⁵ Some study shows that fertilizer use of farmers in irrigated areas is 8-27% higher than those under rain-fed condition.

these changes in crop choice and input use, the value-weighted yields increase by 31-77%, while sales per hectare increase in response.

The development of irrigation facilities also enables the cultivation of new crops to the area/ season. That can stimulate the development of value chains for new crops, and by coupling with horticulture production in schemes, irrigation farming can give significant positive impacts on the nutrition status of the populations.¹⁶

The development of new irrigated land and the sustainable mobilization of water for agriculture can be done in different forms. These include marshland irrigation, hillside irrigation, protected (green house) irrigation, small-scale irrigation and water development. Small-scale irrigation and water development offer the advantage of easy adoption and simple management by farmers. They include small ponds and check dams (water harvesting), reservoirs for fish (aquaculture), livestock watering and other productive activities that can also contribute to nutrition improvement. The success of these investments depends in large part on their adaptability to local condition, local ownership (level community participation), technical design and construction quality. For medium-scale irrigation schemes (on hillside and marshlands), flexibility and the cost of operation and maintenance (O&M) are the key since they are mainly gravity irrigated. On the contrary, most of the areas for hillside irrigation require pumping and hence higher O&M costs, and their adoptability, financial feasibility and sustainability need to be carefully assessed.

4.3.2 Potential Intervention Options

Interventions in the irrigation sub-sector, will improve the nutritional status of vulnerable groups in Rwanda.

- Development of irrigation schemes
- Marshland reclamation
- Promotion of Small Scale Irrigation Technologies
- Organization and capacity building of water users associations
- Building farmers' capacity in water management
- Promotion of horticulture production in irrigation schemes and marshlands
- Enabling rain water harvesting at all households
- Creation of ponds and identifying springs to obtain water for communities through WASH program
- Uncover marshland streams covered by invasive plant species that adversely influence the availability of water.
- Use of micronutrients (iodine, zinc, iron) in irrigation water in commercial farms. Alternatively, at household levels, these nutrients can be made available in sachets; they can be mixed in

¹⁶ Crops such as rice, maize, and sugar cane, currently occupy most of developed marshland. As a nation geared towards fighting against malnutrition, Rwanda can try extensive production of vegetables and fruits utilizing riverbeds and swamps for local nutrition improvement. With the use of big swamps of the national rivers, such as Nyabarongo, Akanyaru and Akagera, there would be more legumes and fruits available locally but also provide increased income for the farmers and the nation through local markets and export of these commodities.

water, and sprayed in backpacks (as in spraying pesticides / fertilizers) in the kitchen gardens or small farms.

- Promotion of innovative irrigation technologies¹⁷
- Innovative management mechanisms for irrigation infrastructure¹⁸
- Conservation of water catchment for sustainable irrigation farming

All the above interventions need to be combined with (i) nutrition education about “better food utilization” for the healthy growth of family member, and (ii) activities for NDF market creation listed below, in order to give significant nutrition impacts;

- Training on the development of “**Nutrition Sensitive Cropping Calendar**”¹⁹ for self-consumption of farming household
- Strengthening linkage between food distribution program under social protection and farmer groups in irrigation schemes through, for instance, contract farming for NDF to be used for food distribution
- Strengthening linkages between school feeding programs and farmer groups in irrigation schemes through, for instance, contract farming for NDF to be used for food distribution. (Home grown school feeding program)
- Strengthening linkages between micronutrients supply under health service programs and farmer groups in irrigation schemes through, for instance, development of nutrition supplement powder (e.g. soybean powder for nutrition enrichment)

4.3.3 Enabling Environment.

According to PSTA 4, Rwanda has 589,711 ha of irrigation potential out of which 37.72 % is on marshlands and 62.28 % is on hillsides. Approximately 7.5 % of this potential has been developed successfully so far, covering 48,508 ha. This implies that Rwanda still has huge potential for further develop new irrigation schemes. In addition, Rwanda has abundant precipitation that enables farmers to have three cropping seasons, while having other water sources such as lakes and rivers. These conditions provide advantage for irrigation development.

Various government policies, strategies and on-going programs support irrigation development. NAP clearly states the importance of irrigation development, and it is reflected in PSTA 4 targeting

¹⁷ Drip irrigation, hydroponic and aquaporin systems can be instrumental innovative technologies in overcoming challenges related to land scarcity and fertility as well as water saving, while improving water efficiencies and boosting high-value crop production (e.g. vegetables). Initially associated with hi-tech irrigated agriculture, these technologies are now being used by a much wider range of farmers in emerging and developing countries. A technical and socio-economic study needs to be carried out to assess feasibility and develop customized Rwandan standards. PSTA 4 supports, as an incubation initiative, the introduction of modern production infrastructure such as greenhouses for vegetables and flowers and hydroponics under PPP arrangements in specific sites to display their potential. The aim is to attract more private sector investment in these areas in future. Commercial farmers should use computerized technologies in the supply of required nutrients, through irrigation, for the plants as various stages of growth.

¹⁸ The management of irrigated infrastructure requires skills, technologies and cash flow that are currently beyond the capacities of most farmers and farmers' organizations. Meanwhile, the state-led management of irrigation schemes is represented by overloaded financial burden to the government. Innovative models of irrigation scheme management are needed such as piloting and scaling up of public-private partnership models for managing irrigation infrastructures.

¹⁹ Calendar to guide farmer for (1) how much of their irrigated land set aside for household consumption, and (2) what commodity to be produced in what combination to supply NDF year-round

102,284 ha to be covered by irrigation within Integrated Water Resource Management (IWRM) that is implemented to ensure efficient, effective, and sustainable agricultural development.²⁰ To supplement these policies, the irrigation master plan has been drafted and awaiting endorsement to act as a support document for implementation of the PSTA 4. In addition, the Government of Rwanda introduced the Small-Scale Irrigation Technology (SSIT) project for improved productivity and commercial farming in order to promote the development of affordable and sustainable irrigation technologies. There is great potential and demand for investment in small-scale irrigation systems to complement the large-scale irrigation investments undertaken to date.

4.4 Post-Harvest.

PSTA 4 states that substantial productivity gains can be made by addressing the issue of post-harvest losses. The degree of post-harvest loss vastly varies depending on agricultural commodities, ranging from beans at 15%, milk at 33%, cassava at 43%, to potatoes as high as 45%. Food losses and waste occur along the entire value chain at harvesting (e.g. improper maturity), post-harvest handling (e.g. rough handling, use of inappropriate containers, spillage, crop damage), drying, processing, storage (e.g. poor temperature management, aflatoxin contamination during storage), distribution and even consumption (e.g. spoilage, household waste). This is a result of the combination of causes such as lack of skills and technology, limited post-harvest handling infrastructure, including suitable storage, and drying spaces, as well as imperfect transaction processes between value chain actors.

In addition to that, the nutritional value of food is hampered if food is not safe or toxic to the consumers, and inadequate post-harvest handling of agricultural commodities can cause this circumstance. During post-harvest processes, two main problems can damage the quality of harvested produce. Firstly, mycotoxins, especially aflatoxins, are the often-underestimated risk for the consumers. Fungi that exists in farmlands produces aflatoxin; they spread easily if the drying and storage practices are not appropriate, then leading to aflatoxin contamination of harvested produce. Aflatoxins can cause liver disease such as liver cancer. Consensus is formed that proper drying before storage is the effective counter measures for mycotoxin control regardless of the storing method selected, thus is of paramount importance. Secondly, the inappropriate use of chemical products and even the biological control measures (e.g. fumigation) applied during storage to protect the produce from insects and rodents may be toxic for humans.

Fruits and vegetables, unlike grains, need extra care right from the field until it reaches the processors/ consumers. The right stage of harvestable maturity using maturity charts, use of farm shades, appropriate containers, use of affordable farm cool storages (e.g., Zero Energy Cool Chamber-ZECC, Cool stores even “Pot in Pot” for an individual farmer or household farmer) and custom designed transportation can maintain the nutritional quality of horticulture products. This enables the farmers to have good price and consume micronutrient dense foods that will help them to overcome malnutrition. Studies have indicated that waiting for trucks in the farm causes loss of moisture in horticulture foods leading to the degraded quality of their produce and the decreased income for them as a result. This could be prevented by utilization of ZECC.

These are the reason why the post-harvest loss remains one of the major challenges in PSTA 4, and with the introduction of NSA to the current PSTA 4, it is expected that nutrition perspective can be mainstreamed in the efforts to solving post-harvest losses.

²⁰ PSTA 4 result framework, Strategic Outcome, Output 2.2 A

4.4.1 Potential Area of Contribution

A balanced diet is needed throughout the year to maintain good health and nutrition. Good post-harvest handling, processing and storage contribute for sure to: maintaining a secure supply of food (and thus of nutrients) throughout the year; preserving the quality of harvested raw material as it moves along the food supply chain from the producer to the market; reducing losses; and making fresh produce available in local markets as well as in distant locations. Proper food storage helps to maintain food quality over an extended period until its final use, permits its deferred use (on an annual or multiannual basis), guarantees the regular and continuous supply of raw materials for processing and helps to balance the supply and demand of agricultural products, thereby stabilizing market prices. At the household level, storage contributes to food and nutrition security by offsetting seasonal scarcity. Although crops have the highest nutritional value when consumed in the fresh state, food processing contributes to nutrition by extending the shelf-life of raw materials and by enhancing the safety and retaining the nutritive value of many foods. Furthermore, it enhances the palatability of food and saves time for cooking and food preparation at the household level. In conclusion, improved post-harvest handling can contribute to the availability, accessibility, utilization and stability of food (and thus of nutrient).

Nevertheless, the rise and prominence on markets of industrially prepared ultra-processed foods and beverages, which tend to have unbalanced formulations (i.e. dense in energy, low in micronutrients and high in fats, sugars and salt) is a challenge. Excessive consumption of these products is a key factor behind rising levels of overweight, obesity and non-communicable diseases.

4.4.2 Potential Intervention Options

Post-harvest handling is strengthened through the development of adequate capacities, technology, and infrastructure. The necessary interventions in line with the National Post-Harvest Strategy include the following:

- Technical capacity building (at the producer, aggregator, transporter, wholesaler and retailer levels),
- Upgraded post-harvest technologies (i.e. mechanization, industrial shelling and drying),
- Upgraded processing, transport and storage infrastructure (infrastructure including cold chain infrastructure),
- Improved information and data on post-harvest losses along the prioritized value chains, and
- Improvement of logistics management and operation
- Promotion of food processing techniques such as fermentation and/or germination of grains/beans that may maintain and even improve the nutrient content of the food

Other important interventions are strengthening the capacity of smallholders and small entrepreneurs, especially women, to store, preserve, process and package foods can help secure a year-round food supply that can improve nutrition and income generation. This can be done through – for example – trainings on techniques to optimize the shelf-life and nutritional quality of foods. Training in home scale preservation of foods is also effective to be used in lean season. Technical assistance (and promotion of relevant technology) to strengthen the value addition and marketing of these products and ensure a greater share of in-country value added (this includes Made in Rwanda branding, as well as sub-sector specific marketing). In addition to training, provision and

maintenance of necessary equipment for storage (e.g. small silos), processing and packaging as well as sustainable supply of inputs, are key.

Harvesting crops at appropriate stage of maturity if their quality is to be maintained throughout their post-harvest life.

Consideration of impacts on the content and bioavailability of nutrients into the choice of processing technique. For example, germination and malting of grains and pulses can enhance their vitamin, mineral and protein content and bioavailability. On the contrary, techniques that include prolonged exposure to heat or sun significantly reduce vitamin content

4.4.3 Enabling Environment.

Government of Rwanda, in its policy documents, emphasizes the importance of reduction of post-harvest loss. The National Post-Harvest Crop Strategy²¹ for Rwanda indirectly contributes interventions, which improve nutritional status of the households in Rwanda, as one of its focuses is the food security by increasing availability of food through minimizing food losses during and after harvests. The strategy also includes processing and value addition to the harvested commodities. PSTA 4 also supports increased value addition through pre-processing and processing of prioritized value chains, in particular in the case of tea and coffee, horticulture, and the dairy sub sector. These include agricultural extension education in drying grains to safe moisture level, use of appropriate storage structures, and maintenance of storage hygiene for grains. While for horticulture crops, use of maturity charts, use of farm shades, appropriate containers, use of affordable farm cool storages (e.g., Zero Energy Cool stores; cooling rooms) and custom designed transportation can maintain the nutritional quality of horticulture.

Furthermore, through an Agribusiness Window under the Agricultural Development Fund²² under Pillar 4, the PSTA 4 aims to facilitate private sector investment in processing and value addition of agricultural commodities in selected value chains. The government efforts in leveraging private investment can contribute to better post-harvest handling and management, especially in the areas where significant investment is needed, such as infrastructure development.

4.5 Small Livestock

Animal-Sourced Foods (ASF) has the potential to combat malnutrition they contain not only protein but also micronutrients vital for promoting growth during pregnancy, infancy and childhood, but research shows that, in Rwanda, consumption of animal source foods remains very low (only one-fifth of Rwandan households regularly consume ASF). Access to ASF is constrained by limited availability, high cost, and cultural barriers to consumption.

Keeping large livestock might call for various capacities to owners (e.g. land and space for keeping, capital for rearing), while small livestock farming can be practiced with relatively small amount of resources and assets. However, to date, no large projects in Rwanda have targeted non-dairy ASF value chains (VCs), leaving other livestock VCs—including poultry, fish, pigs, and goats—underdeveloped. The non-dairy livestock sector is constrained by poor practices and underinvestment but has significant market potential to address the nutrition gap. Ultimately, small

²¹ National Post Harvest Staple Crop Strategy – 2011.

²² The idea of Agricultural Development Fund was transformed into Rwandan Agricultural Risk Sharing Company (RARSCOM) and its establishment awaits the approval at the cabinet as of February 2020.

livestock and backyard poultry not only make a vital contribution to household food and nutrition security but can also foster economic security, generate employment for women and act as a safety net during times of crisis.

