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Enhancing the nutrition-sensitivity of agricultural development interventions in the Eastern Gangetic Plains

Challenges and options

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Introduction

The 1999 World Summit of Food Security established the four pillars of food security as availability, access, utilisation and stability, with nutrition an integral dimension of the system (Ecker and Breisinger, 2012). Historically, however, agriculture has never held nutrient output as an explicit goal of its production systems (Welch & Graham, 1999; Gómez et al., 2013). According to Herforth (2012) there are at least two reasons for the agricultural sector to increase its attention towards nutrition. First, is that "nutrition is inseparable from the goals agricultural programs and policies set out to achieve (i.e. food security and poverty reduction) and second, actions to improve nutrition may remove constraints to productivity and income generation" (especially for women) (Herforth, 2012, p. 9). To this end, a more integrated view of the broader food system is warranted — one that recognises the links between agricultural production, income generation, human health and wellbeing (Welch & Graham, 1999).

Increasing recognition of agriculture's role in influencing nutritional outcomes has prompted a number of international partnerships to create initiatives aimed at reducing the global burden of malnutrition. This has placed increasing pressure on the agricultural sector to become more nutrition-sensitive in their design and implementation of agricultural interventions for development. The Scaling Up Nutrition (SUN) initiative (http://scalingupnutrition.org/) is one example of the international push to improve multisectoral cooperation to reduce the burden of malnutrition.

A dominant paradigm in contemporary approaches to agricultural development (in developing countries) is market-oriented smallholder development (McDermott et al 2013). While increasing agricultural productivity and income are necessary pursuits for improving food security, there is mounting evidence to suggest these achievements are insufficient for improving nutritional outcomes (Gulati et al., 2012; McDermott et al., 2013; Lancet series June, 2013; World Bank, 2007; Heady et al., 2012; Webb, 2013; Garnett et al., 2013; Gillespie et al., 2013).

Agricultural interventions at the community level typically focus on improving availability and access to protein-energy security. Yet neither availability nor access guarantees consumption or adequate biological utilisation of food, despite these steps being implicit in food security definitions.

According to the World Health Organization (WHO) and the Food and Agricultural Organization of the United Nations (FAO), the global prevalence of micronutrient malnutrition is twice that of the cruder measure of hunger and, furthermore impacts on the physical and cognitive development of women and children most profoundly (FAO, 2013; World Bank 2007). In addition, the dominant notion of hunger neglects the emerging problem of obesity that is increasingly evident among the urban poor. The global prevalence

of undernourishment, micronutrient malnutrition and obesity spans urban and rural populations, can co-exist in the same village and household, and can be independent of income (Rutten et al., 2012).

Good nutrition is inextricably linked to a range of individual, social and economic development goals (Lancet series, June 2013; Pinstrup-Andersen, 2007; Hawkes and Ruel, 2006). Maternal and child undernutrition is increasingly recognised as the primary pathway by which poverty is transmitted from one generation to the next, affecting health, wellbeing and productivity across the lifespan (FAO, 2013; Lancet series June 2013; Hammond and Dube, 2012). Poor nutrition directly impacts on child development outcomes through compromised cognitive and social development, increased susceptibility to disease, reduced schooling, decreased labour productivity and limited income earning potential in later life (FAO, 2013; World Bank, 2007). The first 1000 days of life (the period between conception and 24 months), is the critical window for a child's future physical, reproductive and cognitive development. Poor nutrition during this period of development cannot be reversed or regained and will impact on the quality of life across an individual's lifespan (Ahmed and Ahmed, 2009).

Globally, economic growth has generally reduced chronic undernutrition and mortality in children under five (World Bank, 2007). However, low and middle income countries are now increasingly facing a double burden of malnutrition where hunger, micronutrient malnutrition and obesity co-exist even within the same household (Dixon et al., 2007). While a 10% increase in gross domestic product (GDP) has been associated with a decline in the prevalence of stunting, a 7% increase in the prevalence of overweight and obesity has occurred almost simultaneously, especially among women (FAO, 2013; Lancet series June, 2013). Micronutrient deficiencies fall gradually as GDP rises, but continue to persist across populations even in high-income countries.

Evidence suggests that maintaining good nutritional status requires ongoing access to goods and services beyond what can be obtained from dietary sources. It includes, for example: a safe food preparation environment; sufficient time for maintaining good feeding practices; sufficient household decision-making power for making nutrition-enhancing decisions; adequate and culturally appropriate healthcare access; and sufficient nutrition knowledge. Given that food systems are embedded in complex ecological, economic and institutional contexts, a broader more integrative approach to nutrition security is vital for achieving a range of development outcomes.

Nutrition-sensitive agriculture is a relatively new concept for the Australian research for development community. The international community is currently busy mobilising knowledge, resources and networks to tackle global malnutrition multisectorally and this presents Australia with an opportunity to contribute to the work currently underway,

particularly within the Asia-pacific region where the Australian aid system is largely focused (ODE, 2014).

This background paper has two aims. The first is to outline the rationale and merits for enhancing the nutrition-sensitivity of agricultural interventions in general, highlighting recognised pathways which link agro-food systems to nutrition. The second is to apply a nutrition lens to the Eastern Gangetic Plains (EGP) region identifying themes that may serve as entry points for injecting nutrition considerations into regional food security program development.

The remainder of this paper is progressed through a background section that considers the emergence of the nutrition sensitive agriculture policy space, the porous evidence base of impact and definitional considerations for further research. The body of the paper summarises the prevalence and burden of malnutrition across the EGP and considers pathways for linking food systems to enhance nutrition outcomes in the region.

