Food and Agriculture Organization
of the United Nations

MAXIMIZING NUTRITION
IN CROP PRODUCTION

A GUIDANCE NOTE ON IMPACT PATHWAYS FOR MAINSTREAMING NUTRITION BASED ON A CASE STUDY FROM GHANA

World Vision

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Abbreviations and acronyms

AFS	Agriculture and food supply
CAADP	Comprehensive Africa Agriculture Development Programme
CFS	Committee on World Food Security
CSIR	Council for Scientific and Industrial Research
FAO	Food and Agriculture Organization of the United Nations
FBO	Faith-based organization
FFS	Farmer field school
GAP	Good agricultural practice
GSS	Ghana Statistical Service
HHS	Household hunger scale
HLPE	High-Level Panel of Experts on Food Security and Nutrition
IFPRI	International Food Policy Research Institute
IPM	Integrated pest management
MFI	Microfinance institution
MoFA	Ministry of Food and Agriculture
NEPAD	New Partnership for Africa's Development
SBCC	Social and behaviour change communication
SDG	Sustainable Development Goal
TOC	Theory of change
WV	World Vision

Executive summary

Ghana's agricultural sector accounts for 19.7 percent of its Gross domestic product and over 30 percent of export earnings, and it is the largest employer (36 percent) of a population of 31 million people (Ghana Statistical Service, 2019). The crop production sector's GDP growth rate stands at 0.8 percent and is dominated by arable and tree crop farming. Nearly eight in every ten of the 11 million people living in agricultural households cultivate arable crops for subsistence and sustenance. The domestic vegetable market, for instance, is growing at 10 percent per year. The sector plays a vital role in income generation, foreign exchange earnings, employment and food security for over 70 percent of people (Ghana Statistical Service [GSS] & Ministry of Food and Agriculture, 2017/2018).

Increasingly, consumers in Ghana are demanding more high quality fresh produce as a result of the emergence of a large middle class). The most consumed vegetables and fruits domestically include tomatoes, peppers, onions, pineapples, bananas and mangoes. The potential value of vegetable exports is estimated at USD 50 million and the current export value stands at USD 8 million. The potential contribution of the crops subsector makes it an important entry point for mainstreaming nutrition interventions. (GSS, 2019)

Despite the significant role of the crop production sector, limited attention has been given to maximising its potential to address food insecurity and malnutrition. Though Ghana's national agricultural and food security investment plan includes nutrition goals, it lacks the concrete action plan needed to address nutrition (New Partnership for Africa's Development [NEPAD], 2015).

It is in view of this that FAO, in collaboration with World Vision, has produced this guidance note on mainstreaming nutrition into the crop production sector using a food systems approach. Such an approach aims at ensuring that future interventions in the crop food system are able to deliver food security and nutrition by taking into account economic, social and environmental barriers and opportunities. This guidance note is expected to help inform both national level policymakers and key participants in the food system on the issues and opportunities relating to Ghana's fruit and vegetable value chain, with particular focus on smallholder households. It presents impact pathways based on theories of change (TOCs) that could be used as entry points for transformative interventions across the country's food systems.

The key questions addressed include, but are not limited to:

- What is the prevalence of malnutrition?
- What are the basic causes of malnutrition?
- What are the underlying causes of malnutrition?
- What food-related factors influence diets?
- What are the food consumption patterns and the main dietary problems or gaps?
- How can the crop sector contribute to healthy diets and prevent malnutrition?
- How is the crop sector organised in the framework of the food system?
- Which are the most vulnerable groups within the crop sector? What are the drivers of malnutrition and/ or poverty in these groups?

This guidance note was produced using a stepwise approach. However, the development of the impact pathways was not a linear process and involved a cyclical review of documents, evaluation and prioritisation, and repeated attempts to decide what the outputs should be.

A participatory methodology involving consultation of the expert opinions of stakeholders was used to seek practical field-based examples of food system approaches within the crop production sector in Ghana. The process began with a review of the scientific literature and identifying key problems affecting the promotion of nutrition in the crop food system. Subsequently, webinars and virtual and face-to-face meetings were held to allow stakeholders to discuss best implementation models, their experiences and discussed the problem statements that could best be translated into theories of change. These theories of change, in turn, were translated into targeted impact pathways. This process allowed the stakeholders' contribution to the formulation of this guidance note to be as significant as possible. In summary, the preparation of this guidance note involved:

i. a literature review;

ii. a situational analysis using a food systems approach;

iii. identifying the problems and defining the scope;

iv. developing TOCs;

v. defining practice-based impact pathways for the TOCs;

vi. mapping policies and interventions against the practice-based impact pathways;

vii. validating the TOCs and related practice-based impact pathways;

viii. providing a breakdown of activities and related budgets (where available) from existing projects/ programmes; and

ix. assessing opportunities and trade-offs, including potential harm of interventions.

Below are some of the key takeaways from this guidance note

KEY MESSAGES

The predominant agricultural activities in Ghana are arable and tree crop farming. Nearly eight in every ten (77.7 percent) people from agricultural households cultivate arable crops for subsistence and sustenance.

The activities that would contribute towards improved dietary diversity include increasing the amounts and diversity of the nutrient-dense food crops produced, increasing women's income, and providing nutrition education to increase the impact of increased food production and income.

All approaches to mainstreaming nutrition into the crop subsector should empower women; increase access to extension services, information, land and other productive resources; avoid harming women's ability to care for children; and promote labour- and time-saving technologies.

Soil, water, and biodiversity conservation is critical to increasing productivity, resilience to shocks, adaptation to climate change and the equitable access to natural resources.

Most households in Ghana rely more on staple foods and less on fruits and vegetables. Increasing awareness of the importance of fruits and vegetables in the human diet is key to meeting FAO/WHO recommendations (minimum of 400 g/person/day).

Food security and nutrition policies needs to be improved by amending national nutrition strategies and action plans, allocating adequate budgetary resources, and monitoring nutrition outcomes .

Policies in Ghana, including food price policies, subsidies, trade policies and pro-poor policies, need to be coordinated if they are to support nutrition.

Healthy diets are unaffordable for many people, especially the poor. Healthy diets are estimated to be on average five times more expensive than diets that simply meet dietary energy needs through a starchy staple.

There are four areas that need to be considered when taking a food system approach: food production; food handling, storage and processing; the trade in and marketing of food; and consumer demand, food preparation and preferences.

Greater access to inputs, markets and financial services for the fruit and vegetable value chain, and increased availability of improved storage and processing facilities within the food system, will boost the consumption of fruits and vegetables.

Home garden programmes coupled with improved nutritional behaviours can increase the consumption of fruit and vegetables.

Increasing access to a diverse range of nutritious foods requires:

- diversification of production and livelihoods in order to improve food access, dietary diversity, natural resource management, risk reduction and income;
- increasing the amounts of nutrient-dense foods produced, particularly varieties rich in micronutrients and protein chosen based on local nutrition issues and available solutions;
- reductions in post-harvest losses and improvements to processing;
- better market access and opportunities, especially for nutritious foods that smallholders may have a comparative advantage in producing;
- increasing agricultural inputs and providing greater access to market and financial services for the fruit and vegetable value chain;
- improving the availability of improved storage and processing facilities;
- reducing the seasonality of food insecurity through year-round diversification and improved storage and preservation; and
- including explicit nutrition objectives in agricultural policies and programmes.

1. Introduction

Background and purpose of this guidance note

According to the 2019 State of Food Security and Nutrition report, approximately 2 billion people worldwide experience moderate to severe food insecurity (FAO, 2019). Although the current prevalence of malnutrition in Ghana is lower than the West African sub-regional average, it is still far from global targets (Global Nutrition Report, 2020). In Ghana, according to the 2017–2018 Multiple Indicator Cluster Survey, one in every five children under the age of five is stunted, while one in every ten children under five is underweight. Malnutrition in Ghana is recognised as a major impediment to socioeconomic development at both the individual and national levels, causing the country significant financial losses and hindering human development and economic growth. Women and children under five remain the most affected (Ministry of Health, 2013).

In order to address malnutrition amongst Ghana's growing population sustainably, the crop production sector has been identified as an important entry point for mainstreaming nutrition interventions. The crop sector's GDP growth rate stands at 0.8 percent and is dominated by arable farming and the cultivation of tree crops. Nearly eight in every ten people (77.7 percent) living in agricultural households in Ghana (a total of 11 340 947 people) cultivate arable crops for subsistence and sustenance. The domestic vegetable market, for instance, is growing at 10 percent per year. The sector plays a vital role in income generation, foreign exchange earnings, employment and food security for over 70 percent of people (Ghana Statistical Service & Ministry of Food and Agriculture, 2017/2018).

Despite the potential of crop production in terms of improving nutrition, the sector is underdeveloped, and the evidence base for the relationship between nutrition, livelihoods and crops is scant (Thompson and Amoroso, 2014). Moreover, topical methodical appraisals of studies reveal little evidence of the impact of crop production programmes on nutrition and food security (Masset *et al.*, 2011). There is also disagreement over the practicality, adaptability, scalability and documentation of interventions. Nutrition interventions in the crop sector remain overly reliant on increased production and productivity and lack a practical and holistic approach to nutrition. Though the country has national agricultural and food security investment plans with nutritional goals, it lacks the concrete measures needed to address nutrition security (NEPAD, 2015). What is more, Ghana's food security and nutrition policies and programmes lack a coordinated approach and practical measures. Although the government is responsible for the provision of adequate resources to implement their policies and programmes aimed at achieving sustained economic growth and reducing poverty, there is little political will to invest in food security and nutrition as direct economic and infrastructure interventions. For example, the agricultural sector promotes crops with high commercial value and gives little attention to the nutritional value of the crops it produces (MoFA, 2006). The emphasis on addressing food security with comparatively less attention to nutritional needs has staggering unintended nutrition consequences in relation to achieving the Sustainable Development Goals (SDGs).

Key stakeholders in Ghana agree on the need to adapt the crop sector to achieve not only profitability, but also equitable job creation, poverty reduction and nutrition security. To this end, the Food and Agriculture Organization of the United Nations (FAO) has produced together with World Vision (WV) this guidance note in order to address stakeholder concerns by providing guidance on mainstreaming nutrition into the Ghanaian crop production sector.

This guidance note will serve as a:

i. practical guide for mainstreaming nutrition into crop sector policies and programmes, from their initial formulation to the evaluation of their effectiveness after implementation, using impact pathways developed from defined problem statements and theories of change. This approach is based on FAO's food system framework.

ii. flexible and practice-based tool to help optimise the formulation, implementation, monitoring and evaluation of nutrition and food security programmes and interventions for the crop production sector, in order to accelerate progress on addressing malnutrition and food insecurity in Ghana.

iii. document that will improve and become more relevant as it is added to by a community of practitioners, and that will continue to shape the research agenda as a result of new information and priorities in terms of filling the knowledge gaps.

iv. innovative guide that links fruits and vegetables value chain analysis with food systems and nutrition, in the aim that no one is left behind.