4.5.1 Potential Area of Contribution

The benefits of consuming a reasonable amount of animal products are well-known. In general, macronutrients like protein and micronutrients like iron are more bioavailable in Animal-Sourced Foods (ASF) than plant sourced foods. Chicken meat, eggs and milk provide high-quality proteins, which are rich in essential amino acids especially linoleic acid, PUFA that prevents growth retardation; in turn, cereals generally lack these nutrients, unless treated and processed appropriately to expose the bioavailable nutrients. ASFs are also good sources of vitamins and minerals (micronutrients). Milk and milk products like curd and cottage cheese (channa), for instance, are essential sources of protein, calcium, B complex vitamins, iodine and saturated fats needed for brain development. Furthermore, certain parts of livestock and poultry (liver, kidney and brain) are particularly rich in specific macro and micronutrients. For instance, chicken liver is the richest sources of Vitamin A and the second richest source of iron compared to any indigenous fish or plant source food. It also contains significant quantities of zinc. For this reason, use of small amounts chicken liver in the diets of young children and adolescents should be encouraged.

Thus, the development of small livestock industry and market can significantly contribute to the improved availability and accessibility of both macronutrient (particularly protein) and micronutrients that are deficient for Rwandan population. Raising small livestock in a household context significantly increases accessibility and availability of ASF, thereby enhancing opportunities for a diversified and nutritious diet at the households especially with young children and pregnant and lactating women.

4.5.2 Potential Intervention Options

The potential areas of intervention will largely depend on the status of value chain of particular small livestock products. Thorough analyses are needed along the value chain to identify key constraints for production, markets and consumption to address the issues of availability, accessibility and utilization of specific nutrients that can be supplied by ASF. The below table provides the summary of constraints.

VALUE CHAIN	PRODUCTION CONSTRAINTS	MARKET & CONSUMPTION CONSTRAINTS	CONSUMPTION & MARKET OPPORTUNITIES
Poultry	<ul style="list-style-type: none"> - Low availability of quality feed - Indigenous chickens are unproductive 	<ul style="list-style-type: none"> - Domestic produce uncompetitive with imports (~30%-40% higher price) due to lack of infrastructure and commercialization - Supply of eggs is limited 	<ul style="list-style-type: none"> - Consumption rising; doubling of eggs/capita from 2010–2016. Social and Behaviour Change Communication (SBCC) can turn production - New breeds / quality feeds can triple productivity from local breeds; annual import substitution opportunity \$5.6M for eggs, \$12–24M for meat.
Fish	<ul style="list-style-type: none"> - No locally produced fish 	<ul style="list-style-type: none"> - Lack of cold chain 	<ul style="list-style-type: none"> - Growing demand (45.7% annual

VALUE CHAIN	PRODUCTION CONSTRAINTS	MARKET & CONSUMPTION CONSTRAINTS	CONSUMPTION & MARKET OPPORTUNITIES
	feed; 97.4% of production is capture fisheries, only 2.6% is commercial aquaculture.	infrastructure - Fish consumption is only at or near water resources.	increase). - Fingerling introduction into un- or under-utilized lake-aquaculture cooperatives to increase production and consumption.
Pigs	- Production of pork products is 5–50% less than regional competitors.	- High pig-head counts, but low local demand so industry supplies low-value live pigs to Democratic Republic of the Congo. - Reduced cultural sensitivity to consumption, but the price of pig meat is high relative to average rural income.	- Short rearing time enables consistent household off-take for meat without compromising herd size. - Margin can be doubled with value addition compared to live slaughter.
Goats	- No strong commercial production of goat for either meat or milk products.	- Cultural sensitivity to consumption. Produced for meat and special occasions only, minimal milk consumed.	- Goat can be easily incorporated into existing production systems - Cheaper to buy/rear compared other livestock - SBCC to increase consumption for consistent uptake of meat and Vitamin-A rich, low-sodium (encouraged for CVD patients) milk.

Concrete interventions can include:

- Livestock ownership (e.g. cattle, chicken and other poultry, small ruminants such as goats and sheep) can contribute to dietary diversity and nutritional outcomes through home consumption and income generation, especially if accompanied with nutrition education aimed at promoting consumption of ASFs including for complementary feeding. Already *Girinka* program is on-going in Rwanda, but the program for household small stock keeping may be necessary. Support to home-based animal husbandry is often implemented in the context of integrated farming systems (e.g. mixed crop-livestock-aquaculture systems) which have great potential to improve availability of and access to diverse and nutrient-rich foods.
- Milk and dairy production, is often used as a strategy to enhance income and livelihoods. Nutrition objectives can be easily integrated, for example by ensuring consumption by children or linking with school meal programs. Goat can produce 1- 4 litres of milk per day while milking cow can produce more than 10 litres and it is often not reasonable to produce milk only for home consumption.

- Capacity building program is necessary for beneficiaries to practice appropriate animal husbandry.
- Interventions are needed to ensure the supply of necessary inputs for livestock production. These inputs can include quality feed, seed stocks (e.g. chicks, piglets), medicines and necessary equipment for livestock rearing. Supply of feed and seed stocks should be on commercial-base for sustainability, thus need to support private sector.
- Establishment of medicine supply chain, provision of extension and advisory services, and provision of veterinary services are intervention options to be considered, because the access to the necessary extension and veterinary services is important not only for better productivity in livestock production, but also to prevent pandemic of animal diseases such as bird flu.
- Interventions are necessary to strengthen, upgrade and integrate the value chain for small livestock products, as some of small livestock products are traded. Capacity building to retailers who handle these products in market, support for market and other infrastructure (e.g. marketplace, cold room to keep meat products, slaughtering house)
- Projects/programs that promote sales of livestock and ASFs should ensure (as critical “do no harm” consideration) that sales do not translate in reduced home consumption especially for children, that children are not taken out of school to take care of livestock (as these are considered valuable assets to the family, and that income is used for supporting nutrition).
- Animal rearing (such as dairy goat or poultry rearing) are activities for women in many circumstances. Therefore, targeting women can help increase their control over the productive and economic resources concerning livestock and ultimately increase the likelihood of improved maternal, child and household nutrition.
- Consumption of some ASFs is restricted by cultural and traditional food consumption practices. Nutrition education interventions is necessary, and it should consider taboos, gender restrictions and intra-household allocation, and assess how best to address these issues.
- Nutrition-sensitive livestock-based interventions also include measures to prevent and reduce risks for human health associated with livestock rearing (e.g. food and water safety issues and environmental contamination, whereby animals are kept in the house premises, next to where children play or next to water sources; zoonosis).
- Fish products are major ASF along the large water sources such as lakes and rivers. Promoting sustainable fishing and aquaculture (e.g. practices that do not deplete valuable stocks, harm environment, or damage rights of fishing communities) can therefore contribute to long-term food security and nutrition not only as food, but also as an important income source.
- Promotion of home-based aquaculture, integrated multi-trophic aquaculture and/ or aquaponics, agriculture-aquaculture farming systems such as fish production in rice fields are examples of aquaculture-based interventions to enhance dietary diversity and nutrition. Attention should be paid to ensure fish ponds do not become malaria mosquito breeding sites or not become risk for human life, especially for small children (e.g. safety measures may be necessary to prevent children from falling into ponds)

- Additional interventions concerning fish products are: promotion of small fish with high nutrient value that are consumed whole (with bones, heads and viscera); nutrition-enhancing post-harvest handling and processing techniques (reducing post-harvest fish losses and discards ensuring that the most micronutrient-dense parts of the fish are not removed during processing), and nutrition enhancing feeding practices (using feeds rich in omega 3 to increase the health benefits from consumption).

The below interventions are going on under the program of MINAGRI that users of the NSA mainstreaming guideline should take into consideration in planning new interventions in order to coordinate and harmonize with them to maximize the synergy.

- MINAGRI: Promote services and practices that result in improved household food security.
 - *GIRINKA*, the One-Cow-per-Poor-Family Programme.
 - One Cup of Milk per child
 - Establishment of school gardens with assistance for scale up and better linkage to learning objectives in nutrition and household food security.
 - Provision of subsidised fertilizer and free seed as part the Crop Intensification Programme (CIP) targeting vulnerable families.
 - Promotion of improved kitchen garden and small livestock to improve micronutrients, increase protein availability and provide a pathway to increased income for vulnerable families.

It is also important that livestock interventions are accompanied with extension and training on animal husbandry as well as veterinary services which are indispensable for animal health, thus success of interventions.

4.5.3 Enabling Environment

Stunting is one of the top priority issues that the Government of Rwanda is determined to reduce it through various efforts. The government policy and strategy documents recognize that ASFs are effective measures to address stunting issue, and increased animal production is already included as targets of major government strategies;²³ thereby the government allocate some budget for livestock related activities. One example is the small livestock distribution programs targeting youth and women groups.

Development partners also seriously take the nutrition issue, especially stunting, and recognizes the importance of small livestock as one of the solutions to nutritional issues in Rwanda. Bi-lateral and Multi-lateral Donors, Financial Institutions and NGOs, among others have been implementing a number of projects that have livestock components.

Steadily and rapidly growing economy also expand the market for livestock products, thus there exists significant opportunity for development of small livestock industry that can improve availability and accessibility of ASF for Rwandan citizens in general.

²³ PSTA 4 sets targets for increased production of small livestock from by 2024; Poultry more than doubling (from 18,000 MT to 44,000 MT), Pork more than tripling (from 22,000 MT to 79,000 MT) and Fish more than quadrupling (from 27,000 MT to 112,000 MT)

Abundant water base is another advantage that can support fish production. People can take advantage of fish resources in lakes and rivers as the important protein source to improve their nutrition status.

4.6 Kitchen Garden

Kitchen gardens contribute to household food security by providing direct access to food that are harvested, prepared and shared to family members. Even very poor near landless people can practice gardening on small homestead land, edges of a field, or in containers. Gardening may be done with virtually no economic resources, using locally available planting materials, green manures, “live” fencing and indigenous methods of pest control. Thus, home gardening at some level is a production system that the poor can easily enter.

The kitchen garden activities can also contribute to other social and economic benefits like better health, improved nutrition, increased income, employment, food security within the household, and community social life. Households take advantage of homestead land and contribute to supplying fresh daily food and household food system.

4.6.1 Potential Area of Contribution

First of all, kitchen gardening improves availability of food (thereby of nutrients). The availability of vegetables and fruits in a kitchen garden can increase consumption and hence mitigate specific types of malnutrition, especially micronutrient deficiency. In addition, home gardening increases the diversity of foods, which in turn leads to overall better utilization of nutrients. Diet diversification has been used as one of the effective strategies to improve nutrition of population, particularly of the poor, as vegetables and fruits are often the only source of micronutrients in the family diet for poor households.

Homestead production of fruits and vegetables provides the household with direct access to important nutrients that may not be readily available or within their economic reach. Therefore, home gardening would be a good means to improve household food security. Equally, important, home gardening is being shown to be a source of additional income, because the household can sell a portion of the garden’s produce. Studies suggest that this additional income is generally utilized to purchase supplementary food items, further increasing the diversification of the family’s diet. Home gardening is especially important in overcoming seasonal availability of foods and promoting household self-sufficiency. Also coupled with processing, home gardening can also contribute to close the seasonal food and nutrient gaps.

Finally, vegetables and fruits often make other foods more palatable and can lead to overall increase in food intake and aims to improve overall quality of the diet.

Thus, kitchen gardening has potential to contribute to food and nutrition availability, accessibility, utilization and stability. The impacts can be amplified if the support to kitchen garden is supplemented with interventions in food processing and preparation as well as nutrition education.

4.6.2 Potential Intervention Options

To promote the kitchen garden, the following interventions can be considered;

- Promotional campaign for kitchen garden coupled with nutrition education. Inclusion of Nutrition Dense Food in the cropping plan in kitchen garden is critical.

- Provision of technical and advisory support, utilizing FFS and other existing proximity extension services. This is critical especially when promoting new crops as well as new techniques and methodologies (e.g. diversification, cropping timing, inputs).
- Inter cropping and integrated farming in combination with fruit trees (Annex 4 & 5), livestock and/or aquaculture need to be promoted as effective approaches to address nutritional issues. One of the recommendations in the implementation of the national agroforestry strategy is the launch of the national food-security and land-restoration programme; and set a target of over 10% of tree-and-shrub cover on all farmland by 2030
- Establishment of demonstration plots/gardens for visually showcasing the methodologies and potential results/impacts. Training and other group activities around a central demonstration garden can serve to demonstrate different varieties, hybrids or other important garden techniques such as live fencing, composting, use of natural pesticides, year-round production
- Promote growth of indigenous fruits and vegetables in the kitchen garden. Examples of indigenous fruits & vegetables are amaranths, African eggplant (Intoryi), spider plant (Isogi), pumpkin and nightshade (Isogo). The National Plant Genetic Resource for Food & Agriculture (PGRFA) program should be able to conserve these species in their fields should support farmers. However, it is important to encourage appropriate processing of these fruits and vegetables to eliminate their excessive anti-nutrients that can harm the liver. Consumption should be promoted through appropriate extension activities and their inclusion in daily / regular diets can be demonstrated at the community kitchen.

The below are some key approaches to achieving successful Kitchen Gardens in the tropical countries as illustrated by Hellen Keller International (HKI)²⁴ that Rwanda can consider the implementation.

Gardening Inputs: Access to the necessary inputs for gardening from a local, sustainable source is an important element for successful gardening. Such inputs include seeds, seedlings and saplings, a regular water supply, environmentally friendly soil improvement techniques and pest control, live fencing, and credit or capital as necessary.