Background

The nutritional sensitivity of agriculture is an emergent concern in the international development community. As recently as June 2013, the *Lancet* published a landmark series of papers reporting on the current efforts to reduce the global prevalence of maternal and child malnutrition, the milestones reached to date, and the challenges that lie ahead in improving nutrition outcomes. The Lancet series estimated 3.1 million children under 5 die every year from undernutrition – a figure representing 45% of total child deaths in 2011 (Lancet series, June 2013).

The series included a review of the available evidence for four key sectors (agriculture, social protection, early child development and schooling) to contribute to positive nutritional outcomes through targeted programming (Lancet series, June 2013). The evidence of impact of targeted agricultural programs on maternal and child nutrition remains mixed and largely inconclusive (Ruel et al., 2013; World Bank, 2007; Webb, 2013)[1].

Some evidence exists to suggest that home gardens and the consumption of biofortified vitamin A-enriched orange sweet potato can contribute to increased vitamin A intake and status of mothers and their children (Ruel et al., 2013). However, in general, further analysis of the effectiveness of agricultural interventions on positive nutritional outcomes has been hampered by weak study designs: including incomplete elaboration of links and pathways; the absence of explicit nutrition objectives; and poor rigour in evaluation methodologies (Webb, 2013; Ruel et al., 2013). “While the potential to improve nutrition outcomes is clear,

[1] Nutritional status is typically measured using anthropometrics (physical body measurements) for children, body mass index (BMI) for adults and/or biomarkers (bioavailability of specific compounds in the body).

it has yet to be unleashed" was the central message describing the impact of previous efforts to enhance the nutrition-sensitivity of agricultural development programs.

The most entrenched approach to nutrition-sensitive agriculture strives to narrow the gap between availability, access and quality of food needed to maintain a balanced and healthy diet. Previous attempts to coordinate activities across sectors have tended to favour food-based approaches despite the dearth of evidence for the effectiveness of food-based strategies alone to improve nutritional status (Levitt et al., 2011; Ruel et al., 2013). Surprisingly, improving nutrition using primarily food-based approaches continues to be favoured by the FAO and the World Bank (Levitt et al., 2011) and remains the focus for the bulk of peer-reviewed literature on this topic.

Against a food-based approach, nutrition security is both a function of food intake and health status and these are mediated by multiple biological, environmental, behavioural, social and economic factors[2]. The example of using biofortified food crops for improved nutrition illustrates the shortcomings of adopting a narrow view of nutrition which neglects the role of broader systems in achieving significant nutritional outcomes. For a biofortified crop to show significant impact, adequate soil health, successful farmer adoption, adequate consumption across the population, and individual nutrient retention and bioavailability (in effect, an uncompromised individual health status) are just some of the conditions necessary for biofortification to impact on micronutrient deficiencies at scale (Ruel et al., 2013).

In late 2013, the lead author attended two international meetings engaged in scoping the links between agriculture, nutrition and health: the *CGIAR Science Forum 2013* held in Germany and the *International Global Food Security Conference* held in The Netherlands. Three key messages emerged from these meetings about the role of agriculture in improving nutritional outcomes:

1. Despite the vision and potential, the links between agriculture, nutrition and health are not always clearly articulated or elaborated and the mechanisms by which change is expected to occur are not easily demonstrated.

2. The agricultural development sector must involve itself in unfamiliar spaces in order to affect change. Drawing on past experiences from public health, environmental health and health promotion will be crucial for achieving nutrition security. While food is key, nutrition is not only about what's on

[2] Appendix A contains a contemporary adaptation of the pioneering UNICEF conceptual framework on child and maternal nutrition first developed in the 1990s. The framework depicts the interactions between food, health and care in improving nutrition and reducing poverty.

the plate. The gains made in productivity can easily be negated if considerations such as scarcity of clean water, the prevalence of infectious disease and poor sanitation and hygiene are absent from program design.

3. Improved nutritional governance which includes creating an enabling environment for cross-sectoral cooperation must be the central focus for achieving improved outcomes.

Some definitional notes

A cross-sectoral approach to improving linkages between agriculture, nutrition and health needs to start with acknowledging that a healthy diet consists of a combination of essential macronutrients (carbohydrates, fats and protein) and micronutrients (vitamins and minerals) that is prepared and consumed in a safe and hygienic environment. Nutrition security is a function both of nutrient intake and bioavailability (the body's capacity to retain and make use of nutrients) which can be compromised by disease.

For clarity, we preface a definition of nutrition-*sensitive* agricultural approaches with an explanation of a number of key terms frequently used in the literature below.

Undernourishment typically refers to insufficient caloric intake to meet daily energy requirements, a condition suffered by 870 million people globally in 2010-2012 (2013 Global Hunger Index). Undernourishment can lead to *malnutrition* which describes the inadequate, unbalanced or excessive consumption of macronutrients or micronutrients essential for physical and cognitive development. While *overnutrition* is sometimes used to refer to the conditions of overweight and obesity, the use of this term can mislead the reader to conclude that essential nutrients have been met.

Undernutrition is the *outcome* of insufficient food intake and can be associated with compromised immunity. Undernutrition in adults is measured using the Body Mass Index (BMI), but this standard is increasingly recognised as an unreliable indicator of undernutrition. Anthropometry and biomarker identification are typically used to measure nutritional status in children, although their reliability has been contested in the literature.

Protein-energy malnutrition or macronutrient malnutrition, is most commonly linked to anthropometry (the physical measurements and proportions of the body), and is typically associated with stunting, wasting, and underweight.

Underweight is a measure of weight-for-age. *Wasting* is a measure of weight-for-height and reflects severe weight loss associated with starvation and/or disease. Wasting is frequently observed during humanitarian emergencies such as famine and is strongly associated with mortality especially in children under 5 years of age.