Key users

The end users of this technical guidance note will include government and non-government stakeholders such as government ministry and department staff, development partners, programme managers, field actors, policymakers, donors, private-sector agribusinesses and input suppliers.

Key principles

- Principle 1: Identify effects of interventions across the whole food system
- Principle 2: Consider all domains and dimensions of effects
- Principle 3: Account for system dynamics and complexities
- Principle 4: Choose appropriate methods for analysis and synthesis of findings

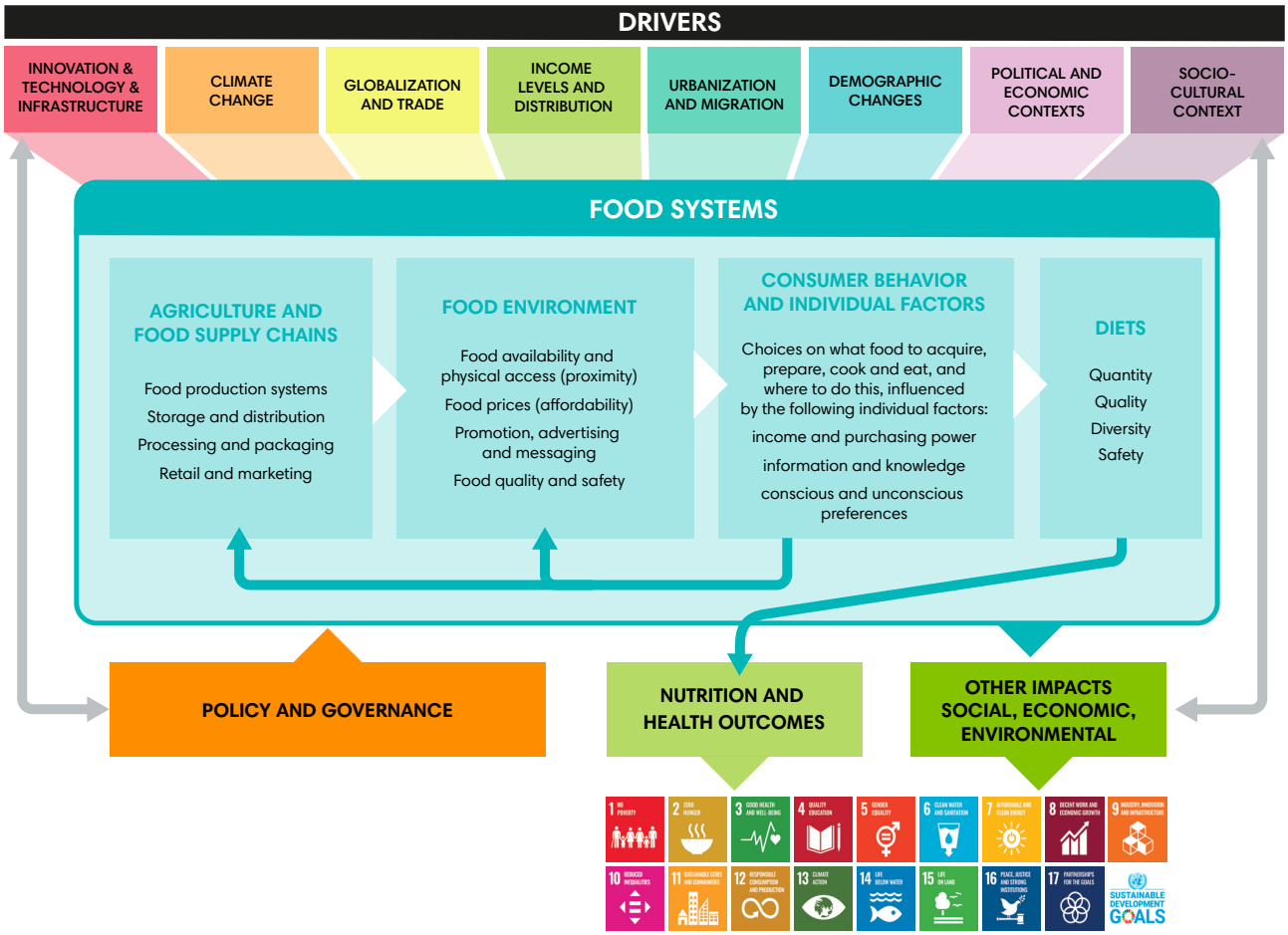
These four principles will ensure the food system delivers food security and nutrition for all in such a way that the people of Ghana are provided with the economic, social and environmental bases to generate food security and nutrition for future generations.

This guidance note uses a stakeholder consultation approach to determine practical ways of mainstreaming nutrition into food systems within the context of the Sustainable Development Goals, whilst ensuring that no one gets left behind.

Food system approach

A food system encompasses the entire range of actors and their interlinked value-adding activities involved in the production, aggregation, processing, distribution, consumption and disposal of food products that originate from crop and livestock production, forestry, fisheries and aquaculture, as well as parts of the broader economic, societal and natural environments in which they are embedded (FAO, 2019). The emergence of a broad range of factors and processes that affect existing food systems (e.g. population growth, urbanisation, changes in consumption patterns, climate change and the depletion of natural resources) has required changes to these food systems. These factors have also resulted in a growing number of challenges, with potentially wide-reaching consequences for the state of food security and nutrition. To achieve a better understanding of how a diverse

Figure 1. Food systems for healthy diets



Source: Adapted from the High-Level Panel of Experts on Food Security and Nutrition of the Committee on World Food Security (FAO, Rome, 2017).

range of food systems function, a framework to assess different food systems was developed to ensure that that they evolve in such a way that minimises their negative impacts and maximises their positive contributions.

Building on the international political momentum created around nutrition by the 2030 Agenda, the 2014 Rome Declaration on Nutrition and the subsequent UN Decade of Action on Nutrition (2016–2025), the UN's Committee on World Food Security (CFS), at its 42nd Plenary session in October 2015, requested that the High-Level Panel of Experts for Food Security and Nutrition (HLPE) prepare a report on nutrition and food systems, to be presented at CFS 44 in October 2017. The conceptual framework developed by the HLPE identified three interacting components of food systems: (i) agriculture and food supply chains, (ii) the food environment and (iii) consumer behaviour and individual factors (HLPE, 2017). In particular, the framework highlighted the central role of the food environment in which the consumer engages with the food system in facilitating healthy and sustainable consumer food choices.

The conceptual framework proposed for this report was based on the following constituent elements and definitions:

Agriculture and food supply (AFS) chain. The AFS chain consists of the activities and actors involved in the production and consumption of food and the disposal of its waste (Hawkes and Ruel, 2012). Food supply chains commonly consist of the following stages from a nutrition and diet perspective: (i) the food production system, (ii) storage and distribution, (iii) processing and packaging, and (iv) retail and marketing.

Food environment. The food environment refers to the physical, economic, political and socio-cultural context in which consumers engage with the food system to make their decisions about acquiring, preparing and consuming food. Specifically, it consists of: (i) "food entry points", or the physical spaces where food is purchased or obtained; (ii) features and infrastructure of the built environment that allow consumers to access these spaces; (iii) personal determinants of consumer food choices (including income, education, values, skills, etc.); and (iv) the surrounding political, social and cultural norms that underlie these interactions. The key elements of the food environment that influence consumer food choices, food acceptability and diets are: (i) physical and economic access to food (proximity and affordability); (ii) food promotion, advertising and information; and (iii) food quality and safety (Caspi, Sorensen, Subramanian and Kawachi, 2012; Swinburn and Moore, 2014; Hawkes, 2015).

Consumer Behaviour. Consumer behaviour reflects all the choices and decisions made by consumers, at the household or individual level, on what food to acquire, store, prepare, cook and eat, and on the allocation of food within the household (including gender repartition and the feeding of children). Behaviour is largely shaped by the existing food environment, which includes personal and collective determinants of consumer food choices (including food prices, income, knowledge and skills, time and equipment, and social and cultural norms).

Diets. Diets comprise the individual foods that a person consumes. Dietary patterns are the quantities, proportions and combinations of different foods and beverages in diets and the frequency at which they are habitually consumed (Hu, 2002). Dietary patterns interact with food systems, not only as an outcome of existing food systems but also as a driver of change for future food systems. Sustainable diets are diets characterised by a low environmental impact which contribute to food and nutrition security and a healthy life for present and future generations. Sustainable diets are "protective and respectful of biodiversity and ecosystems, culturally acceptable, accessible, economically fair and affordable; nutritionally adequate, safe and healthy, while optimising natural and human resources" (FAO, 2012). Food systems, through diets, give rise to a variety of outcomes. These relate not only to nutrition and health, but also to all the aspects of sustainability, which in turn link back to the food system drivers (see below).

Drivers. A driver is an external pressure that effects change. The HLPE conceptual framework identifies five main categories of drivers of food system changes. These were: (i) biophysical and environmental; (ii) innovation, technology and infrastructure; (iii) political and economic; (iv) socio-cultural; and (v) demographic (Ingram, 2011).

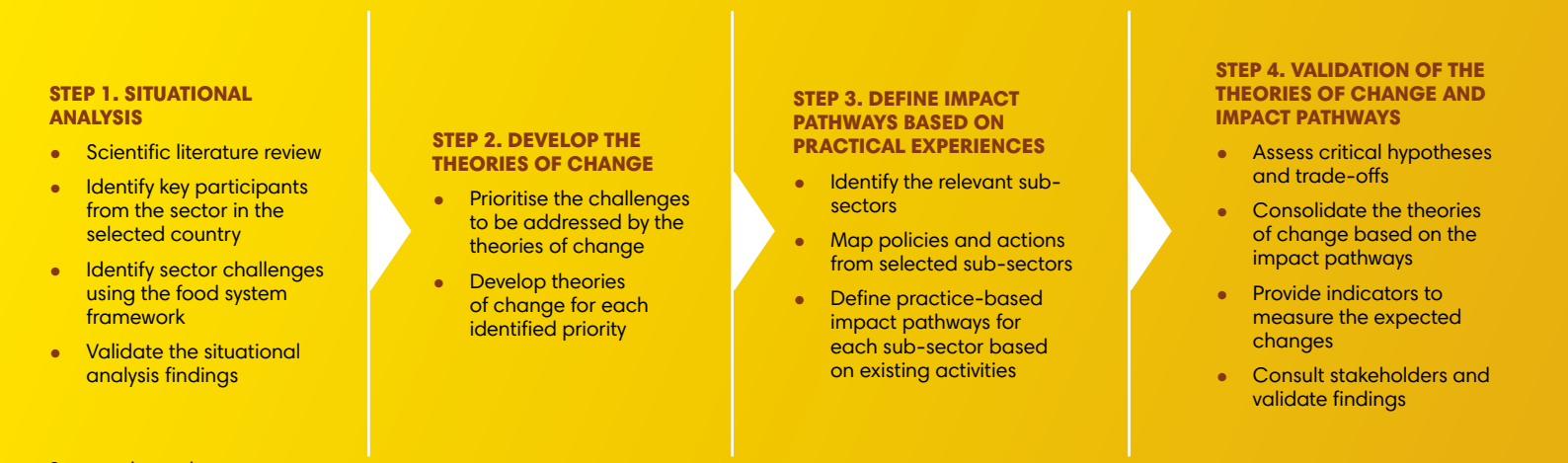
Theory of change. A theory of change (TOC) outlines the process of change, identifying causal linkages between short-term, intermediate and long-term outcomes in a project's design (or a process). A "pathway" shows the logical relationship between the outcomes over time (Taplin and Clark, 2012).