Community Participation: Involvement and participation of the community in project design, implementation and evaluation was a lesson from HKI's very first experience in gardening in 1988. Having two-way channels for information exchange is instrumental for achieving sustainable, improved gardening practices (e.g. Villages, households and working groups of women formed and organized themselves and selected the group leader)

Nutrition education and social marketing within the gardening activity: Experience shows that counselling to change feeding/eating behaviours is generally an important component of food-based strategies. Similar to understanding the indigenous approach to gardening, an understanding of the cultural context and feeding practices and constraints will guide nutrition education to achieve sustainable behavioural changes. The garden or nursery can also be utilized as a focal point for nutrition education and social marketing to promote increased consumption of micronutrient rich foods. In addition, messages about a variety of other the issues that influence nutrient absorption and overall health such as prevention of childhood illness, timing of meals/foods, intake of tea and

²⁴ HKI is an international NGO dedicated to the elimination of vitamin A deficiency and nutritional blindness and improving the conditions of visually impaired around the world.

other factors that inhibit nutrient absorption can be presented to households and discussed among mothers and household members.

Monitoring and evaluation: Monitoring serves as a tool for ensuring that activities are carried out as planned and to improve performance as required. It facilitates the identification of problems and the development of solutions based on sharing between the beneficiaries and the program managers. Indicators are dependent on the program objectives and should include some that can be monitored locally. Continued integration of lessons learned from implementation and evaluation efforts is one of the key aspects to the successful scale up of this program. Evaluation and planning was conducted at the key intervals during the program period to improve the program. Within this program system of implementation, evaluation and planning, HKI operates a similar review process with each of the NGO partners over the three-year program period through supervision and monitoring.

Priority Vegetables to be promoted for fighting malnutrition: A Nutrition Dense Food is rich in vitamins, minerals, complex carbohydrates, protein and healthy fats. Therefore, it is better in practice to focus on the vegetable content able to fill nutrition gaps in Rwanda: vitamin C, iron and vitamin A. Animal-source proteins cannot obviously be provided by vegetables sources though they can supply some proteins. Apart from iron and zinc fortified beans, bamabara nut (similar to beans) that can grow in drought seasons can be cultivated; several researches have proven their usage in overcoming malnutrition. They do not need much care in the field. The nut is rich in essential amino acids than groundnut, with a protein score of 80% as compared to 65% for groundnut, 74% for soya bean and 64% for cowpea.²⁵ Because of the diverse agro- climatic zones, several types of food crops are grown in the country. They include: cabbage, carrots, eggplants, kale, leeks, spinach, onions, squash, papayas, banana, tomatoes, fresh sweet corn, kidney beans, soy beans and beans -especially those enriched in iron, orange flesh potato enriched in vitamin A. Vegetables traditionally grown such as amaranth, spider plant (isogi), cowpea (inkoli), nightshade (isogo) too, but also cassava leaves, taro leaves and other local dark green vegetables. Along with the indigenous trees widely found in the country (Annex 5),²⁶ new fruit trees can be introduced into the kitchen garden that can diversify food in the family and community. They include but not limited to citrus / oranges, drumstick (rich in diverse micronutrients – carotene, vitamin C, calcium, iron etc.), sapota (iron rich), papaya (folic acid and carotene rich), guavas (vitamin C and fibre rich), custard apple (high in antioxidants and vitamin C), (pomegranates (rich source of potassium and fibre). Majority of plant-based foods are rich sources of phytonutrients. Fruits trees are seasonal and when fruits are available during season, they help to override lean period. Initially, MINAGRI can distribute seeds / saplings to communities and facilitate households to encourage fruit trees in kitchen gardens. Red Bananas can also be part of the kitchen garden and is rich in phytonutrients.

In RAB manual on Kitchen Garden (2016), a table with 5 indigenous vegetables (amaranths, spider plant, cowpea, nightshade and kale) and 5 exotic vegetables (cabbage, carrot, spinach, tomato, onion) indicate their respective content in proteins, calcium, iron, beta carotene (precursor to vitamin A) and vitamin C.

²⁵ Mubaiwa J, Fogliano V, Chidewe C, Bakker EJ, Linnemann AR (2018) Utilization of bambara groundnut (*Vigna subterranea* (L.) Verdc.) for sustainable food and nutrition security in semi-arid regions of Zimbabwe. PLoS ONE 13(10): e0204817. <https://doi.org/10.1371/journal.pone.0204817>

²⁶ Celestin Bigirimana, Francis Omuja, Prossy Isubikalu, Elias Bizuru, Bernard Obaa, Michael Malinga, Jacob Godfrey Agea & John Bosco Lamoris Okullo (2016) Utilisation of indigenous fruit tree species within the Lake Victoria Basin, Rwanda Agricultural Science: An International journal (AGRIJ), Vol.1, No.1, Pg: 1-13

Utilization of appropriate processing techniques / technologies to enhance the nutritional value of food crops: Just as fermentation is practiced to eliminate cyanide in cassava, certain processing techniques can be adopted to enhance the nutritional value of staple food crops. Paddy can be parboiled rather than consumed as raw milled rice; this can enhance the thiamine, niacin and riboflavin content in the rice. Such rice is more nutritious than raw milled rice. Furthermore, the husk of paddy can further be used in the extraction of oil; rice bran oil is more nutritious than other forms of vegetable oil. Small, medium and large-scale technologies are available. Finger millet can be promoted as another staple crop that is nutrient rich. Nutrient utilization in finger millet can be enhanced by simple aging and malting technologies that make the nutrients bioavailable.²⁷ Finger millet is one of the nutrient dense crop that has high methionine that is very suitable for the starch-based diets that enable to overcome stunting. It also contains calcium equivalent to that of milk. Prolonged usage of maize based diets in a household can lead to pellagra (deficiency of niacin).²⁸ However, nixtamalization, fermentation, malting can eliminate this condition.²⁹ Nixtamalization involves treatment in alkaline solution for the elimination of anti-nutrients and prevent pellagra. All these can be promoted at home-scale and commercial level.

Interventions by various government agencies along with kitchen gardens (Users of NSA mainstreaming guideline should consider the implementation of NSA activities in harmony with these interventions):

- MIGEPROF: Rwandan laws now guarantee women the right to inherit land and other property, and have codified as criminal gender-based violence. Legal guarantee is provided to women to have “equal access to food production” in the family. Gender sensitivity has become a requirement throughout Government and is actively promoted in the private sector and society. Another program by MIGEPROF is the “*Agakono k’umwana*”, aimed at revitalizing a well-known traditional household practice of having a special “pot” of nutritious foods for young children. MIGEPROF also has an “Annual women’s campaign” mobilising for health and nutrition at family level and advocating the wellbeing of the family as a whole and women in particular. “Family Commitment” programme through which MIGEPROF calls for every family to maintain a “family performance notebook” with objectives and progress on assuring or improving family nutrition, crops, education, economic growth, and early childhood development (ECD).
- MIGEPROF & MINISANTE: “Family campaign’s” to poor in order to assist families with children suffering from acute malnutrition by providing cows, small livestock, seeds, and in some cases high quality foods.
- MINEDUC: All school programs to prioritize the promotion of nutrition along with health hygiene and sanitation services in schools. It also recognizes that food and nutrition issues need to become prominent areas of teaching and learning in schools at all levels through curriculum based, and extra curricula activities. School gardens are proposed as teaching-learning activities that focus on food and nutrition and the inclusion of more strategically identified food and nutrition topics at different levels of the curriculum. Within that policy of

²⁷ Hilda Vasanthakaalama, Aurelia Karayire, Valens Habimana and Choi Nam Hee Nutrient availability in biologically activated fresh and aged finger millet Cereal Technology 04/2019; 164 - 179

²⁸ D. A. Bender (2003) Pellagra, Encyclopedia of Food Sciences and Nutrition (Second Edition)

²⁹ Martin Patrick Ongol, Eugène Niyonzima,, Innocent Gisanura, Hilda Vasanthakaalam (2013) Effect of germination and fermentation on nutrients in maize flour Pak. J. Food sci., 23(4), 183-188

Home-Grown School Feeding Program, the One Cup of Milk per Child program exists. Also recommended are limited levels of school feeding, provision of milk, school gardening and farms that serve as learning opportunities for students and inclusion of some nutrition topics at different levels of the curriculum.

- MINISANTE: the 1st 1000 days Community Based Food & Nutrition Programs (CBFNP) should also include community based interventions such as kitchen gardens, MIYCN, antenatal care, hygiene, food preparation, use of treated bed nets, social protection services, cooking demonstrations, food preservation, micronutrient nutrition, deworming, and other services and practices that help preventing stunting.
- District Plan for the Eradication of Malnutrition (DPEM): *Irerero* – pre-school feeding program and community kitchens

4.6.3 Enabling Environment

In Rwanda, the term "akarima k'igikoni" or (small) kitchen garden has become quite common. Different programs promoting dietary diversity and fighting malnutrition promote the kitchen garden. In the past few years, the Government introduced the Kitchen Garden Program nation-wide with the aim of increasing vegetables and fruit production as well as provision of cheap vegetables and fruit to the household members.

School gardening is seen as source of food for improving children diet and is supporting the school feeding program. It also serves in educating children and promoting agricultural practices and nutrition. MINEDUC (Ministry of Education) is committed to improve nutrition among school children and better using the school curricula and nutrition demonstration gardens to better educate all children on practical aspects of nutrition. The National Food Nutrition Policy (2013-2018) recommends improving nutrition and food security learning through strengthening the curriculum and extracurricular activities including the use of school gardening.

4.7 Social Protection

“Social protection encompasses initiatives that provide cash or in-kind transfers to the poor, protect the vulnerable against risks and enhance the social status and rights of the marginalized – all with the overall goal of reducing poverty and economic and social vulnerability”.³⁰ Nutrition-Sensitive social protection seeks to reach the nutritionally vulnerable, to incorporate explicit nutrition objectives and indicators and to promote strategies that enable households to access healthy and sustainable diets as well as health care. At least, this NSA guideline aims to mainstream nutrition perspective in the Social Protection programs/projects carried out in Rwanda.

CFSVA-2018 and CFSVA-2015 show that there is a direct correlation between poverty and levels of malnutrition both wasting and stunting. Food insecure households were among the poorest (32% of households in *Ubudehe* 1 and 19% of households in *Ubudehe* 2). They have few active members, and often headed by a person with a low level of education, a single person, or a disabled person. Food insecure households mainly depend on their own agricultural production (low-income farmers), daily labour in agriculture, unskilled daily labour in other sector, or on external support for

³⁰ FAO, 2015. *The state of food and agriculture 2015*, Social protection and agriculture: breaking the cycle of rural poverty. www.fao.org/publications/sofa/2015/en/

their livelihoods. Food insecure households engaged in agriculture have no land or a land smaller than 0.5 ha and which are usually not included in the land consolidation program. They cultivate few crops, often without vegetable garden or taking land conservation measures. They do not raise livestock or raise only a few small ones and do not consume their own animal products. (CFSVA-2018).

In this circumstance, the Government of Rwanda has built a social protection system that aims to uplift the living standards for vulnerable and poor families' and improve social welfare. The social protection operations as an intervention measure for reducing malnutrition in Rwanda is carried out mainly by the Ministry of Gender and Social Welfare, under which NECDP implements programs for reducing malnutrition. The flagship social protection program comprises the "Vision 2020 Umurenge Program" (VUP) with its three main components, the Direct Support Program, the Public Works Program and the Financial Services Program. Other initiatives include the Genocide Survivors Support and Assistance Fund (FARG), the Rwanda Demobilization and Reintegration Commission (RDRC) and the *Girinka* 'One Cow per Poor Family' program, National Strategic Grain Reserve as well as subsidized subscriptions for community based health insurance and in-kind social care services. With the new *Ubudehe* categorization framework created in 2014, households were ranked on a scale of 1 to 4, based on their social-economic status, and property ownership– in terms of land and other belongings, and what the household members do to earn a living. Social protection policies and programs hold immense potential for improving the nutrition situation of vulnerable populations. To ensure that these policies holistically combat malnutrition, a nutrition-sensitive approach needs to be employed in their design and implementation.

4.7.1 Existing Social Protection Nutrition Sensitive Initiatives

Social protection program contributes to availability, accessibility, utilization and stability of vulnerable households in terms of food nutrition. Nonetheless, this is a safety-net emergency measure, thus it needs to be coupled with efforts to fundamentally solve the food and nutrition issues for the long run.

Ongoing interventions for social protection related to nutrition include (not limited to);

- Early Childhood Development Program by NECDP
- Fortified blended food support by MINISANTE
- *Girinka* program by RAB
- VUP Nutrition Sensitive Direct Support, VUP Financial Services, Milk Support and *Ubudehe* by Local Administrative Entities Development (LODA)
- One Cup of Milk per Child Program by MINEDUC
- Income Generating Activities (IGA) and Direct Income Support under the Genocide Survivors Support and Assistance Fund (FARG)

4.7.2 Potential Intervention Options

Considering the above-mentioned Rwandan context of social protection through VUP and to complementarily contribute to address nutritional issue together with above-mentioned and other social protection interventions, several interventions are suggested in order to ensure the well-being of the vulnerable population, particularly in terms of nutrition, through better access to quality nutritious food, increasing income and improving access to health services.

- Subsidies for selected nutritious foods can increase affordability of healthy diets and/or incentivize purchase. these subsidies might be at various levels:
 - production (e.g. agricultural subsidies);
 - retail (e.g. subsidies to facilitate establishment of markets for fresh foods, supermarkets and shops in poor and underserved neighbourhoods);
 - catering (e.g. for lowering the cost of healthy meals at the workplace);
 - Consumption (e.g. vouchers for fresh foods).
- Distribution of nutritious food items and/or nutrition supplements
- Cash transfer for purchasing nutritious food. Targeting women as beneficiaries tend to have significant impacts on nutritional state of household members.
- Distribution of food coupon, designated for the use of specific Nutrition Dense Food
- Processors fortifying some foods with additional nutrients such as folic acid, iron, B vitamins (thiamine, niacin and riboflavin).
- Pairing subsidies with well-designed and well-targeted consumer information campaigns, which stimulate demand for nutritious foods, increases the likelihood of success of such strategies.

4.7.3 Enabling Environment

As described in the Section 4.6, the Government of Rwanda has already put in place various Social Protection Programs backed up by the government policy and strategy for safety net to address the basic needs of the vulnerable population as well as those affected by unexpected incidents such as natural disasters.

