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Review of Agri-Food Chain Interventions Aimed at Enhancing Consumption of Nutritious Food by the Poor: Bangladesh

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About this paper

The LANSAs Review of Agri-Food Value Chain Interventions papers have been produced to provide context for LANSAs work. It should be noted these are living / evolving papers, not intended for publication or citation at this time.

About LANSAs

Leveraging Agriculture for Nutrition in South Asia (LANSA) is an international research partnership. LANSAs is finding out how agriculture and agri-food systems can be better designed to advance nutrition. LANSAs is focused on policies, interventions and strategies that can improve the nutritional status of women and children in South Asia. LANSAs is funded by UK aid from the UK government. The views expressed do not necessarily reflect the UK Government's official policies. For more information see www.lansasouthasia.org

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Acronyms

AVRDC	Asian Vegetable Research and Development Centre
BARI	Bangladesh Agricultural Research Institute
BBS	Bangladesh Bureau of Statistics
BDHS	Bangladesh Demographic and Health Survey
BDT	Bangladeshi Taka
BEOL	Bangladesh Edible Oil Limited
BRRRI	Bangladesh Rice Research Institute
CARE	Cooperative for Assistance and Relief Everywhere
CMAM	Community Based Management of Acute Malnutrition
CPD	Centre for Policy Dialogue
FAO	Food and Agriculture Organization
FY	Fiscal Year
GAIN	Global Alliance for Improved Nutrition
GO	Government Organizations
GoB	Government of Bangladesh
HIES	Household Income and Expenditure Survey
icddr,b	International Centre for Diarrhoeal Disease Research, Bangladesh
IFAD	International Fund for Agricultural Development
IPHN	Institute of Public Health Nutrition
MFIs	Microfinance Institutions
NGO	Non-governmental Organization
PRICE	Poverty Reduction by Increasing the Competitiveness of Enterprise
USAID	United States Agency for International Development
WHO	World Health Organization
WFP	World Food Programme

I. Introduction

Bangladesh is primarily an agrarian nation. Most of the people of the country directly or indirectly depend on agriculture. Rural people are more involved in this sector compared to urban people. Agriculture is the single largest producing sector of the economy since it comprises about 18.6 per cent of the country's GDP and employs around 45 per cent of the total labour force (Wikipedia 2015).

The performance of this sector has an overwhelming impact on major macroeconomic objectives like employment generation, poverty alleviation, human resources development and food security. The acceleration in economic and agricultural growth has made a positive impact on the diversity of food intake, away from the rice- and vegetable-based diet in favour of quality food. A recent International Food Policy Research Institute (IFPRI) study notes that nearly 20 per cent of the population is still calorie deficient and the gender disparity in calorie intake still persists. Bangladesh has made significant progress in reducing under nutrition of children. The prevalence of underweight children below five years of age declined from 60 per cent in 1990 to 36 per cent in 2011. However, progress in reducing stunting, the indicator of chronic malnutrition, shows a less encouraging picture. The level is still about 41 per cent, much higher than countries in sub-Saharan Africa with lower levels of income than in Bangladesh (BRAC 2012). An appropriate integration of agriculture and nutrition is essential to achieve better nutrition security, especially for the poor and marginalised people of the country.

The predominant focus of efforts to integrate better agriculture and nutrition towards reducing the prevalence of under nutrition in developing countries has been on boosting production and/or consumption of nutritious foods by farm households. While this is clearly appropriate in countries where a large proportion of the poor have agriculture as their main source of livelihood, as in South Asia, it is increasingly recognised that even in this region the majority of the poor derive some or all of their food through purchases from food markets (Henson et al. 2013). These might include individuals in producer households that are not self-sufficient in food for some or all of the year. This requires that attention is also given to the functioning of the agri-food value chains through which food is produced, processed, stored and distributed, and how this can be improved in terms of the consumption of nutritious food by the poor.

The agricultural value chain is a set of actors (private, public, and including service providers) and it details the sequence of value-adding activities involved in bringing a product from production to the final consumer. In agriculture, the value chain can be thought of as a 'farm to fork' set of processes and flows (Cervantes-Godoy and Dewbre 2010).

A review on existing agriculture value chain-based interventions that focus on enhancing the availability, affordability, acceptability and/or consumption of nutritious foods in households beyond the farm gate in Bangladesh has been undertaken. This review covers

I. Interventions focused on foods that are naturally nutrient-dense

2. Interventions focused on enhancing the nutritional value of foods, including staples and prepared foods, whether directed at particular nutritional uses or for consumption by the general population
3. Food distribution programmes that might incorporate foods in either of the preceding categories

It is important to recognise that the country review does not aim to be comprehensive in that it does not present a complete inventory of value chain-based interventions. Rather, the aim has been to identify a representative cross-section of interventions that is indicative of the main approaches and/or focal foods that highlight instances of innovation.

2. Local Context

The Gross Domestic Product (GDP) in Bangladesh went up by 7.05 per cent in 2016 from the previous year. The GDP growth rate averaged 5.72 per cent from 1994 until 2016, reaching an all-time high of 7.05 per cent in 2016 and a record low of 4.08 per cent in 1994.¹ The total population in Bangladesh, when last recorded in 2015, was 157.9 million people, an increase from 50.1 million in 1960.² As a result of these combined trends, there has been an accelerated growth in per capita income in Bangladesh, rising from \$1,190 to \$1,314³ as well as a decline in rates of poverty from 58 per cent in 1991/92 to 32 per cent in 2010 (BBS HIES 2003; BBS HIES 2011). This indicates that the increasing rate of economic growth of the country should have enabled the food and nutritional security of its population.

The agricultural sector is critical to national food security. Significant achievements in foodgrain production have been achieved over the last 20 to 30 years. Rice production has shown respectable growth due to the adoption of high-yielding varieties. In fact, the growth in rice production kept pace with the population growth in the 1980s and has surpassed it by a significant margin since then. As a result, the challenge of reducing protein-energy malnutrition has been met. Furthermore, in recent years, maize has been replacing wheat because of its higher yield, profitability and suitability to the agro-ecological conditions in Bangladesh. The rapid expansion in the production of cereals was partly achieved through reduction in the area for production of pulses, oilseeds and sugarcane. Pulses and oilseeds are important sources of protein and micronutrients, especially for the poor. The decrease in the production of these crops has had adverse impact on nutritional balance among the people. The production of potato and vegetables, on the other hand, has shown significant growth in recent years.⁴

Fruit and vegetables are highly valued in human diets, mainly for vitamins and minerals. However, the consumption of vegetables in Bangladesh is 161 g/day/capita, which is still far below the minimum average requirement of 300 g/day/capita; the consumption of fruit in Bangladesh is 44.7 g/day/capita while average requirement is 100 g/day/capita. Consumption

¹<http://www.tradingeconomics.com/bangladesh/gdp-growth>

²<http://www.tradingeconomics.com/bangladesh/population>

³<http://www.dhakatribune.com/bangladesh/2015/jul/02/bangladesh-now-lower-middle-income-country>

⁴<http://archive.thedailystar.net/beta2/news/food-security-building-on-a-success-story/>

of milk is 33.7 g/day/capita, while the average requirement is 130 g/day/capita. Fish consumption in the country is 50 g/day/capita, with the average requirement is 60 g/day/capita (BBS HIES 2010). Overall, there have been positive changes in the production of both fish protein and milk, but these have not necessarily led to sufficient improvement in the diets of the most nutritionally-deficient groups in the country.

Given that many of the undernourished live in rural areas, several agricultural interventions have focused on increasing the income of the poor through raising agricultural yields. Such interventions have included a strong focus on rice production because of its importance to poor households and for the food situation in the country as a whole. Equally, such interventions have looked to increase production of high-value products such as vegetables and fish. The advantages of growing these products are three-fold: they are high-value products with strong market demand that help generate increased household income; they provide foods that have the potential to improve the nutritional status of the household if consumed on-farm; they increase the overall availability of nutrient-rich foods in the economy.

