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# A state of the art review of agriculture-nutrition linkages

## An AgriDiet Position Paper

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## Contents

## 1. Introduction

This paper explores the latest evidence on the relationships between agriculture and nutrition in food-insecure regions. First, it summarises the levels and consequences of undernutrition. Second, it reviews some contextual factors that might affect the relationship between agriculture and nutrition. Third, it reviews the state of the art knowledge on the links between agriculture and nutrition, drawing on recent reviews and studies. Fourth, it reviews the key research questions that need to be addressed and suggests some methods for answering them. Finally, the paper concludes with some implications for the AgriDiet project.

## 2. Levels and Consequences of Malnutrition

Malnutrition is one of the world's most serious but least addressed health problems. In developing countries nearly one-third of children are underweight or stunted, meaning they have low height for their age (UNICEF, 2013). In 2011 the prevalence of underweight children under five in developing countries stood at 19.4%, stunting was at 29.9% and wasting at 9.6% (Stevens et al, 2012). Poor foetal growth or stunting in the first 2 years of life leads to irreversible damage, including shorter adult height, lower attained schooling, reduced adult income, and decreased offspring birth weight. The human and economic costs are enormous, falling hardest on the very poor and on women and children. Undernutrition interacts with repeated bouts of infectious disease, causing an estimated 3.1 million preventable maternal and child deaths annually (Black et al, 2013), and its economic costs in terms of lost national productivity and economic growth are huge. It is estimated that 11% of GDP in Africa and Asia is lost to undernutrition every year (Horton and Steckel, 2013) with productivity losses to individuals estimated at more than 10% of lifetime earnings (World Bank, 2006).

Micronutrient deficiencies contribute significantly to the burden of malnutrition. Globally, anaemia contributes to 20% of all maternal deaths. Iron deficiency, which is a common cause of anaemia, poses major health consequences, including impaired physical and cognitive development, increased risk of morbidity in children and reduced work productivity in adults (Victoria et al, 2008). Vitamin A deficiency is the leading cause of preventable blindness in children and increases the risk of disease and death from severe infections. In pregnant women it also causes night blindness and may increase the risk of maternal mortality (WHO, 2013).

In the AgriDiet focus countries, Ethiopia and Tanzania, the rates of chronic malnutrition (stunting) are far higher than the 29.9% average for developing countries, with levels as high as 44% in Ethiopia and 42% in Tanzania (DHS). Levels of micronutrient deficiencies are high in both countries, with the prevalence of anaemia at 44% (Ethiopia) and 58% (Tanzania). Consumption of Vitamin A rich foods is particularly low in Ethiopia, with only 25% of children consuming Vitamin A rich foods within the 24 hours before the DHS interview (47% in Tanzania).

## 3. The Challenges to Achieving Food and Nutrition Security

The global population is rapidly expanding, and populations in Sub Saharan Africa are predicted to more than double by 2050 to 2 billion people (UN, 2013), posing some major challenges to achieving food and nutrition security. Population pressure, urbanization, climate change, water scarcity, food consumption patterns and food price volatility are all areas of concern with great impact on food and nutrition security (FAO, 2012).

The UK Government's Future of Global Food and Farming report (2011) highlighted 6 major drivers affecting the food system:

1. Global population increases, from 7 billion today to 9.6 billion by 2050. This will be accompanied by urbanization. Population increases will be affected by economic growth, educational attainment, child survival and women's access to birth control services

2. Changes in the size and nature of per capita demand. As income and urbanization continue to rise, the demand for diet diversity (more animal source foods) and processed foods will increase. The resource use of these foods is high and the health consequences are mixed.

3. Future governance of the food system at both national and international levels:

    - New food superpowers such as Brazil, China and India: how will they affect the globalization of markets and the deployment of underutilized agricultural land?
    - The trend for consolidation in the private sector, with the emergence of a limited number of very large transnational companies in agribusiness, in the fisheries sector, and in the food processing, distribution and retail sectors.
    - Production subsidies, trade restrictions and other market interventions already have a major effect on the global food system.
    - The extent to which governments act collectively or individually to face future challenges, particularly in shared resources, trade and volatility in agricultural markets.
    - The control of increasing areas of land for food production will be influenced by both past and future land-purchase and leasing agreements – involving both sovereign wealth funds and business.