4.8 Incorporating Nutrition-related Objectives/ Indicators in Design of Projects/Programs

For programs aiming to affect nutritional outcomes, clear food-based nutrition objectives and appropriate indicators should be included at the designing stage. Using the 3 pillars food security framework, government data show that investments to increase production have generally improved food availability and food affordability. Building on this progress, meaningful indicators for measuring availability, access, utilization as well as resilience can be designed to address specific dietary gaps in current and future programs. NSA indicators relevant to the Rwandan context has been adapted and included in the guidelines from a compendium of nutrition sensitive agriculture indicators that users can consider their utilization. (see Annex 2)

To improve specific nutritional outcomes through agricultural resources, clear objectives, strategies, and activities as well as specific NSA indicators reflecting the 4 pillars of food security needs to be included at the designing stage.

The agriculture and nutrition strategy and intervention components should be mutually reinforcing. Activities and messages need to be jointly developed to ensure both income and nutritional outcomes are addressed.

By using the food security framework, government data show that investments to increase production have improved food availability and food affordability.

4.9 Developing and Expanding Markets for Nutrition Dense Foods

Nutrition Dense Foods include dark green leafy vegetables (amaranth, cassava leaves), orange fleshed fruit (pumpkin) or tuberous root (sweet potato), legume (nuts, peas, beans), or fish/ animal sourced products.

- ▶ The marketplace should be the main driver for addressing specific nutritional deficiencies through careful use of agricultural resources. Demand creation is a key strategy for market growth.
- ▶ Resource-poor farmers will not use their limited resources without incentives for either (1) reducing their expenditures on food by growing specific crops missing in their diet and/or (2) by producing revenue generating specific nutrient dense crops meeting consumer demand.
- ▶ Concentrating on market based individual agriculture supply chains is the most effective way to close specific dietary gaps.
- ▶ Joint agriculture and nutrition messages need to be designed to address these two household concerns.
- ▶ Carry out national campaigns based on national dietary guideline, the development of standard menu for school feeding program, the designing food transfer program focusing on NDF (usually it is mostly focusing on calorie based supply and supply of other nutrient is weak) to stimulate market for NDF

4.10 Diversifying Production to Increase Nutrition Dense Crops & Livestock

Diversified agricultural production is a traditional resilience strategy to ensure dietary and income diversity. "... excessive intensification (i.e. monoculture) risks simplifying diets and worsening nutrition in producer communities and threatens ecosystem resilience." ³¹ . However, the specialization will be preferred in case it will contribute to a significant increase of the household income.

4.11 Adaptation of "Do No Harm" Approach in NSA Mainstreaming

In the efforts toward nutrition improvement, Rwanda will adopt new food commodities and/or new methods/ technologies for food production. However, a thoroughly examination of the potential risks and negative impacts of the introduction of any new commodity as well as any new production methods and technologies on human health and natural resource base will be done before. Then there is the adoption of a "Do No Harm" approach in NSA.

One area that often becomes the subject of arguments is seeds, particularly with genetically modified organisms (GMOs). There is no doubt that the supply of sufficient quantities of quality seeds/ seedlings/ planting materials is one of the most critical keys for success in agriculture. Nonetheless, Rwandan agriculture faces challenges in sufficient supply of quality seeds, and to address these challenges, PSTA 4 has maintained the previous strategy of PSTA 3 to continue importing seeds while building local capacity for seed production.

³¹ [FAO Nutrition-sensitive agriculture and food systems in practice](#)

Globally, some seeds improvement were done through biotechnological innovation, commonly referred to as GMOs.³² Consumers in some countries, however, have great concern on the safety and risks of GM food products, and strongly demand examination of GM organisms and GM foods regarding their impacts on both human health and environment.³³ Among the human health concerns of GMOs is the potential risk to provoke allergic reaction (allergenicity). The allergy problem can be caused by livestock products that was produced with GM animal feed or industrial products containing GM agricultural materials. Therefore, necessary measures will be taken to mitigate any potential harm from such imported or locally developed GM seeds.

MINAGRI through PSTA 4 has proposed mitigation measures to counteract effects of GMOs, through capacity building,³⁴ and proper legislation as indicated in PSTA 4 by 2018.³⁵ The PSTA 4 has also planned to build the capacity of the researchers by 2020 to be able to detect GMOs and thereby have enough capacity to produce GMOs.³⁶

NSA mainstreaming also pays attention to other risks such as food poisoning and crop and animal epidemics. The National Disaster Contingency Matrix Plan³⁷ considers food and water borne diseases (e.g. cholera, typhoid fever, dysentery), other food and water poisoning, pathogenic viral diseases (e.g. Yellow fever, Ebola, Influenza) as human epidemics. Besides, using insufficiently decomposed manure can increase the danger of bacterial contamination in food, as highlighted by researchers of the Biotechnical Institute.³⁸ Additionally, the inappropriate use of chemical pesticides and fertilizers can contaminate water sources, thus be other agricultural practices with potential hazards on human health. The National Disaster Contingency Matrix Plan also recognizes crops and animal epidemics, including swine fever, foot and mouth disease, bird flu, crop diseases epidemics, including coffee wilt, banana bacteria wilt and cassava mosaic. Livestock rearing process and use of their products can also represent harm to human health and negative effect on human nutrition. While the MIDIMAR provides technical knowhow in evaluating the risk and development plans to deal with such epidemics, the MINISANTE and MINAGRI provide the expertise to prevent and treat such health-related risks and hazards found in water, crops and animals.

³² According to WHO, GMOs can be defined as organisms (i.e. plants, animals or microorganisms) in which the genetic material (DNA) has been altered in laboratories, rather than by natural selection or breeding. GM foods have been developed and marketed because of their potential advantages for either producers or consumers of respective food commodities. The perceived potential advantages of GM food include high productivity, reduced production costs, greater benefit (in terms of durability or nutritional value), and increased level of crop protection through the introduction of resistance against plant diseases caused by insects or viruses or through increased tolerance towards herbicides.

³³ The Department of Food Safety and Zoonosis of WHO recommends countries to conduct or seek assistance in the identification of foods that should be subject to risk assessment and to recommend appropriate approaches to safety assessment, WHO, Frequently asked questions on genetically modified foods, p. 2

³⁴ PSTA4 – Human Resource capacity Development p. 38. PSTA4 has allocated 532,356,311 RWF for capacity building for climate change, impact studies and GMOs, but has not desegregated the costs per item. It is still difficult to know how much will go to GMOs. Being a new innovation, GMOs require a separate budget to address the notable risks associated with long-term effects

³⁵ PSTA4 – Innovative research and crop improvement and husbandry techniques. p.39

³⁶ PSTA 4 – Page 39. Human Resource Capacity Development.

³⁷ MIDIMAR, National Disaster Contingency Matrix Plan, p. 16

³⁸ Biotechnical Institute, Genetically modified foods, p. 13.

4.12 Agriculture Value Chains that Address Specific Dietary Gaps.

Since food value chains play a key role in determining food availability, affordability, utilization and stability, they can influence diets and nutritional outcomes. Intervention with NSA should adapt market-based solutions to address nutritional gaps. For example, bio-fortified crops are currently promoted through utilization of a crop value chain framework in order to address specific dietary issues. The advocacy and promotion program of bio-fortified crops should also include locally known and grown crops that are rich in nutrients and also having market value. See Annex 1 and 8 for a suggested approach to using specific dietary gaps as the driver for growing agricultural value chains.

Also, by using a value chain approach to address seasonal and/or chronic dietary gaps and related health problems can be drivers for local supply chain upgrading. Through value chain approach on specific food commodity, gaps along the food supply chain can be comprehensively analysed, and to fill these gaps, market-oriented interventions can be suggested which is based on economic incentives, thus are likely to lead to sustainability.

4.13 Empowering Women

Agriculture interventions need to put priority on investing in women, as they are key decision makers in a household's food system. Women are also the key household members in the nexus between agriculture, nutrition, and health. Their engagement is critical to ensuring genuine integration of nutrition sensitive agriculture into household decision-making in food production, purchase, preparation, utilization and consumption. Increasing the involvement of women in nutrition and agriculture support programs can strengthen their capacity, increase their access to, and control over, resources and assets, consequently empower them to make decisions on the purchase and allocation of food, health, and care within their households. Women should also be trained in dietary practice and knowledge about nutrition in order to take good care of the family members through providing sufficient quantity and quality of meals every day (Annex 6). They should also have awareness and knowledge to provide adequate food for young children and adolescents in their family who are at the growth spurt period demanding for energy rich and nutrition dense foods. Adequate nutrition and food intake during these periods determine the basic body development and future growth of children and youths. Thus, it can make them healthy citizens that will be potentially productive labour force to contribute to the GDP of the country. Without Adequate food and nutrient supply, they are to have nutrition related problems such as stunting and wasting, leading to morbid population. It is very important to increase the knowledge and capacity of women in properly cooking and preparing food without losing any nutritional value from dishes. The government of Rwanda has implemented some programs on this matter under NECDP and RBC, and these efforts complement the NSA interventions. Capacity development of women is also necessary in the area of home-scale food processing so that the excess of kitchen garden and/or farm can be processed into even more nutrition rich foods and/or food that can be preserved (Annex 7) that can fill seasonal food and nutritional gaps that their family may have.³⁹ These foods, in case of excess, may be sold in the local market as a value added commodity.

NSA program designs using a gender lens will empower women through:

³⁹ For instance, drying OFSP to make chips and stored that can be rehydrated for future use

- ▶ Understanding their current household food and farming system.
- ▶ Focusing on crops commonly managed by women (women's crops). Starting to learn from what they know, what they grow, why they grow it, where they grow it, when they grow it, and how they grow it.
- ▶ Understanding barriers to change and working out strategies to mitigate the barriers. .
- ▶ Identifying opportunities of income increase and/or value addition in nutrient quality through crop diversification and/or access to improved post-harvest methods. Expanding outreach services is key.
- ▶ Addressing women's needs to provide continuous nutrition dense food for the household directly from her land as well as using the same land for income generation
- ▶ Understanding gender implications when promoting value chain investments. Ensuring proposed changes in land use, her labour and capital will indeed result in positive outcomes. Make sure changes leave sufficient time for good feeding and care practices for infants and young children. Use a *do no harm* framework, including specific project indicators, to avoid potential *disempowerment*.
- ▶ Support for female rights to land title, education, and expanded employment options
- ▶ Support women to understand water and sanitation (WASH) implications. Also ensure that proposed use of agro-chemicals, especially pesticides, are well understood by farmers, especially women, and that overuse, improper use or storage can negatively impact on household drinking water.
- ▶ Create awareness of women that the promotion of new or expansion of livestock rearing, especially in the home compound, will increase fecal material, and therefore there is need to ensure that livestock should be kept properly so that they do not cause health risks, especially to young children.

MINAGRI has the Gender Mainstreaming Strategy in which the gender sensitive approaches are profoundly elaborated. Many of them suggested in the document must be applicable for NSA, thus the users can refer to the documents to ensure gender mainstreaming in designing, planning and implementing NSA.

5 Tips on Interventions for Mainstreaming Nutrition into Agriculture Investments

1. Include 'nutrition sensitive' criteria (4.3) in the selection of agricultural value chains to work within the respective programmes/projects. Closing nutrient specific dietary gaps can be a driver for adding value to supply chains
2. Demand creation is a key. The local dietary gaps must be the base for the messages for awareness creation concerning food and nutrition, and they should be clear and easy to follow. The messages need to be designed to close dietary gaps by increasing local production and consumption of locally known and grown nutrient dense foods. Example: “Carrots are Food for sight”
3. Use the full range of communication methods to create demand for NSA. Identify those that are most effective with target groups from social media to face-to-face training.
4. Dietary diversity through crop and livestock diversification. Supporting households to integrate multiple crops and livestock options into their farming system that serve the purpose of earning income and ensuring food and nutrition security unless the specialization will lead to a very high income.
5. Improving household food systems for nutrition outcomes through training and improved access to agricultural inputs. Interventions to improve the availability of nutrients specifically at household level include the provision of planting materials of nutrition dense crops that can be grown with low-inputs (Annex 3), small stock (particularly poultry) and capacity development program in productivity improvement practices including post-harvest methods.

6 Entry Points for MINAGRI Programmes

By using the checklist in the Programming Principles Section, gaps in current programming will be identified as well as create opportunities to close important gaps by using MINAGRI's existing resources and organizational structure.