Despite these achievements, under-nutrition still remains a major public health problem in Bangladesh (Bhutta et al. 2013), particularly concerning women and children. Although the prevalence of underweight declined from 41 per cent in 2007 to 36 per cent in 2011, other indicators are less encouraging. Thus, stunting declined by only 2 per cent (from 43 per cent to 41 per cent) over the same period. Further, the prevalence of wasting declined little, from 17 per cent in 2007 to 16 per cent in 2011 (BDHS 2012). Health problems related to deficiencies in intake of micronutrients such as vitamin A, iron and zinc are also widespread.

The Food and Agriculture Organization of the United Nations (FAO) found in a study that more than 54 per cent of preschool-age children, equivalent to more than 9.5 million children, are stunted, while 56 per cent are underweight.⁵ An International Centre for Diarrhoeal Disease Research, Bangladesh report (icddr,b et al 2013) stated that “child and maternal malnutrition has been reduced in Bangladesh but the prevalence of underweight (weight-for-age z-score <-2) among children aged less than five years is still high (41 per cent). Nearly one-third of women are undernourished with body mass index of <18.5 kg/m². The prevalence of anaemia among young infants, adolescent girls and pregnant women is still at unacceptable levels.⁶

Many interventions aimed at combating the undernutrition problem in Bangladesh have been undertaken by the government and NGOs in recent decades. These have included a nationwide immunisation programme, supplementation of vitamin A for children aged under⁵, infant and young child feeding counselling (IYCF), iron and foliate supplementation for pregnant women, integration of nutrition into primary health care services, large-scale expansion of iodised salt marketing, etc. However, the implementation of nutrition-sensitive agricultural interventions remains limited. Although the country has achieved tremendous success in boosting food security in term of crop production, nutrition is yet to get priority in effective sense in the agriculture and broader agri-food sectors. There have been some attempts to complement agricultural interventions that are largely targeted at increasing the

⁵http://www.fao.org/ag/agn/nutrition/bgd_en.stm

⁶<http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3312353/>

productivity and income of small and medium-scale farmers with initiatives such as kitchen gardens, vegetable production on pond dykes and careful selection of products so as to increase the potential for household consumption.⁷

3. Review Methodology

The review was done through a synthesis of the literature available on nutrition interventions in agriculture and agriculture value chain modes in the country, using online book reviews as well as analyses of published reports. The interventions relating to dairy, poultry, fisheries, school feeding, fortification and bio-fortification were considered for study, whereas agriculture research and extension related documents, which will generate effect on nutrition only in the long term, were excluded. After identification of a number of interventions, a few of them were considered for further review. To make the study more accurate, information was collected from different institutions through personal contact. The research questions were based on the selection criteria of the interventions.

The overall criteria to identify the interventions were:

- Whether or not any additional nutritional value is being added by the agricultural product, both at the pre- and post-farm gate level
- Whether target population groups or groups consuming the focal foods are predominantly infants and adolescent girls
- Whether the focal foods are nutrient-dense beyond energy
- Whether women are being nutritionally and economically empowered by the interventions
- Whether scalability of the nutrient-dense food was possible
- Whether there was future scope to create a perfect value chain

Considering the above criteria, 19 interventions were selected for this study, as shown in **Table I**.

⁷For example, study of the nutrition-sensitivity of USAID agricultural interventions in Bangladesh found that in a project led by WorldFish a decision was made to introduce small indigenous fish species alongside carp in fishponds in the hope that families would consume some of these small indigenous species even though it was expected that most of the larger fish would be sold on to the market (Henson et al. 2012).

4. Review of Agri-food Value Chain

Types of Interventions and their focus

Out of the 19 agri-food value chain-based interventions, 10 involved foods that are naturally nutrient-dense, 6 concerned efforts to enhance the nutritional value of foods and 3 are related to food distribution. In the second category (additional value interventions), 4 deal with fortified foods and 2 with biofortification. (**Table 1**)

Table 1: Identified agri-food value chain interventions

Agri-food Value Chain Interventions for Nutrient-Dense Foods		
Naturally Nutrient-Dense Foods <ul style="list-style-type: none"> • 3 dairy interventions • 1 poultry intervention • 2 fisheries interventions • 4 vegetables interventions 	Foods of Increased Nutritional Value <ul style="list-style-type: none"> • 4 interventions on infortified foods <ul style="list-style-type: none"> ○ 1 Milk ○ 1 Chips ○ 1 Baby Food ○ 1 Oil • 2 interventions on in bio-fortification 	Food Distribution <ul style="list-style-type: none"> • 3 school-feeding interventions

Table 2 shows different types of interventions.

Table 2: Different types of value chain-based interventions

Nutrient-dense foods	Types of value chain interventions
Naturally nutrient-dense foods	Animal-based foods, (e.g. meat, poultry, fish, dairy, etc.)
	Plant-based foods (vegetables)
Additional nutrient-dense foods	Fortified foods, fortified staples, fortified prepared foods (milk, chips, baby food, edible oil, etc.)
	Bio-fortified foods (high zinc rice, orange fleshed sweet potato etc.)
Food distribution	Public distribution through school-feeding interventions

The range of ways in which nutrient-rich foods that mitigate micronutrient deficiencies can be produced, processed, packaged and delivered to households is very diverse.

Both government and private organisations implement these interventions, in many instances working together to finance and execute them. Nine of the 19 interventions are implemented by BRAC, the world's largest NGO. Three of them are executed by government, 3 by NGOs, one by an international research organisation (World Fish), another by Renata Limited, a pharmaceutical

company, one by CARE, and the last by the edible oil company, BEOL. Some of the interventions are funded by donors and some are self-funded. For example, USAID is funding the production of orange-fleshed sweet potato for improvement of nutritional status of children through school feeding. One of the cereal crops initiative is taken up by the Bangladesh Rice Research Institute (BRRI) that works for the introduction and improvement of rice varieties in the country. One of the programmes in the processed food category is being implemented by the Bangladesh Agricultural Research Institute (BARI) that is working for varietal development and varietal improvement of crops. BARI's post-harvest division also works towards adding value through food processing.

The summary of the value chain interventions is shown in the **Annexure**.

4.1. Naturally nutrient-dense foods

One of the leading ways of increasing nutritional intake is to enhance access to consumption of foods that are naturally rich in micronutrients. These include fresh foods such as fruit and vegetables, pulses, meat, fish and dairy products. Fruit and vegetables, milk and meat are important sources of micronutrients, but they are generally lacking in the diets of low-income households (Ruel et al. 2013). The big challenge for strategies aimed at increasing dietary diversity is the need to ensure that such foods are available and affordable to those that most need them.

Value chain interventions in Bangladesh work with very poor, often landless, households in remote rural areas of the country. They also focus on children and adolescent girls, lactating women and undernourished rural people. All naturally nutrient-dense value chain interventions directly or indirectly aim to increase agricultural production and improve household nutrition along with encouraging increases in income generation. They also focus on creating off-farm employment. Some of the interventions are not specially nutrition targeted, but create an impact on the nutrition status of the community.

The dairy value chain interventions work throughout Bangladesh. The Milk Vita initiative works on strengthening the cooperative system in the dairy value chain by providing technical and organisational support. Cooperative members now own genetically-enhanced cows, providing higher incomes to owners (Ghosh and Aharjan 2004). In the Milk Vita Cooperative model, the collected milk is sent to the milk chilling centre or dairy plant. The chilling centre has the responsibility to chill and process the milk. The processed milk is channelled to the Dhaka dairy plants or the Baghabarighat dairy plant. The dairy plants make various dairy products like butter, cheese, ice cream, and also packet the liquid milk. These milk products are distributed to the retailers. Retailers sell the milk and milk products to the consumers.

