INITIATIVE ON
Asian Mega-Deltas

# Report on Nutrition-Sensitive Deltaic Agri-food Projects/Systems on Nutrition and Health

December 2024

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# Executive Summary

This report examines nutrition-sensitive interventions (NSIs), and agri-food systems positioned in the CGIAR Initiative on Asian Mega-Deltas (AMD), specifically focusing on Bangladesh, Cambodia, and Vietnam. These countries face distinct socio-economic and environmental challenges, making them pivotal in addressing food and nutrition security (FNS). Despite progress in agricultural productivity, economic growth, and nutrition and health, these countries are also faced with the triple burden of malnutrition, encompassing undernutrition, micronutrient deficiencies, and rising obesity rates. Limited access to diverse and nutrient-rich foods, compounded by climate variability and environmental degradation, exacerbates these nutritional issues.

The report utilized a scoping desk review as its primary methodology. This involved qualitative data collection through an extensive review of documents related to NSIs and agri-food systems in the deltaic regions of Bangladesh, Cambodia, and Vietnam. The study analyzed reports, policy documents, and literature provided by AMD and WorldFish, covering implemented projects and national strategies.

Key findings highlight persistent nutritional issues like stunting, anemia, and micronutrient deficiencies, with all three countries falling short of global nutrition targets. Despite increases in food production, access to diverse, nutritious diets remains limited, particularly among vulnerable groups.

The nutritional status in **Bangladesh** indicates high prevalence of stunting (28%) and wasting (9.8%) among children under five (U5), alongside micronutrient deficiencies like anemia (36.7% among women). Dietary diversity remains limited, exacerbating undernutrition and related health issues. Key policies include the National Food and Nutrition Policy and National Agriculture Policy, which promote crop diversification and aquaculture to improve food and nutritional outcomes. Integrated programs like the National Vitamin A Supplementation Program aim to address specific deficiencies, while programs such as the CGIAR Initiatives focus on nutrition-sensitive agriculture. Climate change, urbanization, and resource limitations hinder food production and accessibility. There is also the triple burden of malnutrition, including rising rates of overweight and obesity. Weak healthcare infrastructure and inadequate monitoring of nutrition programs further exacerbate these issues. Insufficient data on the correlation between increased food production on nutrition outcomes and limited technical expertise in nutrition among project teams are key gaps. Empowerment of women and youth in agricultural systems remain underdeveloped.

**Cambodia** is also faced with the triple burden of malnutrition. Stunting affects 32.4% of U5, and anemia is prevalent among 47.1% of women. Dietary diversity is limited, with low fruit and vegetable intake. Initiatives like the Cambodia Roadmap for Food Systems for Sustainable Development 2030 emphasize sustainable agriculture and NSIs. Programs such as the Zero Hunger Challenge focus on equitable access to nutritious food and sustainable food systems. The agricultural sector is vulnerable to climate change, pests, and inadequate inputs. Limited processing infrastructure and market access hinder the ability to add value to agricultural products. Cultural beliefs and low literacy rates also impact food choices. Though a roadmap for Food Systems Development 2030, integrating agriculture with NSIs exists, there is a lack of integration between agriculture and nutrition policies, and most interventions focus on food quantity rather than quality

**Vietnam** has made significant progress in reducing stunting (19.6%) and wasting (5.2%) rates, however rates of obesity in U5 are rapidly rising (7.4% among U5). Micronutrient deficiencies like anemia (20.6% among women) persist, particularly in rural areas. Vietnam's strategies include the National Strategy on Food Security and Socio-Economic Development Plans, promoting diversified, nutrition-sensitive agriculture. Programs like the Zero Hunger National Action Program aim to improve food security and reduce malnutrition. Climate change and urbanization strain food systems. The agricultural focus on quantity over quality results in gaps in nutrient-rich food production. Weak infrastructure and insufficient consumer education on healthy diets exacerbate food safety concerns. While Vietnam integrates nutrition into agricultural policies, regional coordination and value chain efficiency remain inadequate. Urbanization contributes to less diverse diets, and food safety in markets remains a significant concern.

All three countries have agricultural policies that evolved to address FNS, health, and sustainability. In addition, many agencies, including CGIAR centers such as WorldFish, are involved in mainstreaming NSIs. Yet, common challenges persist in all three countries including climate change (floods and salinization), urbanization, agricultural production (soil degradation, pests and diseases, inadequate inputs, and infrastructure), and food safety issues, which all in turn affect FNS and the ability to provide sustainable healthy diets. While there is a strong emphasis on food production and water management, limited attention is given to nutrition-specific outcomes, leaving a gap in projects aimed at directly addressing nutritional challenges, especially among vulnerable communities. In addition, there is limited information on the empowerment of women and youth and their involvement in integrating NSIs into food systems. This indicates an opportunity to align more projects with comprehensive FNS objectives.

While rice and fish serve as the primary production and consumption staples and dietary diversity appears adequate, the low consumption of fruits, vegetables, dairy, and pulses highlights significant nutritional gaps. This highlights the need for strategies to balance production efficiency with accessibility and consumer preferences, ensuring that foods from all food groups are produced, accessed and consumed in adequate quantities to ensure diets are diverse and micronutrient rich. Targeted interventions are thus needed to ensure balanced dietary practices for improving overall health and nutrition outcomes.

In Bangladesh, while the country has achieved significant advances in rice and fish production, food safety remains a concern due to the use of pesticides, lack of cold chain facilities, and inadequate market linkages for smallholder farmers. In Cambodia, limited processing infrastructure restricts value addition, and market access challenges are compounded by poor logistics and price volatility. Food safety issues arise from inadequate facilities for packaging and branding, as well as contamination risks from pesticides and fertilizers. Similarly, in Vietnam, food safety concerns dominate, particularly in informal markets, where the enforcement of standards is weak. The focus remains on quantity over quality, leading to under-diversification of nutritious food. Across all three countries, opportunities lie in developing sustainable processing techniques, improving cold supply chains, and enhancing regulatory frameworks to bolster food safety and market access.

While WorldFish prioritizes aquatic foods, it is crucial to emphasize the importance of promoting diversified diets across all nations. Opportunities thus lie in strategically scaling up transformative food systems approaches to meet the demands of the growing population, diversifying crops to combat micronutrient deficiencies, and fostering community education and collaboration across sectors to strengthen food and nutrition security. By linking agriculture, nutrition, and health, NSIs have the potential to transform food systems, build resilience against climate change, and improve dietary diversity, particularly for vulnerable populations.

Scaling up aquatic food systems across Asia is important it contributes to FNS and has significant economic, livelihoods, environmental and social impacts. This can be done through: promoting backyard hatcheries, diversification of species, implementation of aquaponics, alternate and limited use of eco-friendly pesticides and fertilizers, effective water management, enhancing gender inclusivity and decision-making, value-addition of aquatic food products and scaling up processing through infrastructure development, streamlining the supply chain and enabling direct access for consumers through supporting the local micro, small and medium enterprises (MSMEs), development of Agricultural Cooperatives (ACs) and producer groups, strengthening collaborations among the various aquaculture stakeholders, and promoting fish consumption through comprehensive nutrition education programs, including food preparation skills training (e.g., recipes and preservation). These strategies for aquatic foods address the key pillars of FNS.

While aquatic foods are prioritized, it is crucial to emphasize that the dual burden of undernutrition and overnutrition requires targeted, context-specific NSIs. Promoting dietary diversity through the adoption of balanced, healthy diets that include all major food groups should be a central strategy as it supports improved nutritional outcomes, ensuring sustainable health benefits across the life cycle. To support this goal, a multi-faceted strategy is proposed, including scaling up production of diverse foods (fish rice, fruit and vegetable), and better use of livestock to supplement protein sources.

These strategies matter because they address both immediate nutritional deficiencies and long-term food system sustainability. Vulnerable groups, including women, children, and smallholder farmers, stand to benefit the most, as these interventions can improve their access to nutritious food, increase household incomes, and build resilience against environmental and socio-economic shocks. Ultimately, the report advocates for a collaborative, multi-sectoral approach to achieve lasting improvements in health, nutrition, and livelihoods across the AMD region.

Designing studies and reports is crucial to ensure that they effectively inform policies and interventions aimed at improving FNS. Comprehensive study design provides evidence-based insights into the impact of NSIs and agri-food systems, enabling stakeholders to make informed decisions. High-quality reporting bridges gaps between data and action, offering a clear understanding of challenges, opportunities, and results. Importantly, reports must align with global and national goals, incorporate multi-sectoral perspectives, and integrate nutrition-sensitive frameworks. Emphasizing robust monitoring and evaluation frameworks in studies ensures measurable impacts, addresses gaps, and supports scalability of effective interventions.

# Abbreviations and Acronyms

| | |
|---|---|
| AC | Agricultural Cooperatives |
| ADB | Asian Development Bank |
| AFAO | Asian Food and Agriculture Organization |
| AMD | Asian Mega-Deltas |
| ASEAN | Association of Southeast Asian Nations |
| BWDB | Bangladesh Water Development Board |
| CARD | Council for Agricultural and Rural Development |
| CFR | community fish refuge |
| CGIAR | Consultative Group on International Agriculture Research |
| CRS | Catholic Relief Services |
| CM-MAP | Climate-Smart Mapping and Adaptation Planning |
| DC | District of Columbia |
| e.g. | example |
| FAO | Food and Agriculture Organization of the United Nations |
| FGD | focus group discussion |
| FNS | food and nutrition security |
| FSA | Food Safety Asia |
| G | gram |
| GDP | gross domestic product |
| GIZ | Deutsche Gesellschaft für Internationale Zusammenarbeit |
| HLPE | High Level Panel of Experts on Food Security and Nutrition |
| IAA | integrated aquaculture-agriculture |
| IANP | integrated agriculture-nutrition program |
| IFAD | International Fund for Agricultural Development |
| IFPRI | International Food Policy Research Institute |
| IIRR | International Institute of Rural Reconstruction |
| IRRI | International Rice Research Institute |
| IUU | illegal, unreported, and unregulated |
| IWMI | International Water Management Institute |
| kJ | kilo Joule |
| MIYCN | maternal, infant, and young child nutrition |
| MoH | Ministry of Health |
| MRC | Mekong River Commission |
| MRV | monitoring, reporting and verification |
| MSME | micro, small and medium enterprise |
| N/A | not available |
| NAP-B | National Agriculture Policy in Bangladesh |
| NAP-V | Zero Hunger National Action Plan in Vietnam |
| NAP/ZHC | National Action Plan for the Zero Hunger Challenge in Cambodia |
| NCD | non-communicable disease |
| NFP | national food policy |
| NGO | non-government organizations |
| NSA | nutrition-sensitive agriculture |

| | |
|---|---|
| NSI | nutrition-sensitive interventions |
| RAD | Resilient Asian Deltas Initiative |
| SDG | Sustainable Development Goal |
| SIS | small indigenous fish species |
| U5 | children under the age of 5 years old |
| UN | United Nations |
| UNEP | United Nations Environment Programme |
| UNICEF | United Nations Children's Fund |
| USAID | United States Agency for International Development |
| WAYEO | Women and Youth Empowerment Organization |
| WFP | World Food Programme |
| WHA | World Health Assembly |
| WHO | World Health Organization |
| WP | work package |

# 1 Introduction

## 1.1 Context

### 1.1.1 Nutritional status and Health outcomes

Food and nutrition security (FNS) exists when “all people, at all times, have physical and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life” (FAO 2006). In recent years, the focus has shifted to nutrition security as it is about having access to nutritious foods for a healthy life whereas food security is only about access to the right quantity of foods.

Nutrition is fundamental in building a healthy and productive nation (WFP et al. 2023). Although advances in public health and economic development have markedly improved food security, diet, and nutrition in the past decades in many parts of Asia (Cavalli-Sforza 2015), Bangladesh, Cambodia and Vietnam are still facing nutritional and health challenges. All three of these countries are off course to meet all the World Health Assembly (WHA) targets for maternal, infant, and young child nutrition (MIYCN). Regarding stunting, all three countries have made some progress, however, 28.0% and 32.4% of children under the age of 5 years old (U5) in Bangladesh and Cambodia are still affected, which is higher than the average of 21.8% for Asia, and as compared to 19.6% in Vietnam. Bangladesh and Vietnam have made progress towards achieving the target for wasting, but in Bangladesh, the prevalence of 9.8% is still higher than the Asia region average of 8.9%, and as compared to Vietnam with a prevalence of 5.2%. Cambodia has made no progress (prevalence of wasting 9.7%). The prevalence of overweight among U5 is 2.4% in Bangladesh, 2.2% in Cambodia and 7.4% in Vietnam and all three countries are off course to prevent these rates from increasing (Global Nutrition Report 2022).

Low intakes of all dietary components (e.g., fruit and vegetables, pulses, dairy), except for fish, were observed in all three countries, and low intakes of red meat was also observed in Cambodia and Vietnam (Global Nutrition report 2022). As a result of low intakes of nutritious foods such as fruit and vegetables, micronutrient deficiencies, such as anemia, are still prevalent. No progress has been made towards achieving the target of reducing anemia among women as the prevalence is at 36.7%, 47.1% and 20.6% of women aged 15-49 years old in Bangladesh, Cambodia, and Vietnam respectively (Global Nutrition Report 2022).

Limited progress has also been made towards achieving the diet-related non-communicable disease (NCD) targets, however, the obesity prevalence of men and women in these countries is of the lowest globally (Table 1) (Global Nutrition Report 2022).