4. Climate change. Agriculture is a victim and a culprit of climate change. Growing demand for food must be met against a backdrop of changing climatic conditions. These will affect crop growth and livestock performance, the availability of water, fisheries and

aquaculture yields. Extreme weather events will very likely become more severe and more frequent, thereby increasing volatility in production and prices. The extent to which adaptation occurs (for example through the development of crops and production methods adapted to new conditions) will critically influence how climate change affects the food system. Policies for climate change mitigation will also have a very significant effect on the food system – the challenge of feeding a larger global population must be met while delivering a steep reduction in greenhouse gas emissions.

5. Competition for key resources. Several critical resources on which food production relies will come under more pressure in the future. Conversely, growth in the food system will itself exacerbate these pressures:

    - Land for food production: Overall, relatively little new land has been brought into agriculture in recent decades. Although global crop yields grew by 115% between 1967 and 2007, the area of land in agriculture increased by only 8% and the total currently stands at approximately 4,600 million hectares. While substantial additional land could in principle be suitable for food production, in practice land will come under growing pressure for other uses. For example, land will be lost to urbanisation, desertification, salinisation and sea level rise, although some options may arise for salt-tolerant crops or aquaculture.
    - Global energy demand: This is projected to increase by 45% between 2006 and 2030 and could double between now and 2050. Energy prices are projected to rise and become more volatile, although precise projections are very difficult to make. Several parts of the food system are particularly vulnerable to higher energy costs – for example, the production of nitrogen fertilisers is highly energy intensive: the roughly fivefold increase in fertiliser price between 2005 and 2008 was strongly influenced by the soaring oil price during this period. The financial viability of fishing (particularly capture fisheries) is also strongly affected by fuel prices.
    - Global water demand: Agriculture already currently consumes 70% of total global 'blue water' withdrawals from rivers and aquifers available to people. Demand for water for agriculture could rise by over 30% by 2030, while total global water demand could rise by 35-60% between 2000 and 2025, and could double by 2050 owing to pressures from industry, domestic use and the need to maintain environmental flows. In some arid regions of the world, several major non-renewable fossil aquifers are increasingly being depleted and cannot be replenished, for example in the Punjab, Egypt, Libya and Australia.

6. Changes in the values and ethical stances of consumers. These will have a major influence on politicians and policy makers, as well as on patterns of consumption in individuals. In turn, food security and the governance of the food system will be affected. Examples include issues of national interest and food sovereignty, the acceptability of modern technology (for example genetic modification, nanotechnology, cloning of livestock, synthetic biology), the importance accorded to particular regulated and highly specified production methods such as organic and related management systems, the value placed on animal welfare, the relative importance of environmental sustainability and biodiversity protection, and issues of equity and fair trade. These challenges highlight the need for agriculture to do more for nutrition, but also the challenges to agriculture of doing so. In particular they highlight that many of the factors shaping the relationship between agriculture and nutrition lie outside the agricultural sector and are not easily quantified.

## 4. Agriculture and Nutrition Links: State of the Art Conclusions

### *4.1 Agriculture has the potential to contribute to reducing undernutrition*

Since the publication of the 2008 Lancet Nutrition Series (Horton, 2008), there has been a renewed focus on reducing malnutrition and the need for a subsequent scaling up of a series of direct nutrition programmes. However, these direct or nutrition-specific interventions only address the immediate causes of undernutrition (dietary intake and disease), and can only reduce stunting prevalence by an estimated 20% (Bhutta et al, 2013). Income growth drives declines in undernutrition: estimates suggest a 10% increase in income leads to a 5-6% decrease in stunting levels (Ruel and Alderman 2013). But income growth cannot be relied on and only addresses part of the problem. Given that, under the best conditions, direct interventions and income growth can only solve a part of the problem, policies and programmes in areas like

agriculture, social protection, women's empowerment, health and sanitation are vital if stunting rates are to decline further.