Impact pathways. A pathway map is a sequence of stages between activities (e.g. those involved in a project) and the impact of these activities over time. A theory of change adds to an impact pathway by describing the causal assumptions behind the links in the pathway.

Underlying assumptions. These are assumptions on what has to happen in order to enable the expected changes in the impact pathways.

Trade-offs. These are recognised and/or agreed compromises between two or more options, whereby the risks of favouring one option over another have been duly considered in the decision process.

FIGURE 2. KEY STEPS OF THE METHODOLOGICAL PROCESS



Source: the authors.

2. Stepwise approach

In order to mainstream nutrition into the crop production sector, a stepwise approach was taken. Although this approach is presented as separate steps, it is a cyclical rather than linear process that involves a cyclical review of programme and policy documentation, prioritisation and evaluation. The views of a multi-sectoral range of food system stakeholders in Ghana were sought during this process. Webinars were held to allow stakeholders to discuss current implementation models, experiences and key opportunities for translating problem statements into theories of change and finally impact pathways. Involving stakeholders in this process created on-the-ground ownership of this guidance note and should increase the chances of it being used in practical situations to mainstream nutrition into the crop sector. Stakeholder ownership is key to the process, and experience suggests that theory-based guidance is often misinterpreted or overlooked when developing initiatives.

The stakeholder consultations focused on major food and nutrition security challenges and key nutrition-related policies and programmes. Each consultation brought together 20 to 25 relevant stakeholders spanning the breadth of the crop value chain, including representatives from agriculture, health, education, financial services, the private sector, civil society organizations, development partners, donors, the United Nations and non-governmental organizations.

The figure above details the four main steps for mainstreaming nutrition into the food system.

Step 1. Situational analysis

Literature review

A rapid review was conducted of peer-reviewed articles, published documents, policy papers and grey literature from Ghana or sub-regions of relevance to Ghana. No date restrictions were applied to the search in order to allow all relevant works to be identified. Research and reference management software and search engines were used. The search used the following keywords and phrases: “food systems in Ghana”, “production systems in Ghana”, “food environment in Ghana”, “dietary diversity”, “food consumer behaviour”, “food supply chain”, “food policies” and “links between nutrition, diet and dimensions of food system framework”.

The aim of the literature review was to analyse the evidence that links nutrition and diets within the food system and identify potential areas for improvement. The following questions were asked:

- What is the prevalence of malnutrition?
- What are the basic causes of malnutrition?
- What are the underlying causes of malnutrition?
- What food-related factors influence diets?
- What are the main food consumption patterns and dietary problems or gaps?
- How can the crop production sector contribute to healthy diets and prevent malnutrition?
- How is the crop sector organised in the framework of the food system?
- Which are the most vulnerable groups within the crop sector? What are the causes of malnutrition and/or poverty in these groups?

The literature review provided a deeper understanding was gained of Ghana's food systems, and multi-disciplinary groups with the expertise needed for drafting this guidance note were identified. This information, combined with the stakeholders' practical experience, allowed these groups to identify and prioritise challenges, opportunities and key action points for the crop sector. Decisions on what to prioritise were based on analysis of the political context, knowledge, resources and capacity; the nature of the challenge of each challenge; and the suggested solution for addressing it. The findings were discussed during webinars in which stakeholders shared their experiences.

The findings of the literature review established the importance of fruits and vegetables in Ghana's food systems. The demand for fruits and vegetables is increasing as a result of the emergence of a large middle class and population growth (GSS, 2019). However, fruit and vegetable production and consumption is still relatively low. Crop production systems have been disproportionately biased towards staple production. This bias limits the supply of essential vitamins and micronutrients required to address health and nutrition deficiencies. In order for the crop production system to contribute to nutrition and health, the focus must be shifted onto increasing fruit and vegetable production. Studies conducted by Rousham *et al.* (2020) revealed that only 51 percent of Ghanaians consume fruits, vegetables and legumes as part of their diet. The studies further report that only 27.2 percent of the population consume vitamin A-rich fruits and leafy green vegetables. This indicates that a large percentage of the population does not have access to or does not choose to consume fruits and vegetables (Amo-Adjei and Kumi-Kyereme, 2014). To address this issue, the promotion of indigenous and underexploited safely produced vegetables and fruits is of primary concern (Florkowski, 2012).

The literature review thus suggested that there is a need for:

- access to input, market and financial services for the fruit and vegetable value chain, and improved storage and processing facilities within the food system to be made available in order to increase the consumption of fruits and vegetables;
- natural resources to be managed in order to improve fruit and vegetable productivity, increase resilience to shocks, allow climate change adaptation, and increase equitable access to resources through soil, water and biodiversity conservation;
- increased awareness of the importance of fruits and vegetables in the human diet and FAO/WHO recommended amounts (minimum of 400 g/person/day);
- improved linkages between those identified as operating within the crop subsector pathways, thereby increasing the availability and accessibility of fruits and vegetables;

- more diversified production and livelihoods, leading to greater food access and dietary diversification among smallholder fruit and vegetable producers, as well as reduced risk and larger incomes;
- greater coordination of policies promoting nutrition, including food price policies, subsidies, trade policies, and pro-poor policies targeting the crop subsector, given its significant role in the economy;
- fewer post-harvest losses and improved processing;
- home garden programmes, which, along with improved nutrition behaviours, would increase the consumption of fruit and vegetables;
- greater access to diverse and safe foods of high quality, particularly locally adapted varieties rich in micronutrients and protein; and
- an increase in the production, availability and accessibility of diverse, nutrient-dense foods.

In addition to the above information, Annex 2 contains some of the indicators considered during the situational analysis, and which gave an indication of the functionality of the food system from a nutrition perspective.

SITUATIONAL ANALYSIS

A situational analysis is conducted using the three main components of the food system (supply chains, food environment, and consumer behaviour) and looking at the different external factors that may affect the sector's expected changes.

The analysis is conducted either bilaterally or multilaterally in a participatory manner through country-level consultations with multisectoral stakeholders (ministries and state structures, national and international NGOs/CSOs, technical and financial partners) and based on guiding questions reflecting the structure of the food system framework.

For each component of the food system, participants identify, prioritize and validate cross-cutting issues, and challenges that could affect the ability of crop sector activities to improve food security and the diversification of diets. The priorities should be transversal across the three components of the food system. Problem statements are developed.

1. **Describe the context of the crop sector at national and local levels**
2. **Prioritize barriers to nutrition in the sector**
3. **Identify challenges and opportunities for the fruit and vegetable subsector to improve nutrition and diets**
4. **Problem statements are developed based on the challenges and opportunities identified.**

Crop sector overview

Ghana's agricultural sector accounts for 19.7 percent of GDP and over 30 percent of export earnings and serves as the largest employer (36 percent) of a population of 31 million (GSS, 2019). The crop production sector's GDP growth rate stands at 0.8 percent, and is dominated by arable farming and the cultivation of tree crops. The domestic vegetable market, for instance, is currently growing at 10 percent per year. The crop production sector produces food crops that contribute to both the energy and nutritional needs of humans. Fruits are rich in carbohydrates and water-soluble vitamins, while vegetables provide a significant amount of minerals, vitamins and phytochemicals, which can reduce the incidence of cardiovascular disease and obesity, and act as antioxidants and anti-inflammatories. The sub-sector plays a vital role in the income generation, foreign exchange earnings, employment and food security of over 70 percent of people (GSS & MoFA, 2017/2018). The sector grows a wide variety of agricultural products in different agro-climatic zones. There are an increasing number of consumers in Ghana demanding large quantities of high-quality fresh produce as a result of the emergence of a large middle class (GSS, 2019). The main fruits and vegetables produced in the country include

pineapple, citrus fruit, banana, pawpaw, mango, watermelon, tomato, pepper, okro, aubergine, onion and leafy vegetables. At present, the production and consumption of fruits and vegetables is relatively low in comparison with cereals and tubers.

Main challenges in the crop sub-sector

Based on the food system framework (see Figure 1) and its domains (food supply chain, food environment and consumer behaviour), critical challenges were identified for the entire food system. The challenges affecting the fruits and vegetables subsector were identified, prioritised and validated for each food system domain. This process included identifying issues affecting the entire food system that could complement the different domains in improving food security and achieving dietary diversity. Most of the challenges identified were related to food supply chains (i.e. in production and marketing) and the enabling environment for food production. The main themes explored were the low production and productivity levels of crops (fruits and vegetables); changes in climatic conditions; poor agronomic skills and practices; high cost of inputs; pests and diseases; poor and limited food storage facilities; significant losses affecting agricultural produce; food safety issues; marketing challenges affecting the fruit and vegetable supply chain; weak food commodity value chains; limited public–private investment and partnerships; unfavourable policies; weak institutional framework; and poor co-ordination.

The Ghanaian crop production sector is becoming increasingly characterised by the availability of cheap, imported and commercially processed calorie-dense foods that are associated with an increased risk of morbidity and mortality. In order for Ghana to increase dietary diversity, it needs to sustainably increase productivity; promote neglected and underexploited fruits and vegetables; create and make available improved, drought-resistant crop varieties; conduct trainings on good agricultural practice (GAP) and input use; set up demo farms and organise farmer field schools to provide training on safe and sustainable pest practices (integrated pest management); increase access to input, market and financial services; and increase the consumption of healthy, nutritious and safe diets. To facilitate the above, a suitable enabling environment needs to be created. This could be achieved by, for example, providing the infrastructure needed for trade in the form of suitable market spaces, promoting e-commerce and increasing private sector investment to avoid bottlenecks in the system. Poor food handling, storage, distribution and processing is common, and should be addressed by offering training on how to reduce post-harvest losses and handle, process and package fruits and vegetables and providing storage facilities. These post-farmgate interventions will contribute to food security and nutrition diversity.