Finally, s*tunting* is a measure of height-for-age, and is typically observed in children and adults following chronic inadequate dietary intake and repeated infections. The effects of stunting are intergenerational and often begin with poor maternal nutrition leading to poor foetal growth, low birth weight and subsequently poor child development and growth. The physical and cognitive impairments caused by stunting will impact a child's ability to learn which can lead to reduced income throughout the lifespan. Stunting also impacts on a woman's ability to birth safely due to small pelvic size and is widely associated with obstructed and prolonged labour, increasing the likelihood of child and maternal mortality and morbidity.

Nutrition-sensitive approaches aim to address the underlying determinants of nutrition and health including food and nutrition security, social protection, access to safe water, health services, sanitation and adequate care resources including nutrition and hygiene information. Ideally, nutrition-sensitive programs are multisectoral in design and implementation and seek to bring about positive changes primarily to the nutritional outcomes of women (and their children) in the knowledge that nutrition is largely the domain of rural woman (Jaenicke & Virchow 2013). That is, nutrition-*sensitive* agricultural approaches are attentive to gender dynamics[3].

Nutrition-sensitive programs offer avenues to accelerate nutritional benefits in a number of ways (McDermott et al., 2013) including the protection of livelihoods through investments in food and nutrition security, improvements in women's empowerment, access to water, sanitation and hygiene, access to health and family planning services and increased educational opportunities. Despite international agreement that nutrition needs to move 'beyond the plate', the bulk of research in this space continues to measure the direct effects of diet (quality, safety and diversity) on nutritional intake with evidence of nutritional outcomes notably absent.

Nutrition-*specific* interventions typically apply a public health approach to addressing the immediate determinants of nutrition. Examples include the promotion of optimal breastfeeding practices among mothers and micronutrient supplementation especially in high-risk populations (Ruel et al., 2013). Nutrition-specific interventions are less likely to significantly interrupt chronic conditions such as stunting, wasting and underweight without the support of targeted investment in nutrition-sensitive approaches to nutritional security.

[3] One should not dismiss the role of men in bringing about both positive and negative nutrition outcomes. For example, the impact of alcohol-related domestic violence can have the effect of *dis*empowering women and their ability to affect household nutritional status.

A snapshot of the prevalence and burden of malnutrition across the Eastern Gangetic Plains

In jurisdictional terms, the Eastern Gangetic Plains (EGP) region is comprised of the contiguous states of Bihar and northern West Bengal in the north eastern corner of India, the northwest of Bangladesh, and the Terai plains of Nepal. The EGP remains an agro-ecological region of interest to the Australian Centre for International Agricultural Research (ACIAR) and other interested donors such as the Gates Foundation and USAID due to the contradiction between its high agricultural production potential and its status as the 'poverty square of South Asia'. The EGP is home to 300 million people who bear the world's highest concentration of rural poverty, most of whom are dependent on agriculture for their food and livelihoods.

An agro-ecological and livelihoods gradient runs from the relatively wealthy west to the poverty stricken east of the Gangetic Plains, despite the fact that rainfall increases from west (600 mm/annum) to east (2,000 mm/annum) (Erenstein and Thorpe, 2011). Persistent poor political governance, high population density, small and fragmented land-holdings, male out-migration and the feminisation of agriculture all increase to the east and characterise the EGP as a region.

The Green Revolution that unfolded in the north-western Indian states of Uttar Pradesh and the Punjab achieved national food security for India in the 1970s (Ladejinski, 1969, 1976). However, even with the largest public food distribution system in the world, India struggles to meet the dietary needs of its rural poor. Although Bangladesh reached this national food security threshold 30 years later, approximately 40% of the population still cannot afford an adequate diet (Huq and Arshad, 2010). Nepal has yet to approach national food security and furthermore faces formidable geographical barriers to transporting food from surplus to deficit regions. In all three countries, a large gap exists between availability of food and reliable access to it by vulnerable households, particularly for the most vulnerable members of households.

The evidence base regarding nutrition within the EGP is patchy, with most available data collected at a national scale. Despite India's rapid economic progress in the past two decades, stunting, underweight and micronutrient deficiencies (particularly iron, zinc and Vitamin A deficiencies) continue to disproportionately burden women and children (Gillespie et al., 2012; Heady et al., 2012). One-third of the world's malnourished children reside in India (Gulati et al., 2012; Gillespie et al., 2012).

The table below illustrates the national prevalence of undernutrition among men, women and children across India. The data represents two comparative rounds of the National Family Health Survey (NFHS) conducted in 1998-9 and 2005-6.

Table 1: Undernutrition in India (extracted from Gillespie et al., 2012, pg. 1)

Nutrition indicator	NFHS-2 (1998/99)	NFHS-3 (2005/06)
	(percent)	
Stunting (children < 3)	51	45
Wasting (children < 3)	20	23
Underweight (children < 3)	43	40
Anemia (< 11.0 g/dl) (children 6–35 months)	74	79
Vitamin A deficiency (children < 5)	n.a.	57
Women with BMI < 18.5	36	33
Men with BMI < 18.5	n.a.	28
Women with anemia	52	56
Men with anemia	n.a.	24

Source: National Family Health Survey-3 (2005/06).
Note: n.a.: information is not available.

Significant geographic and social variability exists in the prevalence of malnutrition with the rural poor, scheduled tribes and castes bearing the greatest burden of undernutrition (Gulati et al., 2012). In terms of anthropometric indicators of malnutrition, Bihar within the EGP, remains among the worst performing Indian states with 50% of children either stunted or underweight while 40% of women fall below acceptable range against the body mass index (BMI) (Gulati et al., 2012). Jharkhand, formerly part of Bihar, has even more stunted children. Figure 1 shows the spread of primary malnutrition indicators across Indian states in children less than 5 years. West Bengal, also part of the EGP is the tenth worst performing state nationally.