Table 5: Entry points of NSA in MINAGRI programmes

Programme	Entry Points
	<p>Food safety, nutrition and food security are inextricably linked. Unsafe food creates a vicious cycle of disease and malnutrition, particularly affecting infants, young children, elderly and the sick. Hence, Food safety should be adopted and practiced in all the programs (Annex 9).</p>
<p>Crop Intensification Program (CIP)</p>	<p>Identify the current impact of CIP investments on each of the priority target crops on the following food security components, especially in the lean/hungry season, in terms of increasing:</p> <ul style="list-style-type: none"> ● Availability; ● Access/affordability ● Utilization ● Resilience <hr/> <p>Identify options within each specific crop supply chain for optimizing nutrient quality and income value within the food security components</p> <hr/> <p>Identify options for optimizing land use for both income generation and closing dietary gaps through direct consumption.</p> <hr/> <p>Food Safety: In case of cereals like maize, they are dried to the safe moisture level to prevent mycotoxin. Other strategies of triple bagging to prevent insect infestation can be adopted.</p> <p>In case of horticultural products, like potato cultivation, washing should be done in chlorinated water.</p>
<p>Livestock programs</p> <ul style="list-style-type: none"> ▶ Girinka ▶ One cup per child ▶ Small Livestock ▶ Fish Farming 	<p>Ensure the dietary importance of animal-source foods is understood and encourage consumption, especially by young children, teenagers, pregnant women, lactating mothers</p> <hr/> <p>Ensure that the households receiving cows have sufficient means to care for them; it should not take away too much time and money from the parents - time to care for their young children and money to spend on food items (i.s.o. medicine for the cow); small livestock can be a good alternative for such households.</p> <hr/> <p>Food safety: Promote high standards of home level food safety, especially hygiene, and sanitation, in production, collection, processing and preserving of milk, meat, eggs, and fish. Livestock programs, which focus on the homestead as venue, should be integrated with kitchen garden programs so that both programs will mutually support with each other.</p>
<p>Kitchen Garden (KG) Programme</p>	<p>Start with identifying the current impact of Kitchen Garden Programme investments on increasing micronutrient-rich foods year-round, especially in the lean / hungry season. Identify what specific dietary gaps can be minimised / reduced / closed through a KG Programme.</p>

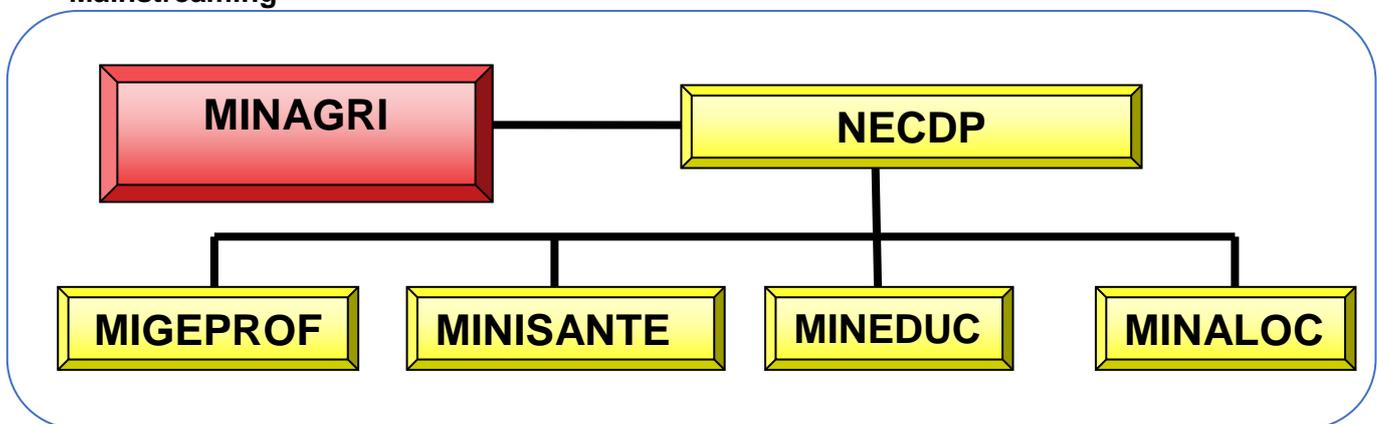
Programme	Entry Points
	<p>Food safety, nutrition and food security are inextricably linked. Unsafe food creates a vicious cycle of disease and malnutrition, particularly affecting infants, young children, elderly and the sick. Hence, Food safety should be adopted and practiced in all the programs (Annex 9).</p>
	<p>Upon identification of specific dietary issues, a range of locally known and grown food crops can be considered to be produced at the home garden to fill the dietary gaps year-round.</p> <p>Design Behaviour Change Communication (BCC) strategy to create awareness of dietary gaps and increase demand / consumption for nutrition dense crops. Agriculture staff can provide the planting materials and technical advice.</p> <p>Food safety: it is a shared responsibility at home level. Everyone has a role to play. The quality of soil, household manure, harvesting practices and washing in chlorinated water influences the quality of foods from the kitchen garden.</p>
<p>Irrigation program to support NDF supply</p>	<p>Inclusion of NDF in the crop production plan at irrigation schemes.</p> <p>Soil testing and identification of nutrient deficiencies in the soil especially in areas where malnutrition is high (e.g. Rutsiro, Nyabihu), - it may be due to soil erosion; it may also be due to the inherent nature of the soil for which soil restructuring / soil reclamation can be done.</p> <p>Specific nutrients deficient in the soil can be added to the irrigation system thus ensuring the availability of nutrients in the food crop</p>
<p>Nutrition Sensitive Value chain</p>	<p>Ensure the enforcement of Standard Operation Procedures for maintaining the nutritional value of food crops and food safety / food hygiene standards.</p> <p>Unsafe food creates a vicious cycle of disease and malnutrition, particularly affecting infants, young children, elderly and the sick. Foodborne diseases impede socioeconomic development by straining health care systems, and harming national economies, tourism and trade. Food supply chains now cross multiple national borders. Good collaboration between governments, producers and consumers helps ensure food safety.</p> <p>Enhancing the nutritional content of food crops through appropriate / suitable handling, processing techniques</p> <p>The upgrade and integration of value chain for NDF</p>

7 Coordination Structure

The Nutrition Sub-Sector Working Group will serve as an advisory organ to coordinate the harmonised implementation of the nutrition sensitive agriculture guideline, through providing technical and operational guidance to the concerned stakeholders including MINAGRI/ RAB. This guideline offers other stakeholders especially to those in the government system the clarity on the link between agriculture and nutrition & food security. It shows entry points for more nutrition sensitivity in the currently on-going government agriculture programs as well as throughout the project cycle – from designing, implementation to M&E stages.

The government has implemented a number of nutrition-related programs. Among the examples is massive campaign to enhance feeding among children in order to boost cognitive, physical and socio emotional development of children. NSA Mainstreaming guideline should be introduced and used in a manner where synergy with these programs are maximized. Therefore, MINAGRI should collaborate with National Early Childhood Development Program (NECDP) and works with MOH, Ministry for Gender and Family Promotion (MIGEPROF), the Ministry of Health (MINISANTE), the Ministry of Education (MINEDUC), the Ministry of Local Government (MINALOC) and the Ministry of Trade and Industry (MINICOM) in dissemination and implementation of NSA mainstreaming guideline. Concretely speaking, MINAGRI shall closely consult with NECDP who coordinate the nutrition related activities across a various ministries and public institutions, while coordinate activities within MINAGRI, RAB and in districts under its responsibility. Also at the district level, the activities by relevant stakeholders are coordinated at the district levels by the district government with support from respective ministries and institutions.

Figure 11: Central level coordination of government activities concerning NSA Mainstreaming



The aforementioned campaign is for instance, to reduce malnutrition from 38 per cent to 19 per cent by 2024, and was started targeting 13 districts (Nyabihu, Ngororero, Karongi, Rubavu, Rutsiro and Rusizi in the Western Province; Nyamagabe, Huye, Nyaruguru and Ruhango in the Southern province and Gakenke in the North as well as Kayonza and Bugesera in the East). MIGEPROF implements campaign through NECDP in conjunction with MINISANTE. They aim to sensitize parent and members of the communities on good feeding practices for infant and children as well as making good use of health services for better health. The campaign also seeks to raise awareness on good practices on Water, Sanitation and Hygiene (WASH) to prevent and reduce diseases related to poor hygiene. The main causes of stunting in children are poverty, poor breastfeeding, parents who do not know how to prepare proper diets. Parents are advised to carryout regular

check-ups by taking their children for growth monitoring and attending “**village kitchen demonstrations**” with a program that consists of teaching parents, especially those who have malnourished children in the village, the way they can cook a balanced diet from their harvests such as soya, sweet potatoes, green vegetables etc. This will help parents learn how to prepare balanced dietary meals.

MINAGRI may also synergise its efforts with MINEDUC to have school kitchen gardens with micronutrient dense foods such as amaranths (β carotene & iron), carrots (β carotene) and fruit trees like guavas, papayas, citrus etc. MINICOM should fortify foods such as cassava flour, maize flour and wheat flour. They can also assist in the standards and procedures through RSB and FDA.

In addition, NSA related activities should be coordinated through the District Plan to Eliminate Malnutrition Committee and should include frontline extension workers (District and Sector Agronomists, SEDOs, Farmer Fields School Facilitators and Farmer Promoters). Collaboration with District Health and Nutritionists and Community Health Workers is preferred to share information on NSA and aligning key messages.

Proposed NSA indicators can be found in Annex 2. The guidelines along with the indicators, checklists and resources, among others form an NSA Mainstreaming package to inform policy makers and local government parties involved in implementation alike.

8 Monitoring and Evaluation of NSA Mainstreaming Guideline

This document provides guidance concerning NSA. Since it is only a guideline, it will be disseminated and utilized rather than implemented. However, since it is expected to be utilised by intervention planners, implementers and public and/or other relevant stakeholders, its dissemination and effectiveness of the document needs to be evaluated. Therefore, a rubric sort of tool is designed and presented in the table below. This will enable the modification of the document for future use. These tables can be filled through surveys to be conducted a few years after the introduction of NSA Mainstreaming Guideline.

Table 6: Matrices to evaluate the NSA Mainstreaming Guideline

	Central Government (Ministries, Public Institutions)	Districts	Sectors	Development Partners/ NGOs
Dissemination/ Distribution				
- Number of guidelines distributed				
- Name of Institutions, Districts, Sectors, Partners				
Utilization				
- Utilized or not				
- Users (Position, title etc.)				
- Way of utilization				
Effectiveness				
- Impression of the users on effectiveness				
- Contents are easily understood or not				
- Guideline is easily usable or not				
- Effective parts of guideline				
- Useful parts of guideline				
- Ineffective parts of guideline				
- Useless parts of guideline				
- Observed Impacts from utilization of guideline				
Suggestions				
- Contents that need to be revised				
- Contents that need to be deleted				
- Contents that need to be added				

FOOD SYSTEM	NSA INTERVENTIONS	UTILIZATION			IMPACT/EFFECTIVENESS		
		High	Medium	Low	High	Medium	Low
Food Production	Diversification and sustainable intensification of agricultural production						
	Nutrition-sensitive livestock and fisheries						
	Biodiversity for food and nutrition including indigenous food crops						
	Biofortification						
	Urban and peri-urban agriculture						
	Irrigation						
Food handling, storage & processing	Nutrition-sensitive post-harvest handling, storage and processing						
	Food fortification						
Food trade and marketing	Trade for nutrition						
	Food marketing and advertising practices						
	Food price policies for promoting healthy diets						
	Food labelling						
Consumer demand, food preparation and preferences	Nutrition education and behaviour change communication						
	Income generation for nutrition						
	Nutrition-sensitive social protection						
	Nutrition sensitive School feeding						
	Proper food preparation						
Cross-cutting issues	Nutrition-sensitive value chains						
	Women's empowerment and gender equality						
	Food loss and waste: prevention, reduction and management						
	Food quality, safety and hygiene						
	Environment protection						

Annex 1 How to Apply NSA: Steps Involved

- ▶ Agriculture and nutrition program “components” should be mutually reinforcing to achieve food security
- ▶ Nutrition staff will need to guide agriculture staff on location specific dietary priorities.
 - What are the main food/ nutrition gaps?
 - Why are there food/ nutrition gaps?
 - When do they happen? Are they acute, chronic or seasonal?
 - What is the current situation on food/nutrition availability and access?
- ▶ Nutrition staff then identifies a range of locally known and grown crops and livestock that can close the dietary gap.
- ▶ Agriculture can then map the supply chains including gender roles for each crop given these factors to identify and analyse value addition opportunities.
- ▶ Agriculture, with a list of key foods, can then design a year-round production and post-harvest intervention plan for supplying foods that can contribute to fill dietary gaps.
- ▶ Through identifying the nutritional needs, nutritionally critical period of time and how to address those needs, the opportunities for joint advocacy become clear.
- ▶ Social marketing or a behavioural change component can then craft messages jointly that will inform, raise awareness, and create demand for specific nutrition dense foods.

Annex 2 Nutrition Sensitive Indicators

[Source: Compendium of indicators for nutrition-sensitive agriculture (2016), FAO]

Potential Nutrition Sensitive Agriculture Indicators

Type of measure	Indicators	What the indicator measures	Resources	Mode of collection
Diet – Individual level	<p>Minimum Dietary Diversity for Women of reproductive age (MDD-W)</p> <p>Minimum Dietary Diversity for young children (MDD age 6-23 months)</p>	A measure of dietary quality, which reflects overall nutrient adequacy and dietary diversity. It does not reflect adequacy of specific target nutrients.	<p>Minimum Dietary Diversity for Women: A Guide to measurement. (FAO/Family Health International (FHI) 360, 2016).¹⁰</p> <p>Indicators for assessing infant and young child feeding practices (WHO, 2008¹¹ and WHO, 2010¹²).</p>	Household survey (individual interview within household)
Food access – Household level	Food Insecurity Experience Scale (FIES)	Severity of food insecurity experience within a household. Can also be measured for individuals.	Description of the indicator available at the Voices of the Hungry website. ¹³	Household or individual su

Measurable outcomes for which various methods are available

Type of measure	Indicators	Resources	Mode of collection
On-farm availability, diversity, and safety of foods	Production of target nutrient-rich foods	There are various ways production of target nutrient-rich foods could be defined and measured, such as change in production volume, but no standard methodology.	Household survey or farm survey
	Diversity of crops and livestock produced	There is no standard method for measuring on-farm diversity for nutritional purposes. Three methods that have been used in the literature include: 1. simple count of species produced over the last 12 months (crops, plants and animals); 2. Shannon Index; ¹⁴ 3. Simpson Index. ¹⁵	
	Months of Adequate Household Food Provisioning (MAHFP)	There is a MAHFP indicator guide available from Bilinsky and Swindale, 2010.	
Food environment in markets	Availability and prices of targeted nutrient-rich foods in local markets	There are various methods for monitoring availability and prices of foods in markets but no standard methodology; see Table 7.4.	Market / Price information systems when they exist; or rapid market survey
Income	Income, disaggregated by gender, to reflect intra-household income control	There are various methods for constructing indicators to reflect household and individual incomes; see Table 7.5.	Household survey and/or enterprise records kept by project
Women's empowerment	Women's access and control over resources (e.g. land/property ownership)	There are various methods for constructing indicators to reflect these constructs, including time use surveys, qualitative inquiry, and some newer indexes; see Table 7.6 for detail.	Household survey and/or qualitative process
	Women's participation in economic activities (e.g. gender gap in crop/livestock sales)		