In summary, if the production of fruits and vegetables is approached sustainably using an inclusive business model, households, especially women and young people, will have greater economic opportunities, an additional source of food and income, and a diverse range of fruits and vegetables to produce and consume. Increasing the accessibility of fruits and vegetables for households will also contribute to income equality across demographics, as well as dietary diversity through the sale and consumption of these products.

Step 2. Develop a theory of change

Taking the evidence defined in the literature review and problem statements as a starting point, the theories of change (TOCs) presented here attempt to identify areas within the crop production food system that can realistically be influenced. Three key theories of change are described below and are also represented in Figure 3.

TOC 1:
Greater investment in productive, safe and sustainable inputs and production and processing techniques would likely result in increased fruit and vegetable production, and thus greater consumption of fruits and vegetables and the opportunity to purchase a more diverse diet.

TOC 2:
An enabling policy and institutional framework would help producers adapt to the modern market and increase resilience to climate change, leading to greater consumption of fruits and vegetables and the opportunity to purchase a more diverse diet.

TOC 3:
Greater promotion of the nutritional benefits of fruits and vegetables would increase public awareness and the demand for and consumption of fruits and vegetables (which would in turn improve dietary diversity).

DRAFTING OF SECTOR THEORIES OF CHANGE

Country-level stakeholders define in a consensual manner the main priorities for the sector in order to achieve healthy and diversified diets. This prioritization process is carried out based on both the literature reviews and the country contextual analyses. The project team explains to country partners how to apply the TOCs to the sector using a food systems approach.

In collaboration with partners, and in order to address the problem statement(s), nutrition changes are mapped on a theory of change. Ultimately, the TOC makes it possible to identify all the outputs that are needed to achieve the short-, medium-, and long-term changes.

1. **Identify and classify priorities by domain**
2. **Develop theories of change for each targeted priority**
3. **Complete and finalize each TOC using working groups composed of country stakeholders.**

Annex 1: Theories of changes visualisation.

Figure 3. **Theories of change**

IF	THEN	THEREFORE
• There is greater investment in productive, safe and sustainable inputs and production and processing techniques • An enabling policy and institutional framework is developed • There is greater promotion of fruit and vegetable consumption	• More fruits and vegetables will be produced • Producers will have better access to the modern market • Producers will be better able to adapt to climate change • The general public's awareness of the nutritional benefits of fruit and vegetables will improve	• Crop farmers will have a higher income for purchasing a diverse diet • Crop farmers will consume more fruits and vegetables • There will be increased demand for and consumption of fruit and vegetables (and thus greater dietary diversity)

Step 3. Define the impact pathways

After defining the theories of change, and in order to identify gaps and opportunities for improving nutritional diversity and food security, stakeholders developed impact pathways for each of the three food system components: (i) agriculture and food supply chains, (ii) food environment and (iii) consumer behaviour. At the end of the exercise, these pathways were combined to form a comprehensive impact pathway. This was achieved by presenting the findings of each individual TOC and related impact pathway in order to measure and set boundaries. Each impact pathway was assigned indicators to monitor the progress of interventions and evaluate their impact (Annex 2). Three main pathways based on the food system domains were identified with the aim of increasing consumption of nutritious foods, decreasing consumption of less nutritious foods and increasing income, which would allow consumers to purchase more nutritious foods. The interventions proposed by these pathways will contribute to a more diverse diet of fruits and vegetables being consumed by Ghanaian households, as is explained in the theories of change (see Figure 3).

DRAFTING OF IMPACT PATHWAYS BASED ON PRACTICAL EXPERIENCES

Development of the impact pathways for each sub-sector is a practice-based exercise. The project team carries out a non-exhaustive mapping of crop sector projects and programmes implemented by the stakeholders in the targeted country. Using the stakeholders' expertise and project and programme activities as entry points, sub-pathways are then developed and validated by the country stakeholders.

Each sub-pathway gives an overview of the entry points, opportunities and gaps for interventions to better integrate nutrition into the crop sector. At the end of the exercise, the pathways are combined to form a comprehensive impact pathway.

- **Collect information on projects and programmes implemented by country stakeholders**
- **Define sub-pathways based on the theories of change and list of projects and programmes**
- **Develop practice-based impact pathways for each identified sub-sector**
- **Finalize and validate the different sub-pathways with the stakeholders and construct a comprehensive impact pathway.**

Annex 1: Graphical representation of impact pathway.

Annex 3: Stakeholder engagement on mainstreaming nutrition into food systems.

Agriculture and food supply chain impact pathway

This impact pathway seeks to directly increase the availability of diverse and sustainable fruits and vegetables and increase food security through more equitable income for farmers. This in turn is expected to increase the purchasing power of households, providing them with greater access to a more healthy and diversified diet. However, the impact on their diets will depend on the accessibility and affordability of the nutritious foods available, as well as their own preferences and choices on how they spend their additional income. The pathway comprises (i) inputs, (ii) production, (iii) process and storage, and (iv) marketing and retailing.

The key problems identified and prioritised can be divided into two categories based on the two main groups of people within the household: those who are not involved in the production process, and those who are, but who do not eat fruits and vegetables for a number of different reasons. Greater consumption of fruits and vegetables by households will require increased production and intra-household distribution, as well as a better understanding of fruit/vegetable cultivation and the development of the appropriate skills for this.

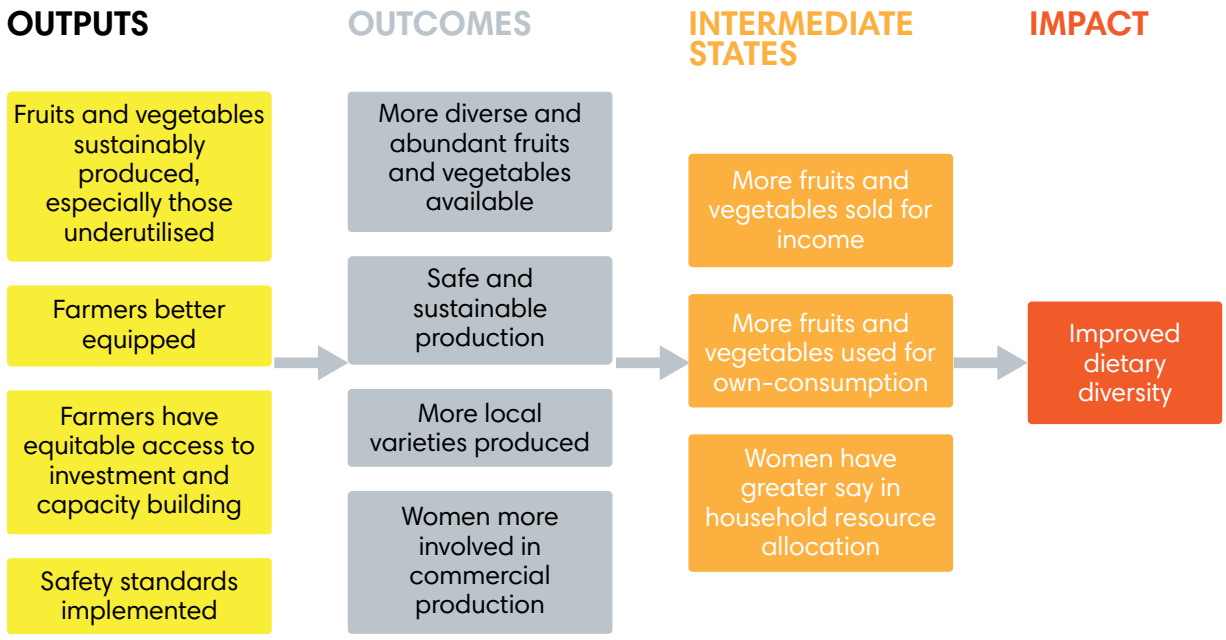
The following outcome was pursued: **increased availability and accessibility of both indigenous and exotic fruits and vegetables**. Two project outputs were identified to help achieve this: (i) more widespread adoption of sustainable production techniques for fruits and vegetables and (ii) greater use of agricultural inputs and assets.

As previously highlighted through the literature review, the increased availability of fruits and vegetables will contribute to greater diversity and sustainability in the production of fruits and vegetables. An enabling environment for the increased availability and accessibility of fruits and vegetables can be achieved by securing land for agricultural production. It is also important to equip farmers with the proper agronomic knowledge and skills, including the appropriate use of the inputs needed to increase fruit and vegetable production, as well as promote the cultivation and consumption of neglected and underexploited fruits and vegetables. Producers of vegetables (onions, peppers and tomatoes) and fruits will need to be trained in best practices for sustainable and climate smart agronomy, the use of improved seeds, soil fertility management, and safe weed control and integrated pest management (IPM). Participants in the fruit and vegetable value chain will need to work closely with the Ministry of Food and Agriculture (MoFA) and the Council for Scientific and Industrial Research (CSIR) Crops Research Institute (CRI) to produce and supply improved and drought-resistant varieties of fruits and vegetables. In addition, strong links should be established between farmers and research institutions to support the creation of demonstration farms, allow farmer field schools to be set up to distribute relevant agricultural information, and encourage the use of technologies that will help increase fruit and vegetable productivity.

Studies and field experience also suggest that access to home gardens would increase dietary diversity. Rural households with access to home gardens are more likely to move from a medium dietary diversity status to a high one. One possible explanation for this is that home gardens provide even the most vulnerable members of the household with direct access to a variety of horticultural crops, including fruits and vegetables, that are rich in micronutrients. Comparable conclusions could be drawn on the positive correlation which exists between household agricultural productivity and improved nutrition. The promotion of home gardens and farmer field schools will help both female smallholders and those interested in entrepreneurship acquire the skills needed to increase their productivity and profitability. (FAO, 2021).