The issue for agriculture is when and how to become nutrition sensitive to contribute further to reducing stunting, especially given the contextual drivers described in the preceding section

### *4.2 We know the pathways*

Agriculture has been highlighted as an area with great potential to improve nutrition in a sustainable way. Making agriculture 'nutritionally sensitive' has become a focus in recent years, with many studies researching the linkages between the two sectors and the pathways through which agriculture might improve nutritional outcomes (Gillespie et al, 2012; Berti et. al., 2003; World Bank, 2007; Arimond et al., 2011; Masset et. al. 2011).

**Box 1. Pathways through which agriculture is hypothesised to affect nutrition outcomes**

1. As a source of food: increases household availability and access to food from own production
2. As a source of income: increases income from wages earned by agricultural workers or through the marketing of agricultural produce.
3. Food prices: agricultural policies (national and global) affect a range of supply and demand factors that establish the price of marketed food and non-food crops; this price in turn affects the income of net seller households, the purchasing power of net buyers, and the budget choices of both
4. Women's social status and empowerment: women's participation in agriculture can affect their access to, or control over, resources and assets, and increase their power to make decisions on the allocation of food, health, and care within their household
5. Women's time: women's participation in agriculture can affect their time allocation and the balance between time spent in income-generating activities and time allocated to household management and maintenance, care giving, and leisure
6. Women's own health and nutritional status: women's participation in agriculture can affect their health (for example through exposure to agriculture-associated diseases) and nutritional requirements (for example through increased energy expenditure); their health and nutritional status can, in turn, affect their agricultural productivity and hence their income from agriculture

**Box 2: The importance of animal source foods in diets**

Animal foods are recognized as having high energy density and as good sources of high-quality protein; readily available iron and zinc; vitamins B6, B12 and B2; and, in liver, vitamin A. They enhance the absorption of iron and zinc from plant-based foods. Evidence from the nutrition Collaborative research support Programme (nCrsP) for Egypt, Kenya and Mexico indicated strong associations between the intake of foods from animal sources and better physical and cognitive development in children. Increasing access to affordable animal-source foods could significantly improve nutritional status and health for many poor people, especially children. However, excessive consumption of livestock products is associated with increased risk of overweight and obesity, heart disease and other non-communicable diseases. Furthermore, the rapid growth of the livestock sector means that competition for land and other productive resources puts upward pressure on prices for staple grains as well as negative pressures on the natural resource base, potentially reducing food security in the longer term. Policy-makers need to take into consideration the trade-offs inherent when designing policies and interventions to promote animal-source foods. Fish is also an important source of many nutrients, including protein of high quality, retinol, vitamins D and E, iodine and selenium. Evidence increasingly links the consumption of fish to enhanced brain development and learning in children, improved vision and eye health, and protection from cardiovascular disease and some cancers. The fats and fatty acids from fish are highly beneficial and difficult to obtain from other food sources. Evidence from Zambia documented that children whose main staple food is cassava and whose diets regularly include fish and other foods containing high-quality protein had a significantly lower prevalence of stunting than those whose diets did not.

Source: State of Food and Agriculture, FAO, 2013.

There are a number of identified pathways through which agriculture is hypothesised to affect nutrition outcomes (Box 1). The pathways are complex, encompassing economic, social and gender considerations suggesting that investing in agricultural production alone does not necessarily result in improved nutrition.

The potential for some interventions seems large. Box 2 from the recent State of Food and Agriculture (FAO, 2013) highlights the potential for animal-source foods to promote nutrition.

However the evidence on the links between agricultural interventions and nutrition outcomes is surprisingly weak.

***4.3 The Evidence***

Reviews conducted on the effectiveness of agricultural interventions aimed at improving nutritional status have had mixed results (Ruel, 2001; Berti et al, 2003; World Bank, 2007; Kawarazuka, 2010; Arimond et al, 2011; Webb and Kennedy, 2012; Masset et al, 2011). Many reviews found that, while interventions were successful in promoting the production and consumption of specific foods, there was very little evidence available on changes in the overall diet (or indeed micronutrient status) and few studies measured nutritional status using anthropometrics.