Type of measure	Indicators	Resources	Mode of collection
	Women's access to and control over benefits (e.g. agricultural income earned and controlled by women)		
Nutrition (and food safety) knowledge and norms	(Indicators will be project-specific)	There are guidelines available with questionnaires on knowledge, attitudes and practices related to most common nutrition topics (Fautsch Macías and Glasauer, 2014).	Household survey and/or qualitative process
Natural resource management practices	Access to improved drinking water source (see Table 7.9 for indicator definitions)	The WHO/UNICEF Joint Monitoring Programme has established a standard set of drinking-water and sanitation categories that are used for monitoring purposes.	Farm survey

Potential Indicators on Diet quality – Individual level

Indicator	What it measures	Population	Data collection	Data analysis	Notes
MDD-W (Minimum Dietary Diversity – women of reproductive age)	A measure of dietary quality, which reflects nutrient adequacy and dietary diversity	Women of reproductive age (15-49 years)	Data are collected on the foods and beverages consumed in the previous 24 hours which are aggregated into 10 distinct food groups. Does not require quantitative food intake.	Several indicators can be derived from the basic data, including (i) proportion of women who consume 5 or more food groups out of ten; (ii) mean dietary diversity score; (iii) proportion of women consuming any specific food group such as animal source foods.	<p>VALIDITY This indicator has been validated as an indicator of likelihood of micronutrient adequacy among women of reproductive age. There is a recent global consensus on this indicator as the best, most valid measure of women's dietary diversity; it replaces the WDDS (Women's Dietary Diversity Score) that had been previously developed by FAO and Food And Nutrition Technical Assistance project (FANTA). Unlike former measurements, it offers a threshold for women's micronutrient needs. Consortium of International Agricultural Research Centers (CGIAR) and USAID Feed the Future have mainstreamed the use of this indicator in their evaluations.</p> <p>CUTOFF (available) Women who consume foods from at least 5 out of 10 food groups have a higher likelihood of micronutrient adequacy.</p> <p>METHODOLOGY (standardized) Standardized methodology for data collection and analysis is available from FAO/FHI 360, 2016.</p>
Minimum Dietary Diversity – Young children	A measure of dietary quality, which reflects nutrient adequacy and dietary diversity	Children under 2 years	Same as above. The guidelines recommend open recall but Demographic	Proportion of children 6-23 months of age who receive foods from 4 or more food groups (of 7)	<p>VALIDITY Consumption of foods from at least 4 food groups out of 7 on the previous day would mean that, in most populations, the child had a high likelihood of consuming at least one animal-source food and at least one fruit or vegetable that day, in addition to a staple food (grain, root or tuber).</p>

Indicator	What it measures	Population	Data collection	Data analysis	Notes
	feeding practices		and Health Surveys (DHS) use a list	It is recommended that the indicator be further disaggregated and reported for the age groups: 6–11 months, 12–17 months and 18–23 months	<p>CUTOFF (available) The cutoff of at least 4 of the above 7 food groups above was selected because it is associated with better quality diets for both breastfed and non-breastfed children.</p> <p>METHODOLOGY (standardized) This indicator is a result of discussions by a large technical stakeholder group – WHO, UN Children's Fund (UNICEF), USAID, University of California (UC Davis), the International Food Policy Research Institute (IFPRI) – and has been published by WHO, 2008.</p>
Individual Dietary Diversity Score (IDDS)	A measure of dietary quality, which reflects nutrient adequacy and dietary diversity	Usually children over age 2 years	Consists of either an 8-question list (one for each food group), or a qualitative 24-hour food list (i.e. what was eaten by the child yesterday, without amounts)	Sum score – can calculate a mean or percentiles	<p>VALIDITY This indicator has not been validated as a measure of micronutrient adequacy, and it has been defined by FANTA. It has been used for children age 2-14 years, which is an age range that lacks a validated indicator of dietary diversity.</p> <p>CUTOFF No cutoff is defined in this indicator.</p> <p>METHODOLOGY This indicator is found in Swindale and Bilinsky, 2006.</p>
Unique Food Items/ Dietary variety	A proxy for dietary quality	Individual	Qualitative 24-hour food list (i.e. what was	Count of the unique food items consumed	<p>VALIDITY Validity of food variety as an indicator of nutrient adequacy has been assessed with a food frequency questionnaire for Western Mali (Torheim, et al. 2003).</p>

Indicator	What it measures	Population	Data collection	Data analysis	Notes
			consumed by the respondent yesterday, without amounts)		
Quantitative nutrient intakes	This is the most detailed measure when the primary concern is specific information on precise nutrient intakes	Individual	Quantitative 24-hour recalls (i.e. what was consumed by the respondent yesterday, using methodology to acquire amounts consumed), weighed food records or diaries (estimated food records)		<p>VALIDITY</p> <p>Quantitative 24-hour recalls: assess average usual intakes of a large population provided that the sample is truly representative and that the days of the week are adequately represented.</p> <p>Multiple replicate 24-hour recalls are needed to estimate usual intakes of individuals.</p> <p>Can be used with illiterate individuals.</p> <p>Weighed food records: assess actual and usual intakes of individuals, depending on number of measurement days. Accurate, time consuming and expensive. Requires literate participants.</p> <p>Estimated food records: assess actual and usual intake of individuals. Accuracy depends on the conscientiousness and ability of subjects to estimate quantities. Requires literate participants.</p> <p>CUTOFF</p> <p>Nutrient intakes can be compared to recommended daily intakes in order to derive information on:</p> <p>(i) mean nutrient intake of a group; (ii) percentage of population “at risk” of inadequate nutrient intake; (iii) ranking individuals by food or nutrient intake.</p> <p>METHODOLOGY</p> <p>Methodological guidance for measuring food</p>

Indicator	What it measures	Population	Data collection	Data analysis	Notes
					<p>consumption of individuals can be found in: Principles of Nutritional Assessment (second edition). Gibson (2005).</p> <p>A useful document on methodology for multi-pass 24-hour recalls, available from Gibson and Ferguson 2008.</p> <p>Note: this indicator is more time-intensive than others and requires significant training of enumerators to collect data and time/funds for data analysis</p> <p>Note: the Agriculture for Nutrition and Health (A4NH) programme managed by the CGIAR uses the indicator Dietary intake of selected micronutrients</p>
Consumption of 400g fruits and vegetables per day	Whether individuals are meeting the WHO recommendations for fruit and vegetable consumption	Individual	Quantitative 24-hour recalls, weighed food records or diaries (see methodologies above)	Sum the gram total of fruits and vegetables consumed in the previous day	<p>VALIDITY</p> <p>Using the techniques for measuring quantitative food intakes, this would be a valid indicator of its definition: whether an individual consumes the recommended amount of fruits and vegetables.</p> <p>METHODOLOGY</p> <p>See above for measuring quantitative food intakes</p>
Proportion of the diet consisting of processed/ultra-processed foods	Useful when chronic disease and obesity are concerns. A lower proportion may be associated with improved dietary quality	Individual	Quantitative food consumption surveys, either at household or individual level	This indicator has been constructed in terms of % calories from ultra-processed products	<p>VALIDITY</p> <p>Methods are experimental at this point.</p> <p>METHODOLOGY</p> <p>Guidelines on the collection of information on food processing through food consumption surveys (FAO, 2015). Note: this guide does not define an indicator.</p> <p>DEFINITIONS</p> <p>Monteiro et al. (2013) define “ultra-processed” foods as “food products manufactured from industrial ingredients resulting from the extraction, refinement</p>

Indicator	What it measures	Population	Data collection	Data analysis	Notes
	related to risk of chronic disease (Monteiro et al., 2013)				<p>and modification of constituents of raw foods with little or no whole food.”</p> <p>The International Agency for Research on Cancer (IARC) definition of “highly processed” foods: foods that have been industrially prepared, including those from bakeries and catering outlets, and which require no or minimal domestic preparation apart from heating and cooking (such as bread, breakfast cereals, cheese, commercial sauces, canned foods including jams, commercial cakes, biscuits and sauces).</p> <p>Moubarac et al. (2014) define four categories of processing: i) unprocessed and minimally processed foods; ii) processed culinary ingredients; iii) processed foods; and iv) ultra-processed food and drink products.</p>

Indicator	What it measures	Population	Data collection	Data analysis	Notes
Vitamin A-rich food consumption	Useful when vitamin A-rich foods are targeted and/or when vitamin A intake is of primary concern	Individual	At a household or individual level, requires a household survey	Many kinds of indicators could be used or created as appropriate to the specific intervention. Examples include (i) number of vitamin A-rich foods consumed at least once over a specified period; (ii) mean frequency of consumption of vitamin A-rich foods over a specified period	<p>METHODOLOGY</p> <p>Depending on the indicator selected, data could be gathered using 24-hour qualitative recall methodology or a food frequency questionnaire. These are quicker alternatives compared to quantitative intakes from a quantitative 24-hour recall (see above Quantitative nutrient intakes).</p> <p>One food frequency method: the Helen Keller International (HKI) Food Frequency Method generates information about the availability, accessibility, preparation and seasonality of foods. It creates scores combining food groups of yellow/orange flesh fruits or vegetables, dark leafy green vegetables, in order to provide information on frequency of consumption of vitamin A-rich foods as well as information on feeding practices. It may underestimate vitamin A intake for young children consuming breastmilk and other milk. A tool is available online.</p> <p>DEFINITION</p> <p>The Codex Alimentarius Guidelines provide thresholds for considering a food as a “source” or a “high source” of different nutrients, based on the percent of the Nutrient Reference Value (NRV) provided by the food. A food must provide 15% of NRV per 100 grams to be considered a “source” of the nutrient. A food must provide double the “source” threshold, i.e. 30% of NRV per 100 grams, to be considered a “high source” of the nutrient.</p>

Indicator	What it measures	Population	Data collection	Data analysis	Notes
Iron-rich food consumption	Useful when iron-rich foods are targeted and/or when iron intake is of primary concern	Individual	At household or individual level, requires a household survey	There could be many indicators to measure this concept. One is specifically designed for young children: “proportion of children 6–23 months of age who receive an iron-rich food or iron-fortified food that is specially designed for infants and young children, or that is fortified in the home.”	<p>METHODOLOGY Depending on the indicator selected, data could be gathered using 24- hour qualitative recall methodology or a food frequency questionnaire. These are quicker alternatives compared to quantitative intakes from a quantitative 24-hour recall (see above “quantitative nutrient intakes”).</p> <p>DEFINITION The Codex Alimentarius Guidelines^{29,30} provide thresholds for considering a food as a “source” or a “high source” of different nutrients, based on the percent of the Nutrient Reference Value (NRV) provided by the food. A food must provide 15% of NRV per 100 grams to be considered a “source” of the nutrient. A food must provide double the “source” threshold, i.e. 30% of NRV per 100 grams, to be considered a “high source” of the nutrient.</p>
Protein-rich food consumption	Useful when protein-rich foods are targeted and/or when iron intake is of primary concern	Individual	At household or individual level, requires a household survey	There could be many indicators to measure this concept. One is specifically designed for young children: “proportion of children 6–23 months of age who receive an	<p>METHODOLOGY Depending on the indicator selected, data could be gathered using 24- hour qualitative recall methodology or a food frequency questionnaire. These are quicker alternatives compared to quantitative intakes from a quantitative 24-hour recall (see above “quantitative nutrient intakes”).</p> <p>DEFINITION The Codex Alimentarius Guidelines^{29,30} provide thresholds for considering a food as a “source” or a</p>

Indicator	What it measures	Population	Data collection	Data analysis	Notes
				protein-rich food that is specially designed for infants and young children”	“high source” of different nutrients, based on the percent of the Nutrient Reference Value (NRV) provided by the food. A food must provide 15% of NRV per 100 grams to be considered a “source” of the nutrient. A food must provide double the “source” threshold, i.e. 30% of NRV per 100 grams, to be considered a “high source” of the nutrient.
Consumption of specific target foods	Useful to track whether individuals are consuming foods promoted by an intervention, or regardless of an intervention	Individual	At household or individual level, requires a household survey		<p>METHODOLOGY Depending on the indicator selected, data could be gathered using 24-hours qualitative recall methodology or a food frequency questionnaire.</p> <p>DEFINITIONS Feed the Future (FTF) Indicator Handbook** has defined three examples of this kind of indicator.²⁸ Many others could be created that are appropriate to the specific scope and desired outcomes of an intervention.</p> <p>Examples include (i) if any of the specific food was consumed over a specified period (e.g. 1 day, 1 week); (ii) how frequently the specific food was consumed over a specified period (e.g. through a food frequency questionnaire); (iii) how much of the specific food was consumed over a specified period (quantitative intake in grams); (iv) diversity of consumption of foods within a food group over a specified time period (e.g. diversity of fruits and vegetables consumed).</p>

Potential Indicators on Diet quality – Food access (Household level)

Indicator	What it measures	Population	Data collection	Data analysis	Notes
Food Insecurity Experience Scale (FIES)	Severity of food insecurity experience	Household or individual	8 question survey module	Thresholds set on the score to classify the severity status of respondents	<p>VALIDITY</p> <p>The FIES has been collected in over 145 countries since 2014 in the Gallup World Poll. Each country dataset has been validated with the Rasch model (Item Response Theory), demonstrating that the scale is capturing the latent trait of food insecurity (access dimension). Statistical techniques have been developed to equate country results against a global standard that allows comparison across all countries. The global data reveal that the FIES shows significant and high correlations in the expected direction with most accepted indicators of development, including child mortality, stunting, poverty measures and the Gini index.</p> <p>METHODOLOGY (standardized)</p> <p>Description of indicators available at the Voices of the Hungry website</p>
Household Dietary Diversity Score (HDDS)	Household access to and consumption of a variety of foods	Household	Consists of a simple count of the different food groups that a household or an individual has consumed over the preceding 24 hours. Data	Foods consumed at household level aggregated into twelve food groups. Mean score.	<p>VALIDITY</p> <p>The Household Dietary Diversity (HDD) indicator has not yet been tested for its performance in predicting micronutrient adequacy and should therefore not be used as an indicator of dietary quality at the household level, although it can be a useful indicator of food access. It excludes food eaten outside the home so information may be missed.</p> <p>CUTOFF (not available)</p> <p>There is no established number of food groups to indicate adequate or inadequate DD for the HDDS. However, for a project with interventions to improve</p>