For producers to increase their income, it is important for them to have ready and affordable access to agricultural inputs that help increase production. Households with access to farm inputs such as fertilizers, agro-chemicals and irrigation equipment are more likely to achieve high dietary diversity. Access to inputs allows producers to grow a variety of cash and domestic horticultural crops, which may directly increase the diversity of their household food groups. The use of appropriate inputs makes food easily available throughout the year and provides greater economic and nutritional benefits. Indirectly, income from the sale of excess farm produce allows households to purchase other food groups and diversify their diet. This would suggest a positive relationship between access to inputs and high dietary diversity (MoFA, 2006). Similarly, results from a study by Florkowski *et al.* (2012) on the fruit and vegetable consumption of urban households in Ghana indicate that income has a considerable influence on fruit and vegetable consumption. The study also found a positive association between income and high dietary diversity. Moreover, higher income can lead to higher expenditure on non-food items such as health care and the prevention of health risks, thereby improving health status, which is critical to improving maternal and child nutritional outcomes. With regard to gender dynamics, studies conducted in Ghana by the German Association of Rural Women (2020) have revealed that women controlling household income results in greater consumption of nutritious food. There are therefore a number of studies demonstrating that higher income has a positive effect on dietary diversity when supported by food access and consumer education (Florkowski *et al.*, 2012; Amfo, 2019; Mensah, 2013).

For illustrative purposes, the agriculture and food supply chain impact pathway has been mapped below.



Food environment impact pathway

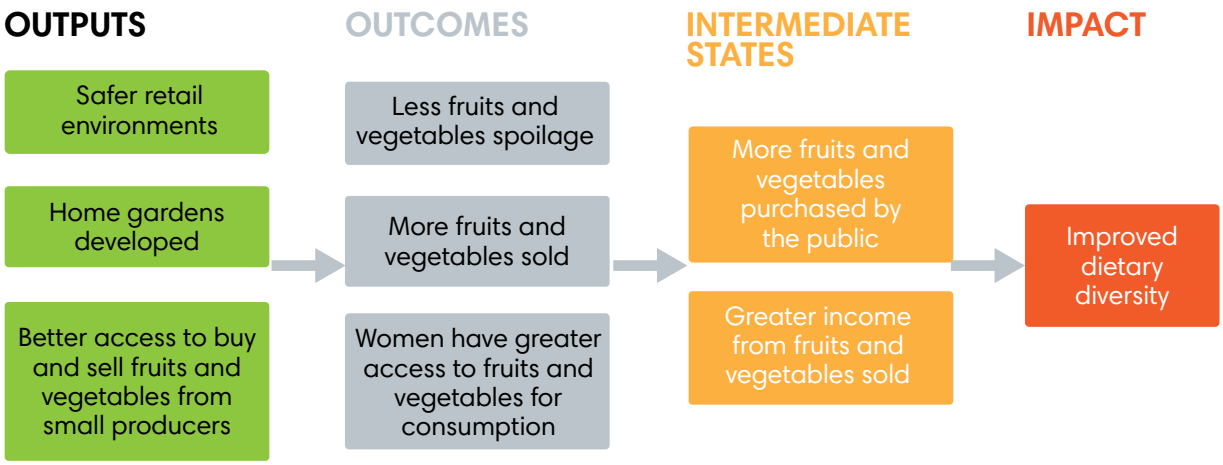
This impact pathway seeks to improve the availability and sale of a diverse range of safe fruits and vegetables. This will result in increased domestic demand for locally produced fruits and vegetables, leading to a more equitable income for smallholder farmers. The key elements of the food environment are: (i) physical and economic access to food (proximity and affordability); (ii) food promotion, advertising and information; and (iii) food quality and safety. In order to achieve the impacts described by this pathway, producers' assets and income need to be increased to allow them to purchase other nutritious food. This is supported by two immediate outcomes: (i) more fruits and vegetables purchased from markets and (ii) an increase in farmers' income from the sale of fruits and vegetables. For producers to increase their income to the extent that they are able to purchase other nutritious food, it is important for households to have ready and affordable access to market and financial services that will help them increase the numbers of fruits and vegetables they produce and sell. Access to these services offers an opportunity for producers to grow a variety of cash and domestic horticultural crops which may directly increase the diversity of their household food groups.

Despite efforts to increase dietary diversity in the fruit and vegetable value chain, consumer education in relation to food safety remains a challenge. Over a third (30 to 40 percent) of Ghana's harvest of fruits and vegetables are lost on their way to the end consumer (Egyir, 2008). Post-harvest food handling, storage and processing refers to the ways in which crops are made ready for sale. This includes the processing of produce, and its transportation, storage and packaging. Factors responsible for post-harvest losses include pests and diseases, late harvesting due to dependence on manual labour, use of obsolete machinery, limited value addition, losses during distribution and a lack of agro-processing centres. In order to reduce food loss and wastage and increase household consumption of safe and healthy fruits and vegetables, three immediate outcomes will be pursued: (i) minimised losses and a longer shelf life for fruits and vegetables, (ii) improved safety of fruit and vegetables, and (iii) better use of the transport system. Participants in the food system will be trained in post-harvest management practices, post-harvest loss management, and the handling, processing and packaging of fruits and vegetables. In addition to these interventions, appropriate transport and storage facilities must be used to ensure fruits and vegetables are maintained in a good state. These steps are essential for preserving

food, increasing its shelf life and preventing food loss, which in turn stabilises food supply and prices throughout the year. Proper food handling, storage and processing also broadens the range of food products that can be consumed, and improves safety, digestibility and palatability (FAO, 2015). Taking into account the role of women in the handling and processing of food at household level is paramount, as women are often responsible for food preparation. It is therefore important to target women as part of any campaign to raise awareness and provide training in safe food handling and processing. Food safety can also increase food availability and accessibility by reducing waste. Moreover, higher incomes, especially for caregivers, who are often women, would lead to greater consumption of nutritious foods, including fruits and vegetables.

In summary, the above interventions aim to address issues of logistics; infrastructure; poor handling, storage and processing; distribution; post-harvest losses; and food safety affecting the food system, and which will likely contribute to the reduction of diet-related non-communicable diseases (Holdsworth *et al.*, 2019). The food environment is the link between the food system and consumers' diets. Food supply chains interact with the food environment and can potentially guide consumers towards improved diets and nutrition, as described in Figure 2.

For illustrative purposes, the food environment pathway has been mapped below.

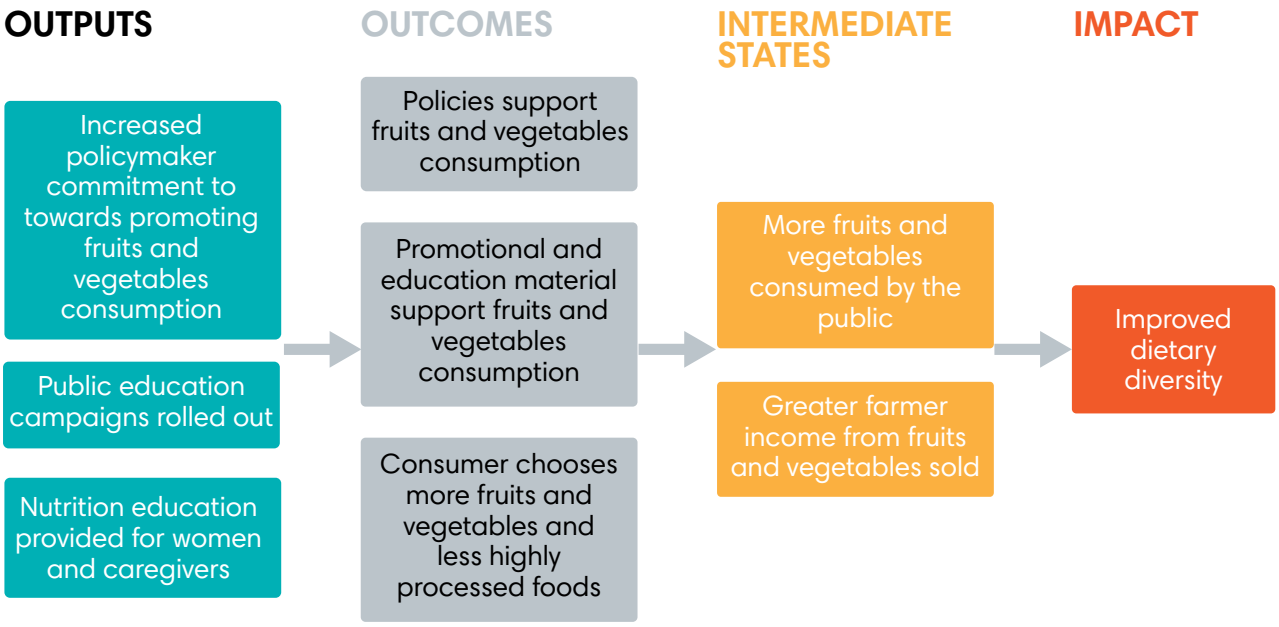


Consumer behaviour impact pathway

This impact pathway seeks to directly increase domestic demand for a diverse range of safe and high-quality fruits and vegetables that have been locally and sustainably produced. This will have an impact on the consumption of fruits and vegetables and lead to more diverse diets. Consumer behaviour comprises all the choices and decisions made by consumers on what food to acquire, store, prepare, cook and eat, and on the allocation of food within the household. It is largely shaped by the existing food environment, which includes personal and collective determinants of consumer food choices (e.g. food prices, income, knowledge and skills, time and equipment, and social and cultural norms; HLPE, 2017).

A study by Amo-Adjei *et al.* (2014) found that greater household consumption of fruits and vegetables is dependent on the availability and accessibility of these products. It also found that increased consumption was strongly influenced by consumer behaviour. These changes can be achieved by increasing the availability and accessibility of fruits and vegetables, as well as raising awareness of their role in dietary diversity through public- or private-sector public education/awareness campaigns to inform households of the benefits of fruits and vegetables. Such nutritional awareness will help to ensure higher incomes lead to greater purchasing and consumption of fruits and vegetables.

For illustrative purposes, the consumer behaviour pathway has been mapped below.



Step 4. Validation of theory of change and impact pathways

Underlying assumptions and trade-offs

A number of trade-offs were identified as relevant to the TOCs and impact pathways. The most critical of these were the following:

Trade-off 1: Fruit and vegetable production needs to be increased to feed the rapidly growing population. The trade-off is that continuous cultivation could lead to land being overexploited, and the clearing of vegetation could cause environmental degradation.

Trade-off 2: Innovation, technology and infrastructure are needed to improve the food system. The trade-off is that already scarce natural resources affected by climate change could suffer environmental degradation.

CONSOLIDATION OF THE TOCS AND DEFINITION OF MONITORING INDICATORS

The identification of critical hypotheses and trade-offs and the consolidation of the TOCs is carried out based on stakeholder discussions and the proposed impact pathways. The connection between the activities and the expected short-, medium-, and long-term changes are collectively discussed. Causal links between direct benefits and the activities that are needed to achieve the changes are collectively validated. Defining the indicators allows the progress made on nutrition to be monitored and facilitates any necessary adjustments to the proposed interventions.