**Table 1.** Prevalence of NCDs (Global Nutrition Report 2022)

| | Bangladesh | | Cambodia | | Vietnam | | Regional average | |
|---|---|---|---|---|---|---|---|---|
| | Men % | Women % | Men % | Women % | Men % | Women % | Men % | Women % |
| Obesity | 3.0 | 6.2 | 3.5 | 6.0 | 2.2 | 3.3 | 7.5 | 10.3 |
| Diabetes | 11.9 | 10.9 | 9.1 | 7.9 | 6.5 | 5.5 | N/A | N/A |
| High blood pressure | 24.6 | 25.2 | 27.1 | 26.1 | 25.8 | 22.0 | N/A | N/A |

Although nutrition-specific interventions are crucial, it is not enough and incorporating nutrition-sensitive interventions (NSIs) and other development programs is also necessary to ensure optimum nutrition (Ruel & Alderman 2013; CRS 2024). In 1990, the United Nations Children's Fund (UNICEF) introduced a comprehensive framework to analyze the multifaceted drivers of child and maternal undernutrition, breaking them down into basic, underlying, and immediate factors (UNICEF, 1990). This framework focused on child malnutrition. However, due to the persistent prevalence of malnutrition and its diverse immediate and underlying causes, a broad range of actions is essential to reduce and eliminate it (CRS 2024). The UNICEF framework was revised in 2022, and the updated framework addresses the growing triple burden of malnutrition—undernutrition, micronutrient deficiencies, and overweight and obesity. It emphasizes the critical role of diets and care as immediate determinants of maternal and child nutrition. Building on the UNICEF framework, the 2013 Lancet Maternal and Child Nutrition Series developed an action-oriented conceptual framework (Figure 1) (Black et al. 2013). Extensive research has informed this framework, emphasizing the complex interconnections between agriculture, health, and nutrition (World Bank, 2007; IFPRI, 2011; Pinstrup-Andersen, 2012; Jaenicke and Virchow, 2013; Ruel and Alderman, 2013; Herforth and Harris, 2014) and identified three key action areas for achieving optimal child nutrition and development: (a) delivering a set of targeted nutrition-specific interventions; (ii) integrating nutrition goals into broader sectoral strategies, including agriculture and food systems, to promote nutrition-sensitive development; and (iii) establishing a supportive 'enabling environment' essential for sustainable progress in nutrition (Black et al., 2013).

Agriculture is essential for FNS, providing key staples and diverse foods needed for achieving sustainable healthy diet. Aside from nutrition outcomes, food production also shapes livelihoods, incomes, and access to food. Small-holder farmers, a large portion of the rural poor, rely on agriculture for subsistence and income. Boosting productivity, diversifying incomes, improving market access, and empowering women can enhance FNS. However, more food production alone does not guarantee better nutrition, especially if the foods lack nutritional value or access is limited by poverty or poor infrastructure. A nutrition-sensitive intervention (NSI) is required, emphasizing food quality, diversity, and equitable access over mere quantity. Nutrition is closely tied to equity, with income, gender, and social status impacting access to healthy diets. Women and girls in particular face nutritional challenges due to increased nutritional requirements and existing inequalities (Ruel & Alderman 2013). Transitioning agriculture to a nutrition-sensitive model requires a shift in approach—reframing how agriculture is planned, executed, and coordinated across sectors. This shift also calls for the active engagement of a wide range of stakeholders from diverse sectors and for the identification of critical entry points where nutrition objectives can be integrated into agri-food systems (Jaenicke & Virchow, 2013).

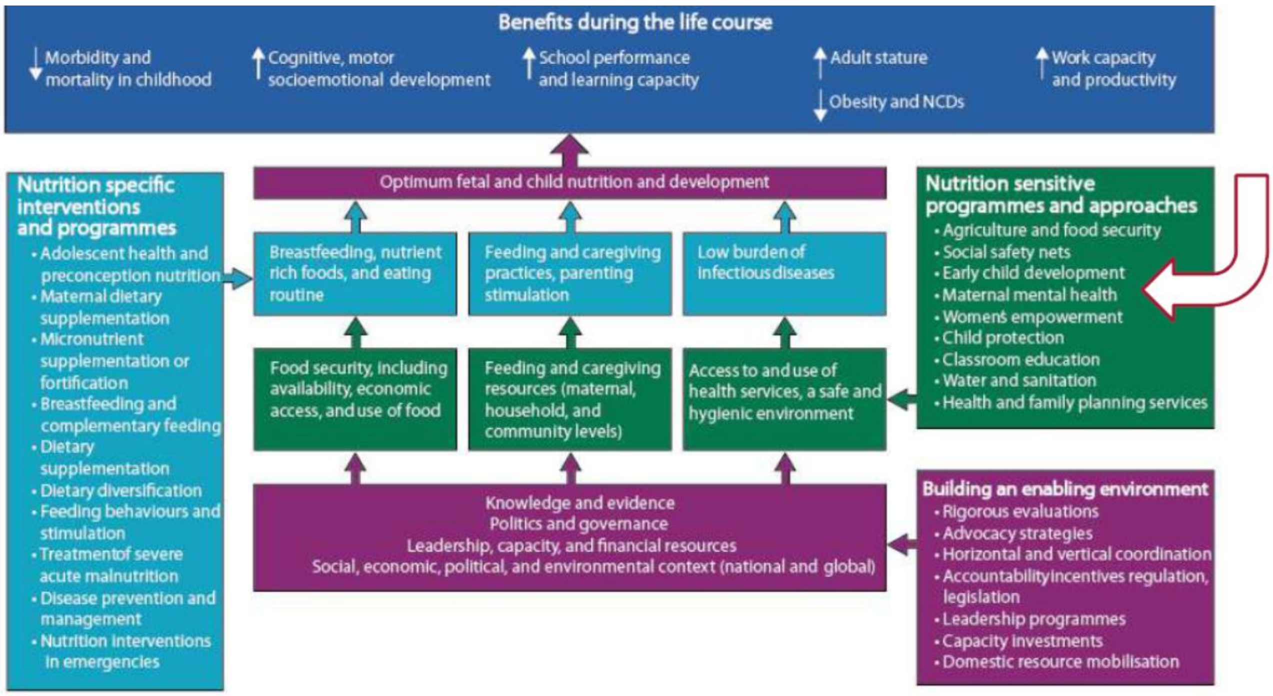



**Figure 1** Conceptual framework for improving health and nutrition through nutrition-specific and -sensitive programs and approaches (Ruel & Alderman 2013)

### 1.1.2The Role of Nutrition-Sensitive Interventions in Addressing Food and Nutrition Security

NSIs are actions, policies, or programs that address the underlying determinants of malnutrition, namely poverty, food insecurity, and access to care resources by incorporating specific nutrition goals and actions in programs across sectors like agriculture, early child development, health, social protection, education and school nutrition, and water and sanitation (CRS 2024; Ruel & Alderman 2013). Key strengths of these programs are their focus on critical nutrition determinants, large-scale implementation, and their ability to reach poor, malnourished populations, often serving as effective platforms for delivering targeted nutrition interventions (Ruel & Alderman 2013). This integrated strategy focuses on preventing food and nutrition insecurity and malnutrition at the household and community levels (CRS 2024). Nutrition-sensitive programs are also crucial for protecting vulnerable populations from global food security threats and shocks—whether financial, weather-related, or conflict-induced. They mitigate the impact of rising food prices, climate change, and frequent natural disasters, which can lead to reduced food availability, lower dietary diversity, and increased infectious diseases. By safeguarding assets and well-being, nutrition-sensitive programs support health, nutrition, and child development outcomes (Ruel & Alderman 2013). Furthermore, these programs can influence nutrition by positively affecting food prices, household income, and empowering women, creating environments that promote child growth and development (Ruel & Alderman 2013).

There is growing evidence for nutrition-sensitive agricultural interventions (NSAs) in stable developing regions. Systematic reviews over the past decade have examined how these interventions, such as homestead food production, biofortification, livestock and fisheries, and irrigation programs, impact FNS and health in low- and middle-income countries (LMICs). Findings consistently show positive effects on agricultural production, dietary diversity, and income, with recent reviews highlighting benefits for women and child nutrition and health (Al Daccahe et al. 2024).

The global imperative to redesign agricultural systems to better support nutrition and health is well acknowledged and was a central theme in the establishment of the United Nations (UN) 2030 Agenda for Sustainable Development (UN 2017). This shift is evident in the increasing number of initiatives that support national governments in embedding nutrition goals into their agricultural development and investment strategies. Additionally, a clear understanding has emerged of the crucial role that women's empowerment and status play in mediating the agriculture-nutrition linkages. This recognition has spurred the development of new initiatives and investments aimed at harnessing agriculture to improve nutrition outcomes. Yet, the question remains: what is the current evidence on the effectiveness of agricultural development programs in enhancing nutrition, and through what mechanisms do they achieve these outcomes (Gillespie & Nesbitt 2019)?

The CGIAR Initiative on "Securing the Food Systems of Asian Mega-Deltas for Climate and Livelihood Resilience" (AMD) focuses on developing resilient, inclusive, and productive delta systems in Bangladesh, Cambodia, India, Myanmar, and Vietnam. Using a transdisciplinary impact pathway approach, AMD links with other CGIAR Initiatives to support accelerated local adaptation efforts while also aiming to protect against nutrition security threats, reducing investment barriers, strengthening inclusive and gender-equitable governance of natural resources, and development planning based on risk and vulnerability. Through these strategies, AMD seeks to shape policies that foster adaptation opportunities and mitigate the impacts of future threats through five work packages (WP), namely:

- WP1: Adapting deltaic production systems.
- **WP2: Nutrition-sensitive agri-food systems**
- WP3: Derisking delta-oriented value chains
- WP4: Inclusive, gender-equitable governance and policy for natural resources
- WP5: Evidence-based delta development planning

WP2 specifically focuses on nutrition-sensitive deltaic agri-food systems and seeks to ensure improved equitable nutrition security through a deltaic food systems approach (CGIAR 2022).

Until 2023, AMD produced more than seventy new knowledge products and conducted ninety-three capacity-sharing-for-development activities with a reach of 14,000 participants in Bangladesh and Cambodia, as well, as training workshops, stakeholder consultations, and strategic meetings in all three countries. These were focused on climate-related challenges and risk management. AMD also reported sixty-three innovations. One example is in Bangladesh where diversified rice cropping, water governance, climate justice, and farmer field schools were implemented to improve farming practices. AMD also made substantial progress in innovation use. Examples include creating digital crops and forecasting maps for salinity-prone areas, and interactive voice messaging to warm farmers about harvest risks. In Vietnam, AMD supported the development and promotion of monitoring, reporting, and verification (MRV) tools. In addition, AMD influenced policies at the local and national levels in all three countries. Examples are AMD's science that contributed to the design and approval of Vietnam's policy and strategy for the sustainable development of the One Million Hectares program, and in Cambodia, AMD played a crucial role in shaping the 3rd National Strategy for Food Security and Nutrition 2024-2028 and the Food System for Sustainable Development 2030 Roadmap (CGIAR AMD 2024).

The goal of this review report is to perform a comprehensive desk review of the provided documentation concerning the NSIs and agri-food systems in the deltas of Asia, with a focus on three countries, namely Bangladesh, Cambodia, and Vietnam. This review will encompass an examination of relevant literature, reports on NSIs and AMD work packages, and national policy documents related to agriculture and health/nutrition. **The aim is to identify existing knowledge gaps and explore opportunities for enhancing nutrition and health outcomes in these delta regions.**

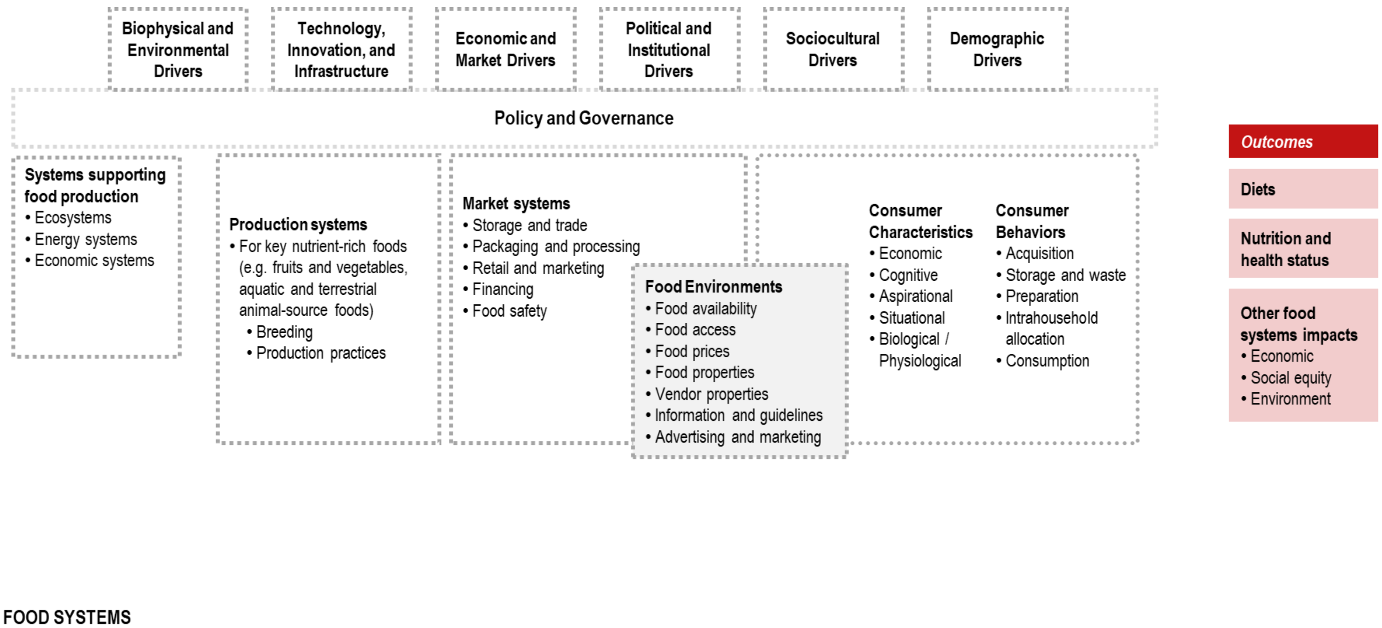
## 1.2 Objectives

The specific objectives of the review report are to:

1. Assess the alignment of nutrition-sensitive interventions and work packages with the national health, agriculture, and nutrition policies in the three countries.
2. Evaluate and identify the challenges and opportunities of nutrition-sensitive interventions/work packages on food availability, access, and consumption, as well as sustainability to determine their influence on health and nutrition outcomes in the three countries.
3. Identify gaps in the current knowledge, services, programs, and interventions/work packages.
4. Provide evidence-based recommendations for the implementation of nutrition-sensitive interventions to improve nutrition and health status in the deltas of Asia.