Initially BRAC used to enable farmers to buy land and cows in order to produce milk through micro financing. It was observed that dairy farmers still did not have consistent access to the market. The demand for milk in a single village was not enough to generate a large profit. A lot of milk went to waste because dairy farmers could not sell all their milk and there were no proper refrigeration facilities to store the unsold milk. Considering this problem, a dairy initiative, Aarong Milk, (**Box 1**) was started to collect milk from local farmers for a fair price.

Box 1: Aarong Milk (BRAC Dairy & Food Project)

Aarong Milk was initiated in 1998 under the BRAC Dairy & Food Project (BDFP) programme, to act as the market for rural dairy farmers. Primary beneficiaries of this intervention are rural poor farmers. Aarong Milk is currently supporting over 40,000 farmers to develop rural entrepreneurship. This intervention aims to help the rural dairy farmers to protect and to grow their dairy enterprises and to improve their market access. One of the goals of BRAC Dairy is to provide high quality products. For this purpose BRAC started its artificial insemination enterprise. It also provides training to farmers on how to rear healthy cows, providing vaccinations, nutritious feed, and other technical training.

This intervention plays a dual role of benefiting both the supplier and consumer: increasing the dairy farmers' milk production and household income as well as the quality of the dairy products. A further qualitative case study is being conducted to find the actual value chain of the intervention.

BRAC follows the group-based approach in fresh milk collection. BRAC Dairy has a processing factory in Gazipur in the central part of Bangladesh and has 100 chilling stations in different parts of the country. Independent dealers purchase milk from dairy farmers at a fair price and then the dealers travel to one of the chilling stations to sell and preserve their milk. From the chilling stations, milk is transferred to the processing centre. In the processing centre, numerous dairy products like pasteurised liquid milk, UHT liquid milk, low fat liquid milk, chocolate milk, mango milk, full cream milk powder, low fat milk powder, sour and sweet curd, ghee, butter, etc., are produced. Finally, the milk-based products are distributed via an internal and external distribution chain. For external sales, dealers purchase Aarong dairy products and sell them to various retailers. Aarong also has its own distribution channel in 35 places, forming an internal retail chain.

No particular assessment has been undertaken so far, but recently this enterprise is estimated to serve roughly 40,000 farmers in northern parts of Bangladesh. Consumers of Aarong dairy products have access to high quality and hygienic dairy products. One particular feature of this intervention is that all of the profits are fed into BRAC's poverty alleviation programmes.

Another dairy value chain intervention⁸ is implemented by CARE Bangladesh where approximately 90 per cent of the milk is channelled from farmers to consumers or to sweet producers or to confectionery shops through middlemen and only 10 per cent of the milk is collected by private processors or co-operatives directly from producers. The project

⁸ Information was sourced from different reports and evaluation of CARE on dairy value chain. These are: Strengthening dairy value chain in Bangladesh, Care Bangladesh. Available at: <http://edu.care.org/Documents/SDVC%20Project%20Overview.pdf>.

CARE, Bangladesh. 2008. Pro-poor Analysis of the Dairy Value Chain: Strengthening the Dairy Value Chain Project, CARE Bangladesh. Available at: http://www.carebangladesh.org/publication/Publication_6751088.pdf.

Alam A, Ahmed A, Quisumbing A, Hassan Z, and Zobair M. 2011. Evaluating the dairy value chain project in Bangladesh: Midterm report. IFPRI. Available at: http://www.carebangladesh.org/publication/Publication_5093098.pdf

aimed to increase the income of 35,000 targeted smallholding and landless milk producer households by at least \$20 per month from a current \$18-\$30.

BRAC Chicken⁹ includes poultry farms that produce high-yielding varieties of day-old chicks, commercial broiler farms that produce chickens, a broiler processing plant and a poultry disease diagnostic laboratory. Since there is excess demand in the poultry sector of Bangladesh, BRAC plays an important role in strengthening marketing efforts of rural farmers and supplying broiler meat. Hotels, restaurants, supermarkets and individual consumers, especially in urban areas, are targeted. Currently, it can process approximately 5,000 chickens per day and has the only automated plant of its kind in Bangladesh.

In 2008, BRAC initiated its own hatchery¹⁰ and evolved as an enterprise with the goal to make quality fish spawn available to rural fish cultivators. It is working to meet the fish protein demand among the rural population. Currently, BRAC fisheries have 14 hatcheries situated in 11 locations; and products are sold all over the country. The rural population involved in BRAC Fisheries are now solvent and highly educated in this field. They have also played a major role in distributing high quality fish spawn throughout Bangladesh in a commendable quantity.¹¹

IFAD has funded a project called “Linking Fisheries and Nutrition: Promoting Innovative Fish Production Technologies in Ponds and Wetlands with Nutrient-Rich Small Fish Species” that supports the establishment of fish ponds by households in northwest Bangladesh and in the wetlands of the Haor regions. The outputs/outcomes of some of the activities completed, such as collection of brood fish of *mola* and *darkina*, rearing in ponds before distribution to farmers, etc., showed valuable lessons learned which is of importance for promotion of small fish culture. It was observed that household consumption of small fish increased from 9.5 per cent in 2011 to 18.6 per cent in 2012. It was also observed that the demand and sale of small fish is largely at the farm gate and in local markets, as they can be purchased even in small quantities easy to afford by poorer consumers. The intervention’s priority is towards improving the nutrition of pregnant women, lactating mothers and children.¹²

The promotion of horticulture value chains can also be considered to address improved nutritional diets as well as income generation for the poor people of the country. Red okra¹³ is anthocyanin enriched along with other minerals like the green okra. The red okra vegetable is targeted to increase the nutritional status of consumers, especially marginalised people and adolescent poor girls. Currently, through the BRAC-AVRDC home garden project, attempts are undertaken to popularise red okra among the beneficiaries in the project areas.

The yellow-coated mung bean¹⁴ variety is good in terms of nutritious value, containing very good levels of minerals, particularly calcium and zinc, with low fat content.

⁹Web information available at: <http://enterprises.brac.net/brac-chicken>

¹⁰Published report in souvenir of Fisheries week by DOF.

¹¹<http://enterprises.brac.net/brac-fisheries>

¹²http://pubs.iclarm.net/resource_centre/WF_2942.pdf; <http://www.scienceforum13.org/sites/default/files/download/session10/Benoy-Kumar-Barman-Small-Fish-in-Improving-Nutrition-Increasing-Incomes-and-Developing-Downstream-Market-Linkages.pdf>

¹³Information sourced through communication in person with Agriculture and Food Security Program,

¹⁴AVRDC-Asian Vegetable Research and development Centre. Bulletin: FEEDBACK from the field. Issue: 19, Sept: 2013

Sunflower oil¹⁵ is the non-volatile oil compressed from sunflower seeds where the kernel contains 45-55 per cent oil. The oil is totally cholesterol free and it contains appreciable quantities of vitamin E. BRAC, with the assistance of DAE and BARI, started sunflower cultivation from 2010 in the southern region of Bangladesh where the cropping intensity is comparatively low. The intervention, aimed to improve the cropping intensity of the area and increase the availability of the edible oil, is primarily targeted at the undernourished young and adolescents to increase post-farm gate consumption. BRAC assists farmers to find easy ways of trading the oil seeds to different edible oil processing companies; it also advocates promoting sunflower cultivation in the climate-vulnerable southern zone of the country through media and policy advocacy.

Katalyst, an NGO in Bangladesh, works on developing farmers' knowledge and information for effective and large-scale market development of vegetable production.¹⁶ Specifically, the intervention aims to improve the agricultural performance of poor farmers by facilitating access to inputs, markets and services. It also works to develop the policy environment towards the facilitation of the sector.

4.2. Foods of increased nutritional value

Another strategy for delivering micronutrients is to add these to food products. There are various ways in which this can be done. First, nutrients can be added to staple products. The most prevalent strategy in this area is food fortification, and, in particular, the mandatory fortification of widely-used staple products such as wheat flour, cooking oils and salt. This strategy has the advantage of building on existing widely-acceptable products distributed through well-established value chains. Fortification of staple products can be carried out voluntarily, although it will require companies selling the fortified products to establish their quality and added value in the eyes of consumers and to convince them that the products really possess the benefits claimed. Furthermore, adding micronutrients to a product may however increase its price, making it less affordable for the poorest.