As noted in the paper on nutrition-sensitive interventions in the recent *Lancet* series, "The lack of evidence is surprising given the multiple pathways of potential influence that these types of programs have" (Ruel and Alderman, 2013). Box 3 elaborates on this position.

Perhaps the strongest set of evidence on the impacts of agricultural interventions on nutrition has come from home gardens and homestead food production; small scale interventions focusing on foods of high value and high nutritional value such as animal source foods, fruits and vegetables.

As Ruel and Alderman (2013) report:

- There is little evidence that homestead food production programmes are effective in improving the nutritional status of mothers or children (either in measures of anthropometry or micronutrients), with the possible exception of vitamin A status. For child anthropometry, a few studies reported an effect on at least one indicator, but effects were generally small.
- Nutritional effect is more likely when agriculture interventions target women and include women's empowerment activities (for example, improvement in their knowledge and skills through behaviour-change communications or promotion of their increased control over income from the sale of targeted commodities).

**Box 3: Excerpts from the Lancet Series (2013) Executive Summary Relating to Unlocking the Potential of Agricultural Nutrition-Sensitive Programs.**

Targeted agricultural programs play an important role in supporting livelihoods, food security, diet quality and women's empowerment, and complement global efforts to stimulate agricultural productivity and thus increase producer incomes while protecting consumers from high food prices. Evidence of impact on nutrition outcomes, however, is inconclusive, with the exception of impacts on vitamin A intake and status from homestead food production programs and distribution of biofortified vitamin A-rich orange sweet potato. Evidence also suggests that targeted agricultural programs are more successful when they incorporate strong behaviour change communications strategies and a gender-equity focus. Though firm conclusions have been hindered by a dearth of rigorous program evaluations, weaknesses in program design and implementation also contribute to the limited evidence of nutritional impact so far.

The potential of nutrition-sensitive programs to improve nutrition outcomes is clear, but it has yet to be unleashed. It is important to note that several of the programs documented so far were not originally designed with clear nutrition goals and actions from the outset and were retrofitted to be "nutrition-sensitive." The nutrition-sensitivity of programs can be enhanced by: improved targeting; using conditionalities to stimulate demand for program services; strengthening nutrition goals, design and implementation; and optimizing women's nutrition, time, physical and mental health and empowerment.

**Box 4: Guiding Principles for Agricultural Policymakers on Having a Greater Nutrition Impact**

1. Incorporate explicit nutrition objectives and indicators into their design, and track and mitigate potential harms
2. Assess the context
3. Target the vulnerable and improve equity
4. Empower women
5. Maintain or improve the natural resource base
6. Facilitate production diversification, and increase production of nutritious foods
7. Improve processing, storage and preservation
8. Expand markets and market access for vulnerable groups, particularly for marketing nutrient rich foods
9. Incorporate nutrition promotion and education
10. Collaborate and coordinate with other sectors

Source: Herforth, 2012

With the exception of two studies of biofortified orange sweet potato, impact evaluation studies have generally been too poor and sample sizes often too small to draw definite conclusions about effects on nutritional status.

In summary, there is very little high quality evidence that agricultural interventions affect nutrition status of children and adults as measured by anthropometry. The evidence is stronger that agricultural interventions, designed in the right way, can improve household and child food consumption, both in terms of quantity and quality.

The lack of evidence is due to (a) badly designed interventions and (b) badly designed evaluations (where there might have been a positive impact but the design does not allow us to identify it).

The challenge, then, is to design good interventions and good evaluations to assess their impact. In a synthesis of guiding principles for improving agriculture for nutrition, Herforth (2012) outlines 10 key recommendations which aim to serve as a guide for policy makers and agricultural programming (Box 4).

### *4.4 Research Gaps*

Given that the evidence base for the impact of agriculture on nutrition is still relatively weak, there is a need for well-designed studies in this area that focus on strengthening the current evidence, but also address the research gaps. In a recent review of the current and planned research in this field, Hawkes et al (2012) identified some of these gaps (Box 5).