Figure 1: Child malnutrition indicators across Indian states 2005/6 (extracted from Gulati et al., 2012)

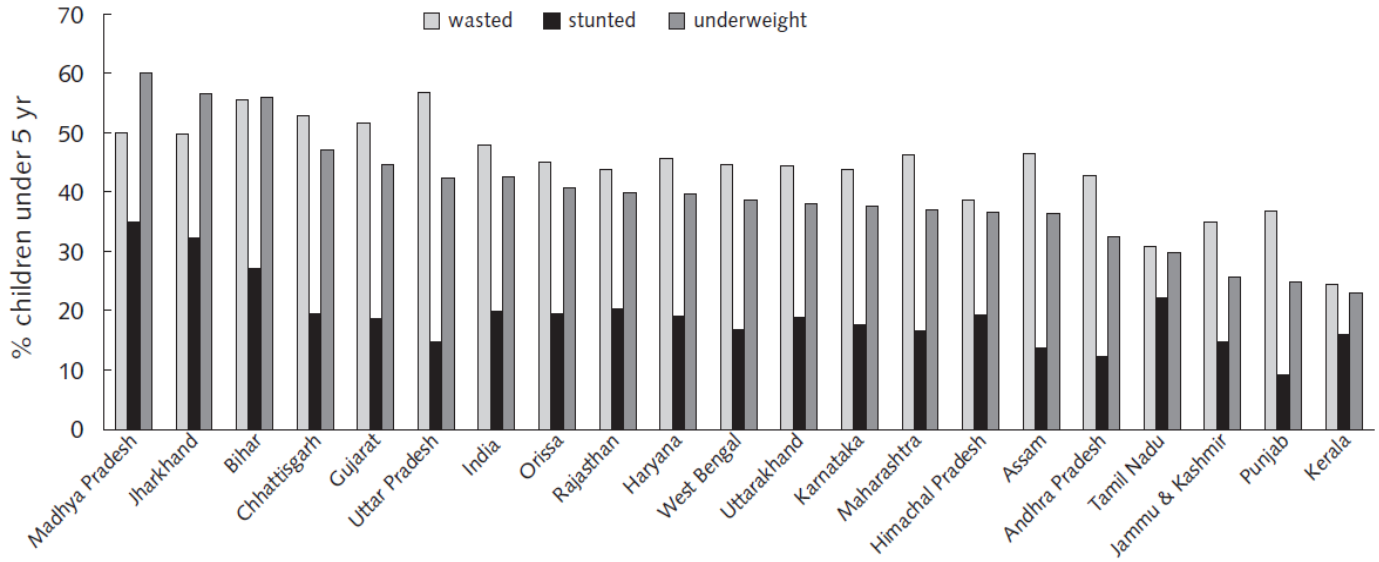

FIG. 3. Child malnutrition indicators across states, 2005/06. States are arranged in descending order of percentage of children under 5 years of age who are underweight.
Source: International Institute for Population Sciences and Macro International [9]

In Bangladesh nationally, short birth interval (spacing between multiple births), size at birth, mother's BMI during pregnancy, and parent's education were found to be the strongest determinants of malnutrition in children under 5 years (Rayhan and Hayat Khan, 2006). Close to one-third of Bangladeshi women of child-bearing age remain malnourished leading to intrauterine growth retardation during pregnancy. While the national prevalence of malnutrition has fallen from 68% in the late 1980s to 41% in 2007 (Ahmed and Ahmed, 2009), in 2009 anaemia remained at 80% among infants and 40% among pregnant women. Anaemia and calcium deficiency in pregnant women significantly increases the likelihood of complications during labour and contributes substantially to maternal mortality.

Early pregnancy in life (typically associated with early marriage), poor feeding and care practices and seasonal food insecurity adversely impact on maternal and child nutrition and health outcomes in Bangladesh (Rayhan and Hayat Khan, 2006). Suboptimal breastfeeding practices lead to increased mortality among infants under 2 years of age. Maternal and child malnutrition (especially micronutrient malnutrition) increases the likelihood of repeated exposure to infectious disease with respiratory and diarrhoeal disease the most common cause of child morbidity and mortality. The north-west of Bangladesh, including the elevated and drier Barind Tract, lies within the EGP.

In the lowland Terai districts of Nepal, Singh and colleagues (2009) studied a range of factors associated with underweight and stunting in children and found the prevalence of underweight in children at more than 53% while stunting affected more than one-third, or 36% of the study sample. A woman's underweight during pregnancy, higher birth order and lower standard of living score were risk factors for stunting in children while the mother's

education history (> 5 years) and participation in nutrition-specific programs were found to be protective factors against underweight and stunting in children (Singh et al., 2009).

In addition to undernutrition, the global nutrition transition occurring across both India and Bangladesh has led to a rapid rise in overweight and obesity in children and adults (especially among urban poor and rural women) who are at increased risk of developing non-communicable and chronic diseases including hypertension, diabetes and cardiovascular disease (Shafique et al., 2007). While a number of epidemiologic, demographic and economic shifts in the population partly explain the rapid rise in overweight and obesity, the role of biological triggers during the perinatal period also account for this rise[4]. Recent studies indicate 20% of Bangladeshi women living in urban neighbourhoods are now overweight, a rate which has doubled since 2000 (Khan and Talukder, 2013; Chen et al., 2013; James, 2004). Considering the high incidence of low birth weight (LBW) in Bangladesh, economic progress will bring significant public health challenges to Bangladesh in the next two decades with affected infants increasingly likely to develop degenerative disease during their lifespan (Victora et al., 2008; ACC/SCN 2000).

These outcomes in such an area of such high potential agricultural productivity are counterintuitive. Population pressure in West Bengal and Bangladesh, and inequitable access to land and irrigation waters as well as poor infrastructure and services in Bihar and the Terai are large factors in this irony.