## 1.3 Scope of Report

The conceptual framework of food systems for diets and nutrition in Figure 2 (UN 2017) was used to inform the review report, specifically reviewing the food supply chains, food environment, consumer behavior and diets, and nutrition and health outcomes of the AMD in Bangladesh, Cambodia, and Vietnam. This framework was chosen as it covers all the pillars of food and nutrition security.




**Source:** Global Food Policy Report, 2024. Framework Adapted from High Level Panel of Experts on Food Security and Nutrition of the Committee on World Food Security, *Food Security and Nutrition: Building a Global Narrative Towards 2030* (Rome: 2020).

**Figure 2**: Conceptual framework of food systems for diets and nutrition (HLPE 2017)

# 2 Methodology

The study design is a scoping desk review that employed a qualitative method for data collection. A list of documents pertaining to the projects implemented in Bangladesh, Cambodia, and Vietnam by AMD and WorldFish, as well as policy documents were included in the scoping desk review. Furthermore, a search was undertaken to identify the nutritional status of the population in these three countries.

The documents were reviewed as per the guidelines provided in Figure 2 for appropriate policies and work packages to identify the food supply chains, food environment, consumer behavior and diets, and nutrition and health outcomes of AMD in Bangladesh, Cambodia, and Vietnam as per Figure 3.


**Figure 3** Methodology steps

# 3 Review of Nutrition-sensitive Interventions

Food security in Bangladesh, Cambodia and Vietnam presents a mix of challenges and advancements, influenced by economic growth, climate change, and agricultural practices.

Overall, while all three countries show progress in addressing food security, ongoing challenges related to climate change, economic disparity, and nutrition must be tackled to ensure sustainable improvements.

## 3.1 Bangladesh

Bangladesh faces significant food security challenges, driven by high population density, poverty, and vulnerability to natural disasters. According to the Global Hunger Index (GHI) 2023, Bangladesh was ranked 75$^{th}$ out of 125 countries, with a score indicating "moderate" hunger. The percentage of the population facing food and nutrition insecurity is significant, especially among rural and marginalized communities. The government has implemented programs to boost agricultural productivity and improve nutrition, but persistent issues like malnutrition and seasonal food shortages remain. Efforts to strengthen resilience against climate impacts are critical for long-term food security.

### *3.1.1 Policy analysis*

Bangladesh has a rich agricultural heritage, with most of its population depending on agriculture for their livelihood. In recent years, the government of Bangladesh has focused on both improving agricultural productivity and ensuring food security for its growing population. The National Food Policy (NFP) of Bangladesh was formulated to ensure food security for all citizens, while the Bangladesh National Agriculture Policy (2018) which is designed to address challenges in the agricultural sector, focusing on increasing productivity, sustainability, and profitability. The most common topic in the policies examined was food and nutrition, followed by production and food safety. Specifically, nutrition areas were concerned with food security, diversity, under-nutrition, and micronutrient deficiencies. Almost all of them had an emphasis on transparent, democratic, and accountable governance, with equal access, sustainable food production and supply chain.

In recent years, the government has also started prioritizing sustainable food systems, which integrate food production, distribution, and consumption in a way that is environmentally, socially, and economically sustainable. These include:

i. Promotion of Agroecology: Supporting agroecological farming systems that work in harmony with the environment, reduce reliance on chemical inputs, and enhance biodiversity.
ii. Diversified Farming Systems: Encouraging the diversification of crops and livestock to improve resilience to market and climate shocks.
iii. *Agricultural Extension and Rural Development Policies*: Bangladesh has several policies aimed at improving rural livelihoods and agricultural extension services, such as the National Extension Policy and the Rural Development Policy.
iv. Capacity Building: Training farmers on new farming techniques, climate adaptation strategies, and better resource management.
v. Access to Credit and Insurance: Increasing farmers' access to affordable credit and insurance to help them cope with agricultural risks, such as floods, droughts, and price volatility.
vi. Women's Empowerment: Promoting gender equality in agriculture by encouraging women's participation in decision-making processes, improving access to resources, and enhancing their roles in food production and processing.

In Bangladesh, policies related to nutrition-sensitive agri-food systems are closely aligned with efforts to improve food security, reduce malnutrition, and enhance the overall health of the population, particularly in rural and vulnerable communities. Nutrition-sensitive agri-food systems emphasize integrating nutrition into agriculture and food production, recognizing that agriculture plays a pivotal role not only in food availability but also in improving the quality and diversity of diets. Some of the ways in which Bangladesh's policies align with nutrition-sensitive agri-food systems are:

a) National Food and Nutrition Policy (NFNP)

The policy aims to address both food security and malnutrition by promoting agricultural systems that ensure access to diverse and nutritious foods. This aligns directly with the concept of nutrition-sensitive agri-food systems, which aim to enhance food quality alongside food quantity.

b) The National Agriculture Policy (NAP-B)

This policy promotes the diversification of agricultural production. This involves integrating more nutrient-rich crops and livestock into farming systems to ensure dietary diversity. For example, the policy encourages growing vegetables and fruits alongside staple crops like rice to improve the nutrient profile of food available to the population.

The policy also promotes the development of sustainable aquaculture (such as fish farming) and livestock farming, which contributes to improving protein and micronutrient intake, particularly for rural and vulnerable populations. Such initiatives ensure that agriculture supports not just food security, but also better nutrition outcomes.

c) National Food Policy (NFP)

The National Food Policy (NFP) aims to achieve food security through adequate availability, access, and utilization of food. A key aspect of this policy is the promotion of nutrition-sensitive food systems, where food systems are designed not only to provide enough calories but also to ensure that the food available is rich in essential nutrients.

d) Food Security Act

The Food Security Act focuses on improving the nutritional quality of food available to vulnerable groups such as pregnant women, children, and the elderly. Policies encourage micronutrient supplementation and support for fortified foods, ensuring that marginalized populations receive adequate nutrition.

e) Integrated Nutrition Programs

Bangladesh has several integrated programs that link agriculture and nutrition:

The National Vitamin A Supplementation Program: This program provides regular doses of vitamin A to children to reduce deficiencies and promote better health outcomes. It often works in tandem with agricultural interventions that focus on increasing the production of vitamin A-rich foods (such as sweet potatoes, mangoes, and leafy greens).

The Integrated Agriculture-Nutrition Program (IANP): This initiative seeks to integrate agriculture-based nutrition interventions with health and social programs. The program encourages farmers to grow diverse, nutrient-dense crops while also educating communities on proper nutrition, dietary diversity, and food safety.

### 3.1.2 Nutrition-sensitive Interventions, programs, and agreements implemented

Bangladesh has implemented a variety of nutrition-sensitive interventions and programs that aim to improve the nutritional status of its population, particularly vulnerable groups such as children, pregnant women, and lactating mothers. These interventions differ from previous programs as improved nutrition considerations are integrated into sectors such as agriculture, education, and social protection. We highlight a few programs, interventions, commitments and agreements implemented in the country to address nutritional challenges.

a) CGIAR initiative "securing the food systems of Asian Mega-Deltas for climate and livelihood resilience (AMD)". Other initiatives including SHiFT, Aquatic Foods and TAFSSA also work on other nutrition-sensitive food systems aspects, especially on policies and social safety nets.

b) The United Nations Sustainable Development Goals (SDGs). Bangladesh has committed to the Sustainable Development Goals (SDGs), particularly SDG 2 ("End hunger, achieve food security and improved nutrition, and promote sustainable agriculture"). This commitment aligns with Bangladesh's own National Food Policy and the various nutrition-sensitive programs it has implemented. Bangladesh is also committed to the United Nations Food Systems Summit (UNFSS) that is the national pathways for food systems transformation

Nutrition and Poverty Reduction: SDG 1 (no poverty) and SDG 2 are strongly linked in Bangladesh's approach, with nutrition-sensitive interventions targeting both malnutrition and poverty alleviation.

c) Bangladesh has partnered with international organizations such as the World Bank, UNICEF, and the World Food Program (WFP) to implement various nutrition interventions, including micronutrient supplementation, nutrition education, and food assistance programs.

d) Bangladesh partners with WFP to implement school feeding programs, which ensure that school-going children receive daily nutritious meals, and emergency food assistance during natural disasters and periods of food insecurity.

### 3.1.3Challenges and Opportunities

The documentation provided and reviewed highlights the following key challenges:

Bangladesh faces many challenges from urbanization, salinity, and water management and is extremely vulnerable to climate risks and sea-level rise.

Moreover, an increase in the prevalence of diseases related to unhealthy food and water consumption and unsafe food is a national constraint in Bangladesh further exacerbating the multiple burdens of malnutrition.

The food security system in Bangladesh is vulnerable because of significant production deficits, low food supply, ineffective distribution, and vulnerability to natural disaster.

The healthcare workforce, particularly in rural areas, is insufficient and often undertrained in nutrition-related aspects of health. Health professionals, including doctors, nurses, and midwives, often lack adequate training in counseling for nutrition, maternal health, and infant feeding. There is a gap in the integration of nutrition into medical curricula and continuing education for healthcare workers. There is a need for more nutrition specialists (e.g., dietitians, nutritionists) in both healthcare and community settings to address the increasing burden of malnutrition.

The healthcare system in Bangladesh is often overstretched, with inadequate human, economic and infrastructural resources, particularly in rural areas. This affects the delivery and quality of health services, including maternal and child health care, nutrition counseling, and follow-up services for patients with chronic diseases.

There is a lack of robust monitoring and evaluation systems to track the effectiveness of nutrition and health interventions. Many programs do not collect adequate data on malnutrition rates, food security, and dietary intake, making it difficult to assess progress or identify emerging challenges.

On the other side, Bangladesh has many opportunities:

Commitment of the Bangladesh government to the UN's SDGs: Bangladesh has endorsed the United Nations Sustainable Development Goals (SDGs), particularly SDG 2 (Zero Hunger), which aims to end hunger, achieve food security, improve nutrition, and promote sustainable agriculture by 2030. This provides a strong policy framework for action.

Bangladesh has received extensive support from international development partners such as World Bank, UNICEF, WHO, WFP and FAO, which strengthens its efforts to combat malnutrition and improve food security.

Fertile Land: The country has a significant amount of arable land, particularly in the Ganges-Brahmaputra Delta, which is suitable for diverse agricultural practices and crop cultivation.

Water Resources: Abundant inland water bodies, including rivers, reservoirs and ponds, provide irrigation opportunities, essential for crop production, especially during dry seasons.

Biodiversity: A rich variety of indigenous crops, vegetables, and livestock offers opportunities for sustainable farming practices and diversification of food sources.

Labor force: A large and relatively inexpensive labor force is available for agricultural activities, providing potential for both traditional farming and modern agricultural practices. Traditional and indigenous knowledge: Farmers possess valuable traditional and indigenous knowledge and practices that can be integrated with modern techniques to improve agricultural productivity and sustainability.

## 3.2 Cambodia

### 3.2.1 Food and Nutrition Security

Cambodia has achieved notable economic growth in recent years, with agriculture remaining a vital pillar of the economy, significantly contributing to national FNS. Despite these advances, Cambodia faces persistent challenges and opportunities in addressing nutrition, public health, and agricultural policy integration.

While food security and malnutrition have improved since 2014, 23% of the population remains unable to meet basic nutritional needs, highlighting a significant economic disparity. Additionally, the country experiences the triple burden of malnutrition, encompassing undernutrition, micronutrient deficiencies, and overweight and obesity, particularly affecting women and children under five years old, with rural areas disproportionately impacted.

### 3.2.2 Current Policy Landscape

Most of the policies in the country focus on agriculture and the production of food to address the challenges around food security, health, and sustainable agricultural development. Although Cambodia has implemented seventeen policies targeting various aspects of food systems, existing frameworks lack the connection between agriculture and nutrition, specifically related to sustainable food consumption patterns. The Cambodia Roadmap for Food Systems for Sustainable Development 2030 addresses sustainable agricultural production—including crops, horticulture, fish, and livestock—as well as FNS initiatives focused on agribusiness, cooperatives, food quality, and food safety standards (Kingdom of Cambodia 2021).

*Nutrition-focused Initiatives*: Two policies aim to improve health services and nutrition access for vulnerable populations, including pregnant women and children under two years old, through social assistance, food production, and school nutrition programs. The National Social Protection Framework 2016-2025 promotes home-grown vegetables in school nutrition programs to enhance the nutritional status of school-aged children. The National Nutrition Strategy 2009-2015, along with the Fast-Track Road Map, advocates for equitable nutrition access for women and children, with a focus on counseling services and nutrition awareness. The National Action Plan for the Zero Hunger Challenge in Cambodia (NAP/ZHC 2016-2025) aligns with SDGs by setting forth a comprehensive agenda to end hunger, achieve food security, improve nutrition, and promote sustainable agriculture. The NAP/ZHC prioritizes the following five strategic pillars: 1) Equitable access to nutritious food for all throughout the year; 2) Zero stunting among children under two years old; 3) Sustainable food systems; 4) 100% increase in productivity and income for small-holder farmers; and 5) Zero food loss and waste. This policy framework emphasizes a coordinated approach to realizing Cambodia's commitment to the SDGs, advancing national goals for hunger eradication, nutritional improvement, and sustainable agricultural development (Kingdom of Cambodia 2016).

*Harmonization and Coordination Efforts*: The Ministry of Health (MoH) has developed five policies with strategic recommendations to enhance coordination and harmonization at the sub-national level, aiming to improve nutritional outcomes for women and children. Additionally, two policies prioritize early childhood development, incorporating both childcare and nutrition components.

The Cambodian government and NGOs are working to enhance agricultural practices and increase food production. The country has been successful in largely achieving food security, with significant gains in rice production through investments in irrigation systems and infrastructure, as well as market access through better roads and trade agreements. However, issues such as climate change (floods and salinization), sea level rise, the increasing population, urbanization, changes to the biophysical and hydrological system, agricultural production challenges (soil degradation, pests and diseases, inadequate inputs and infrastructure), and water scarcity threaten the long-term sustainability of the agricultural sector, which in turn affects food security and the ability to provide sustainable healthy diets.