1. **Validation of key assumptions and trade-offs to consolidate the TOCs**
2. **Definition of key performance indicators.**

Trade-off 3: There is a need to increase the quality and safety of fruits and vegetables in the crop subsector. The trade-off is that increased food quality and safety standards may increase production costs, making local fruits

Trade-off 4: It is hoped that women and young people will be empowered by their inclusion in the fruit and vegetable value chain. The trade-off is the increased burden on their time and competing priorities with child and family care. A potential economic failure without a safety net may expose them to additional risks, including sexual exploitation.

Trade-off 5: Interventions will include protective measures in response to COVID-19 for those involved in the fruit and vegetable value chain. A potential trade-off could be the loss of work for unequipped workers and increased production costs, resulting in additional marginal costs.

Other underlying assumptions identified included the following:

- Farmers will have greater access to finance and training.
- The country will monitor and enforce regulations relating to fruit and vegetables.
- The government will maintain policy and budgetary support aimed at increasing food security and nutrition.
- Household income will be re-invested in the fruit and vegetable value chain.
- Consumers will be willing to accept additions to their diets in the form of non-traditional fruits and vegetables, and to pay a premium for "safe", certified and well-presented fruit and vegetables and fruit and vegetable products.
- The government, NGOs and donors will support the scaling-up of successful evidence-based interventions.
- Households will increase their consumption of fruit and vegetable products, leading to improved health outcomes.
- The government will support investment in basic facilities, such as roads, pack houses, markets and telecommunication infrastructure, to support the activities and services that make up the fruit and vegetable value chain.

In the fruit and vegetable subsector, the hypothesis of the theory of change is: if there is a) greater investment in productive, safe and sustainable inputs, and production and processing techniques; b) greater promotion of fruit and vegetable consumption; and c) an enabling institutional and policy framework, then there will be a) more fruits and vegetables produced, b) better access to the modern market, c) opportunities for better adaptation to climate change, and d) greater public awareness of the nutritional benefits of fruit and vegetables and the role they play in households' nutritional diversity and food security.

Findings from the literature and practice suggest that the outcomes of these interventions will be dependent on the entry points along the impact pathways and the focus of the intervention. Increases in the availability of fruits and vegetables at the household level can be achieved by carrying out specific interventions and activities at different points along the value chain, as detailed in Annex 2. Similarly, improvements in the quality and availability of healthy fruits and vegetables can be achieved through interventions that support improved markets and economic access whilst addressing food safety issues.

3. Conclusion and recommendations

This guidance note describes how a food systems approach can be used to mainstream nutrition into the crop sector. The process of producing this guidance note involved reviewing the literature on this subject, conducting a situational analysis, identifying problems, defining the scope, and developing theories of change and impact pathways in consultation with stakeholders.

The conclusions and recommendations summarised in Table 1 propose further action that could be taken based on the findings from the impact pathways.

Table 1. Conclusions and recommendations

IMPACT PATHWAY	CONCLUSIONS	RECOMMENDATIONS
AGRICULTURE AND FOOD SUPPLY CHAIN	Households require consistent access to natural resource bases (water, soil, land, climate, biodiversity) and farm inputs, as well as measures to prevent disasters and promote home gardens, in order to increase food availability and accessibility. To increase dietary diversity, it is important to increase crop production and diversification. The two pathways to dietary diversity are direct access to a more diverse diet on farms and increased household income.	Government should promote diversification of crops, including underexploited traditional fruits and vegetables, for sustainable food production. Researchers should improve crop varieties and promote them. Government should strengthen institutions, policies, programmes and services to increase the resilience of the food supply in areas affected by climate change or disaster. Government should support local food production by smallholder farmers, paying special attention to women's empowerment, while recognising that efficient and effective trade is key to achieving nutrition objectives. Farmers should increase productivity of fruits and vegetables, including leafy vegetables.
FOOD ENVIRONMENT	Market access is essential for improving dietary diversity. The promotion of highly marketable crops will also increase household income. Opening up new sources of income will improve the purchasing power (income) of communities.	Government should promote nutrition-sensitive market-led crops to increase income level of farmers. Government should expand market access for vulnerable groups for nutrient-rich foods, which should improve dietary diversity. Storage, preservation, transport and distribution technologies and infrastructure should be improved to reduce seasonal food insecurity, food and nutrient loss, and waste. Government should increase market access and opportunities, particularly for nutritious foods that smallholders may have a comparative advantage in producing. In order to stabilise the availability/accessibility of agricultural products all year round, it is critical for those contributing to the value chain to improve post-harvest storage and processing where it is most needed. The processing and packaging of fruits and vegetables should be improved using modern technologies to prolong shelf life. Government should increase investment in infrastructure to promote agricultural processing facilities and markets. The links between farmers, agricultural input suppliers, researchers, agricultural extension agencies and credit institutions should be strengthened. This is key to improving production systems. Government should improve rural markets to high-quality markets. Government should improve access to market outlets to ensure food accessibility. Processors should improve processing to retain nutritional value, prolong shelf life, increase food safety and make healthy foods convenient to prepare. Agricultural assets, finance, inputs and training should be made available to smallholder farmers (especially female farmers).

IMPACT PATHWAY	CONCLUSIONS	RECOMMENDATIONS
CONSUMER BEHAVIOUR	Consumption of fruits and vegetables is highly dependent on consumers' awareness of the benefits of fruits and vegetables. The private sector influences marketing and awareness of the benefits of fruits and vegetables. Nutritional education programmes specifically targeting women tend to broaden their understanding of the nutritional health benefits of a diverse diet. Friends have a strong influence on dietary behaviours, particularly amongst males, thus friendship groups and social settings could be important targets for intervention.	The government should pass legislation to regulate the promotion, sponsorship, advertisement and sale of food and drink with added sugars and other nutrients of concern (saturated fatty acids/ trans fats, salt) in schools, the media and other places children have access to. This legislation should be enforceable with fines to prevent obesity and chronic non-communicable diseases. Citizens should help develop, adopt and (where appropriate) adapt guidelines on healthy diets. Government should implement regulatory instruments to promote healthy diets, such as marketing, publicity and labelling policies, and economic incentives or disincentives in accordance with Codex Alimentarius and World Trade Organization rules. Programme implementers should incorporate into their projects the promotion of nutrition, and education on food and food systems that builds on existing local knowledge, attitudes and practices. Social and behaviour change communication (SBCC) is needed for the selection of crops to be planted (availability), foods to be purchased (access) and foods for cooking (utilisation). Planners should develop culturally sensitive nutrition programmes and implement them. There is a need to raise awareness on food safety for sustained food security and diet diversity. Planners should target beneficiaries of nutrition interventions using existing community-level associations, such as farmer-based, faith-based and community-based organizations, and village savings and loans associations, in order to encourage the sharing of nutrition knowledge to continue even after training, creating sustainability and promoting group cohesion.
GENERAL	A food systems approach is needed to improve the availability, accessibility, affordability and consumption of fruits and vegetables in households. Three main food supply chain interventions were identified: to increase consumption of nutritious foods; reduce consumption of less nutritious foods; and increase income, which would enable consumers to purchase more nutritious foods. The conclusions of this guidance note highlight how income, gender, access to inputs and home garden ownership can contribute towards high dietary diversity. Gender issues have an impact on all the pathways, affecting, for instance, access to production resources (availability), access to income which can be used by women (access), and the intra-household distribution of foods (utilisation).	There is a need for the government to coordinate national policies and investments in a way that integrates nutrition objectives into the crop production sector. In order to achieve nutritional goals, policies and interventions should strategically target and invest in the vulnerable, especially women, to improve equity through participation and access to resources. Government should facilitate cross-sector coordination to allow the successful implementation of policies and programmes. The government should prioritise food transfer over cash transfer and other safety net programmes when providing support to vulnerable individuals/households to allow them to avoid being disadvantaged by the relative high cost of nutritious food The Government should implement subsidies to increase the affordability of healthy foods. Government should establish food or nutrient-based standards for hospitals, childcare facilities, workplaces, universities, schools, food and catering services, government offices and prisons, to make healthy food and diets accessible to all. All stakeholders should include social and behaviour change communication and gender issues as a core element of their programmes. Development practitioners should design programmes to increase income and create employment, creating sustained food security.

Research priorities and information gaps

- One recommendation for further research would be to produce an estimation of implementation costs and capacity gaps. The purpose of this assessment would be to understand the barriers and incentives to increased fruit and vegetable consumption so that more targeted interventions can be implemented.
- Public perception of and willingness to adopt bio-fortified crops will need to be ascertained in order to achieve their widespread use.
- Further research will also need to be conducted on the socio-cultural barriers to improving nutrition in Ghana.
- Due to its sudden occurrence, this guidance note has not adequately documented how the COVID-19 pandemic has impacted the food system in Ghana, or the consequences of this for mainstreaming nutrition into the crop subsector. Further research on this topic would add to the value of this work.