A second route to enhancing the nutritional value of staples is bio-fortification, which involves plant breeding, so that the breeders naturally synthesise micronutrients or their precursors. Golden rice, high zinc rice, quality protein maize and wheat are examples of this. There are considerable value chain challenges in combining innovations in the agricultural system (new seed varieties, new production practices) with processing and distribution systems that are capable of capturing value produced on the farm. Where bio-fortified and unfortified products are more or less indistinguishable, it may be difficult to create efficient markets.

Finally, there is a wide variety of foods that are specially formulated and prepared to meet particular nutritional needs. Examples include weaning mixes for infants and Ready-to-use Therapeutic Foods (RUTFs) directed at those who have severe acute malnutrition. Some foods, such as the Shakti Doi product sold by Grameen Danone Foods in Bangladesh or

¹⁵ Information sourced from Agriculture and Food Security Programme, BRAC, Bangladesh
<http://afsp.brac.net/>

¹⁶Bringing knowledge to vegetable farmers: improving embedded information in the distribution system, Katalyst. Available at:
<http://www.katalyst.com.bd/docs/Vegetable.pdf>.

micronutrient sprinkles which are sold in many countries, are formulated to target specific population groups.

Commercially available fortified foods in the review include fortified yogurt, chips, baby food and edible oil. Nutritional value is being added in these products, targeting children, women and the poor people of the country.

Grameen Danone, a social enterprise involving Group Danone and Grameen Enterprises, has developed and is distributing a fortified yogurt that aims to enhance the intake of children aged 3 to 15 years (**Box 2**).¹⁷ The business model around this innovation is still evolving, yet provides an interesting illustration of efforts to distribute innovative fortified foods through retail markets directed at the poor.

¹⁷ There are extensive publications on the Grameen Danone Foods initiative, and a study of this project will be undertaken linked to the LANSAs programme but financed by the A4NH initiative.

Box 2: Shakti Doi: Fortified Yoghurt

Shakti Doi is fortified yoghurt produced by Grameen Danone Foods Ltd, a joint venture between Group Danone and Grameen Enterprises in Bogra, Bangladesh. Shakti Doi contains cow's milk and date molasses enriched with micronutrients, as well as calcium and proteins, and is fortified with zinc, iron and vitamin A. The goal of the intervention is to improve the health status of children aged 3 to 15 years by meeting 30 per cent of their zinc, iron and vitamin A requirements (if consumed twice weekly), the primary beneficiaries being children in the local communities around the factory.

Shakti Doi uses locally available ingredients to mobilise local resources and also to minimise the cost of raw materials. The processing plant optimises the local resources with high-tech machineries. The primary raw material (milk) is obtained from a variety of sources, collected by specially refrigerated vehicles that operate across various collection centres. Staffs at the collection centres test the quality of milk with lactometers and if the minimum quality standards are met, payments are made at pre-agreed rates. The milk is then transported and processed at the plant into fortified yoghurt.

There are two channels to distribute and sell the product. One channel is a number of small retail stores (300 to 400), which lack refrigerators, located in and around Bogra. The second channel is the Grameen ladies who are also borrowers of Grameen Bank and are engaged in the selling process by the door-to-door service model. Local distributors are in charge to deliver the yogurts in some villages to women sellers called Shakti Ladies.

This product has special features to ensure it reaches the low income target population. The price of Shakti Doi is only 10 BDT (0.13 USD) per container in the shop. It makes the product affordable to the consumers; even the poorest Bangladeshi families could purchase it regularly. As the distribution of the product is done by Grameen ladies, it is giving them the opportunity to earn additional income. Since the factory is utilizing the local inputs in the production process, it is also strengthening the local economy and infrastructure. Micro credit is offered by Grameen Enterprises to livestock producers to increase their milk production.

Bangladesh Agricultural Research Institute (BARI) has been working from 2010 on preparing potato and banana chips.¹⁸ Since children like eating chips, the BARI post-harvest division envisaged improving the nutrition of children with true potato or true banana chips. The intervention was aimed for the nutritional benefit of children, as well as additionally generating income by selling the chips at local markets.

Iron and zinc deficiency is a very common problem affecting the children in this country. In 2008, Social Marketing Company (SMC) began distributing a micronutrient powder under the brand name MoniMix to address childhood iron deficiency anaemia (IDA). The product contains five micronutrients essential for proper growth, including iron, zinc, vitamin A, vitamin C, and folic acid. In Bangladesh, SMC introduced 'Sprinkles' in the brand name of

¹⁸ Information was sourced in person communication with Agriculture and Food Security Program, AVRDC-Asian Vegetable Research and development Centre. Bulletin: FEEDBACK from the field. Issue: 19, Sept: 2013

MoniMix in manufacturing partnership with Renata Ltd. MoniMix is a small packet of micronutrient powder containing iron and some other essential vitamins and minerals. The intended beneficiaries in Bangladesh are mostly children below 24 months, going up to those below five years.

Bangladesh Edible Oil Ltd. (BEOL)¹⁹ has initiated an intervention under the guidance of the Ministry of Industry's "Vitamin A Fortification Project" with the help of UNICEF Bangladesh and GAIN (Global Alliance for Improved Nutrition), to distribute Rupchanda oil, which is edible oil enriched with vitamin A. The soyabean oil is fortified with vitamin A in the mill/industry and then distributed through traditional market channels. Rupchanda soyabean oil is rich in omega 3 and omega 6 components which help to control blood pressure, provide more nutrition for the lactating mother and unborn child, support healthy skin and hair for all ages, and help better eyesight and also prevent glaucoma.

Two bio-fortified interventions are available in this review. Bio-fortification is a process in which plant breeders search for seeds having high nutritional value among existing varieties of crops. They then cross-breed the high-nutrient varieties with high-yielding varieties to provide seeds with high yield and increased nutritional value.²⁰

It is widely known that zinc deficiency causes stunting while zinc supplementation can reduce the severity of morbidity from a number of common childhood diseases including diarrhoea and pneumonia. The prevalence of zinc deficiency in Bangladesh is 45 per cent in preschool age children and 57 per cent in non-pregnant and non-lactating women (icddr,b, UNICEF, GAIN and IPHN 2013).

Given the facts, BRRI managed to identify some of the indigenous rice varieties with unique features of having naturally high zinc concentration. Then they continued to cross-breed different varieties to get that agronomic trait of zinc and developed a high-yielding rice variety (BRRI dhan62) in 2013. In the year 2014, another high zinc variety (BRRI dhan64) was released that contains more zinc. Excess fertiliser is not required for high zinc rice. On the other hand, the newly bred zinc rice is also high yielding and early maturing. After demonstration in one or two growing seasons, the variety may become familiar to the farmers of the country.

The aim of the orange-fleshed sweet potato (OFSP) intervention was to increase the vitamin A content in the diet of the people of the country. In this project, women, preschool and school-going children were particularly targeted. There is scope for commercial marketing at a larger level. The potato became popular day-by-day and farmers are getting interested in cultivating the sweet potato variety.

¹⁹ Information sourced from wikipedia.org/wiki/Sunflower_oil.

²⁰<http://www.thedailystar.net/another-rice-variety-ready-for-release-37554>

4.3. Food distribution

A third category of initiatives is food distribution. The emphasis on targeting consumption through distribution may be combined with the promotion of specific value chain initiatives, such as local sourcing of dairy products. Various public initiatives are seen in Bangladesh, India and Pakistan that make (fortified and unfortified) staples available to the poor at subsidised prices. Similar but more targeted initiatives include school-feeding programmes. Distribution systems, often involving both public and private sector actors, may be particularly effective in targeting populations known to face particular nutritional problems, as well as a means of reaching populations in rural areas, where high distribution costs can be a disincentive for market-oriented actors. At the same time, public-private models also exist and these may help to defray the costs of public distribution. However, these can be costly to operate and suffer from distortions (Bruyeron et al. 2010).