### 3.2.3 Overview of Nutrition-Sensitive Interventions

A growing number of donor agencies and development organizations, such as World Food Programme (WFP), United Nations Children's Fund (UNICEF), Council for Agricultural and Rural Development (CARD), Consultative Group on International Agriculture Research

(CGIAR), WorldFish, Alliance Biodiversity & CIAT, International Potato Center (CIP), CIMMYT, IFPRI, International Institute of Rural Reconstruction (IIRR), and the International Water Management Center (IWMI), are committed to supporting nutrition-sensitive agriculture. However, most of these organizations are mainly involved in a technical advisory role.

a) CGIAR Initiative on the Asian Mega Deltas (AMD):

Most of the activities implemented from 2022 to 2024 focused on surveys and desk reviews to determine the nutritional status of Cambodians, as well as reviewing the deltaic agri-food systems in the aspects of production, processing, and consumption patterns. These studies offer a comprehensive assessment of the current situation. Based on their findings, targeted interventions should be prioritized to address the identified challenges at the community level (see below).

I. Agricultural and collective business training for small-holder farmers, families on topics including production, feed and organic fertilizer processing techniques, seed selection, good agricultural practices
II. Capacity building of ACs to become more effective enterprises. These include bookkeeping, business plan development, leadership, and management, and how to access funding.
III. Mobilizing and creating chicken, rice, and vegetable producer groups
IV. Implementing co-investment funds to start agricultural businesses to support nutrition-sensitive agri-food systems
V. Educating and encouraging members of families and small holders to grow a variety of vegetables in homestead gardens
VI. Marketing training for ACs and small-holder farmers
VII. Cross-cutting issues included gender, youth inclusion, climate change and natural resource management.

In 2023, a total of 119 projects were active in the Mekong Delta, but only ten were specifically targeting FNS. Among the thirty-five projects led by NGOs, just twelve addressed food systems, particularly NSA food systems. The primary focus of these projects has been on food production, market development, and local economic development by enhancing livelihoods, especially among vulnerable population groups. WorldFish and the Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) provides financial aid, technical support and help restore conservation areas in the rural Mekong Delta (CGIAR AMD 2023).

Work Package 2 (WP2) of the AMD Initiative included the development of at least three nutrition-sensitive interventions to reduce, for example micronutrient deficiencies, aligned with the vision of the Cambodia's Roadmap for Food Systems for Sustainable Development 2030 of ensuring that "all Cambodians will have access to healthy diets and safe food … to break the intergenerational cycle of malnutrition and address the nutrition transition" (Kingdom of Cambodia 2021). In addition, the objective of WP2 is also aligned with the NAP/ZHC (2016-2025) to "support integrated actions to eradicate hunger and malnutrition by 2025" (Kingdom of Cambodia), thus reinforcing the broader strategic goals.

### 3.2.4Evidence Collected on Food Systems

*Production:* While Cambodia has made substantial progress in food security through economic and agricultural advancements, challenges in achieving nutrition security persist. National food production currently meets and exceeds the basic energy and protein needs of the population. However, micronutrient deficiencies remain a concern, potentially due to limited access to diverse and nutrient-dense foods. Cambodia’s agriculture sector is predominantly driven by small-holder farmers, who contribute significantly to the national supply of staple foods such as rice, fish, and aquaculture products. Despite this, production of essential food groups remains insufficient, with current supplies of fruit, vegetables, pulses, and milk meeting only 25%, 23%, 22%, and 2% of daily recommended intake levels, respectively. Per capita fruit and vegetable consumption is limited to approximately 140 grams per day, which is much lower than the recommended per capita intake of 400g. The Mekong Delta, known for its biodiversity, fertile soil, and productivity, serves as a primary food source supporting about 80% of Cambodia’s population. Within this region, agricultural households predominantly cultivate non-aromatic paddy rice, and many are engaged in livestock (primarily cows and pigs), poultry (chickens and ducks), and insect farming, with fewer households involved in fish or aquaculture production. Some farmers also engage in fruit and vegetable cultivation to diversify production and enhance food security. A growing number of small-holder farmers have adopted modern, mechanized farming techniques. While most farmers still rely on rain, improved irrigation infrastructure in specific provinces enables up to three rice harvests per year, as compared to the traditional single annual harvest. This shift toward modernization and enhanced water management represents a critical step in addressing food security needs; however, further efforts are necessary to promote diverse crop cultivation to ensure nutrition security.

*Processing:* Despite Cambodia’s progress in food production, there remains a critical shortage of infrastructure for processing, packaging, and branding of agricultural products. This gap restricts the potential for adding value to raw products, limiting income opportunities for small-holder farmers and reducing the availability of processed, high-quality food products in local markets.

*Consumption*: In Cambodia, most small-holder farmers prioritize food production for household consumption, with surplus production sold in local markets. However, no single food group is produced entirely by households; instead, families rely on a combination of home-grown and purchased foods to meet their dietary needs. This mixed approach reflects both the limitations in self-sufficiency and the need to access a diverse range of foods for balanced nutrition. High levels of rural poverty, a dependence on subsistence farming, and poor road conditions restrict access to a diverse range of nutritious foods for much of the population. The Cambodian diet is heavily reliant on rice (>300 g per capita per day) and animal protein, predominantly sourced from freshwater fish, and condiments with variable diversity in food intake across regions. Although the country produces a variety of vegetables, the average vegetable consumption is only 140 grams per capita per day—substantially below the World Health Organization's (WHO) recommended daily intake of 400 grams. Recent data indicates low vegetable consumption alongside an increase in the intake of fats, sugars, non-alcoholic beverages, fruits, and pulses. In addition, although recent data show an increase in milk and dairy, the intake is inadequate as it is seldom consumed. Ultra-processed foods and snacks and widely available, affordable, and consumed. This shift points to changing dietary patterns that may not align with optimal nutrition and health outcomes.

### 3.2.5Key Challenges and Opportunities

Recent publications highlight several ongoing challenges affecting nutrition and food security in Cambodia, including:

*Production challenges and opportunities:* Cambodia is ranked as one of the 12 most vulnerable countries impacted by to climate change in the world. In addition, the Cambodian deltaic food system is undergoing rapid social and economic transformations. These may impact FNS, and sustainability as follows:

I. The current food environment relies mainly on small-holder farmers with small homestead size and land available for agricultural activities.
II. Low productivity and poor-quality produce because of poor agricultural knowledge and skills, poverty leading to low access of high-quality seeds, lack of local markets resulting in post-harvest losses, and an inadequate supply system for new seeds.
III. Lack of agricultural laboratories and testing facilities to determine the nutrient content or safety of foods
IV. High input mechanization costs as most farmers are not able to afford the equipment
V. Climate change resulting in either flash flooding, flooding, or droughts – more resilient crops/seeds or cultivation techniques are needed.
VI. Limited water access during the dry season
VII. Irrigation resulted in more rice harvesting three times a year, but using more water causes rapid exploitation of natural water resources that may jeopardize the supply of aquatic foods
VIII. Pests and diseases, especially during the dry season, and the need for pesticides and fertilizers that increase input costs and have adverse effects on production, soil degradation, and the probable negative effect on food safety - heavy toxic metals and microbial and chemical contamination of the food supply (rice, fish, and vegetables)
IX. Decline in fish stocks
X. Migration, especially youth, to urban environments result in more elderly people involved in agricultural activities.
XI. Insufficient governmental budget for agricultural extension services.
XII. Most of the agricultural activities implemented by NGOs and the government focus on quantity of food availability; a shift towards quality is equally important.
XIII. Schools have ample land available for food production, but lack of awareness and knowledge among teachers about food production and nutrition on school grounds.

*Access of food and markets challenges:*

Limited processing, packaging, and branding facilities restrict the ability to add value and improve food quality, leading to income constraints for small-holder farmers.

Poor access to domestic market organizations and logistic investments to connect to premium market and exports for official trade.

Price volatility and high competition from imported products. While higher rice prices and export income provide economic benefits to farmers, the impact of this increased income on overall FNS, dietary intakes and nutritional status remains unclear.

In areas where rice is harvested three times annually, the surplus from the additional harvest is exported, primarily to Vietnam. This export activity results in higher local rice prices, generating increased income for farmers but also necessitating the purchase of additional food for household consumption.

*Food Consumption, Health and Nutritional Challenges:* Despite sufficient overall food production, especially rice staple, there is a persistent lack of micronutrient-rich foods, leading to deficiencies that affect public health. Challenges observed from the literature include:

I. Average daily energy intakes are low (1150 kJ and 1109 kJ per person per day in rural and urban areas) compared to global recommendation of 2,700 kJ/person/day
II. While dietary diversity is adequate among most households, however, the consumption of fruits, vegetables, dairy, and pulses remains low.
III. Fish is a dietary staple and provides up to 80% of animal protein consumption in Cambodia. However, fish farming and overall supply are on the decline.
IV. Increased intake of unhealthy foods, including energy drinks and ultra-processed foods that often contain high levels of sugar, unhealthy fats, and additives, contributing to poor health outcomes such as obesity, diabetes, and cardiovascular diseases.
V. Limited consumption data throughout the life cycle – lacking data for 6–23-month-old infants, the elderly, and men.
VI. Limited research on NCDs in general, as well as cause and effect studies relating to micronutrient deficiencies – thinness observed in 29% of women.
VII. Low literacy rates remain a challenge in nearly one-third of Cambodian households, limiting the population's ability to access, understand, and apply essential nutrition information. Most training done on food groups and households has limited knowledge about balanced diets, benefits of certain foods/food groups and ingredients.
VIII. Schoolchildren receive pocket money at least once per week; the majority consume at least one unhealthy drink/food at school.

Although the Mekong Delta is a major producer of rice, aquaculture and fruit and vegetables, a large percentage of the population cannot secure the basic requirements for FNS in the region. Socio-cultural beliefs that affect food choices, e.g., a belief that rice alone provides adequate nutrition and a belief that rice-based meals are healthy irrespective of portion size and unhealthy ingredients that are added. Social status is associated with more expensive foods that may limit consumption of other nutrient-dense foods.

In response to these challenges, several opportunities have emerged, including:

Biodiversity: Shifting from rice monoculture to more diversified agricultural systems can help increase the availability of nutritious foods like vegetables, fruits, and legumes, addressing micronutrient deficiencies and providing more balanced diets.

Policy integration: The government's recognition of the link between agriculture, nutrition, and health provides a unique opportunity to integrate nutrition into broader agricultural, economic, and social policies. This can be achieved through cross-sector collaboration between the ministries of health, agriculture, education, and social welfare.

Nutrition education campaigns: Leveraging the increasing public interest in health and wellness, Cambodia can expand national campaigns to promote balanced diets, reduce processed food consumption, and encourage healthier lifestyles.

Climate-smart farming: Investing in climate-resilient crops, such as drought-resistant rice varieties or nutrient-dense crops like legumes and vegetables, can help ensure the availability of nutritious foods despite changing weather patterns.

Water-efficient irrigation and sustainable land management techniques can improve agricultural yields while conserving resources, supporting both FNS and environmental sustainability.

## 3.3 Vietnam

Vietnam has made significant strides in improving food security over the past few decades. The country transformed from a net food importer to one of the world’s largest rice exporters. Government initiatives focus on agricultural innovation, infrastructure development, and social safety nets. Despite progress, issues like climate change and land degradation pose ongoing threats.

### 3.3.1 Policy Analysis

Vietnam, with its rapidly growing economy and significant agriculture sector, faces both challenges and opportunities in terms of nutrition, public health, and agricultural policies. The country has made notable progress over the last few decades in improving nutrition and health outcomes, yet still grapples with emerging issues tied to the triple burden of malnutrition: the coexistence of undernutrition, particularly in rural areas, alongside increasing rates of overweight and obesity among children under 5 in urban populations. Overweight and obesity have become growing public health concerns in Vietnam, particularly with the country's rapid economic development, urbanization, and changing dietary patterns. While undernutrition has been a significant focus in the past, the rise in overweight and obesity rates is now emerging as an equally important issue, particularly in urban areas. Agricultural and health policies have evolved to address these challenges, seeking to balance food and nutrition security, health, and sustainable agricultural development.

Agriculture plays a central role in Vietnam's economy, with rice being the staple food and the country's primary agricultural export. Over the years, agricultural policies have focused on improving productivity, ensuring food security, preventing hunger, and increasing farmers' income.

The country has been successful in achieving food security, with significant gains in rice production making it one of the world's largest rice exporters. The Vietnamese government has invested in agricultural research, irrigation systems, and infrastructure, contributing to productivity gains. However, issues such as climate change, soil degradation, and water scarcity threaten the long-term sustainability of the agriculture sector, which in turn affects food security. Several policies were put in place, with focus on sustainable food production and supply chain, equal access and affordability, nutrition education and behavioral change, food and nutrition assistance, and women empowerment.

Vietnam has made significant strides in addressing undernutrition, which has been a crucial focus of public health efforts in the country. Over the past few decades, Vietnam has successfully reduced the rates of undernutrition, particularly among children, through a combination of governmental policies, international support, and community-based initiatives. Vietnam has made notable progress in decreasing child stunting and wasting, two key indicators of undernutrition. According to the World Bank and UNICEF, the prevalence of stunting in children U5 has dropped significantly from over 30% in the early 2000s to approximately 24% in recent years. Wasting rates have also decreased, reflecting improvements in food and nutrition security.

Micronutrient deficiencies, particularly iron, iodine, and vitamin A, have been a challenge in Vietnam, but there have been significant improvements. For example:

I. The implementation of salt iodization policies has virtually eliminated iodine deficiency in the population.
II. Vitamin A supplementation programs have been successful in reducing the prevalence of this deficiency, particularly in rural and remote areas.
III. Efforts to fortify foods with iron, along with increased awareness about iron-rich diets, have helped reduce the prevalence of anemia, especially among women and children.