**Box 5: Some Research Gaps in the Agriculture-Nutrition Nexus**

1. Research that considers the full pathway of change from agricultural inputs, practices, value chains, food environment to nutrition outcomes
2. The indirect effect of changes in agriculture on nutrition, through income and economic growth and associated changes in health and investments in health and education services
3. The effects of agricultural policy on nutrition as mediated through the value chain
4. Governance, policy processes and political economy as it relates to the development of agriculture-for-nutrition policies and programmes, the ability to implement them (and scale up) and for them to achieve their stated goals once implemented
5. The way research on agriculture and nutrition is conducted, such as the development of methodologies and appropriate metrics
6. Consumers as a broader target group, notably rural workers and non-rural populations
7. The rural and urban poor at risk from nutrition-related non-communicable diseases
8. Cost-effectiveness

Source: Hawkes et al, 2012

Overall, the poor quality of the evidence prevents us from drawing any firm general conclusions on the impact of agricultural interventions on nutrition, and as noted in the recent brief from Webb and Kennedy (2012), "the sooner methodologically rigorous studies can produce findings that offer guidance on how best to leverage agriculture's potential for nutrition the better."

There is one additional research area that we believe is vital and has been overlooked. While there is much focus within the research on 'what' works in terms of agriculture and nutrition interventions and programmes, the underlying assumption is that there is a degree of willingness among agricultural professionals to focus on nutrition. However, some systematic research on what incentivises farmers and other professionals working within agriculture to think more about nutrition is needed.

## 5. Implications for Methods Choices

The overarching question of AgriDiet is 'which agricultural practices, policies and interventions can make a positive impact on the nutritional status of vulnerable rural households?'

Four types of analysis can be used to approach this question. These are summarised in Table 1.

The first question asks whether we need to and can reset the nutrition expectations and aspirations for agriculture? The second question asks about incentives and barriers to greater connectedness. Researchers often assume the framings and incentives are in place and they tend to focus on the third question: what is the strength of the links between agricultural and nutritional outcomes? Finally, when we find a strong link, we need to understand why it is strong, and this requires a range of qualitative approaches.

### *5.1 Understanding the macro and meso framings*

Often the expectations of agriculture are set in a limited way. Is it about raising yield, producing more food, raising farm profit, increasing household income, increasing household food security, increasing rural and urban food security, reducing poverty, or reducing undernutrition?

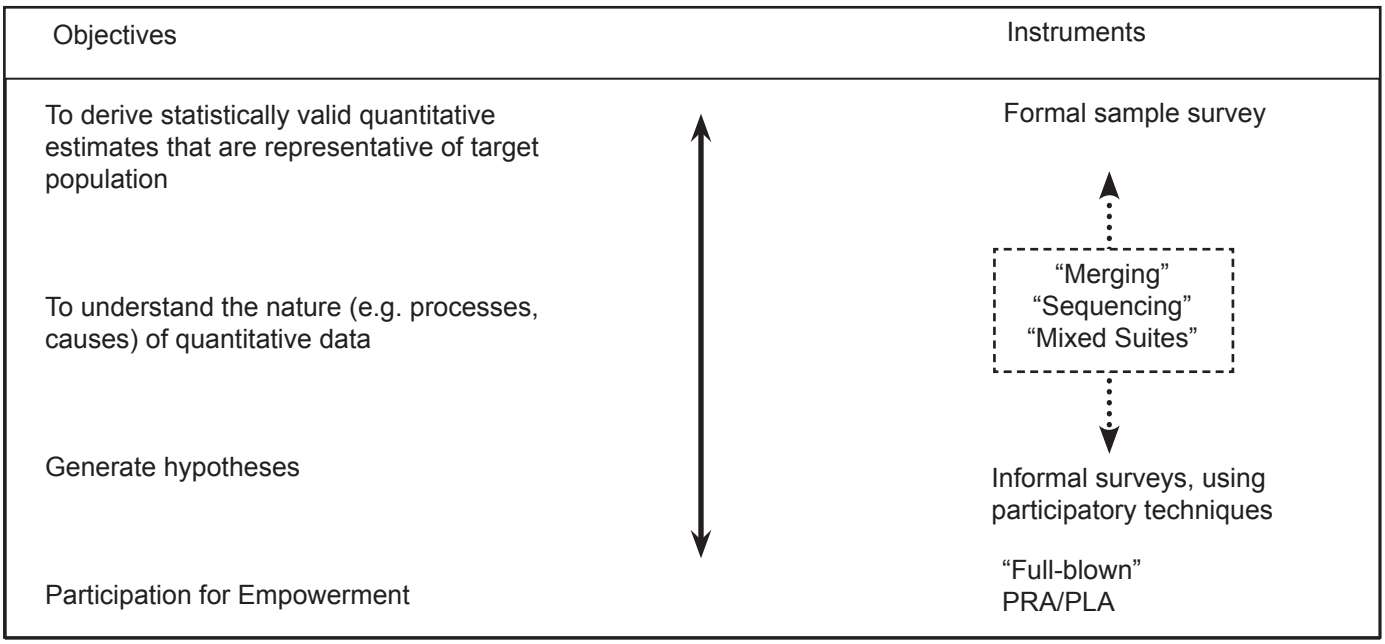
Work needs to be done with agricultural policymakers, thought leaders and the media to untangle these framings.