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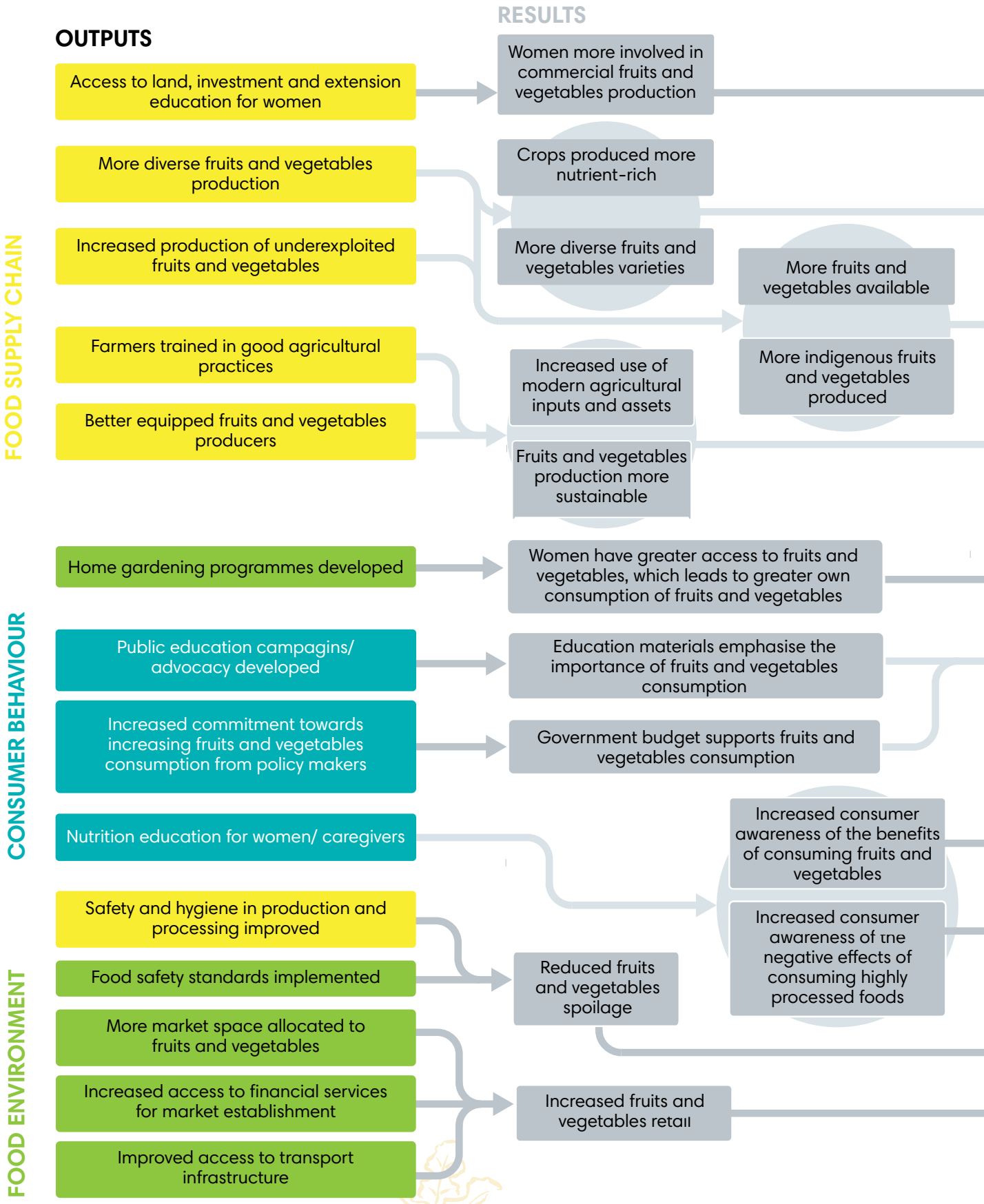
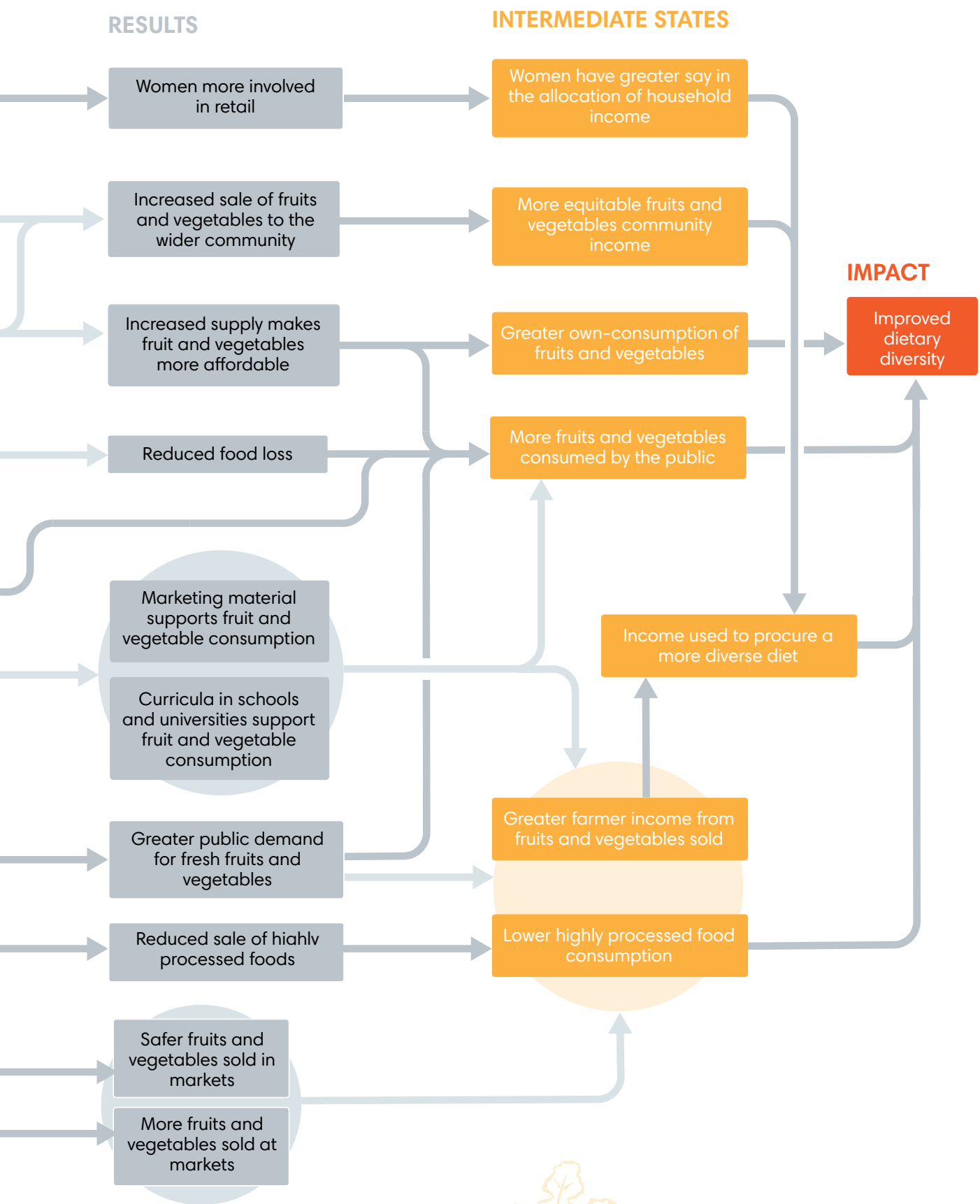
Annexes

Annex 1. Fruit and vegetable impact pathway



To visualize the impact path in a two-page view, go to Adobe Reader ribbon and click on View > Page display > Two pages, then check Show Cover Page in Two Pages View.



Annex 2. Impact pathway tables

Impact pathway and indicators for the fruit and vegetable value chain

Key drivers *(external pressures that effect change)*				
Biophysical and environmental	**Innovation, technology and infrastructure**	**Political and economic**	**Socio-cultural**	**Demographic**
Natural resource ecosystem services Climate change and variability, severe and frequent natural disasters such as floods and droughts Declining environmental quality and habitat loss.	Technology (larger motorised fuel-efficient machines) Fruit and vegetable harvesting technologies Innovation Infrastructure (road, transport, telecommunications).	Trade and globalisation Specific food policies such as food subsidies and import policies Food prices and price volatility Policies on land tenure and use Conflict and humanitarian crises Poverty, unemployment and economic disparity.	Food choices Cultural, religious and social norms Empowerment of women taboos/ traditions.	Population growth Urbanisation Migration and forced displacement Changing age distribution.

Outputs and activities

DOMAIN	OUTPUT	ACTIVITIES
FOOD SUPPLY CHAIN	More diverse fruit and vegetable production	Develop and supply improved and drought-resistant crop varieties Conduct supply chain analyses Increase institutional capacity to maintain diverse fruit and vegetable habitats.
	Increased production of underexploited fruit and vegetables	Promote neglected and underexploited fruits and vegetables Support adoption of sustainable production techniques Develop and supply improved and drought-resistant crop varieties.
	Farmers trained in Gap	Conduct trainings on Gap and input use Provide training on safe and sustainable pest practices (IPM) Provide training on post-harvest management practices and food loss Provide training on the handling, processing and packaging of fruit and vegetables.
	Better equipped fruit and vegetable producers	Set up demo farms, organise farmer field schools and provide extension services Promote subsidised agricultural inputs for farming Put producers in contact with market and financial services (village saving and loan associations, microfinance institutions, banks, co-operatives).

DOMAIN	OUTPUT	ACTIVITIES
	Access to land, investment and extension education for women	Provide access to agricultural assets, finance, inputs and training Conduct financial literacy and business management training.
	Improved safety and hygiene in production and processing	Train handlers and retailers on safety and hygiene practices for handling and processing fruit and vegetables Identify and promote appropriate technologies that lead to higher quality and safer products Provide training on food safety.
FOOD ENVIRONMENT	Food safety standards implemented	Train handlers and retailers on safety and hygiene practices for handling and processing fruit and vegetables Work with community retailers to adopt, brand and promote products that meet local hygiene/safety standards.
	Home gardening programmes developed	Promote home gardens.
	More market space allocated to fruit and vegetables	Establish links with local and municipal markets selling fruit and vegetables produce to promote dietary merits of fruit and vegetables Facilitate connections between those participating in the value chain Establish market centres Promote e-commerce Increase investment in fruit and vegetable supply chain infrastructure, e.g. markets, storage facilities.
	Improved access to transport infrastructure	Increase investment in fruit and vegetable supply chain infrastructure, e.g. markets, storage facilities Provide storage facilities, transport.
CONSUMER BEHAVIOUR	Nutrition education for women/ caregivers	Provide nutrition education (on dietary diversity, feeding and food preparation, healthy foods, and hygiene) through community groups, faith-based organizations (FBOs), health centres, households, schools, etc. Launch radio and social media campaigns to promote nutrition.
	Improved public education campaigns/ advocacy	Train public policy staff on Food Based Dietary Guidelines Provide nutrition education (on dietary diversity, feeding and food preparation, healthy foods and hygiene) through community groups, FBOs, health centres, households, schools, etc. Support local/regional campaigns using advertising, radio, social media and public awareness campaigns to promote behavioural change towards increased fruit and vegetable consumption.
	Greater commitment from policymakers to increasing fruit and vegetable consumption	Implement supportive policies (taxes, subsidies) Promote government schemes such as food and cash transfers to support vulnerable individuals/households Integrate nutrition-sensitive value chains in other sector policies Strengthen cross-sectoral platforms for coordination on nutrition and nutrition-related policies and plans Improve food security and nutrition governance by amending national nutrition strategies and action plans Establish SBCC, education and cooking demonstrations.