In Vietnam, WP2 of the AMD Initiative are closely tied to policies aimed at improving food and nutrition security, and sustainable agricultural development. These systems are designed to address the challenges of food and nutrition insecurity while promoting economic development and environmental sustainability. The relationship between nutrition-sensitive agri-food systems and policies in Vietnam is multifaceted, involving government strategies that integrate agricultural practices, food systems, and nutrition outcomes. Below are examples in which these systems are linked to policies in the country:

a) National Policies on Agriculture and Food Security

Vietnam has long recognized the need for integrating agriculture with nutrition through its National Agricultural Development Strategies and Food Security Plans. These policies aim to ensure that agricultural growth contributes to improved food security by enhancing the availability of diverse, nutritious foods. The National Strategy on Food Security (2021-2030) emphasizes ensuring sufficient, safe, and nutritious food for the population, including vulnerable groups. This includes supporting diverse farming practices (e.g., rice, vegetables, livestock) to increase the availability of nutrient-rich foods.

b) Integration of Nutrition into Agricultural Development

Vietnam's Socio-Economic Development Plan (2021-2025) incorporates a focus on agriculture, rural development, and nutrition. This policy seeks to move food production systems towards sustainable, diverse, and nutrition-sensitive agricultural practices.

The government has introduced policies encouraging multi-sectoral collaboration to link agricultural, health, and nutrition sectors. This integration ensures that agricultural practices promote not just food quantity but also food quality, for nourishing people.

c) Climate-Smart and Sustainable Agriculture

Policies aimed at strengthening climate resilience, such as the Green Growth Strategy and Vietnam’s Climate Change Adaptation Plans, also support nutrition-sensitive agri-food systems. These policies encourage agricultural practices that maintain or improve soil health, increase biodiversity, improve food production for long-term nutrition outcomes while reducing environmental impacts.

Climate-smart agriculture (CSA) can also improve nutrition outcomes by making available nutritious, climate-resilient crops, hence, increasing access to diverse food types (e.g., vegetables, legumes, fruits) and improving.

d) Food Systems and Healthy Diets Policies

The government has endorsed policies that promote diverse diets, such as encouraging the production of biofortified crops (e.g., rice enriched with zinc or vitamin A) to combat nutrient deficiencies. Policies on diversifying food sources and reducing reliance on a narrow range of crops (such as rice) are designed to improve access to nutrient-dense foods.

To improve the extent to which the policies govern and support nutrition-sensitive food systems, additional emphasis on the following areas are recommended: (i) multisectoral approaches, (ii) capacity sharing, (iii) climate adaptation and resilience, (iv) nutritious and diverse diets, and (v) gender equality, empowerment, and social inclusion. Many policies already exist in Vietnam that focus on these multisectoral linkages, including Vietnam’s Green

Growth Strategy (2012), National Program for Rural Development and Poverty Alleviation (2010-2020), National Strategy on Nutrition (2011-2020).

### 3.3.2 Nutrition-sensitive Interventions, Programs, and Agreements Implemented

Vietnam has implemented a range of interventions and programs aimed at improving public health, food and nutrition security, and agricultural sustainability. These initiatives have been designed to address the triple burden of malnutrition, improve FNS, and promote healthier diets and lifestyles, all within the context of a rapidly changing socio-economic and environmental landscape. Although there are other programs implemented by the government with support from other developments, here are some of the key programs and interventions:

a) CGIAR is a global partnership focused on reducing poverty, improving food and nutrition security, and enhancing sustainability in agriculture and food systems, and together with the National Institute of Nutrition (NIN) and the International Center for Tropical Agriculture (CIAT) had an agreement to implement activities through the "Securing the Food Systems of Asian Mega-Deltas for Climate and Resilience (AMD)" Initiative from July 2023-Dec 2023. The objectives include prioritizing nutrition-sensitive interventions by means of analyzing the nutritional data from the General Nutrition Survey, stakeholder consultation, and developing the Food Balance Sheet in Vietnam.

Activities implemented through the AMD Initiative include assessing nutrient consumption, household economic status, and workshops for stakeholders.

b) An agreement between CIAT and Can Tho University of Medicine and Pharmacy include the development of contents and materials to integrate nutrition-sensitive agricultural food systems approaches identified through WP2 of AMD Initiative into suitable courses/programs within the teaching and advanced training curriculum in the Mekong Delta region.

c) Zero Hunger National Action Program (NAP-V) includes sixty-eight main tasks; fifty-two are integrated tasks implemented by many parties such as ministries and agencies. It is a plan to ensure that all Vietnamese people have enough food. The program was launched in 2018 and is part of the United Nations Sustainable Development Goals (SPG2). The Goals:

I. Ensuring households have enough food all year.
II. Reduce malnutrition in children under 2 years old.
III. Developing a sustainable food security system
IV. Increasing the productivity and income of most family farming small holders.
V. Reducing food loss and waste.
VI. Promote and integrate NSA under the zero Hunger NAP in the period of 2023-2025.

### 3.3.3Key Challenges and Opportunities

Consultation workshops report from different regions of Vietnam indicate that key challenges in achieving FNS include:

I. Agricultural production still emphasizes quantity over quality, and weak enabling environment to support diversification of produce, and adapted to changing climate.
II. The nutritional quality of food available in school meals.
III. Consumers' nutritional awareness and knowledge is limited. Consumption of diverse and nutrient-dense foods are still low among the local population, especially in the face of rapid urbanization. Food safety along the supply chain, including in traditional and for international markets, remain a big concern for consumers.
IV.
V. .
VI. The establishment of food supply chains has not achieved the desired efficiency. Infrastructure has not received comprehensive investment, especially infrastructure adapted to climate change.
VII. Regional linkages and cooperation remain loose and ineffective. There is a lack of comprehensive information and shared database.
VIII. Climate change, and adaptability of food systems in responding to climate shocks.

Vietnam has several unique opportunities that can support and enhance nutrition-sensitive food systems interventions aimed at improving the country's FNS and health outcomes. These opportunities stem from the country's socio-economic development, rich agricultural heritage, favorable government policies, and ongoing efforts to address key challenges in food systems and public health. Here are the key opportunities:

I. Diversification of crops: Complementing rice monoculture with more diversified agricultural systems can help increase the availability of nutritious foods like vegetables, fruits, and legumes, addressing both micronutrient deficiencies and providing more balanced diets.
II. Policy integration: The government's recognition of the link between agriculture, nutrition, and health provides a unique opportunity to integrate nutrition into broader agricultural, economic, and social policies. This can be achieved through cross-sector collaboration between the ministries of health, agriculture, education, and social welfare.
III. Incentives for farmers: Policies that incentivize the production of diverse, nutrient-rich crops (e.g., vegetables, fruits, and livestock)
IV. Social protection programs: Programs like cash transfers, food assistance, and maternal and child health services, which focus on vulnerable populations, can be leveraged to improve access to nutritious food for low-income and marginalized groups.

V. Health education campaigns: Leveraging the increasing public interest in health and wellness, Vietnam can expand national campaigns to promote balanced diets, reduce processed food consumption, and encourage healthier lifestyles.

VI. Climate-smart farming: Investing in climate-resilient crops, such as drought-resistant rice varieties or nutrient-dense food like legumes, vegetables, and aquatic foods can help ensure the availability of nutritious foods despite changing weather patterns.

VII. Water-efficient irrigation and sustainable land management techniques can improve agricultural yields while conserving resources, supporting both FNS and environmental sustainability.

# 4 Comparative Analysis

Bangladesh, Cambodia, and Vietnam have rapidly growing economies and strong agricultural bases. While all three countries have made progress in nutrition and health separately, they continue to face challenges in FNS, dealing with the triple burden of malnutrition Their agricultural policies have evolved to address FNS, health, and sustainability. In addition, many agencies are involved in NSA interventions. Yet, common challenges in all three countries remain, e.g., climate change (floods and salinization), urbanization, and agricultural production challenges (soil degradation, pests and diseases, inadequate inputs, and infrastructure), which in turn affect FNS and the ability to provide sustainable healthy diets. While there is a strong emphasis on food production and water management, limited attention is given to nutrition-specific outcomes, leaving a gap in projects aimed at directly addressing nutritional challenges and promoting nutrition among vulnerable communities. In addition, there is limited information on the empowerment of women and youth and their involvement in NSA activities. This indicates an opportunity to align more projects with comprehensive FNS objectives. The recommendations highlight opportunities for further improvement in the AMDs.

# 5 Recommendations

## 5.1 Gaps in Terms of Programs Observed in Bangladesh, Cambodia, and Vietnam

The review found that while many documents included nutrition as an objective and discussed NSA, few reported specific nutrition measurements and outcomes. This indicates potential gaps in both measurement and reporting of nutrition impacts. There is also limited consensus on what needs to be tracked and what success looks like. In addition, while some impacts were observed, it was not possible to attribute changes, such as improvements in dietary diversity, specifically to the WP2 interventions. The reliance on national data made it unclear whether these outcomes resulted from the WP2 interventions, or broader government and other NGO initiatives, or a combination of these. Clearer attribution mechanisms and targeted evaluation frameworks are needed to accurately assess the specific contributions of WP2 interventions.

The provided documentation primarily focuses on food production. Although the objectives reference women and youth empowerment, the documentation lacks clear evidence demonstrating the impact of activities on these groups. Additionally, the evidence provided is insufficient to substantiate nutrition or diet-related outcomes. For example, while the documentation mentions that three rice harvest cycles contributed to increased household incomes, it does not address the subsequent impact on household nutritional outcomes. It should be noted that increased food production and income do not inherently result in improved dietary diversity or nutritional status. The link between agricultural interventions and nutrition outcomes involves complex and often indirect pathways. These pathways encompass food production, nutrition-related knowledge, agricultural income, women's empowerment, and the strengthening of local institutions (Sharma et al., 2021). Therefore, further analysis and clarification of these pathways are necessary to substantiate any nutrition-related impacts.

While most reports align with government strategies, there is insufficient clarity regarding coordination with other stakeholder programs and activities, which should be integrated into program design. Many reports rely on national surveys to observe changes, such as dietary intake and dietary diversity, over periods from 2004/2014 to 2020. However, the specific contributions of the various implemented activities to these observed changes remain unclear and require further examination.

Given the multiple contributing causes of food and nutrition insecurity, multi-sectoral and multi-disciplinary approaches are essential to enhance nutrition outcomes. Such approaches should be integrated within NSA programs or in coordination with other initiatives, incorporating behavioral change models in all interventions to optimize impact. It should also incorporate relevant sectors such as education, health, and social protection to maximize reach and impact. Capacity development measures are also needed to address potential gap in technical nutrition expertise among project teams

## 5.2 Scalable Initiatives/Programs:

This review underscores the need for stronger integration between agricultural and nutrition experts/researchers to foster sustainable NSA and promote healthy consumption practices, addressing the complex nutrition challenges facing vulnerable populations in Bangladesh, Cambodia, and Vietnam. Although many partners and stakeholders are currently collaborating on these programs and initiatives, there is a need to further strengthen these collaborations. Stakeholder roles should be clearly defined and expanded to encompass not only technical support, but also financial, and community engagement contributions, ensuring a more holistic and sustainable approach. Incorporating a nutritionist in all stages of project planning is essential to ensure that nutritional objectives are effectively integrated and achieved.

Rice and fish are staples across all three countries, and their production must be maintained and strategically scaled up to meet the demands of the growing population. While this section prioritizes aquaculture, it is crucial to emphasize that to address the triple burden of malnutrition, targeted interventions are essential. Promoting dietary diversity through the adoption of balanced, healthy diets that include all major food groups should be a central strategy as it supports improved nutritional outcomes, ensuring sustainable health benefits across the life cycle.

To support this goal, a multi-faceted strategy is proposed to complement fish and rice consumption through scaling up of fruit and vegetable production, increased use of livestock to supplement protein sources, enhanced nutrition education, and other NSI to ensure sustainable dietary intake improvements.

### 5.2.1 Aquatic Food Systems

Aquatic food systems, including aquaculture and capture fisheries, are considered one of the most important food production systems, valued for its significant economic impact and contribution to FNS. The continued advancement of this industry is a cornerstone of strategies aimed at ensuring global nutritional security. Environmental degradation, chemical contamination, suboptimal nutrition, and the prevalence of diseases are key challenges that hinder the aquaculture sector's ability to contribute effectively to global food security. Addressing these issues is critical to ensuring the sustainability and resilience of this vital food production system. (Fajardo et al. 2022).

**Bangladesh** is one of the world's leading producers of fish, with a significant portion of its population relying on fish for both nutrition and income. The country's diverse aquatic ecosystems support a variety of fish species, both freshwater and marine. According to the Bangladesh Bureau of Statistics (BBS), the country produces over four million metric tons of fish annually, making it one of the top fish-producing countries globally. Types of fish production:

Freshwater Fisheries: Most of the fish production in Bangladesh comes from freshwater sources such as rivers, ponds, and lakes. Popular species include carp (Rui, Katla, Mrigal), tilapia, pangasius (catfish), and sweet water shrimp.

Marine Fisheries: Bangladesh has a vast coastal area along the Bay of Bengal, where marine fish species such as hilsa (Ilish), shrimp, and pomfret are caught.

Aquaculture: The growth of aquaculture (fish farming) has been particularly significant in recent years, with pond aquaculture being the dominant method. Aquaculture contributes substantially to both the domestic supply and export of fish.

The fisheries sector forms the cornerstone of **Cambodia**'s economy and FNS with a per capita fish availability of 52.4 kg. The primary sources of fish include the Tonle Sap Lake, the Mekong River, and the Bassac River, with secondary sources located in the coastal areas of the Gulf of Thailand. While inland fisheries dominate overall production, marine fisheries are progressing gradually. Aquaculture is predominantly centered on freshwater fish farming, utilizing methods such as cage culture, pond culture, and fish culture in rice fields. Although aquaculture remains smaller in scale as compared to capture fisheries, its contribution to the country's total fish production has grown significantly. Coastal pond aquaculture and marine cage culture, though promising, currently represent a minor share of national production.

Fish seeds are currently produced in thirteen government hatcheries and numerous small-scale private hatcheries (FAO 2024). While rice production meets domestic demand due advancements in agricultural practices such as improved irrigation systems and the application of pesticides and fertilizers, fish production has experienced a notable decline in recent years despite many strategies employed in Cambodia. These agricultural advancements, while beneficial for rice yields, have adversely impacted the availability of wild caught fish. The declining wild fish stocks have led to an increased reliance on market-purchased fish in both urban and rural areas. A significant proportion of the fish available in local markets is now imported, often in processed forms such as dried fish powder or fermented fish paste. This shift underscores the need for sustainable policies that balance agricultural productivity with the conservation of aquatic ecosystems and the promotion of local fish production in Cambodia.