It must be noted that an accurate and comprehensive picture of malnutrition prevalence across specific EGP jurisdictions is difficult to compile. The manner in which malnutrition is characterised, evaluated and reported varies significantly across regions and the veracity of available data has previously been questioned. Retrieving specific nutrition indicators across specific population groups within geographical and socio-economic contexts would be an ideal approach to mapping the malnutrition prevalence across the EGP. While national data on the prevalence of malnutrition and nutrition-specific interventions is vast, considerable gaps remain. Available data and literature describing and analysing the linkages between nutrition and agriculture in the region remains sparse (Gillespie et al., 2012; Gulati et al., 2012; Headey et al., 2012).

[4] Maternal undernutrition typically results in low birth weight babies who are undernourished and underweight. The *thrifty phenotype hypothesis*, or Barker's hypothesis has been observed to occur when nutrient deprivation occurring early in life, *in utero*, triggering a metabolic response which leads to nutrient retention later in life, especially in times of plenty.

Pathways linking food systems to nutrition in the Eastern Gangetic Plains

Food based interventions for improving nutrition security through agricultural development programs tend to focus efforts on the following impact pathways:

(1) Improving nutrient composition of food (e.g. biofortification of rice or sweet potato);

(2) Improving food safety (e.g. reducing aflatoxin contamination in maize);

(3) Increasing dietary diversity (e.g. promoting home and kitchen gardens); and

(4) Increasing income to enhance food security.

The utilisation of food is typically neglected in agricultural investments for food security research. The shift required to realise nutrition security will demand, among other things, an understanding of food use and practice at various levels. Intra-household food allocation, the effects of various food preparation methods on respiratory health, and culturally-embedded food restrictions during pregnancy and lactation[5] are just some examples of the impact of food use on nutrition security in the food system.

Gillespie and colleagues (2012) identified seven key pathways which linked agriculture to nutrition in India in their effort to map the evidence available for each:

(1) Agriculture as a source of household food;

(2) Agriculture as a source of household income through agricultural work or sale of produce;

(3) Actual expenditure of agriculturally-derived income on nutrition-enhancing goods and services;

(4) Agricultural policies and their effect on food prices;

(5) Women's socioeconomic status and their household decision-making power;

[5] Maternal practices relating to food avoidance, food taboos and food restrictions during the antepartum and postpartum period in Bangladesh and India have been documented (See for example, Goodburn et al., 1995; Mukhopadhyay & Sarkar, 2009; Shannon et al., 2008). The origins of mothers' consumption behaviours have been linked to traditional religious, spiritual, and cultural beliefs. These beliefs range from avoiding foods from protein sources in the fear that labour would be difficult if the baby grew too large, to ascribing key food groups with 'humoral' qualities such as "hot" and "cold". Given the cultural sensitivity of this topic, the literature is largely contained to describing these taboos and further work is needed to determine their impacts on maternal and child nutrition more broadly.

(6) Women's ability to manage the care, feeding and health of young children; and

(7) Women's own nutritional status including energy expenditure, food quality and intake and the risk and level of exposure to agricultural hazards (Gillespie et al., 2012).

The authors found there was "an extraordinarily thin evidence base for the links between major agriculture-related institutional, technological and policy shifts in the past two decades and the nutritional status of women and children" (Gillespie et al., 2012, pg. 16). The absence of nutritional outcome objectives in most studies, and the one-dimensional treatment of malnutrition as a consequence of inadequate caloric intake have in part contributed to the paucity of evidence available (Gillespie et al., 2012). The empirical disconnect between agriculture and nutrition variables in available datasets render analysis of agriculture-nutrition linkages difficult (Headey et al., 2012; Gillespie et al., 2012).

A number of international partnerships and initiatives focussed on cross-sectoral activities are underway in the EGP region and surrounds. While each carries a range of objectives, a central aim for most is to mobilise diverse stakeholders for institutional change. Leveraging Agriculture for Nutrition in South Asia (LANSA), Tackling the Agriculture Nutrition Disconnect in India (TANDI), Partnerships and Opportunities to Strengthen and Harmonize Actions for Nutrition in India (POSHAN), Agriculture for Nutrition and Health (A4N&H) – CGIAR, and the South Asia Food and Nutrition Security Initiative (SAFANSI) are all sharply focussed on improving nutrition through multisectoral research and action. Helen Keller International (HKI) and Action against Hunger – ACF International also share a long history in building capacity for institutional change at national and regional levels at the agriculture-nutrition interface using participatory processes (McDermott et al., 2013). These initiatives may present future collaborative opportunities for strengthening the nutrition-sensitivity of Australian-supported agricultural interventions in the EGP.

Enhancing the nutrition-sensitivity of agricultural interventions in the EGP – Key themes for consideration

1. Make women farmer and women-headed households the key targets for intervention

Given the critical role women play in influencing household nutrition and health, the conditions of female employment in agriculture is a critical link between agricultural production and child nutritional outcomes (Headey et al., 2013) as well as women's own

health and nutrition status. Women farmers and women-headed households (WHH) need to be made the key targets for participation in food security and agricultural development programs given the increasing feminization of agriculture in the region, in part a result of male labour migration (Headey et al., 2012; Darbas et al., 2013).

2. Develop mechanisation approaches that benefit women

Women's time use and their available physical energy will influence their capacity to care for themselves, their children and the extended household. A number of commentators warn against overlooking the impact of agricultural innovations for women given their role in influencing the nutritional and health status of the household (Jaenicke & Virchow, 2013; Heady et al., 2012; Darbas et al., 2013). The extent to which women actually benefit from mechanization (Heady et al., 2012) and the impact of adoption of higher yielding maize varieties upon women's time and energy for meal preparation (Jaenicke & Virchow, 2013) are two examples of interventions with potentially adverse effects on women's health and nutritional status as well as that of their children.