It is clear from this consideration of the different routes through which food-based interventions can reach target populations that the value chain challenges vary quite considerably. Some require multiple interventions along the value chain to succeed, while others may be focused on specific parts of the chain. Nevertheless, the different value chain challenges can all be linked to the degree to which the interventions meet both the social challenge of mitigating under-nutrition and the business challenge of creating sustainable business models. The full-length case studies that will be chosen as a result of this analysis of in-country interventions will examine how these challenges are resolved (or not resolved) in particular interventions.

The Government started a national school-feeding programme in September 2011 which initially supported 55,000 students, reached 1.4 million children in 2012, and from March 2013 is assisting more than 1.7 million children.

WFP continues to reach 1 million schoolchildren in food-insecure and poverty-prone areas (**Box 3**).²¹

The Government of Bangladesh (GoB) is trying to improve the status of primary education by targeting the most vulnerable by encouraging an alliance with the private sector to implement a school-feeding initiative. The aim is to deliver hot-cooked meals; the programme is on its pilot phase.

BRAC has also implemented a school-feeding project with the support of the Government of Bangladesh, GAIN and Dubai Cares Foundation. The initiative is expected to provide schoolchildren with good nutrition, promotion of cognitive, psycho-social and brain development, and reduction of hunger during school time, thus contributing to food security, as also nutritional and educational attainment.

BRAC conducted this school-feeding programme at Jessore and Barishal districts of Bangladesh during 2013. More than 1500 students were engaged under this programme. The aim was to introduce orange-fleshed sweet potato in the school meals. The programme started working with three schools to conduct the pilot programme and to check its further

²¹ WFP in Bangladesh, Annual Report 2012

prospect. The feeding programme continued on a pilot basis with different types of monitoring tools used to check its (sweet potato) acceptance, tests and health improvement issues. It was observed that students accept the food item with pleasure.

Box 3: WFP School-feeding Programme

In 2012, funding for school feeding came from Bangladesh, Australia, Spain, the United States Department of Agriculture (USDA), corporate donor Unilever and private donors through the Japan Association for WFP (JAWFP). For families who cannot afford enough nutritious food every day, school feeding is a powerful incentive to enrol their children in school and ensure they attend class every day. Enrolment in targeted schools has increased by 11 per cent from 2007 to 2009 and attendance rates have increased from 76 per cent in 2007 to 87 per cent in 2012.

The nutritious biscuits give children the energy to concentrate on their lessons and help address widespread micronutrient deficiencies. Fortified with essential vitamins and minerals, the biscuits ensure children meet 67 per cent of their daily vitamin and mineral needs.

The school feeding programme also includes an essential learning package for the children as well as their parents, teachers and other community members. Activities focus on vegetable gardening, dietary diversity, health, nutrition and hygiene, and reinforce good practices such as hand-washing. In partnership with the government, WFP is establishing school feeding in more schools in a sustainable way. In 2013, WFP started providing cooked meals in 41 schools in Barguna and Jamalpur, working with communities to provide a home-grown lunch instead of biscuits. Vegetables, fruit and spices are purchased from local women cultivators and cooked by women, helping entire communities to benefit from the school meals programme.

Self-employment will need to play an important role in sustaining and accelerating the gains made at household level. Therefore, in the third programme year, 18,000 women from participating households were trained on developing a small business and receive a 12,000 taka cash grant for investment as well as a monthly cash transfer of 500 taka for consumption support. The monthly payment allows them to grow their investment and build their families' economic resilience while covering their families' day-to-day needs.

5. Nutrition Targeting and Measurement

Interventions which are covered in this study have a direct or indirect nutritional aspect. To assess whether the interventions have nutritional implications, we relied on published and unpublished reports about the different programmes. Agricultural interventions towards nutrition have nutritional implication for households in multiple pathways: farmer's household level consumption, increased availability of nutritional products in the market for targeted people and consumption of nutritious foods from farming income. This section

identifies the extent to which the interventions discussed in the previous section include attempts to deliver the nutritionally-rich foods they produce to those population groups most in need of the nutritional benefits they can provide. In fact, some of the interventions are not targeted to increase the nutritional status of any particular segment of the population.

Some of the interventions, though, are very specifically targeted at groups whose nutritional needs are high priority. Intervention like Shakti Doi and MoniMix are directly targeted to children and are increasing their nutritional status. All of them contain numerous micro-nutritional intakes which help children to boost their nutritional status. The fortified yoghurt Shakti Doi contains calcium and proteins essential for children's growth and bone strength. A study found that 34 per cent of children and 39 per cent of women of child-bearing age are iodine deficient, 68 per cent of preschool children are iron deficient, and 46 per cent of pregnant women are anaemic.²² MoniMix is an iron-rich food (iron 12.5 mg) for children under five which will help reduce their iron deficiency. It also contains vitamin C, folic acid and zinc. But whether the initiative is successful or not was not studied in this review.

In contrast, dairy-based interventions like Aarong Milk and Milk Vita increase the income of farmers at the pre-farm gate level and also increase the milk supply into the market at the post-farm gate level. These produce other milk products as by-products which are also nutritious. Such interventions in the dairy value chain increase liquid milk supply into the market and could potentially improve the nutritional status of consumers. However, the full benefits of such interventions would only be realised if particular groups of consumers were targeted. There are examples from other countries of such targeting. In Kenya, dairy chain interventions sought to expand overall demand for milk products through both school-feeding programmes (hence targeting the young, if not the youngest) and through marketing efforts that made such products more accessible to the poorest. These included reducing the size of milk cartons and providing low-cost packaging that increased affordability (Henson et al. 2012).

The vegetable intervention by Katalyst has increased vegetable production and supply in the market. Different leafy and non-leafy vegetables are important sources of nutrition. Red okra is rich in anthocyanin and carotene which have immense impact in addressing specific micronutrient deficiency. Yellow-seeded mung bean also contains very fair levels of minerals, particularly calcium and zinc, with low fat content. If this new vegetable can be popularised on a larger scale, marginalised people and poor adolescent girls will be benefited.

Zinc and iron deficiencies are severe in Bangladesh, particularly affecting pregnant women and children below five, causing different kinds of diseases and sometimes even leading to mortality. Since rice is the main staple food of the country, it was aimed to develop high zinc rice which would help reduce zinc deficiencies to some extent. The high zinc rice variety contains more zinc compared to the traditional rice varieties grown in Bangladesh. High zinc rice, BRRI dhan62, released in 2013, contains around 19 to 20 parts per million (ppm) zinc against 14 to 16 ppm in other high-yielding rice varieties. However, the newly-released high zinc rice breed (BRRI dhan64) contains zinc as high as 25 ppm. After the National Seed

²²<http://www.micronutrient.org/english/View.asp?x=602>

Board (NSB) released the first high zinc rice, the government, NGOs and private seed associations all together have supplied over 10,000 farmers with seeds and educated them about the technologies to be used in cultivating crops during the Aman season.²³ This intervention is not exclusively targeted towards a particular region or population group, but rather increases the zinc component in rice, the staple food of Bangladesh. High zinc rice may be taken as a new nutritional intervention for target populations, including future school nutrition programmes.

Cholesterol-free sunflower oil will not only increase the edible oil availability in the country but will also work towards reducing health hazards. Many of the people in the country suffer from heart diseases and it is expected that use of sunflower oil will reduce the risk of such cardiac problems.

In Bangladesh, a large portion of protein intake comes from fish consumption. Besides protein, the small indigenous fish species contain Ca, vitamin A, Fe and Zn. Unfortunately, indigenous small fish like *mola*, *dhela*, *chela* are about to disappear from the country. It is aimed to bring back the rearing of such indigenous fish species to augment nutritional supplementation for adolescents, women and children.