WorldFish has implemented projects in Cambodia to combat micronutrient deficiencies using small indigenous fish species (SIS) as a sustainable solution to address malnutrition. Harvested from community waterways and flooded rice fields, SIS are processed into a nutrient-rich fish powder and a supplementary snack product for use during off-seasons. This was done in collaboration with Save the Children, UNICEF and a private company, Vissot, respectively.

Fish production in **Vietnam** is a vital part of the country's economy, FNS, and cultural identity. The country's diverse water resources, including the Mekong Delta, rivers, and coastal areas, support both wild-caught fisheries and aquaculture. Vietnam is one of the top fish-producing countries globally, and fish is a major source of protein for the Vietnamese population. Vietnam's annual fish production is around 4-5 million metric tons, with a substantial portion coming from aquaculture. Around 60-65% of Vietnam's fish production comes from aquaculture, while the remaining portion is from wild-caught fisheries.

One of the most challenging issues in fish production is overfishing. Overfishing in marine areas, especially in the South China Sea, threatens wild fish populations. Efforts are being made to promote sustainable fisheries and combat illegal, unreported, and unregulated (IUU) fishing. Rising temperatures, floods, droughts, and changes in salinity levels in coastal areas are impacting fish farming, especially in the Mekong Delta, which is prone to salinity intrusion.

Another challenge is food safety in aquatic foods that can impact diet quality. Contamination (pesticides and fertilizers) during production, improper handling and processing, as well as environmental factors such as polluted water that increases the risk of bacterial (e.g., salmonella, *E.coli*), viral, and parasitic contamination of fish, which can cause food-borne diseases. In addition, warmer temperatures can lead to harmful algae blooms and salinity changes may lead to potentially increased pathogen levels in fish, posing as health risks in consuming aquatic foods.  Food safety is further exacerbated by lack of cold chain facilities, unsanitary handling of fish, and improper drying and smoking practices. Most of the fish along the Mekong delta are sold through informal markets where enforcement of food safety standards is weak, increasing the risk of consuming contaminated or low-quality fish. Spoiled or poorly processed fish result in nutrient losses, specifically protein and omega-3 fatty acids Contaminated fish can also affect dietary diversity if access to other protein sources is limited.

Aquatic foods production and consumption should be scaled up and recommendations include:

Small-holder farmers produce a significant proportion of fish. However, challenges such as small land holdings, the impacts of climate change, and reduced water levels during the dry season pose threats to consistent production. To address these challenges and ensure year-round availability of fish for household consumption, the promotion and use of backyard hatcheries and diversification of species, including genetically selected species or pond polyculture, are viable solutions. Backyard hatcheries enable small-holder farmers to maintain sustainable fish production, enhancing FNS and resilience in the face of climatic and seasonal variability.

Careful management of aquatic environments, including the use of fertilizers, pest/disease control, and water management is needed to ensure fish production meets the population needs. The successful implementation of environmentally friendly rice-fish systems requires farmers to be equipped with knowledge and skills of the rice-fish production system, and the benefits of this intervention to FNS, socio-economic status and livelihoods, and the environment.

Enhance gender inclusivity in aquatic food systems by providing equal access to resources, training, and decision-making opportunities for men and women, as well as the youth. This could include offering targeted support (access to credit, land, and equipment) to women, who often play a significant role in fish production, processing and marketing but also face barriers such as limited access to resources, training and decision-making roles. Women should thus be trained in sustainable aquatic food systems and value-addition interventions such as processing fish powders and micronutrient-rich snacks, as well as representation in ACs, producer groups, and decision-making processes. Empowering women can thus lead to more equitable and efficient food system while improving household nutrition outcomes.

Prioritize the scaling up processing of existing value-added fish products, e.g., fish powders, to be available in local and national markets at an affordable price and ensure product quality by developing and adhering to product specifications and regulatory standards. Investments in infrastructure, technology, and workforce development will be needed. These include local cold chain facilities and distribution systems to reduce post-harvest losses and ensure that aquatic foods remain as consistent, affordable source of nutrition. This may include the development of cold chain infrastructure, training in hygienic processing methods, and facilitating market access for small-scale producers. Another strategy is the application of nanotechnology to extend shelf life, however, this is still in the development stages and expensive.

Making fish products more affordable can be achieved by reducing reliance on large retailers and intermediaries, thereby streamlining the supply chain and enabling direct access for consumers to locally marketed fish through the training and development of micro, small, and medium enterprises (MSMEs). Training can include aspects such as sustainable business practices, hygiene and food safety standards, and diversification of fish products catering to local dietary and food preference needs. Incentives such as subsidies or tax deductions could be included for MSMEs that produce value-added aquatic foods such as fish powders or dried fish. It is also important to enable MSMEs to access affordable financing for aquatic foods processing and eco-friendly packaging facilities.

At the household level, recipes for fish and vegetable preservation can be developed, workshops on training women and youth on processing fish and vegetables can also be conducted. Household fish processing can include smoking, canning, pickling, drying (solar), and fermenting. Fish paste can be made using whole SIS, while fish "waste" such as fish heads of bigger species can be made into butter or oil, hence, preserving valuable nutrients such as omega-3 fatty acids.

Food safety issues can be addressed through stricter regulations, better infrastructure, consumer awareness campaigns, and training for all aquatic food producers, large- and small-scale processors, household members, ACs, health care workers, educators in schools, and school nutrition program workers.

Aquatic foods consumption can be promoted through the development and implementation of context-specific community-based nutrition education program focusing on the health benefits through the use and preparation of locally farmed fish. Key stakeholders including producers, processors, all household members, with a focus on women, market actors, health workers, agricultural cooperatives (ACs), and educators should be targeted in these programs. Collaborations with local departments of education to incorporate fish products into daily school meal programs and integrate nutrition education, focusing on the benefits of fish as part of a diversified diet, into the national curriculum should also be established.

Aligning aquaculture practices with sustainable fruit and vegetable production, communities can benefit from enhanced dietary diversity, better nutrition, and a reduced environmental footprint through Integrated Aquaculture-Agriculture (IAA) where different types of crops are cultured together using the same water source. IAA is broadly categorized into two broad categories, e.g., crop-fish systems and livestock-fish systems. Crop-fish integrated systems include rice integrated with fish systems (Melaku & Natarjan 2019) that are already practiced in Bangladesh, Cambodia, and Vietnam. As fruit and vegetable consumption is low in these three countries, aquaponics can also be introduced. Aquaponics integrate aquaculture with hydroponics (growing plants, such as vegetables and fruits, in water) where nutrients from aquaculture waste (e.g., fish excreta and unused feed) can be used as organic fertilizers for the plants in the water, and the plants grown hydroponically will in turn purify the water. This reduces the reliance on synthetic fertilizers and promotes sustainable farming and promoting production of fresh vegetables, herbs, and fruits alongside fish (Word Economic Forum 2021). Aquaponics are particularly suitable for urban or land-constrained areas such as smallholder farmers, encouraging local production of fruits and vegetables, which can enhance dietary diversity. Incorporating edible nutrient-rich hydroponic plants e.g., water spinach, lettuce, duckweed, cucumbers, tomatoes, strawberries, kale, bell peppers, gourds, green beans, chives, and watercress into aquaculture systems can contribute to dietary diversity and intakes throughout the year. In addition, climbing vegetables can be grown on frames over ponds and fruit trees can be planted on the banks of the ponds. Developing innovative and affordable food recipes/products that combine aquaculture and horticulture outputs (e.g., fish-vegetable meals or salads) can encourage consumption. However, as hydroponic systems tend to be warm environments, and combined with standing water, this can facilitate the growth and spread of bacteria and viruses, leading to the spread of waterborne diseases. These systems may serve as habitats for intermediate hosts of parasitic worms, like those causing bilharzia, and as breeding grounds for mosquitoes. These risks can be reduced by keeping ponds weed-free and well-stocked. Food safety practices are important in these systems.

The recommended strategies for aquaculture are designed to address the key pillars of FNS through targeted interventions supported by diverse stakeholders. Table 3 provides a breakdown of how these strategies align with the FNS pillars and possible partnerships is included.

### 5.2.2Rice production

Rice production has improved across all areas because of mechanization efforts, enhanced irrigation systems, training for small-holder farmers, and the implementation of Climate-Smart Mapping and Adaptation Planning (CS-MAP). Enhanced rice production will not only address local demands but also create opportunities for surplus to be sold or exported, thereby generating additional income for farmers. Investing in the expansion of irrigation systems is critical, particularly in regions that rely heavily on seasonal rainfall. Additionally, farmers should receive training in efficient water management practices, including rainwater harvesting, drip irrigation, and soil moisture conservation techniques, to optimize water use and ensure sustainable agricultural productivity.

It is essential to adopt multi-disciplinary planning approaches to ensure one strategy are complementary and does not adversely affect another. It is important to consider the impact of irrigating rice fields on water resources, as extensive irrigation can deplete rivers, reducing fish populations and impacting local protein sources. Conventional rice farming and intensive fish culture often rely on significant amounts of chemicals and drugs to control diseases, pests, parasites, and weeds, which can harm product quality and the environment. Rice-fish culture, however, offers a sustainable and symbiotic alternative. Fish play a key role in reducing pest and disease incidence in rice, lowering pesticide use by up to 50%, and in some cases eliminating the need for pesticides altogether. Additionally, fish contribute to weed control, such as grass carp, which can consume up to 80 kg of weeds per kilogram of fish produced. To ensure the health of both rice and aquatic species, environmentally friendly pesticides and fertilizers should be used. Coordination with water resource management, fisheries, and nutrition experts is needed to balance agricultural and ecological needs. A holistic approach helps maintain FNS, and ecosystem health concurrently. Sustainable agricultural methods, such as crop rotation, organic fertilizers, and integrated pest management, should be encouraged and adopted to ensure long-term productivity without depleting resources, especially fish resources, that are adversely affected using fertilizers and pesticides.

**Table 3** Strategies and possible partnerships to address the six pillars of food and nutrition security in Bangladesh, Cambodia and Vietnam

| Availability | Access | Consumption | Stability | Sustainability | Agency |
|---|---|---|---|---|---|
| **Strategies** | | | | | |
| Fish production – nutrient-rich species<br>Eco-friendly fertilizers and pesticides<br>Aquaponics<br>Farmer training<br>Climate change<br>Water management and safety<br>AC<br>Food safety, transportation and storage | Food preservation<br>Household and commercial fish products<br>Processing infrastructure<br>Food safety and specifications<br>Markets<br>Income generation | Nutrition education<br>School nutrition programs<br>Women empowerment<br>Nutrient-rich fish species<br>Water safety and preservation<br>Hygiene and food safety | Governance<br>Monitoring and evaluation<br>Financial assistance<br>Mitigate risks from climate change, water scarcity and market fluctuations | NGO and government support<br>Income generation<br>Water management and safety | Community-based participatory projects<br>ACs<br>Fish producer groups<br>Women and youth empowerment |

| Availability | Access | Consumption | Stability | Sustainability | Agency |
|---|---|---|---|---|---|
| **Possible partners** | | | | | |
| FAO | WFP | WHO | Asian Development Bank (ADB) | United Nations Environment Programme (UNEP) | NGOs |
| WFP | FAO | FAO | FAO | International Fund for Agricultural Development (IFAD) | ACs |
| IFAD | World Bank | WFP | IFAD | WFP | Community leaders |
| Asian Development Bank (ADB) | NGOs | International Food Policy Research Institute (IFPRI) | World Bank | IFPRI | Project HOPE |
| World Bank | Local government departments | IFAD | WFP | World Bank | |
| IRRI | Private-sector partners | UNICEF | NGOs | FAO | |
| Asian Food and Agriculture | Community-based-organizations | Global fund for women | National Governments and Ministries | Mekong River Commission (MRC) | |

| | | | | | |
|---|---|---|---|---|---|
| Organization (AFAO) | | | | | |
| Local governments and ministries | IFAD | UN Women | Private Sector and Agricultural Industry | ASEAN (Association of Southeast Asian Nations) | |
| Bangladesh Water Development Board (BWDB) | Food safety Asia (FSA) | BWBD | | BWBD | |
| Southern Institute of Water Resources Science | | Southern Institute of Water Resources Science | | Southern Institute of Water Resources Science | |
| Resilient Asian Deltas (RAD) | | RAD | | RAD | |
| Food Safety Asia (FSA) | | | | | |

### 5.2.3 Cultivation of Diverse Crops

The focus on promoting dietary diversity has led to initiatives encouraging farmers to cultivate a variety of nutrient-rich and indigenous crops, including fruits, vegetables, legumes, and pulses, as well as to integrate livestock farming into their agricultural practices. This is essential, especially in rural areas, to improve access to essential vitamins and minerals needed for child growth and development, and overall health and wellbeing of the population.

Although all households are encouraged to cultivate a diverse range of crops within their gardens to meet nutritional needs and promote food security, an alternative is a community garden where the government can identify and allocate suitable land within villages or communities. These gardens will serve as shared agricultural spaces to supplement household gardening efforts and support the nutritional and economic well-being of participating households. Another strategy can be the establishment of barter-based farmers markets where smallholder farmers are encouraged to voluntarily adopt a crop diversification strategy. Each farmer or farming group will specialize in one or two additional crops or livestock varieties, leveraging their expertise to enhance productivity and efficiency. Smallholder farmers will then collaborate to organize weekly or biweekly farmers markets where agricultural produce and livestock products can be exchanged without the use of money. This barter system will allow the exchange of nutrient-dense foods such as vegetables, fruits, eggs, milk, or meat, fostering a diversified diet for all participants, e.g., farmer A may exchange spinach for gourds with farmer B, and farmer A may also exchange spinach for eggs with farmer C. This approach can result in agricultural and dietary diversity across the community. However, local ACs and community leaders should oversee the implementation and monitoring of this strategy to the sustainability of the initiatives and equitable access to community garden resources and barter markets.