3. Conduct gender analysis geared towards understanding the links between nutrition and women's empowerment

Darbas et al., (2013) found that while international labour migration in Bangladesh had a positive effect on increasing women's household decision-making power, India has not experienced a comparable improvement on measures of women's empowerment from national labour migration (Darbas et al., 2013). Conceptually, there is an important link between women's empowerment and nutrition outcomes[6] (McDermott et al., 2013) however, studies measuring specific aspects of women's empowerment as a pathway to improved nutrition are few and their results mixed (van den Bold et al., 2013). Conducting and utilising comprehensive gender analyses to better understand how gender relations impact on nutrition outcomes is an essential step in improving nutrition security in the region.

4. Partner with organisations dedicated and experienced in social mobilisation of women

The proliferation of self-help groups (SHG) especially in West Bengal has enabled the poor (particularly women) to gain access to micro-finance credit, a particularly effective social protection resource. SHGs are valued globally for their effectiveness in promoting and enabling access to health information and services. Partnering with organisations dedicated to improving empowerment of asset poor rural women and girls provides an entry point to improving the nutrition sensitivity of food security programs. Examples here include the

[6] We recognise the indicators outlined in the Women's Empowerment in Agriculture Index (WEAI) developed by IFPRI to include the domains of production, resources, income, leadership and time. See Sraboni et al., 2013.

national Indian NGO PRADAN which facilitates rural livelihoods via repair of the natural resources of upland tribal communities characterised by male out-migration. Regionally oriented NGOs such as SAHKI and JEEViKA focus their rural livelihood work with women in remote northern Bihar.

5. Determine the benefit to women of diversification into high value products

The final report of the ACIAR project – *Policy constraints in rice-based farming systems in Bangladesh* (ASEM/2011/005)[7] concluded the continuous decline in farm size for the sustainability of rice-based farming was a challenge but that this created an opportunity for investment in homestead horticulture, potentially increasing nutrient intake. Diversification into higher value agriculture including horticulture and pisiculture for women can boost income especially for WHH (Levitt et al., 2011; Darbas et al., 2013) providing women with the purchasing power to spend on higher-quality food or health care for household members. While the link between increased dietary diversity and consumption through home gardening has the potential to improve the nutritional status of the household, the efficacy of this pathway for overall improved nutritional outcomes is linked to factors unrelated to dietary intake, such as utilisation.

6. Remain alert to unexpected adverse effects of current practices and interventions

Arsenicosis, or the effect of prolonged exposure to arsenic contaminated water, food or air, poses an increased risk for farmers and agricultural labourers in Bangladesh and parts of India who use shallow wells for irrigation. Skin lesions, arsenic-related cancers, circulatory disease and reproductive disorders are some of the health effects attributable to prolonged arsenic exposure. Poor nutritional status has been associated with increased susceptibility to arsenic-related skin lesions in both Bangladesh and West Bengal, India, illustrating the potentially detrimental health costs associated with widespread shallow tubewell (STW) use (Chakraborti al., 2013; Samal et al., 2013).

Finally, it is important to note that a concerted effort to track and mitigate adverse nutritional outcomes is potentially equally as impactful as activities which aim to bring about positive nutritional benefits. The inclusion of explicit objectives and indicators within nutrition-sensitive interventions is probably *the* pivotal action any research for development project can take in this space. Appendices B and C present two complementary versions of widely accepted recommendations for improving the nutrition-sensitivity of agricultural programs.

[7] Available from http://aciar.gov.au/project/asem/2011/005

Conclusions

Efforts to improve the health and nutrition of individuals and communities through multisectoral collaboration have been tried since the 1960s (Garrett and Natalicchio, 2011). While nutrition and health sectors have commonly partnered with social protection and education to improve the effectiveness and sustainability of development outcomes, an international movement for the agricultural sector to become more nutrition-sensitive is gathering pace.

While nutrition-sensitive agricultural approaches alone will not solve the global malnutrition problem, the manner in which nutrition and nutrition security is defined and framed will significantly impact on the effectiveness of development interventions. Given that food systems are embedded in complex ecological, economic and institutional contexts, a broader more integrative approach to nutrition security is vital for achieving a range of development outcomes. Nutrition goes far beyond 'what's on the plate'.

Sustainable strategies for improving the health and nutrition status of poor people will require multisectoral effort. Multisectoral attempts at convergence in programming at the community level are most likely to yield the highest impact in improving malnutrition in India (Ved & Menon, 2012). Given the well-documented limitations of agricultural extension-services in reaching women (Darbas et al., 2013; Jaenicke & Virchow, 2013) and given that nutrition training and services traditionally attracts female extension staff, the involvement of established community health workers in promoting and supporting nutrition-enhancing activities may present opportunity for meeting shared development goals.

Remaining sensitive to, and mitigating against, the potentially negative effects of adopting new agricultural technologies and practices, especially among women, also provides potential to improve nutritional outcomes. Engaging cross-sectorally with sectors experienced in nutrition policy development and programming such as social protection, health and education can increase the effectiveness and sustainability of nutrition-sensitive initiatives. Child and maternal malnutrition in India, Bangladesh and Nepal is viewed as an important challenge to overcome by respective national governments. Established community-based health and education infrastructure in all countries presents strong opportunities for multisectoral interventions to improve nutritional outcomes.

Malnutrition in all its forms imposes unacceptably high costs on society in human and economic terms (FAO, 2013). Nutrition and health security are inseparable from the goals rural and agricultural development programs pursue – food security and poverty alleviation. An integrated approach which sets nutrition security in a broader context of choices relating to farm and non-farm investments, activities, gender roles and food use (Webb, 2013; Levitt et al., 2011) is likely to better facilitate improvements in malnutrition across the EGP.