Indicators

DOMAIN	OUTPUT/ OUTCOME/ INTERMEDIATE STATE/ IMPACT	DESCRIPTION	INDICATORS
FOOD SUPPLY CHAIN	Output	More diverse fruit and vegetable production	Number of additional fruit or vegetable varieties grown by farmers.
	Output	Increased production of underexploited fruit and vegetables	% increase in hectares of land on which improved production techniques are being used % increase in average crop yields.
	Output	Farmers trained in GAP	% of farmers with farmer field school (FFS) certification % of farmers (or individuals) trained in improved and sustainable agricultural techniques % increase in number of farm demonstration sites and farmer field schools established % increase in number of farmers with access to agricultural extension services.
	Output	Better equipped fruit and vegetable producers	% increase in number of farmers with access to agricultural extension services % of community members trained in financial literacy Number of male and female farmers provided with resources to support improved crop production % increase in use of agricultural inputs and assets.
	Output	Access to land, capital, investment and extension education for women	% increase in number of active savings groups Proportion of land (in hectares) used Number of groups in contact with agricultural input suppliers and credit institutions Value of loans accessed % increase in number of farmers in contact with village saving and loan associations/banks/rural and community banks Number of women who report that they are able to exercise increased control over income.
	Output	Improved safety and hygiene in production and processing	Proportion of households with access to potable water in sufficient quantities for production and agro-processing activities.
	Outcome	Crops produced more nutrient-rich	Number of nutritive improved crop varieties released and promoted Number of men and women farmers using improved crop varieties on their farms.
	Outcome	More diverse fruit and vegetable varieties	Number of caregivers trained on dietary diversity.
	Outcome	Increased sale of fruit and vegetables to the wider community	% increase in volume of produce marketed by smallholders.
	Outcome	More fruit and vegetables available	Number of additional fruit or vegetable varieties grown.
	Outcome	More indigenous fruit and vegetables produced	% increase in hectares of land on which improved production techniques are being used Number of indigenous fruit and vegetables cultivated.

DOMAIN	OUTPUT/ OUTCOME/ INTERMEDIATE STATE/ IMPACT	DESCRIPTION	INDICATORS
	Outcome	Increased use of modern agricultural inputs and assets	Number of men and women farmers provided with resources to support improved crop production.
	Outcome	More sustainable fruit and vegetable production	Hectares of land on which conservation agriculture practices are being used.
	Outcome	Women more involved in commercial fruit and vegetable production	Proportion of farmer groups led by women.
	Outcome	Increased supply makes fruit and vegetables more affordable	% increase in volume of fruits and vegetables produced by smallholders.
	Outcome	Less food loss	Number of caregivers trained in food preservation in the target communities.
	Outcome	Women more involved in retail	Proportion of women with increased sales revenues.
	Intermediate state	More equitable fruit and vegetable community income	Proportion of producers with increased sales revenues.
	Intermediate state	Greater direct consumption of fruit and vegetables by producers	Number of farmers with a home garden.
	Intermediate state	Women have greater say in the allocation of household income	% increase in women empowered through income generation activities % of women who report that they are able to exercise increased control over how their income is used.
FOOD ENVIRONMENT	Output	Food safety standards implemented	% of people complying with food safety standards.
	Output	Home gardening programmes developed	Number of farmers with a home garden.
	Output	More market space allocated to fruit and vegetables	# of new fruit and vegetable outlets created at food markets % of smallholder farmers with links to markets % increase in number of farmers with links to markets.
	Outcome	Safer fruit and vegetables sold at markets	% of stalls and other market outlets that meet safety standards.
	Outcome	More fruit and vegetables sold at markets	% increase in volume of produce marketed by smallholders % of total produce sold marketed by smallholders.
	Intermediate state	More fruit and vegetables consumed by the public	% increase in the proportion of fruit and vegetables in the average diet Frequency with which fruit and vegetables are consumed by individuals.
	Intermediate state	Greater farmer income from fruit and vegetables sold	# and % of poor households that increased their income as a result of income-generating activities Proportion of households who report having access to sufficient credit.

DOMAIN	OUTPUT/ OUTCOME/ INTERMEDIATE STATE/ IMPACT	DESCRIPTION	INDICATORS
CONSUMER BEHAVIOUR	Output	Nutrition education for women/caregivers	# and % of enrolled caregivers who prepare nutrient-dense meals at home % increase in active community groups focused on nutrition Number of demonstrations on the preparation of nutrient-dense diets conducted for the benefit of caregivers.
	Output	Better public education campaigns/ advocacy	% increase in number of local partner groups involved in raising community awareness of the nutrition situation.
	Output	Greater commitment from policymakers to increasing fruit and vegetable consumption	% increase in budgetary allocation for fruit and vegetable production.
	Outcome	Increased consumer awareness of the benefits of consuming fruit and vegetables	% of people educated on the benefits of fruit and vegetables.
	Outcome	Greater public demand for fresh fruit and vegetables	% increase in demand for fruit and vegetables.
	Outcome	Increased consumer awareness of the negative effects of consuming highly processed foods	Number of trainings conducted on healthy eating % of participants trained on wholesome foods.
	Outcome	Reductions in the sale of highly processed foods	% of people who sell processed foods.
	Outcome	Education materials emphasising the importance of fruit and vegetable consumption	% increase in number of people educated on nutrition-sensitive topics.
	Outcome	Government budget supports fruit and vegetable consumption	% increase in budgetary allocation for the crop production sector.
	Outcome	Marketing material promoting fruit and vegetable consumption	Number of people to receive fruit and vegetable materials.
	Intermediate state	Reduced consumption of highly processed food	% of people who consume processed foods.
	Intermediate state	Income used to procure a more diverse diet	Proportion of households with insufficient access to food as indicated by a low score on the household hunger scale (HHS). % of households containing women and children who are able to afford fruit and vegetables.
GENERAL	Impact	Improved dietary diversity	Dietary diversity score Minimum Dietary Diversity for Women score.

ASSUMPTIONS

1. Farmers will have greater access to finance and training.
2. The country will monitor and enforce fruit and vegetable regulations.
3. National and sub-national government will maintain policy and budgetary support for increased food security and nutrition.
4. Household income will be re-invested in the fruit and vegetable value chain.
5. Consumers will be willing to accept non-traditional fruit and vegetables in their diets and pay a premium for "safe", certified and well-presented fruit and vegetables and fruit and vegetable products.
6. The government, NGOs and donors will support more widespread implementation of interventions that have been proven to work.
7. Households can demonstrate increased consumption of fruit and vegetable products, which translates into improved health outcomes.
8. The government supports investment in basic infrastructure, such as roads, pack houses, markets and telecommunications, to support the activities and services that make up the fruit and vegetable value chain.

TRADE-OFFS

1. Increased fruit and vegetable production is needed to feed the rapidly growing population. The trade-off is that continuous cultivation of land could lead to its overexploitation, and any vegetation cleared could pose environmental degradation challenges.
2. Innovation, technology and infrastructure is needed to improve the food system. The trade-off is that already scarce natural resources affected by climate change could suffer environmental degradation.
3. There is a need to improve the quality and safety of fruits and vegetables in the crop subsector. The trade-off is that increased food quality and safety standards may increase production costs, making local fruits and vegetables less competitive compared to imported ones, and thus reducing consumption of local produce.
4. It is hoped that women and young people will be empowered by their inclusion in the fruit and vegetable value chain. The trade-off would be the increased burden on their time and competing priorities with child and family care. A potential economic failure without a safety net may expose them to additional risks, including sexual exploitation.
5. Interventions will include protective measures in response to COVID-19 for those involved in the fruit and vegetable value chain. A potential trade-off could be the loss of work for workers without protective equipment and increased production costs, resulting in additional marginal costs.

Annex 3. Stakeholder engagement on mainstreaming nutrition into food systems

Table 2. List of stakeholders

	Title	Name	Sex	Organization	Designation
1	Miss	Afua Atuobi-Yeboah	Female	School of Public Health, University of Ghana	Research Coordinator/PhD Candidate
2	Dr	Edzesi Wisdom Mawuli	Male	University College of Agriculture and Environmental Studies	Lecturer/researcher
3	Mr	Seth Asante	Male	International Food Policy (Research Institute (IFPRI	Research Officer
4	Miss	Solace Makafui Tamakloe	Female	Women in Agricultural Development Directorate MoFA	Assistant Agriculture Officer
5	.Prof	Richmond Aryeetey	Male	University of Ghana School of Public Health	Associate Professor
6	Mr	Nana Yaw Reuben	Male	Ghana Agricultural & Rural Development Journalists	Projects Coordinator
7	Mr	Edwin Zu-Cudjoe	Male	Social Enterprise Ghana	Executive Director
8	Mr	Isaac Ampomah	Male	Concern Health Education Project	CEO
9	Mrs	Alina Djanie	Female	Horticulture Unit, Directorate of Crop Services, MoFA	Senior Agricultural Officer
10	Miss	Esinu Agozie	Female	SunShine Processing Company	Market Lead
9	Mr	Archibald Adams	Male	Planned Parenthood Association of Ghana	Communications & Advocacy Manager
10	Mr	Mark kwame Offei	Male	FAO Ghana	Nutrition and Food Systems Coordinator
11	Miss	Judith Saare	Female	Ghana Health Service	Health & Nutrition Advocacy Officer
12	Miss	Bernice Nsiah	Female	Sun Network	Health & Nutrition Advocacy Lead
13	Mrs	Esi Amoaful	Female	Ghana Health Service	Deputy Director
14	Mr	Labram Musah	Male	Ghana Non Communicable Diseases (NCDs) Alliance	Program Manager

	Title	Name	Sex	Organization	Designation
15	Miss	Catherine Adu-Asare	Female	Ghana Health Service	Project Officer
16	Mr	Stephen Frimpong	Male	Research Development (Centre (RDC	Research Fellow
17	Mr	Kekesi Defoe	Male	Coalition of Food Security & Nutrition	Executive Director
18	Mr	John Gershom Koomson	Male	National Board for Small Scaled Industries	Senior Business Advisor
19	Mr	Chris Ibyisintabyo	Male	World Food Programme	Sustainable Food Systems Coordinator
20	Mr	Louis Acheampong	Male	Social Support Foundation	Executive Director
21	Mr	Ti Kian	Male	FAO	Nutrition Officer
22	Mrs	Irene Dzathor	Female	World Vision Ghana	Cross-Sector Coordination Manager
23	Mr	Wumpini Sayibu	Male	World Vision Ghana	Cross-Sector Project Officer Acts-West
24	Mr	Ambulah Mamey	Male	World Vision USA	United States
25	Mr	Justice Tiigah	Male	World Vision Ghana	Project Officer, Bawku West Cluster
26	Mr	Maxwell Amedi	Male	World Vision Ghana	Food Security & Resilience Technical Programme Manager
27	Mrs	Awurabena Dadzie	Female	World Vision Ghana	Health & Nutrition Technical Programme Manager
28	Miss	Nita-Tua Esi Coffie	Female	World Vision Ghana	Knowledge Management and Research Manager

For more information check also:

Maximizing nutrition in crop production using a food systems approach

An evidence-based literature review

www.fao.org/documents/card/en/c/cb5564en

Maximizing nutrition in the crop production sector in Ghana

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