It is further recommended to include biofortified crops rich in nutrients like iron, zinc, and vitamin A. In addition, encourage regional collaborations and investment in aquaculture and livestock development to reduce reliance on a narrow range of staple foods. Lastly, financial support is needed to assist farmers to acquire additional land and agricultural equipment, enabling them to diversify and increase production.

### 5.2.4 Training and Development of the Agricultural Cooperatives (ACs)

Training workshops and capacity building sessions for small-holder farmers have been implemented, leading to enhanced knowledge and significant improvements in rice production and yields. Additionally, the establishment of ACs to provide ongoing farmer support is expected to boost morale and facilitate further advancements in agricultural productivity. It is recommended to continue with training on best practices in modern agriculture, climate adaptation, and efficient resources used to empower farmers. Training of women on agricultural practices and business skills should be scaled up to empower them to make decisions and increase productivity, which benefits both household nutrition and income. In addition, AC activities support small-holder farmers, e.g., pooling of resources, negotiating skills, and improving farmers' bargaining power should be strengthened. It is also recommended to create more leadership opportunities for women within ACs, involving them in decision-making processes for community-based agriculture and nutrition programs to ensure that their unique needs are addressed.

### 5.2.5 Market Linkages, Food Processing and Value addition of Food Products

Value chain approaches often face challenges when integrated into NSI pathways. The causal link between agricultural market development and nutritional outcomes is seldom clearly articulated during program design. Additionally, tensions arise in targeting market system approaches, which frequently exclude the poorest and most vulnerable populations. Agricultural market development initiatives often engage various private and public sector actors but may also target smallholder farmers who are producers of food for their marketable surplus (CRS 2024). Some projects have integrated value addition, such as producing fish powder, pickling mustard greens, and developing chicken feed processing techniques. Smallholder farmers are also encouraged to process chickens and vegetables for local market sales, reducing production costs and increasing profits. Many market-related challenges persist in all three countries, and it is recommended to:

Improve infrastructure: Invest in roads, storage facilities, and transportation networks to reduce transportation costs, minimize post-harvest losses, and enhance farmers' access to markets.

Strengthen digital platforms: Make the digital tools and platforms that have been developed accessible to more farmers to connect with buyers and MSMEs, provide real-time market information (e.g., accurate information about prices, demand chains), and facilitate e-commerce for agricultural products.

Promote and implement Quality Standards and certification: Implement standards and certification programs that help farmers meet the quality requirements of domestic and international markets, especially for exports. Assist local government departments to develop and enforce food safety standards and certifications to improve consumer confidence and meet regulatory requirements for both domestic and international markets.

Invest in processing infrastructure: Develop and improve processing facilities, especially in rural areas, to reduce food waste, extend shelf life, and add value to raw agricultural products.

Encourage small-scale and local processing: Support MSMEs in food processing to create local jobs, reduce transportation costs, and boost rural economies.

Training and skill development: Provide training on processing techniques, food safety standards, and quality control for both commercial and small-scale processors and households. For commercial processors, focus on advanced skills, quality assurance, and regulatory compliance to maintain high standards. For small-scale local processors, provide training in product development, branding, and packaging, enabling small-scale producers to create competitive, high-quality items. Additionally, train local suppliers in sourcing, storage, and distribution to ensure a steady flow of locally produced raw materials. For households, offer practical workshops on safe and efficient food preservation, storage, and basic processing methods to reduce waste, improve food safety, and enhance household FNS. This approach will help raise food quality and safety standards at all levels, empowering local communities, and processors.

Promote product diversification: Encourage the development of diverse, nutrient-rich processed products that cater to local dietary needs and help reduce malnutrition. At the household level, offer workshops on recipe development and safe food processing methods to create nutritious products, such as preserved foods. For small-scale processors, provide training on formulating nutrient-rich food products that are affordable, acceptable for the local community, and safe for human consumption, e.g., fortified snacks. This approach promotes nutrition, supports local economies, and fosters community self-reliance.

Strengthen farmer and market linkages: Facilitate connections between smallholder farmers and food processors to ensure that processed products are affordable and reach local markets efficiently.

### 5.2.6 Implementation of Comprehensive Interventions, including Nutrition Education

It is evident that most training programs for smallholder farmers, women, ACs, and schools focus on agricultural practices and food groups. Nutrition appears to be treated as a secondary consideration, and the training programs lack adherence to scientific rigor, potentially limiting their effectiveness in addressing comprehensive nutritional goals. It is recommended that nutrition education be scaled up by ensuring that all projects targeting food production and processing also incorporate elements of nutrition education, dietary diversity, and health informed by behavior change theories/models. In addition, focus on practical advice for nutrition at every life stage, emphasizing maternal, infant, and child nutrition by providing women with context-specific nutrition education and training on food preparation, child feeding practices, the importance of dietary diversity, nutrient-rich foods, food contamination, and safe cooking methods, as well as information about the health risks of consuming energy drinks and ultra-processed foods, emphasizing the importance of balanced, nutrient-rich diets. It is further important to encourage the consumption of locally grown, nutrient-rich foods to enhance dietary diversity.

The nutrition education programs should be scaled up to include health workers and schoolteachers, ensuring consistent messaging across all sectors and to ensure that the same message is communicated by all for effective reach. Specific nutrition manuals can be developed and should be included in scaling up the nutrition education programs. Social media can also be employed to disseminate nutritional information on a regular basis.

Nutrition education should also be included in the school nutrition program for children. In addition, the Access to Water, Sanitation, and Hygiene (WASH) program should be scaled up through inclusion in all agricultural interventions as clean water and sanitation are critical for reducing disease transmission, improving health, and supporting optimal nutrition, particularly for young children.

## 5.3 General Recommendations

### 5.3.1 Food Waste Management

Effective food waste management is essential for minimizing environmental impact, conserving resources, and promoting sustainable practices in food production and consumption. The following is recommended:

- Conduct awareness campaigns on the importance of waste reduction, recycling, and composting. Educate communities on the environmental impact of waste and how to manage it sustainably.
- Facilitate community composting programs for organic waste, especially in rural and peri-urban areas, turning food scraps and yard waste into valuable compost for local agriculture, e.g., introducing vermiculture.
- Offer workshops on upcycling waste materials into usable products, e.g., season and bake vegetable peels to produce vegetable chips or make nutrient-rich broth from

vegetable offcuts. In addition, offer workshops for women and the youth on upcycling waste materials into usable and sellable products, e.g., jewelry from coconut shells, to prevent migration to cities.

### 5.3.2 Monitoring and Evaluation Systems

Monitoring and evaluation are critical components for assessing the effectiveness, efficiency, and impact of programs, ensuring accountability, and guiding informed decision-making for continuous improvement. The following is recommended:

- Establish a clear monitoring and evaluation system for all programs to be implemented by:
  - Defining clear measurable indicators to track nutrition and health outcomes (e.g., dietary diversity, food security, anemia prevalence, and childhood growth metrics)
  - Developing standardized data collection protocols that are valid and reliable
  - Using technology for real-time monitoring and evaluation
  - Setting up a baseline assessment with the existing data collected
  - Engaging all stakeholders in planning and review
  - Creating a centralized data management system
  - Analyzing and disseminating findings regularly
  - Evaluating program impact periodically to assess the effectiveness of the NSA interventions
  - Establishing feedback mechanisms for communities and program implementers.
- Capacity Building of Local Staff: Provide ongoing training for local healthcare workers, community leaders, and program staff in data collection, analysis, and interpretation to strengthen local capacity to maintain a sustainable, effective monitoring system over time.
- Use Data to Inform Policy and Program Adjustments: Regularly review monitoring and evaluation results to refine interventions. Flexibility in program design enables timely modifications based on evidence, enhancing the system's responsiveness and effectiveness.
- Assess Income and Nutrition Outcomes: Conduct research to evaluate how additional income from rice exports influences household food spending, access to nutritious foods, and overall dietary diversity.

### 5.3.3 Women and Youth Development

Women and youth development is a cornerstone of sustainable progress, fostering inclusive growth by empowering these key demographic groups with the skills, resources, and opportunities needed to drive social and economic transformation.

In addition, women leaders from local communities can be identified based on their interest, knowledge, and potential to serve as trainers and change agents in agricultural and nutritional practices. A structured "Training-of-Trainers" program can be developed to empower the selected women by providing comprehensive training in aspects including sustainable agricultural practices, food processing techniques, basic nutrition, menu planning, personal hygiene, food safety, leadership, and community engagement skills. Trained women champions will act as peer models within their communities, sharing knowledge and best practices, and providing guidance, to other women. Support in terms of access to training materials, ongoing mentorship, and providing incentives, may ensure their effectiveness and sustained impact. This strategy can enhance the reach and effectiveness of the NSIs as

Establish community childcare centers or mobile daycare services near farming sites to support small-holder women farmers.

Track children's growth and nutrition outcomes as part of NSA interventions to assess impact. Regular monitoring helps to identify any nutritional deficiencies early and ensures interventions are meeting their goals.

### 5.3.4 Strengthening Micronutrient Supplementation and Food Fortification

Scaling up food fortification programs and micronutrient supplementation (e.g., iron, vitamin A, iodine) can combat widespread micronutrient deficiencies, especially in vulnerable groups like pregnant women and young children. It is recommended to collaborate with the local government departments to strengthen the supplementation and fortification programs.

## 5.4 Gaps and Recommendations for Project Design

The design and implementation of development projects in countries like Bangladesh, Cambodia and Vietnam often face unique challenges due to differences in socio-economic conditions, cultural contexts, governance structures, and environmental factors. While these countries have made significant strides in various sectors (e.g., agriculture, public health, education), gaps persist in the design and models of development projects. Below are some common gaps observed across projects in these countries:

### 5.4.1 Intervention Design

Interventions should be nutrition-sensitive, with clear goals and objectives, including nutrition and health outcomes. Standardized data collection protocols should be followed for implementation, monitoring, and evaluation of the program. Baseline data should be used to justify the intervention and target population. Measuring instruments and data collection and analyses methods should be clearly described. Pre- and post-intervention results should be described and changes reported in detail, followed by conclusions and recommendations. All stakeholders, including nutrition experts, should be included in the planning, implementation, and evaluation of the intervention. Community-based participation is essential in all steps of the design process.

### 5.4.2 Refine the Objectives

Ensure that the o0bjectives are clear, specific, and measurable. Well-defined objectives/questions are crucial for determining the study's design, methods, and analysis. In the material provided for each country, the study/proposal objectives/questions were not clear, with no clear focus on answering the questions of the study.

### 5.4.3 Determine the Sample Size

Conduct analysis to determine the minimum sample size needed to detect a meaningful effect, balancing precision, and practicality. The population for each focus is different and should be precisely identified, e.g., for production issues, stakeholders, farmers, ministries are targeted. Specific focus, including health, diseases, and nutrition, should involve public (especially women and children), hospitals, health facilities and clinic, physicians, and ministry of health. Be specific about who the population is (e.g., age range, location, clinical condition) to ensure better disaggregation and specificity of results.

### 5.4.4 Improve Data Collection Methods

Use multiple sources of data (e.g., surveys, interviews, observation, biomarkers) to increase the robustness of findings and reduce bias. Establish clear protocols for data collection to ensure consistency, reduce errors, and maintain quality control throughout the study.

### 5.4.5 Lack of Baseline Data

The publications evaluated were predominantly reporting surveys, with many findings drawn from national studies, limiting the ability to attribute specific actions or outcomes to AMD's surveys/interventions. While annual reports reference 14,000 beneficiaries, the specific activities conducted or outcomes measured among these beneficiaries were not detailed in the publications, which instead focused on smaller sample sizes or generalized national data. This lack of clarity hampers a comprehensive assessment of AMD’s impact.

Inadequate baseline data or improper baseline studies make it difficult to assess whether a project is making a real difference in the target community. Without accurate data, the effectiveness of interventions cannot be evaluated, and improvements are often not well-documented. It is thus important to include pre- and post-intervention measurements to measure change and thus impact of the program/initiative.

### 5.4.6Develop and Implement Interventions

Ensure that projects targeting food production and processing also incorporate elements of nutrition education, dietary diversity, and health informed by behavior change theories/models. The content of educational materials should be determined, designed and written by experts in nutrition and agriculture for several important reasons. Experts bring specialized knowledge, credibility, and a deep understanding of the complexities surrounding both disciplines, which is crucial for crafting accurate, evidence-based, and impactful content. In this project. It was mentioned that there were educational materials developed but the content was not clearly defined and by whom it was developed was not clear.

### 5.4.7Workshops

The number of participants in each workshop should be expanded at the community level. Although in the policy report it was mentioned that there were many workshops and conferences implemented, the purpose of the workshops was not identified clearly, and it should be on a larger scale to be representative of all the countries.

### 5.4.8Gender Blindness

Many projects in Bangladesh, Cambodia, and Vietnam do not adequately consider the gendered dynamics of development. Women often play central roles in agriculture, nutrition, and household decision-making, yet their needs and contributions may be overlooked in project design. This leads to missed opportunities to empower women and enhance project outcomes.

### 5.4.9Cost-effectiveness and Cost-benefit Analyses

Cost-effectiveness and cost-benefit analyses are crucial to demonstrate the economic benefits of such investments, identify the most impactful and cost-efficient and strategies, and to support the long-term viability of NSA interventions.