Appendix A

In 1990, the United Nations Children's Fund (UNICEF) published a conceptual framework highlighting the interactions between food, health and care in improving nutrition and reducing poverty. This framework has been foundational in developing contemporary understanding of the specific pathways which link agriculture, nutrition and health. The framework has since been further developed, modified and expanded by various individuals and groups and its use continues to inform multisectoral programming. An adaptation of the framework appears below, most recently published in the Lancet Nutrition series June 2013. The executive summary of the series, including the adapted framework, can be accessed here
http://www.unicef.org/ethiopia/Lancet_2013_Nutrition_Series_Executive_Summary.pdf

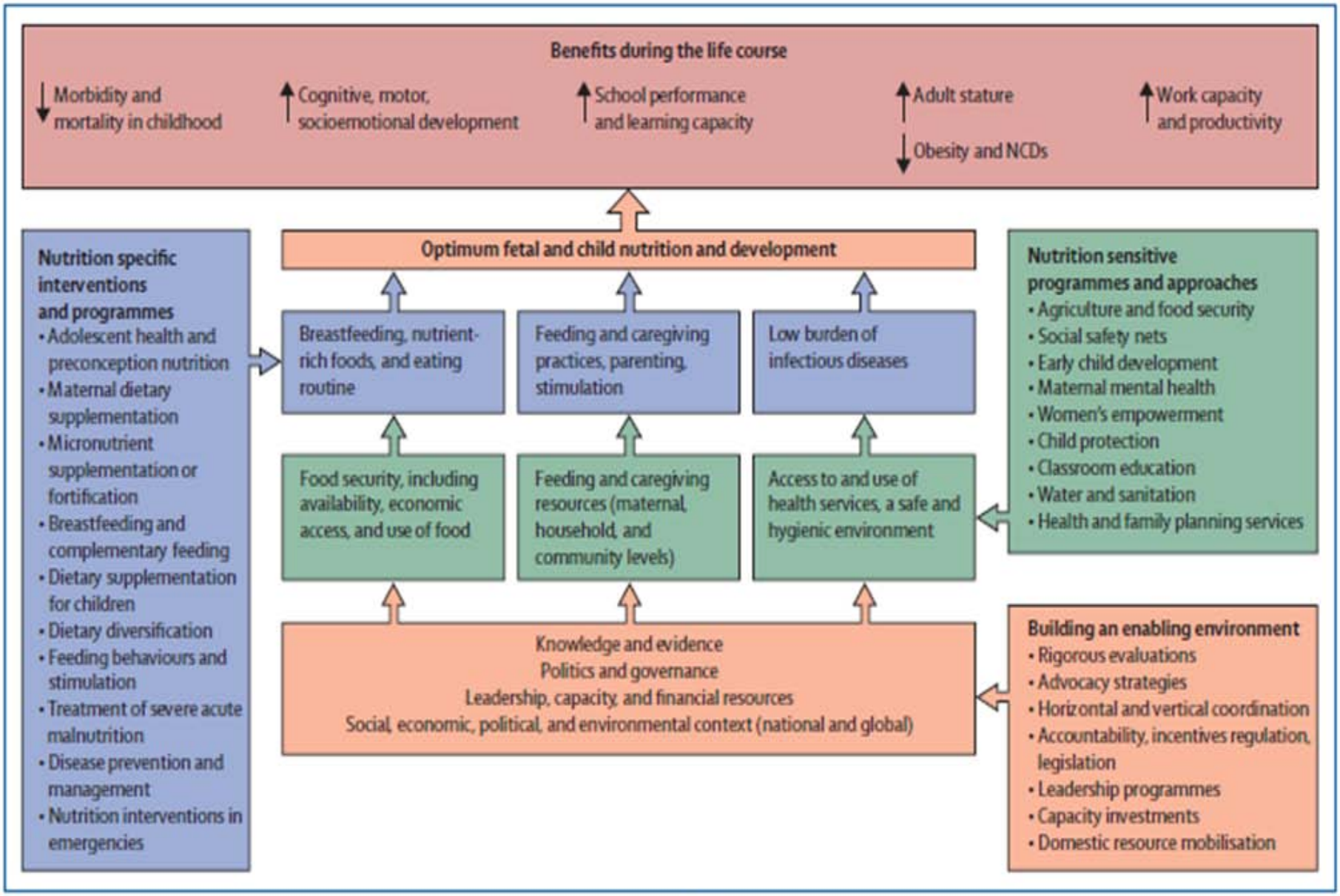

Figure 1: **Framework for actions to achieve optimum fetal and child nutrition and development**

Appendix B

The United Nations System Standing Committee on Nutrition (UNSCN) has established an Agriculture-Nutrition Community of Practice (Ag2Nut CoP). The group has released a set of *Key Recommendations for Improving Nutrition through Agriculture* formulated after broad cross-sectoral consultation and extensive review of available guidance on agricultural programming for nutrition led by the Food and Agricultural Organisation (FAO).

The broad set of guiding principles for improved programming is included below and is accompanied by a complimentary set of policy recommendations for improving nutrition through agriculture that is not included here. For further information refer to http://www.unscn.org/en/nut-working/agriculture-nutrition-cop/join-the-group.php

Key recommendations for Improving Nutrition through Agriculture

Food systems provide for all people's nutritional needs, while at the same time contributing to economic growth. The food and agriculture sector has the primary role in feeding people well by **increasing availability, affordability, and consumption of diverse, safe, nutritious foods and diets,** aligned with dietary recommendations and environmental sustainability. Applying these principles helps strengthen resilience and contributes to sustainable development.