Indicator	What it measures	Population	Data collection	Data analysis	Notes
			are collected on the foods and beverages consumed in the previous 24 hours to ascertain if anyone in the household consumed any item from different food groups.		<p>food access and household food security, the mean HDDS of the wealthiest tercile (one-third) could be used to set the HDDS target.</p> <p>METHODOLOGY (standardized) Guidelines for measuring household and individual dietary diversity (FAO, 2012a).³² Note that in this publication, the HDDS methodology was adapted from Swindale and Bilinsky (2006); and the WDDS described in it is now replaced by the new MDD-W indicator – see above. In short: use this publication for household dietary diversity. Use MDD-W for women's dietary diversity.</p>
Food Consumption Score (FCS)	Household access to consumption of diverse food; weighted by nutrient density	Household	Information about frequency of consumption (in days) by a household over a recall period of the past seven days is collected from a country-specific list of food groups	The score is calculated using the frequency of consumption of different food groups consumed by a household during the 7 days before the survey	<p>VALIDITY The FCS has been validated against per capita calorie consumption within the household and several alternative indicators of household food security (percentage expenditures on food, asset and wealth indices). The food consumption score is being used widely by WFP in their surveillance activities.</p> <p>THRESHOLDS (available) The thresholds for the Food Consumption Groups (FCGs) should be determined based on the frequency of the scores and the knowledge of the consumption behaviour in that country/region. The typical thresholds are: 0-21 Poor; 21.5-35 Borderline; > 35 Acceptable.</p> <p>METHODOLOGY (standardized) Technical Guidance Sheet - Food Consumption</p>

Indicator	What it measures	Population	Data collection	Data analysis	Notes
					Analysis: Calculation and Use of the Food Consumption Score in Food Security Analysis (WFP-VAM, 2008).
Household Food Insecurity Access Scale (HFIAS)	Severity of food insecurity experience, requiring local adaptation	Household	9 questions in 4 domains, survey module	Responses may be categorized into 4 levels, or summed into a score ranging from 0-27	<p>VALIDITY This indicator must be adapted to the local situation. It may not be valid without adaptation.</p> <p>METHODOLOGY Coates, Swindale and Bilinsky, 2007 available online.</p>
Escala Latino-americana y Caribeña de Seguridad Alimentaria (ELCSA)	Severity of food insecurity experience, cross-culturally valid in Latin America and the Caribbean	Household	15 questions in 4 domains, survey module (8 questions refer to adults, 7 refer to children)	Responses may be categorized into 4 levels, or summed into a score ranging from 0 to 15	<p>VALIDITY The ELCSA was developed taking into account previously validated food insecurity assessment scales at household level (US Household Food Security Supplement Module, Escala Brasileña de Inseguridad Alimentaria (EBIA), among others).</p> <p>CUTOFF (available) Different cutoff points referring to the level of food insecurity.</p> <p>METHODOLOGY (standardized) Manual by FAO (2012b) available online.</p>
Household Hunger Scale (HHS)	Cross-culturally valid measure of the severity of food insecurity experience	Household	3-question survey module	Thresholds set on the score (ranging from 0-6) to classify the severity status of respondents	<p>VALIDITY This indicator is a cross-culturally valid indicator of hunger and has demonstrated the potential for both internal and external validity, with strong relationship with household income and wealth scores. It is most sensitive to severe food insecurity (hunger), and is less useful in situations of moderate or mild food insecurity.</p> <p>CUTOFF (available)</p>

Indicator	What it measures	Population	Data collection	Data analysis	Notes
					<p>Different cutoff points refer to the level of food insecurity.</p> <p>METHODOLOGY (standardized)</p> <p>Household Hunger Scale: Indicator Definition and Measurement Guide. Ballard et al. (2011).</p> <p>NOTES ON USE</p> <p>The HHS is being used by USAID Feed the Future projects.</p>
Coping Strategies Index (CSI)	Severity of food insecurity experience, requiring local adaptation. Used to identify vulnerable households and estimate long-term changes in food security	Household	A locally-adapted list of coping strategies and their severity weightings, is obtained through focus group discussions		<p>VALIDITY</p> <p>Not clearly demonstrated across contexts, but useful for understanding how people respond to lack of food.</p> <p>METHODOLOGY (standardized)</p> <p>Manual by WFP-VAM (2008)³⁷ available online.</p> <p>NOTES ON USE</p> <p>The CSI has been used by the World Food Programme (WFP), CARE International and other NGOs.</p>
Months of Adequate Household Food Provisioning (MAHFP)	Measures perceived household food adequacy throughout the past year and reflects the seasonality aspect of food	Household		Sum total of number of months in the past year the household had inadequate food	<p>VALIDITY</p> <p>Not clearly demonstrated across contexts, but useful for understanding seasonality of food security.</p> <p>CUTOFF</p> <p>No cutoff is available but targets could be established based on the months of adequate food provisioning of the top tercile (one-third) of the households or the average months of adequate food provisioning of the richest income tercile.</p>

Indicator	What it measures	Population	Data collection	Data analysis	Notes
	security				<p>METHODOLOGY (standardized) Available from Bilinsky and Swindale (2010)</p> <p>NOTES ON USE It has been incorporated as a standard impact indicator in all Africare's food security programs.</p>

Potential Indicators on Diet quality – On-farm availability, diversity and safety of food

Indicator	What it measures	Population	Data collection	Data analysis	Notes
Availability of specific foods on-farm	Useful to track whether specific foods of interest are available, such as those promoted by an intervention	Household or community	Household survey or observation		There are various ways this indicator could be defined, such as “availability of micronutrient-rich target foods on farms: Increased / decreased production in volume, across seasons and % compared to without project”. USAID uses the indicator “total quantity of targeted nutrient-rich value chain commodities set aside for home consumption by direct beneficiary producer households,” found in FTF, 2016.
Diversity of foods produced on-farm	A measure of availability of diverse nutritious foods	Household or community	Household survey or observation		METHODOLOGY There is no standard or validated method for measuring on-farm diversity for nutritional purposes. Three methods that have been used in the literature include: . simple count of species produced over the last 12 months (crops, plants and animals); . Shannon Index; . Simpson Index.
Functional diversity index	A measure of availability of diverse nutritious foods	Household or community	Household survey and observation	See Remans et al. 2011	METHODOLOGY Assessing Nutritional Diversity of Cropping Systems in African Villages. Remans et al. (2011).
Proportion of staple crop production that is biofortified	A proxy for micronutrient density of staple crops produced on farm	Household or community	Household or community survey		This is not a standard validated measure but could be used in projects that seek to increase micronutrient intake via bio-fortified crop production.
Implementation of good	Safety of agricultural	Household or	Farmer surveys or		Indicators will be project specific. Specific practices that improve safety of food production will depend on

Indicator	What it measures	Population	Data collection	Data analysis	Notes
agricultural practices	production targeted by project (Chemical contaminants can be present in food and feed as a result of the use of agrochemicals, such as residues of pesticides and veterinary drugs, contamination from environmental sources (water, air or soil pollution), cross-contamination or formation during food processing and natural toxins)	community	observation to capture KAPs (Knowledge Attitudes and Practices)		the nature of the production systems. These practices could be related for example to pesticide or veterinary drugs use; value chain specific cultivation practices; storage practices on farm; other hygiene practices (washing of agricultural products). If there is set of legislated standard practices, an example of indicator could be: % of compliance of primary producers to practices; increase of % of primary producers certified.
Grain loss (Some of the methods developed for grains could	Post-harvest loss	Community, farm and field levels			No uniform concepts, definitions and measurement techniques have been used in different studies estimating losses. This review of methods available for estimating grain loss covers techniques to estimate losses during

Indicator	What it measures	Population	Data collection	Data analysis	Notes
potentially be applied to other crops, and/or new crop-specific methods could be developed)					<p>harvesting, stacking, threshing/ shelling, cleaning, drying, storage, transport, processing, packaging and/or due to insects, molds and pests.</p> <p>More information is available from the Global Strategy to improve Agricultural and Rural Statistics (GSARS)</p>

Potential Indicators on Diet quality – Food environment in markets

Indicator	What it measures	Population	Data collection	Data analysis	Notes
Availability of specific foods in markets	Useful to track whether specific foods of interest are available, such as those promoted by an intervention	Market	Market / Price information systems when they exist; rapid market survey if not, at a point in time or over seasons/ Surveys of actors along the value chain		<p>METHODOLOGY (not standardized)</p> <p>There are various ways this indicator could be defined, such as “availability in markets of foods promoted by investment (volume/ across seasons)”.</p> <p>Note: depending on the intervention activities, it may be appropriate to add indicators relevant to agricultural processes to increase availability of nutrient-rich foods: e.g. Reduced post-harvest losses of nutrient-rich foods; implementation of processing techniques that retain nutritional value.</p>
Prices of specific foods in markets	Useful to track whether specific foods of interest are affordable, such as those promoted by an intervention.	Market	Market / Price information systems when they exist; rapid market survey if not, at a point in time or over seasons.		There are various ways this indicator could be defined, such as “prices of foods promoted by investment in project areas compared to areas without project”.
Food prices	Useful to track whether a basket of foods is affordable.	Market	Market / Price information systems		Often the price of a basic food basket is tracked, typically not based on nutritious diets. Prices of staple grains are often monitored by FAO and

Indicator	What it measures	Population	Data collection	Data analysis	Notes
			when they exist; rapid market survey if not, at a point in time or over seasons.		WFP-VAM.
Cost of a healthy diet	The minimum cost of a diet meeting minimum requirements of nutrients or food-based dietary guidelines.	Community	Methodology is not standardized. Sample methodology is published by Save the Children (see notes).	Linear programming	Save the Children piloted an approach “to quantify the extent to which households could afford to feed their children under the age of 2 and a whole family of 5 people, with a diet meeting minimum requirements of macro and micronutrients.” Additional resources are published by USAID.
Functional diversity index	A measure of access to diverse nutritious foods.	Household or community		See Remans et al. 2011	Indicator description can be found in Remans et al. (2011)
Indicators of food safety within the food environment *		Market	Sample collection at market level		Specific indicators are not well defined, but could include: - % reduction of chemical or microbiological contaminants in products offered to consumers at retail - % compliance of product with national regulations for a specific product Sampling guidance tools are available online. Note: Representative samples might be very costly and important variations might occur between places/timing for sampling.

Indicator	What it measures	Population	Data collection	Data analysis	Notes
Food loss in the supply chain	The amount of decrease in safe and nutritious food mass available for human consumption in the different segments of a specific supply chain.	Supply chain	Survey of producers, processors or handlers/sellers and other knowledgeable persons of the supply chain being assessed, complemented with ample and accurate observations and measurements and a literature review.	Results include qualitative and quantitative elements.	Specific indicators are not well defined, but some techniques are available for estimating food loss along the supply chain: Global Initiative on Food Loss and Waste Reduction (SAVE FOOD) field case study methodology.

*Implementation of good hygiene practices in food production can play a large role in food safety. Specific indicators are not well defined and would depend on project context and interventions. The methodology could include surveys of actors along the value chain. Additional resources can be found online:

FAO food safety and quality website.

Recommended International Code Of Practice - General Principles Of Food Hygiene.

Codex Alimentarius standards, guidelines and advisory texts.

Potential Indicators on Diet quality – Income

Indicator	What it measures	Population	Data collection	Data analysis	Notes
Wealth indices / poverty levels	Wealth / socioeconomic status, a proxy for income.	Household	Various methodologies exist (see notes), all of which are based on a household survey		The DHS contains a wealth index. Poverty rates are usually monitored by Governments. A gender-sensitive indicator guide is available online.
Sales of agricultural products	Value of incremental sales (collected at farm-level) attributed to project implementation.	Household	Household survey and/or Enterprise records		USAID uses the indicator “value of incremental sales (collected at farm-level), attributed to Feed the Future implementation” found in FTF, 2016.
Income or consumption	Purchasing power of farm household or consumption of food items	Household	Household survey and/or Enterprise records. A detailed household consumption survey would typically not be undertaken by a single project, but is rather part of		There are various ways this indicator could be defined* The majority of investment projects in agriculture, rural development and value chain expect to increase incomes and aim to demonstrate these at design stage by undertaking an Economic and Financial Analysis (EFA) of the project based on crop budgets, farm models and enterprise models. The EFA guidelines under development by IFAD (with contribution by the FAO Investment Center) can be used as a reference when finalized. The first volume (basic concepts and rationale) is already available online. ⁵⁴ In 2016, two more volumes should be published, the last one comprising a series of case studies, including one on nutrition-sensitive agriculture investment. Such projected increased incomes should

Indicator	What it measures	Population	Data collection	Data analysis	Notes
			Household Consumption and Expenditure Surveys administered periodically in most countries (including Living Standards and Measurement Studies (LSMS), Household Budget Surveys (HBS), etc.).		then be monitored during project implementation.
Household asset index	The sets of key assets within the household	Household	Household asset lists can be gathered as part of a household survey.	The set of key assets can change from one rural context to another; the final composition of the asset list should reflect distinct	The assumption underlying this indicator is that households with a greater investment in key consumer durables are more economically secure, i.e. they have access to more income. An asset index is part of a review published by the Livelihood Monitoring Unit (LMU) Rural Livelihoods Program CARE Bangladesh, Measuring Livelihood Impacts: A Review of Livelihoods Indicators

Indicator	What it measures	Population	Data collection	Data analysis	Notes
				<p>consumer preferences. Once the list is compiled, a monetary unit values is attributed to each of the assets, then the index is calculated as the total value of all assets owned by the household.</p>	

Potential Indicators on Diet quality – Nutrition and Food Safety knowledge and norms

Indicator	What it measures	Population	Data collection	Data analysis	Notes
Indicator of nutrition and food safety-related knowledge – to be specified according to intervention	Nutrition and food safety-related knowledge and attitudes (KAP) at the community level	Usually women	Household survey and/or qualitative process		<p>These indicators will be project-specific, depending on what sort of knowledge or behaviour is promoted.</p> <p>VALIDITY Knowledge and attitudes do not refer to physical objects but to psychosocial and subjective concepts. It is therefore not possible to validate the results concerning knowledge and attitudes in KAP surveys because no objective benchmark or reference exists.</p> <p>METHODOLOGY (standardized) FAO Guidelines for assessing nutrition-related Knowledge, Attitudes and Practices (2014)¹⁷ comprise predefined questionnaires that capture information on critical knowledge, attitudes and practices related to most common nutrition topics. Note: if agricultural knowledge (e.g. knowledge of improved practices) is sometimes assessed in projects, relevant nutritional knowledge could be added.</p>
Changes in specific behaviours promoted with regard to food safety	Awareness about safety at household (consumers') level	Households or community	Household survey and/or qualitative process		Indicators would be intervention-specific. They could also be built around the concept of the WHO 5 keys for safer foods.