Soyabean oil is popular edible oil in the country. So, increasing the nutritional quality of the soyabean oil has a wider implication for public health and nutrition. Rupchanda soyabean oil is rich in omega 3 and omega 6 and it is also cholesterol free and defensive for heart diseases, as well as providing more nutrition for lactating mothers and their children. This intervention is not directly targeted towards any particular group of people, rather provides overall nutritional impact to consumers, and the product is available all over the country.

Potato and banana chips are dry foods with addition of sugar, salt and edible oil. Their consumption is a suitable way to increase the nutritional requirement of children. This intervention is also not targeted specifically to undernourished children.

The BRAC chicken intervention is aimed to increase supply in the urban regions. Chicken is an important source of protein and other micronutrients. Varied new processed products like nuggets and sausage are made from chicken meat to make it more attractive, especially for children. But this intervention is also not directly targeted towards the undernourished children of the country.

WFP, in association with GoB, initiated the school-feeding programme wherein nutritious biscuits that contain additional vitamins and minerals are supplied. Cooked vegetables also form part of the diet of school-going children. The nutritional status of the students increased through the distribution of hot cooked diversified and fortified foods as part of the BRAC rural school nutrition programme. Through literature reviews and personal contact, it was observed that all the interventions targeted to increase the income of the farmers or households at pre-farm gate level have also nutritional implications. Although many of the interventions were not specially focused on increasing nutrition for targeted groups like children and women, several of them did play an important role in doing so. In a

²³<http://www.thedailystar.net/another-rice-variety-ready-for-release-37554>

recent survey in the southern parts of Bangladesh by BRAC, it was observed that the percentage of households consuming highly nutritious food (meat, milk and eggs) per week has increased from 39 per cent to 99 per cent (BRAC 2014). This is because BRAC's intervention with improved agricultural and aquacultural technologies has increased overall household incomes. Through the increased income, households can afford more expenditure on nutritious foods and have become more nutrition sensitive. It is hoped that in Bangladesh, with the additional household income, people may begin taking more nutritious food for their daily consumption.

6. Cross-Cutting Themes

Gender as well as environmental and political fragility, is a key to success in different agricultural value chain interventions. Nutrition is inextricably linked to persisting gendered social norms, as well as a woman's access to education, her age at marriage and at birth of first child, and her ability to control key resources are crucial determinants of nutrition. Bangladesh has been classified as highly vulnerable to climate change. Agricultural value chain interventions should address climatic variability to secure the nutritional security of the country. It is also necessary to facilitate innovative interventions and their distribution and application in Bangladesh.

6.1. Gender

In the documentation of the studies reviewed in this report, most gender issues did not appear with great clarity, with just a few exceptions that are detailed here. First, women were identified as the key targets for sales efforts. For example, Grameen Foods conducts the marketing of the product through female borrowers of Grameen Bank, targeting women in the villages as the key decision-makers with respect to purchases of the product. Similarly, the interventions for banana and potato chips identify women as their target group, creating employment opportunities for them. Other interventions work to engage women in vegetable production.

Second, there are gender issues relating to nutrition challenges that have been addressed. Apart from children and adolescents, high zinc rice is targeted towards lactating mothers to reduce zinc deficiency. Sunflower cultivation has become a beneficial occupation for women farmers in the southern region of the country. Vitamin A-enriched Rupchanda soyabean oil also benefits the health condition of women and lactating mothers. Women to some extent are engaging in the cultivation of small indigenous fish, reviving their daily consumption rate all over the country. Freshness and availability of small indigenous fishes can reduce vitamin A deficiency affecting children and adolescents as well as lactating women.

Further, the WFP school-feeding programme is highly involved with poor village women, giving them frequent training through which the women became self-employed in the production of vegetables and cooked food that were purchased for school feeding. Awareness of the women groups about nutritional requirements for school-going children was ensured in the rural school nutrition programme of BRAC. Women were trained in nutrition and hygiene and their capacity building and leadership development were also

undertaken. In the orange-fleshed sweet potato project, women, preschool and school-going children were particularly targeted.

The analysis of specific case studies will pay particular attention to these gender questions and also examine the way nutritional interventions will have implications for household workloads, pertaining to issues such as acceptability. Businesses are well aware that issues of time spent in purchasing food (its availability close to households) and the time needed to process it are factors that influence household decision-making. This will have consequences for value chain sustainability.

6.2. Fragility

The Government of Bangladesh can create institutional frameworks to facilitate nutritional initiatives and act as partners with private sector players to facilitate the interventions. Such partnerships are particularly important in the context of bottom-of-the-pyramid initiatives, where the challenges of reaching the poor and selling products that are affordable and acceptable to them are particularly difficult to meet.

Some of the interventions, like Milk Vita, Aarong Milk, BRAC Chicken, etc., particularly target urban households. There is lack of focus on the nutritional requirements of the rural population. Also there is need to establish and accelerate some value chains like sunflower oil and orange-fleshed sweet potato. Private sector initiatives must be encouraged in the processing industry. Government should take more initiatives to make newly-released technologies popular at the grassroots level, such as organizing large-scale demonstrations on growing high zinc rice and orange-fleshed sweet potato.

6.3. Innovation

Bangladesh has made commendable progress in domestic foodgrain production, especially rice production, due to rapid dissemination of HYV technology. Future agricultural growth, and also food and nutrition security, are threatened by population growth, shrinking resource base (such as land and water) and the deterioration of their quality and productivity. Moreover, the adverse impacts of climate change compounded by minimal investments in agricultural research and deteriorating extension services are likely to exacerbate the problem of food and nutrition security in the coming decades.²⁴ It is time to concentrate on nutritional security along with food security.

In order to achieve nutritional security, interventions will be required at multiple points along the value chain. Linking improvements in food production at the farm level to improvements in the nutritional intake of nutritionally-deficient people and households frequently requires a number of simultaneous interventions. Aarong Milk is an example of value chain restructuring involving multiple interventions. Aarong Milk helps farmers produce more, get fair price for their milk and at the same time ensure quality milk supply to the market. First in the supply chain, independent dealers purchase milk from dairy farmers for a fair price. These dealers travel to one of BRAC's milk chilling stations to sell and preserve their milk. BRAC Dairy purchases the milk from dealers for a higher price than other dairy retailers, allowing the dealers to continue giving farmers a fair price for their

²⁴<http://archive.thedailystar.net/beta2/news/food-security-building-on-a-success-story/>

milk. Finally, BRAC processes the milk at its own factory in Gazipur, where it produces numerous dairy products such as pasteurised liquid milk, UHT liquid milk, low fat liquid milk, chocolate milk, mango milk, full cream milk powder, low fat milk powder, sour and sweet curd, ghee, butter, etc.²⁵ This is an example of a complete value chain. A similar task is being done in the Milk Vita intervention. In addition, Milk Vita uses a two-tier cooperative system. Producer level cooperatives and urban distributor cooperatives facilitate both groups to generate income.

Consumption of sunflower oil, besides soyabean and mustard oil, is a new initiative in the country. Sunflower oil has not been commonly used in Bangladesh. However, after assessing its high production rate, economic and health benefits, production and consumption is becoming accepted. Demand for sunflower oil is particularly high in large shops and supermarkets. Adding vitamin A to soyabean oil is another new innovation with great nutritional implication, particularly since most people use soyabean oil.

Shakti Doi is another example of a product of added nutritional value that uses locally available resources and makes multiple interventions along the value chain. Milk is collected from dairy farmers at kiosks that are located near them. Farmers are paid a fixed price for milk upon delivery to the collection centre. Raw milk is brought to a chilling facility in the morning and evening by cycle rickshaw and is stored at the facility until a truck picks it up and brings it to the factory. The collection and chilling centres are either owned by the company or by milk collection partners. In addition to milk, Grameen Danone needs to source sweeteners and nutritional supplements in order to make its yogurt. Date palm molasses, which is prevalent in the Rajshahi division, is Grameen Danone's primary sweetener and a popular sweetener for other Bangladeshi foods and beverages too. The yogurt also includes iron, calcium, vitamin A and iodine nutrients that are typically imported from Europe. The finished yogurt is then packaged in plastic cups or sachets.