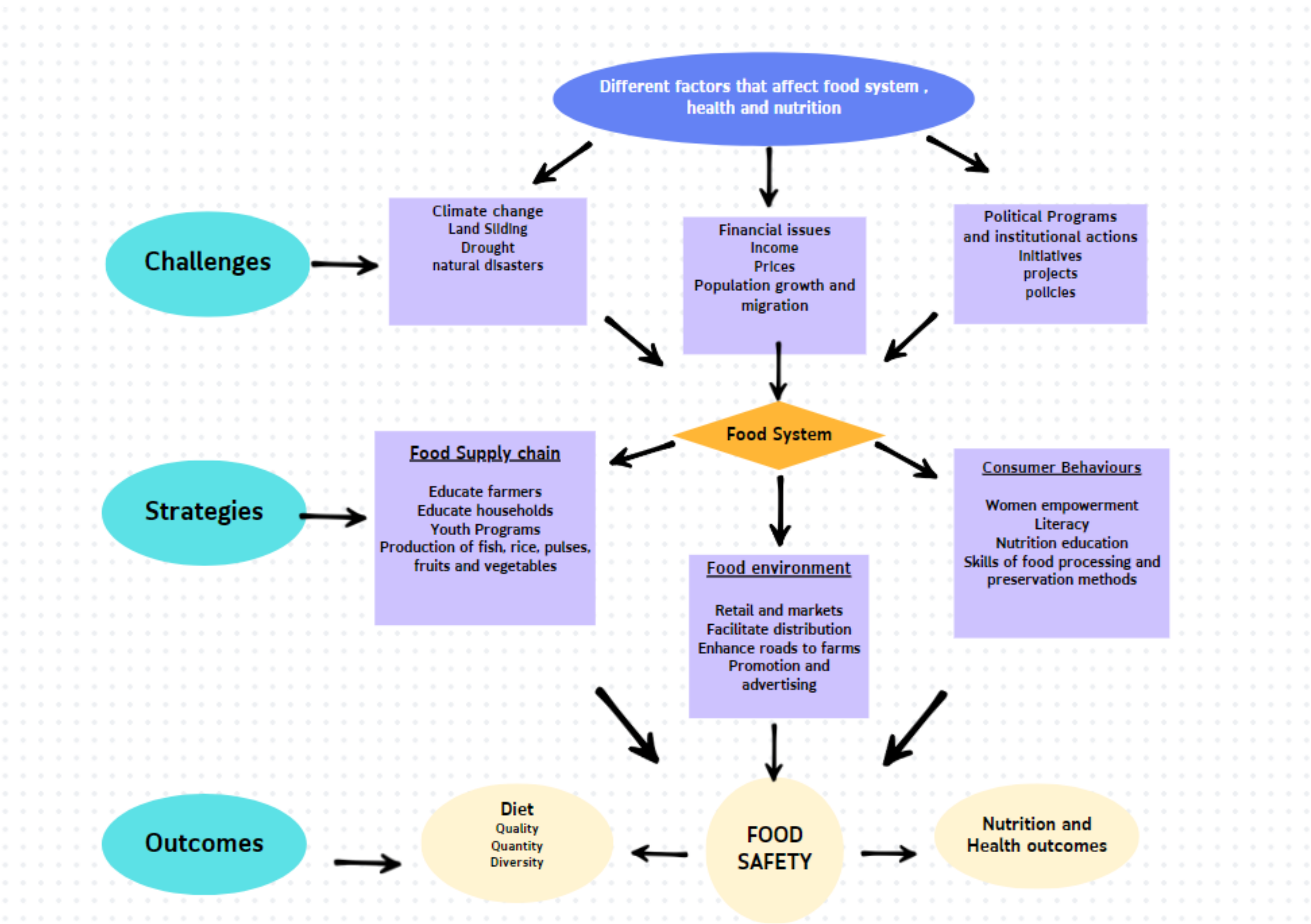



**Figure 4** Summary of main challenges and strategies to address nutrition and health outcomes

# Conclusions

Malnutrition, encompassing undernutrition overnutrition, and micronutrient deficiencies, remains a persistent challenge across the deltas of Bangladesh, Cambodia, and Vietnam. While rice and fish serve as the primary production and consumption staples and dietary diversity appears adequate, the low consumption of fruits, vegetables, dairy, and pulses highlights significant nutritional gaps. This highlights the need for strategies to balance production efficiency with accessibility and consumer preferences, ensuring that foods from all food groups are produced, accessed and consumed in adequate quantities to ensure dietary diversity and a micronutrient-rich diet. Targeted, context-specific interventions are thus needed to ensure balanced dietary practices for improving overall health and nutritional outcomes.

Numerous policies, strategies, and stakeholders are actively engaged in NSA to address malnutrition and challenges within the food system. Despite progress in agricultural productivity, economic growth, and nutrition and health, common challenges in all three countries remain, e.g., climate change (floods and salinization), urbanization, and agricultural production challenges (soil degradation, pests and diseases, inadequate inputs, and infrastructure), and food safety issues, which all in turn affect FSN and the ability to provide sustainable healthy diets. While there is a strong emphasis on food production and water management, limited attention is given to nutrition-specific outcomes, leaving a gap in projects aimed at directly addressing nutritional challenges and promoting nutrition among vulnerable communities. Additionally, cross-cutting issues, such as the empowerment of women and youth and their decision-making roles in food production and processing, remain underexplored. Addressing these gaps is essential to unlocking the full potential of NSAs for sustainable and inclusive development.

Given the multiple contributing causes of FNS, achieving FNS and addressing malnutrition requires comprehensive multi-sectoral and multidisciplinary approaches that integrate agriculture, nutrition, and health while addressing local contexts. Sustainable NSA, as well as promotion of healthy consumption practices through nutrition awareness and education programs, are recommended to address the complex nutritional challenges facing vulnerable populations in Bangladesh, Cambodia, and Vietnam. Improved stakeholder engagement, gender inclusivity, and enhanced monitoring and evaluation frameworks will be critical to ensuring sustainable and impactful outcomes. Additionally, critical areas such as post-harvest food processing, food safety, and the cost-effectiveness of interventions should also be given attention. While existing partnerships and stakeholder collaborations are advancing these efforts, they must be strengthened. This includes providing not only technical expertise but also strategic guidance, financial support, and community engagement. Incorporating a nutritionist at every stage of project planning and implementation is essential to ensure that nutritional objectives are effectively addressed and achieved. This integrated and inclusive approach will enhance the sustainability and effectiveness of efforts to improve nutritional outcomes across the three countries.

# References


Al Daccahe M, Zeid BA, Hojeji L, et al. 2024. Systematic review on the impacts of agricultural interventions on food security and nutrition in complex humanitarian emergency settings. BMC Nutrition; 10: 60. https://doi.org/10.1186/s40795-00864-8. Accessed: 15 Oct 2024.

Black RE, Victora CG, Walker SP, et al. 2013. Maternal and child undernutrition and overweight in low-income and middle-income countries. The Lancet; 382(9890): 427-451.

Cavalli-Sforza LT. 2015. Public health & nutrition in the Asia-pacific: reflections on a quarter century. Asia Pacific Journal of Clinical Nutrition; 24: 1-9.

CGIAR. 2022. Asian Mega-Deltas: From risk to resilience. CGIAR initiative briefer. Asian Mega-Deltas - CGIAR Accessed: 31 Oct 2024.

CGIAR Research Initiative on Asian Mega-Deltas (CGIAR AMD). 2024. Annual Technical Report 2023: CGIAR Research Initiative on Asian Mega-Deltas. Montpellier, France: CGIAR System Organization. https://hdl.handle.net/10568/141651. Accessed: 07 Oct 2024.

CRS. 2024. Feeding the future: leveraging agriculture for netter diets and nutrition. Baltimore, MD: Catholic Relief Services (CRS).

De Silva SS & Davy FB. 2009. Success stories in Asian aquaculture. Ottawa, Canada: International Development Research Centre. Success Stories in Asian Aquaculture. Accessed: 22 Nov 2024.

Fajardo C, Martines-Rodriquez G, Blasco J, et al. 2022. Nanotechnology in aquaculture: Applications, perspectives and regulatory challenges. Aquaculture and fisheries; 7(2): 185-200.

FAO. 2006. The state of food insecurity in the world. 2006. Rome, Italy: Food and Agriculture Organization of the United States (FAO).
chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://www.fao.org/4/a0750e/a0750e00.pdf Accessed: 30 Oct 2024.

FAO. 2024. Fishery and aquaculture country profiles: Cambodia. https://www.fao.org/fishery/en/facp/khm#prodsectorintroinlandfishingsystems. Accessed: 20 Nov 2024.

Gillespie S & Nisbett N. 2019. Governance and leadership in agri-food systems and nutrition. In: Shenggen F, Yosef S & Pandya-Lorch R (eds). Agriculture for improved nutrition. Seizing the momentum. Gloucester, UK: Severn.

Gillespie S & van den Bold M. 2017. Agriculture, food systems and nutrition meeting the challenge. Global challenges 2017, 1, 1600002.

Global Nutrition Report 2022. Bangladesh.
https://globalnutritionreport.org/resources/nutrition-profiles/asia/southern-asia/bangladesh/
Accessed: 30 Oct 2024.

Global Nutrition Report. 2022. Cambodia. https://globalnutritionreport.org/resources/nutrition-profiles/asia/south-eastern-asia/cambodia/ Accessed: 30 Oct 2024.

Global Nutrition Report. 2022. Vietnam. https://globalnutritionreport.org/resources/nutrition-profiles/asia/south-eastern-asia/viet-nam/ Accessed: 30 Oct 2024.

Herforth A & Harris J. 2014. Understanding and applying primary pathways and principles. Brief #1. Improving nutrition through agriculture technical brief series. USAID/Strengthening Partnerships, Results, and Innovations in Nutrition (SPRING). Arlington, VA. https://spring-nutrition.org/publications/briefs/understanding-and-applying-primary-pathways-and-principles. Accessed : 30 Oct 2024.

HLPE. 2017. Nutrition and Food Systems, A report by the High-Level Panel of Experts on Food Security and Nutrition of the Committee on World Food Security. Rome. Available at: https://openknowledge.fao.org/server/api/core/bitstreams/4ac1286e-eef3-4f1d-b5bd-d92f5d1ce738/content. Accessed: 30 Oct 2024.

IFPRI. 2011. Leveraging agriculture for improving nutrition and health: Highlights from an international conference. Washington, DC: International Food Policy Research Institute (IFPRI).

Jaenicke H & Virchow D. 2013. Entry points into a nutrition-sensitive agriculture. Food Security; 5(5): 679-692.

Kingdom of Cambodia. 2016. National Action Plan for the Zero Hunger Challenge in Cambodia (NAP/NHZ 2016-2025). Phnom Peng

Kingdom of Cambodia. 2021. Cambodia's Roadmap for Food Systems for Sustainable Development.

Lachal J, Orri M, Speranza M et al. 2013. Qualitative studies among obsess children and adolescents : a systematic review of the literature. Obesity Reviews; 14: 351-368.

Melaku S & Natarjan P. 2019. Status of integrated aquaculture – Aquaculture systems in Africa. International journal of fisheries and aquatic studies; 7(4): 263-269.

Morris S, Cogill B & Uauy R. 2008. Effective international action against undernutrition: why has it proven so difficult and what can be done to accelerate progress? The Lancet; 371(9612): 608-621.

Nisbett N, Gillespie S, Haddad L et al. 2014. Why worry about the politics of child nutrition? World Development; 64: 420-433.

Pinstrup-Andersen P. 2012. Can agriculture meet future nutrition challenges? European Journal of development Research; 25(1): 5-12.

Ruel MT. 2019. New evidence on nutrition-sensitive agricultural programs. In: Shenggen F, Yosef S & Pandya-Lorch R (eds). Agriculture for improved nutrition. Seizing the momentum. Gloucester, UK: Severn.

Ruel MT & Alderman H. 2013. Nutrition-sensitive interventions and programmes: how can they help to accelerate progress in improving maternal and child nutrition? The Lancet; 382(9891): 536-551.

Sharma IK, Di Prima S, Essink D, et al. 2021. Nutrition-sensitive agriculture: A systematic review of impact pathways to nutrition outcomes. Advances in Nutrition; 12(1) 251-275. https://www.sciencedirect.com/science/article/pii/S2161831322003787?via%3Dihub. Accessed: 10 Nov 2024.

Swinburn B, Egger G & Raza F. 1999. Dissecting obesogenic environments: the development and application of a framework for identifying and prioritizing environmental interventions for obesity. Preventive Medicine; 29(6): 563-570.

UNICEF. 1990. Strategy for improved nutrition of children and women in developing countries. New York: United Nations Childrens' Fund (UNICEF).

UNICEF. 2021. UNICEF Conceptual framework on maternal and child nutrition. New York, NY: UNICEF. https://www.unicef.org/media/113291/file/UNICEF%20Conceptual%20Framework.pdf. Accessed: 31 Oct 2024.

USDA National Agricultural Library. Aquaculture and Aquaponics. https://www.nal.usda.gov/farms-and-agricultural-production-systems/aquaculture-and-aquaponics. Accessed: 05 Dec 2024.

World Bank. 2007. From agriculture to nutrition: Pathways, synergies and outcomes. Washington, DC: International Bank for Reconstruction and Development/World Bank.

World Economic Forum. 2021. What is integrated aquaculture and how can it help feed the world? https://www.weforum.org/stories/2021/08/integrated-aquaculture/#:~:text=Integrated%20aquaculture%20means%20different%20types,instead%20of%20leaving%20the%20system. Accessed: 05 Dec 2024.

WFP, UNICEF & Council for Agricultural and Rural Development (CARD). 2023. Fill the Nutrient Gap, Cambodia. Phnom Penh, Cambodia: World Food Programme (WFP).

# Acknowledgments

This report was supported by the CGIAR Initiative, Securing the food systems of Asian Mega-Deltas for climate and livelihood resilience (AMD) under Work Package 2: Nutrition sensitive deltaic agrifood systems. We would like to thank all funders who supported this research through their contributions to the CGIAR Trust Fund: www.cgiar.org/funders.

This report was developed with the valuable contributions and expertise of several individuals. We extend our heartfelt gratitude to Wilna Oldewage-Theron, PhD, RD (SA), Professor and Graduate Advisor in the Department of Nutritional Sciences at Texas Tech University, who served as a consultant for the Asian Mega Deltas Initiative. We also sincerely acknowledge the invaluable contributions of Dr. Wanjiku Gichohi, Senior Scientist and Impact Area Lead for Nutrition and Public Health at WorldFish; Ben Wisemen, Manager, Nutrition Impact Platform at WorldFish; and Dr. Khondker Murshed-E-Jahan, Scientist at WorldFish and Co-lead of the Asian Mega Deltas Initiative. Their dedication and efforts were essential in shaping the findings and recommendations presented in the report.

### Design support

Palash Dhar, WorldFish.

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