Agricultural programmes and investments can strengthen impact on nutrition if they:

1. **Incorporate explicit nutrition objectives and indicators into their design, and track and mitigate potential harms,** while seeking synergies with economic, social and environmental objectives.
2. **Assess the context at the local level, to design appropriate activities to address the types and causes of malnutrition,** including chronic or acute undernutrition, vitamin and mineral deficiencies, and obesity and chronic disease. Context assessment can include potential food resources, agro-ecology, seasonality of production and income, access to productive resources such as land, market opportunities and infrastructure, gender dynamics and roles, opportunities for collaboration with other sectors or programmes, and local priorities.
3. **Target the vulnerable and improve equity** through participation, access to resources, and decent employment. Vulnerable groups include smallholders, women, youth, the landless, urban dwellers, the unemployed.
4. **Collaborate and coordinate with other sectors** (health, environment, social protection, labor, water and sanitation, education, energy) and programmes, through joint strategies with common goals, to address concurrently the multiple underlying causes of malnutrition.
5. **Maintain or improve the natural resource base** (water, soil, air, climate, biodiversity), critical to the livelihoods and resilience of vulnerable farmers and to sustainable food and nutrition security for all. Manage water resources in particular to reduce vector-borne illness and to ensure sustainable, safe household water sources.
6. **Empower women** by ensuring access to productive resources, income opportunities, extension services and information, credit, labor and time-saving technologies (including energy and water services), and supporting their voice in household and farming decisions. Equitable opportunities to earn and learn should be compatible with safe pregnancy and young child feeding.
7. **Facilitate production diversification, and increase production of nutrient-dense crops and small-scale livestock** (for example, horticultural products, legumes, livestock and fish at a small scale, underutilized crops, and biofortified crops). Diversified production systems are important to vulnerable producers to enable resilience to climate and price shocks, more diverse food consumption, reduction of seasonal food and income fluctuations, and greater and more gender-equitable income generation.
8. **Improve processing, storage and preservation** to retain nutritional value, shelf-life, and food safety, to reduce seasonality of food insecurity and post-harvest losses, and to make healthy foods convenient to prepare.
9. **Expand markets and market access for vulnerable groups, particularly for marketing nutritious foods** or products vulnerable groups have a comparative advantage in producing. This can include innovative promotion (such as marketing based on nutrient content), value addition, access to price information, and farmer associations.
10. **Incorporate nutrition promotion and education** around food and sustainable food systems that builds on existing local knowledge, attitudes and practices. Nutrition knowledge can enhance the impact of production and income in rural households, especially important for women and young children, and can increase demand for nutritious foods in the general population.

These recommendations have been formulated following an extensive review of available guidance on agriculture programming for nutrition, conducted by FAO (see: http://www.fao.org/docrep/017/ap194e/ap194e00.htm), and through consultation with a broad range of partners (CSOs, NGOs, government staff, donors, UN agencies) in particular through the Ag2Nut Community of Practice. They are also referred to as "guiding principles" by some partners.

Appendix C

A joint initiative between the World Bank Secure Nutrition Knowledge Platform Collaboration and the Global Forum for Rural Advisory Services (GFRAS) has recently released a compendium of experiences, lessons and recommendations for integrating nutrition into extension and advisory services. Note these recommendation mirror many of those provided by the UN Standing Committee on Nutrition (UNSCN) shown in Appendix B.

The following principles for improving nutrition through agriculture are reproduced below. For the complete reference, see http://www.g-fras.org/en/480-the-integration-of-nutrition-into-extension-and-advisory-services.html

Guiding principles for improving nutrition through agriculture

Planning for nutrition

1. Incorporate explicit nutrition objectives in agriculture policy and program design.

2. Assess the context and causes of malnutrition at the local level, to maximize efficacy and reduce negative externalities.

3. Do no harm. Identify potential harms, develop a mitigation plan, and set in place a well-functioning monitoring system.

4. Measure nutritional impact through program monitoring and evaluation.

5. Maximize opportunities through multi-sectoral coordination.

6. Maximize impact of household income on nutrition, such as through increasing women's income.

7. Increase equitable access to productive resources.

8. Target the most vulnerable.

Taking action

All approaches should:

9. Empower women, the primary caretakers in households, through: income; access to EAS and information; avoiding harm to their ability to care for children; labor and time-saving technologies; and support for rights to land, education, and employment.

10. Incorporate nutrition education to improve consumption and nutrition effects of interventions. Employ agriculture extension agents to communicate on nutrition as feasible.

11. Manage natural resources for improved productivity, resilience to shocks, adaptation to climate change, and increased equitable access to resources through soil, water, and biodiversity conservation.

These can be combined with approaches to:

12. Diversify production and livelihoods for improved food access and diet diversification, natural resource management, risk reduction, and improved income.

13. Increase production of nutritious foods, particularly locally adapted varieties rich in micronutrients and protein, chosen based on nutrition gaps at the local level, and available solutions.

14. Reduce post-harvest losses and improve processing.

15. Increase market access and opportunities, especially for smallholders.

16. Reduce seasonality of food insecurity through improved storage and preservation and other approaches.

Creating a supportive environment

17. Improve policy coherence regarding support for nutrition, including food price policies, subsidies, trade policies, and pro-poor policies.

18. Improve good governance for nutrition, by drawing up a national nutrition strategy and action plan, allocating adequate budgetary resources, and implementing nutrition surveillance.

19. Build capacity in ministries at national, district, and local levels.

20. Communicate and continue to advocate for nutrition.

Source: Fanzo, J., Marshall, Q., Wong, J., Merchan, R.I., Jaber, M.I., Souza, A., Verjee, N. (2013) *The Integration of Nutrition into Extension and Advisory Services: A Synthesis of Experiences, Lessons, and* Recommendations. A Global Forum for Rural Advisory Services (GFRAS) and the World Bank Secure Nutrition Knowledge Platform Collaboration

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