The review of the selected case studies will include a focus on the importance of innovating at multiple points along the value chain in order to achieve success. The value chain approach will allow for an analysis of innovations in products, farming, distribution and consumption that might be the key to the successful introduction of new products to combat under-nutrition.

7. Conclusions

At present value chain-based interventions targeted to improve the nutritional status of a particular group are very limited. In some cases, it was seen from the evidences that the foods are consumed by the targeted groups at post-farm gate level even though this may not be an explicit objective of the intervention. There are some common features of the interventions related to agriculture and nutrition.

²⁵<http://enterprises.brac.net/brac-dairy>

Most of the interventions work in the pre-farm gate stages of the value chain.

There are no notable interventions at post-farm gate stages to facilitate the access of the product to a target group. Interventions worked with primary level producers, small and marginal landholders who lack necessary inputs for production and fail to gain access to markets. Interventions like those that facilitate access to credit, extension services and other services are intended to improve the productivity of farmers and their involvement with the market system.

There is no significant attempt to make the product familiar to target population.

In some cases, even though the product has broader goals to improve the nutrition of a particular group, it lacks necessary awareness building strategies like advertising, campaigning, etc. This situation applies more to products manufactured by non-profit organisations. So, comprehensive attempts to make the products accessible to the targeted population have huge potentials to achieve the nutritional goals.

A number of approaches have been taken based on the category of the products. Interventions can be organised into pre-farm gate, where the objective is to increase farm income and farm household consumption, and post-farm gate, where consumers are introduced to the products.

Approaches and instruments vary with the type of products and supply chain. In the vegetable and dairy value chain interventions, main emphasis was given at the producer level, to improve the access of poor households to inputs markets and output markets with no specific nutrition targets

BRAC's other agricultural interventions like meat and fish are very similar, working mostly in the pre-farm gate stages to increase the consumption of chicken in urban areas or fish in rural areas.

It was found that few interventions have a specific target group.

Shakti Doi mainly targets children, though it also has post-farm gate interventions to engage female borrowers of Grameen Bank in marketing the product. MoniMix is also directly targeted to children, as also the banana and potato chips intervention, where children are the main beneficiaries. At the same time, income-generating opportunities are also created for some people.

Other interventions do not have such a specific target group. The BRAC dairy intervention, Aarong Milk, has a wider goal to improve the nutrition status of the population but does not have any specific target group. The same is also true for the dairy intervention run by Milk Vita.

An important aspect is fortifying traditional and popular products with more micronutrients (Shakti Doi and MoniMix are examples) so that consumers attain more nutrition with existing food habits and demand behaviour. Agricultural interventions by BRAC try to attract consumers more to vegetables by bringing some variation in colour, taste and nutritional intake and production seasons. BRAC's vegetable interventions (red okra, orange-fleshed sweet potato and yellow-seeded mung bean) achieve the dual purpose of

increasing both household level consumption of nutritious vegetables as well as availability of vegetables in the market throughout the year.

Sunflower oil is a highly potential agricultural intervention where there is scope to increase the household consumption as well as to develop a value chain. However, lack of oil processing facilities is a drawback. To establish a complete sunflower oil value chain, private sector initiative is required.

Carp-mola polyculture is a good example of combining traditional varieties with new cultivation systems. Since people prefer traditional varieties, especially in the rural areas, this intervention has immense potential to be a successful one. Rice is the main staple crop in Bangladesh and zinc-enriched rice can improve the nutritional status to a large scale; even rural poor households, who are mostly subsistence farmers, can attain high nutritional intake from this type of rice cultivation. The introduction of soyabean oil fortified with vitamin A on a large scale and to a wider population will definitely improve the nutritional status of the population.

Diet-based strategies may be the most promising approach for sustainable control of macro/micronutrient deficiencies. Increasing dietary diversification through consumption of a broad variety of foods, preferably from home gardens, as also through indigenous fisheries and small livestock production, needs to be emphasised. Nutrition awareness campaigns and intensive nutrition education will increase the nutritional security of the country.

I. References

- BBS HIES. 2003. Report of the Household Income and Expenditure Survey 2000. Bangladesh Bureau of Statistics, Ministry of Finance, People's Republic of Bangladesh.
- BBS HIES. 2010. Report of the Household Income and Expenditure Survey 2010. Bangladesh Bureau of Statistics, Ministry of Finance, People's Republic of Bangladesh.
- BBS HIES. 2011. Report of the Household Income and Expenditure Survey 2010. Bangladesh Bureau of Statistics, Ministry of Finance, People's Republic of Bangladesh.
- BDHS 2012 Bangladesh Demographic and Health Survey Report (BDHS) 2011, National Institute of Population Research and Training (NIPORT) and Mitra and Associates, Dhaka; Macro International Cleverton, Maryland. 167
- Bhutta, Z.A.; Das, J.K.; Rizvi, A.; Gaffey, M.F.; Walker, N.; Horton, S.; Webb, P.; Lartey, A.; Black, R.E.; The Lancet Nutrition Interventions Review Group and The Maternal and Child Nutrition Study Group, 2013. Evidence-Based Interventions for Improvement of Maternal and Child Nutrition: What Can Be Done and at What Cost? *The Lancet* 382 (9890), 452-77.
- BRAC Annual Report. 2012. 8-9.
- BRAC 2014. Monitoring Report: Agriculture and Food Security Program, BRAC, 75 Mohakhali, Dhaka, Bangladesh.
- Bruyeron, O.; Denizeau, M.; Berger, J. and Trèche, S. 2010. Marketing Complementary Foods and Supplements in Burkina Faso, Madagascar, and Vietnam: Lessons Learned from the Nutridev Program. *Food and Nutrition Bulletin* 31 (2 (supplement)), S154-S67.
- Cervantes-Godoy, Dalila and Joe Dewbre 2010. Economic Importance of Agriculture for Poverty Reduction. OECD Food, Agriculture and Fisheries Working Papers, No. 23, OECD Publishing. P. 5
- Ghosh A K and Aharjan KL, 2004. Development of Dairy Cooperative and Its Impacts on Milk Production and Household Income: A Study on Bangladesh Milk Producers' Cooperative Union Limited, *Journal of International Development and Cooperation*, Vol.10, No.2, pp. 193–208.
- Hawkes, C. 2009. Identifying Innovative Interventions to Promote Healthy Eating Using Consumption-Oriented Food Supply Chain Analysis. *Journal of Hunger & Environmental Nutrition* 4, 336–56.
- Hawkes, C. and Ruel, M.T. 2011. Value Chains for Nutrition, paper presented at Conference Leveraging Agriculture for Improving Nutrition and Health, New Delhi, February.