Nutrition Sensitive Agriculture Indicators- Kitchen Garden Programme (KG)

Proxy indicator	Baseline	Investment (output)	Target	Verification Source
Frequency of consumption of specific nutrient dense food items (<i>demand creation/utilization</i>)	No baseline available	A demand creation package will be designed and promoted for nutrient-dense foods (e.g. adapt Harvest Plus model)	Percentage of households that now grow and consume 3 x YY days /week fresh nutrition dense foods and or livestock products during the lean/hungry season	Food frequency survey/ Household Dietary Diversity Score baseline-mid-term and end line surveys
Increased productivity in home garden crops and livestock (availability/stability)	Current crop cycle management system	A low input nutrient enhancement package will be designed and promoted.	The number of new or improved gardens that include:	Crop productivity score (production/pot harvest) baseline-mid-term and end line surveys
Increased diversity of crops and livestock	Current home lot crops and livestock	Low input traditional crops that are nutrient dense will be promoted. Planting materials will be made available	<i>Vegetables/seasonal crops.</i> At least one micronutrient dense crop from a and from b: (a) green leafy - cassava, sweet potato, dodo, pumpkin tips, etc. and (b) orange flesh-pumpkin, orange sweet potato, passion fruit, etc.	
		Low input tree crops that are nutrient dense will be promoted. Planting materials will be made available	<i>Trees:</i> At least one tree each year- Ex. Avocado, guava, citrus, papaya, drumstick (moringa)	Crop productivity score (production/pot harvest) baseline-mid-term and end line surveys
			<i>Small livestock:</i> number that continuously produces milk or eggs	Livestock survey
Increased number of months of available micronutrient dense food (<i>availability/stability</i>)	Current months of supply of nutrient dense crops from home gardens	Promote availability of micronutrient dense foods and or livestock products during the lean/hungry season	At least % of targeted HH will increase the number of weeks available by %.	MAHFP Survey baseline-mid-term and end line surveys

Annex 3 Example of Nutrient Sensitive Agriculture within a Value Chain Framework

Nutrient Sensitive Value Added Agriculture (e.g. beans)

Key Steps	Planting Material (HH)	Crop Management (HH)	Post-Harvest (HH)	Local market
<p><u>NSA Program Approach</u></p> <p>(Including Information Communication Technologies (ICTs) and Behavioural Change Communication (BCC) for each intervention)</p>	<ul style="list-style-type: none"> Promote diversity in bean planting material. Bio fortified and traditional Home seed test before planting. Promote use of inoculum before planting. 	<ul style="list-style-type: none"> <i>Diversity.</i> Plant a mixture of beans in one plot. <i>Intensification.</i> Promote mixed cropping with other non-bean crops. <i>Food safety.</i> Use of bio-safe pesticide. <i>Agronomic bio fortification.</i> Use on- farm crop and livestock by-products to improve soil fertility/crop yields. 	<ul style="list-style-type: none"> <i>Food safety.</i> Build on existing practices to retain nutrient and market value i.e. <ul style="list-style-type: none"> harvest timing transport from field to home sorting grading storage 	<ul style="list-style-type: none"> Consumption of bean leaves and seeds. Create consumption demand by working with value chain actors on <ul style="list-style-type: none"> <i>quality</i> <i>quantity</i> <i>market timing</i>
<p><u>NSA Policy</u></p> <p>Market based incentives within a value chain framework</p>	<ul style="list-style-type: none"> Promoting certified seeds (if profitable) Home level testing for viability of saved seed 	<ul style="list-style-type: none"> Sustainable application of on-farm resources using small plot based technology to enhance productivity (Agronomic biofortification) Climate Smart 	<ul style="list-style-type: none"> Low capital input and incremental to retain nutrient and market value. Food safety. Prevention of mould attack. Prevention in the use of pesticide infested beans to prevent health risks. 	<ul style="list-style-type: none"> Promotion of bean seeds and leaves as essential in daily diet. Food safety to retain nutrient quality

Annex 4 Nutrient Dense Trees (hybrid varieties are more suitable):

1. Sapodilla or sapota (chikoo) - rich in iron, vitamin C, dietary fiber
2. Moringa – rich in calcium, iron, carotene, antioxidants, dietary fiber etc.,
3. Pomegranate – rich in phytochemicals, potassium, dietary fiber and vitamin C
4. Guavas – rich in antioxidants, vitamin C and carotenoids (in red variety)
5. Papaya – carotenoids, vitamin C, folate, dietary fiber
6. Amla – vitamin C, antioxidants (phenolic compounds)
7. Fig tree – antioxidants, iron rich
8. Mango - carotenoids, vitamin C

Annex 5 Indigenous Fruit Trees in Rwanda [identified in Bugasera, Kirehe & Nyamagabae]

Scientific name	Local name
<i>Ximenia caffra</i> (Sond.)	Amasasa
<i>Ancylobotrys amoenia</i> (Hua)	Amakamire
<i>Parinari curatellifolia</i> (Planch. ex Benth.)	Amanazi
<i>Sytrychnos</i> sp.	Amahonnyo
<i>Garcinia buchananii</i> (Baker)	Amasarasi
<i>Lanea schimperi</i> (Hochst. ex A. Rich.)	Imimuna
<i>Pappea capensis</i> (Eckl. & Zeyh.)	Imimena
<i>Carissa edulis</i> (Forssk.) Vahl	Iminyonza
<i>Anona senegalensis</i> (Pers.)	Imisharamariya
<i>Dovyalis macrocalyx</i> (Oliv.) Warb.)	Imitegengeri
<i>Myrianthus holstii</i> (Engl.)	Imyufe
<i>Acokanthera schimperi</i> (A. DC.) Schweinf.)	Umusagwe
<i>Haplocoelum foliolosum</i> (Hiern) Bullock	Imijwiri

Annex 6 Dietary Goals for Smallholder Farmers

DIETARY GOALS

1. Maintain a state of positive health and optimal performance in the family at large by helping the family members to maintain ideal body weight.
2. Ensure adequate nutritional status for pregnant women and lactating mothers by eating a balanced diet of food from both plant and animal sources.
3. Improvement of birth weights and promotion of growth of infants, children and adolescents to achieve their full genetic potential by encouraging families to consume seasonal fruits and vegetables.
4. Achievement of adequacy in all nutrients and prevention of deficiency diseases throughout lifespan for all members of the family.
6. Maintenance of the health of the elderly and increasing the life expectancy.

Annex 7 Dietary Guidelines for Smallholder Farmers

Right nutritional behaviour and dietary choices are needed to achieve dietary goals. The following 13 dietary guidelines provide a broad framework for appropriate action:

1. Ensure to grow diverse foods that can be consumed at household and also be used for sales when in excess.
2. Avoid eating monotonous food but eat variety of foods to ensure a balanced diet. Adopt right pre-cooking processes and appropriate cooking methods. Do not overcook foods. You may lose some nutrients.
3. Ensure that food is available for consumption at least three times a day. Keep harvested fruits and vegetables within sight of family members. Example: boiled orange flesh sweet potatoes, plantain would be a good breakfast idea.
4. Ensure provision of double portion of food (mother 1+ baby 1 = 2 portions) and healthcare to pregnant women and extra food for lactating women.
5. Promote exclusive breastfeeding for six months and encourage breastfeeding till two years or as long as one can.
6. Feed home based semi solid foods in the form of mashed bananas, cooked & mashed vegetables – potatoes/ carrots/ green leafy vegetables etc., to the infant after six months, in addition to the continuation of breastfeeding.
7. Ensure adequate and appropriate diets for children and adolescents, both in health and sickness.
8. Eat plenty of seasonal vegetables and fruits. They are rich in their flavour and taste; available at its peak and the price is more affordable. Women aged 19-30 should consume 2 cups (1 cup = 150g) of fruit each day and women over the age of 31 should consume 1 ½ cups of fruit daily. Men aged 19 years and older should consume 2 cups of fruit daily.
9. Ensure moderate use of edible oils and consume animal foods once a week. Encourage children to take 1 boiled egg per day
10. Restrict salt intake to minimum.
11. Wash foods thoroughly to ensure the use of safe and clean foods. Keep cooked foods always covered.
12. Drink plenty of water and take soda and alcoholic beverages in moderation.
13. Include micronutrient-rich foods (green leafy vegetables, carrots, beetroots etc.,) in the diets of elderly people to enable them to be fit and active.

Annex 8 “5-STEPS” of NAS Approach Targeting Smallholder Farmers

STEP 1: ASSESSMENT OF THE NUTRITIONAL MILIEU IN THE AREA

- a) identification of nutritional gap of the target population (iron, vitamin A, calories, vitamin C etc.,) based on the nutrition report
- b) identification of seasonal varieties of food crops and their nutritional content
- c) Identification of local varieties and their contribution to nutritional gaps
- d) Identification of gender roles and responsibilities at household level.
- e) Identification of WASH challenges

STEP 2: SELECT PRIORITY CROPS BASED ON THE EXISTING NUTRITIONAL SCENARIO

- a) Identification of crops to fill nutritional gaps based on seasonality
- b) Identification of crops that are economically viable based on seasonality
- c) identification of appropriate biofortified crops or improved breeds to fill nutritional gaps

STEP3: ASSESSMENT OF CROP OPTIONS FOR NUTRITIONAL CHANGE

- a) Assess if selected crops will fill the nutritional gaps, then, value chain approach should be adopted and determine the loss of nutrients along the value chain. Promote nutrition education to maintain nutritional value along the value chain.
- b) Assess if selected crops will fill the economic gap rather than nutritional gap that can enable small holder farmers to earn revenue, then marketing of such foods should be encouraged. The revenue earned can be used in purchasing foods that are diverse and consumed by the family. this can be done through BCC strategy.
- c) Households to be trained in home scale food preservation and processing for lean period / dry season. Household storage of food should be encouraged through training

STEP4: PLAN FOR APPROPRIATE AGRICULTURAL & NON AGRICULTURAL INTERVENTIONS

- a) For crops that fill nutritional gaps appropriate agricultural interventions are to be taken to strengthen the inputs (example - hybrid varieties of seeds / breeds of small ruminants, disease resistant / drought resistant seeds, biofortified crops etc., supply of fertilizers,)
- b) For crops that cannot fill the nutritional gap, but can fill the economic gap, encourage through appropriate trainings, the need to diversify food consumption for nutrition. Through BCC the importance of nutrition can be emphasized.
- c) Intercropping, off season production, kitchen gardens, rearing of chickens, rearing small ruminants, apiary etc., can all be planned.
- d) Work with RAB and University scientists to research biofortification on staple food crops.
- e) Introduction of labour saving devices (example - pressure cooker works well even on charcoal stove)
- f) Households to be trained on WASH

STEP5: PLAN FOR APPROPRIATE HARMONIZING INTERVENTION

- a) Increase the role of women in kitchen gardens, farm production, control of food / revenue resources
- b) Improve access to cash through piggy bank (household savings), community saving schemes etc.,

- c) Improve access to community safety nets
- d) Support off farm revenue generation examples: tailoring, boutique, masonry etc.,

Annex 9 Food Quality Safety & Hygiene

Food safety refers to the assurance that food will not cause harm to the consumer when it is prepared and/or eaten according to its intended use. Safe food is free from hazards – i.e. any biological, chemical or physical agent in food with the potential to cause an adverse health effect.

Food contaminated with biological, chemical or physical hazards, including harmful pathogens, natural toxins and chemicals can contribute to undernutrition and cause adverse health effects. Most of the burden of food-borne disease is associated with fresh animal-source food and vegetables. Detection and elimination of these food-borne risks is complex and challenging; as international connectivity of food markets increases, supply chains lengthen and the number of actors in the food system grows. Increased food trade may also introduce new safety hazards, reintroduce previously controlled risks and spread contaminated food widely. Food quality, hygiene and safety standards are therefore systematic preventive approaches to food safety that aim to protect public health and improve accessibility of nutritious and safe foods in ways that address modern food environments.

Risks related to food safety and hygiene need to be controlled all along the food supply chain, from production to processing, trade, preparation and consumption. A risk-based approach allows for better resource allocation, which is particularly important in poorer countries.

Risks can be controlled at various points of the supply chain. They include: through reduction of pesticide use in cultivation and antibiotics in animal production; prevention of harvest contamination by animals; implementation of basic sanitation; air circulation and humidity controls in storage and processing facilities; aflatoxin control; improved hygiene and safety practices of street food vendors; and delivery of messages to households on hand-washing and safe food handling and preparation.

Simple innovations such as food grade containers or chlorinated water can result in substantial improvements to food safety and quality, even in low technology sectors such as the informal food sector. The uptake of appropriate technology should be encouraged.

Where the informal sector predominates, it is advisable to “professionalize” them through appropriate trainings. Combining capacity development of the informal sector with incentives to further motivate behavior change has proven an effective approach to advancing food safety in many developing countries.

Annex 10 References

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