- Hawkes, C.; Turner, R. and Waage, J. 2012. *Current and Planned Research on Agriculture for Improved Nutrition: A Mapping and a Gap Analysis*. Report for DFID, London and Aberdeen: Leverhulme Centre for Integrative Research on Agriculture and Health and Centre for Sustainable International Development.
- Henson, S.J., Humphrey, J. and McClafferty, B. 2013 *Nutritious Agriculture by Design: A Tool for Program Planning*, Washington DC in Brighton: The Global Alliance for Improved Nutrition and Institute of Development Studies.
- Henson, S.J.; Humphrey, J.; McClafferty, B. and Karim, Z. 2012. *Assessing the Integration of Agriculture and Nutrition in USAID Target Programs: Findings from a Rapid Assessment in Bangladesh*. Brighton and Washington DC: Institute of Development Studies and Global Alliance for Improved Nutrition.
- Henson, S.J., Humphrey, J., McClafferty, B. and Waweru, A. 2012. *Assessing the Integration of Agriculture and Nutrition in USAID Target Programs: Findings from a Rapid Assessment in Kenya*, Brighton and Washington DC: Institute of Development Studies and Global Alliance for Improved Nutrition.
- Henson, S.J. and Humphrey, J. 2014. *Assessing the Effectiveness of Agri-Food Value Chain Interventions Aimed at Enhancing Consumption of Nutritious Food by the Poor: Conceptual Framework*. LANSAs Working Paper, Brighton: Institute of Development Studies.
- icddr,b, UNICEF, GAIN and IPHN, 2013. National Micronutrients Status Survey 2011-12.
- Mazur, R.; Kizito Musoke, H.; Nakimbugwe, D. and Ugen, M. 2011. *Enhancing Nutritional Value and Marketability of Beans through Research and Strengthening Value Chains*. Washington DC: International Food Policy Research Institute.
- Ruel M.T. and Alderman H. The Maternal and Child Nutrition Study Group, 2013. [Nutrition-sensitive interventions and programmes: how can they help to accelerate progress in improving maternal and child nutrition?](#) Lancet 2013; 382: 536–51
- Wikipedia, 2015. https://en.wikipedia.org/wiki/Agriculture_in_Bangladesh

Annexure: Summary of Agri-Food Value Chain Interventions

Naturally Nutrient-Dense Foods

Intervention	Aim	Primary Beneficiaries	Description / Key Activities	Expected Outcome
Milk Vita	To generate farmers' income at pre-farm gate level and increase post-farm gate consumption	Children, adolescent girls and boys	Follows a cooperative model in milk collection as well as milk distribution. Helps farmers to earn off-farm income	Increase in milk supply into the market. Balanced nutrition for children. Employment creation for women
Aarong Milk	To generate income for rural farmers and to supply high quality milk to consumers	All age groups, especially children	Works at both pre- and post-farm gate levels. BRAC provides necessary inputs to the farmers to increase milk production, buys back from them and supplies quality milk products to consumers	Availability of milk and milk products with nutritional value .
Dairy Value Chain	To generate income for rural farmers and facilitate their market access	Rural farmers	Boosts milk production and works as intermediary in facilitating market access for small farmers	Increase in the income of small farmers as primary outcome; also helps increase the supply of milk in the market
BRAC Chicken	To increase post-farm gate consumption	Consumers in urban areas	Helps breeders to earn more by supplying chicken in various processed	Increase in the consumption of chicken in urban areas,

Intervention	Aim	Primary Beneficiaries	Description / Key Activities	Expected Outcome
			varieties to urban markets.	thus providing protein and other micro nutrients
BRAC Fisheries	To increase the availability of quality fish seeds in rural markets	Rural households	BRAC supplies quality seeds, trains farmers in fish production.	Mitigation of protein deficiency in rural households
Carp-Mola Polyculture	To augment post-farm gate consumption	Women and adolescents	Facilitates production of indigenous nutrient-rich small fish species	Creation of a good source of protein and vitamin A, Fe and Zn
Red Okra	To develop household level consumption as well as post-farm gate consumption	All groups of people, especially adolescents	BRAC's homestead garden project introduces the vegetable to farmers	Red okra is rich in anthocyanin and carotene which have immense impact in addressing specific micronutrient deficiencies
Yellow-coated Mung Bean	To develop household level consumption as well as post-farm gate consumption	All groups of people, especially adolescents	Being introduced in the eastern part of Bangladesh, where it is gaining popularity.	Yellow-coated mung bean contains very fair levels of minerals, particularly calcium and zinc with low fat content, and will boost nutritional outcomes
Sunflower Oil Seed	To increase post-farm gate consumption	All groups of people, especially adolescents	Augments production of sunflower oil seeds which are climate adaptive and rich	Availability of cholesterol-free edible oil will reduce nutritional

Intervention	Aim	Primary Beneficiaries	Description / Key Activities	Expected Outcome
			in essential vitamin E and low in saturated fat	deficiency
Bringing Knowledge to the Vegetable Farmer	To improve access to inputs, markets and services and improve the policy environment toward the facilitation of the sector	Rural farmers	Helps farmers through providing information and inputs with the help of some micro finance institutions	Increase in availability of vegetables in the market will lead to increase in house hold consumption as well
Foods with Additional Nutrient Value				
Shakti Doi	To promote income generation and post-farm gate consumption	Children, adolescent girls and boys	Uses local resources in production and facilitates distribution by women borrowers of Grameen Bank	Children will have balanced nutrition and women will be gainfully employed
Potato and Banana Chips	To increase income generation and post-farm gate consumption	Children	Boosts the consumption of the popular dry food augmented with sugar, salt and edible oil	Creation of a substitute source of carbohydrates and vitamins
MoniMix	To develop post-farm gate consumption	Children	Introduces the nutrient-rich food product specially for the reduction of iron deficiency in children	Enrichment of iron along with vitamins A and C, folic acid and zinc
Fortified Edible Oil with Vitamin A	To increase post-farm gate consumption	Women and adolescents	Distributes the most commonly used cooking oil, soyabean oil, that has been fortified with vitamin A, through market channels	The fortified cholesterol-free edible oil fulfills nutritional requirements through its omega 3 and omega 6

Intervention	Aim	Primary Beneficiaries	Description / Key Activities	Expected Outcome
				components
High Zinc Rice Variety	To foster post-farm gate consumption	Children	Introduces improved rice variety with unique features of naturally occurring high zinc concentration	Reduction of childhood diseases, including diarrhoea and pneumonia
Orange-fleshed sweet potato	To increase household consumption as well as post-farm gate consumption	Children	Ensures good quality seeds to farmers	Fulfilment of nutritional requirements through beta carotene, vitamin E, and pro-vitamin A

Food Distribution

Intervention	Aim	Primary Beneficiaries	Description / Key Activities	Expected Outcome
WFP School Feeding Programme	To Improve maternal and child nutrition and also encourage vegetable gardening, dietary diversity, health, nutrition and hygiene (e.g. hand washing).	School-going children and village women	Provides nutritious biscuits that are fortified with essential vitamins and minerals among the school-going children. Vegetables, fruit and spices are purchased from local women cultivators and cooked by women, helping communities to benefit from the school meals programme. Also, women are trained in developing new businesses.	Around 67 per cent of daily requirement of vitamins and minerals among vulnerable children was ensured and employment opportunities were created to benefit poor women
BRAC's Rural School Nutrition Programme	To improve the status of primary education along with provision of good nutrition, promotion of cognitive, psycho-social and brain development, and reduction of hunger during school time.	Primary school-going children	Enhances quality education and improves educational standard of the children. Reduces dropout rate to an acceptable level and increases enrolment in the schools. Provides supplementary nutrition to children aged 5 to 11 years through primary schools and ensures reach of good quality, diversified and fortified foods to the vulnerable children in the country. Demonstrates the technical and operational feasibility of providing a variety of fortified/enriched foods through scaled-up School Nutrition Programmes in Bangladesh	School attendance, enrolment rate, completion rate in GoB primary level schools increased and universal primary education ensured. Nutritional status of the students enhanced through distribution of cooked food. Mother groups are made aware about the nutritional requirement for school-going children. Training about nutrition and hygiene provided to teachers, community

Intervention	Aim	Primary Beneficiaries	Description / Key Activities	Expected Outcome
				people, women Capacity building of local women and development of women leadership in the community
Introduction of Orange-fleshed Sweet Potato in School Feeding Programmes	To popularise orange-fleshed sweet potato in order to improve nutritional status of children.	Primary school-going children	Pilot programme conducted through three schools to check the future prospect of the programme, engaging more than 1500 students. Is targeted to add some additional nutritional value in the daily diet of the schoolchildren.	Reduction of vitamin A deficiency affecting school-going children and partially fulfilling nutritional requirements.