In terms of data collection, Figure 1 identifies the continuum of methods available by objective.

**Table 1: Four types of analysis.**

| Aim of question | Candidate primary research approaches |
|---|---|
| Understand the macro and meso framings of agriculture as a potential force for nutrition improvement | Political economy analysis |
| Understand the incentives and barriers to greater linkages between agriculture and nutrition | Political and ethnographic Analysis |
| Assess the strength of the links between agricultural practices and nutrition outcomes | RCTs, econometric modelling, Value Chain Analysis |
| Understand the factors and processes shaping the strength of the estimated links | Qualitative and ethnographic methods |

**Figure 1: Methods available by objective**




*PRA - Participatory Rural Appraisal*

*PLA - Participatory Learning and Action*

Using a variety of methods, we need to find out the following from these actors:

- How much do they know about nutrition?
- What are their views about what agriculture is for?
- What are their views about how much agriculture should do for nutrition?
- What do they think could be done?
- What do they see as the trade-offs?
- What needs to happen to make agriculture more pro-nutrition?

### *5.2 Understanding the incentives and barriers to greater linkages*

Once expectations are set, we need to understand the incentives for and barriers to meeting the expectations. A mix of systematic quantitative and quantitative methods are likely to be needed here.

Qualitative work will be needed to identify the barriers and incentives, and how they work. As Adato (2008) notes "Qualitative research enables the exploration of social issues and impacts requiring open-ended rather than closed responses; improves our understanding of people's perceptions, as expressed in their own words; raises underlying and less obvious issues, including those that the researchers may not have anticipated; allows us to probe responses (including internal contradictions and conflicting responses between respondents) and explore relationships between topics and responses; and finally, enables solicitation of respondents' solutions for the problems they identify."

Quantitative work could focus on the strength of perception about the nature of the barriers and incentives and the associations with other quantified factors such as education, gender and years of experience.

We need to find out the following from these actors:

With farm household members:

- What are the key agriculture decisions? Who makes them?
- How much do nutrition considerations factor into these decisions? Why or why not?
- What are the knowledge, attitude and practices of different farm household individuals with respect to nutrition?
- What do farmers think are the key incentives and barriers to considering nutrition? What are the important trade-offs and information gaps?

With other stakeholders in the farm system such as extension workers, agricultural researchers, agricultural trainers, agricultural evaluators and agricultural funders:

- How much do they know about nutrition?
- What are their views about how much agriculture should do for nutrition?
- What do they think could be done?
- What do they see as the trade-offs?
- What needs to happen to make agriculture more pro-nutrition?

### *5.3 Assessing the strength of the links between agricultural and nutrition outcomes*

To better understand the significance and magnitude of the links between agriculture and nutrition, specific individual and household level information is needed on actual food consumption, dietary diversity and specific nutrition related anthropometric measurements such as weight and height, in relation to a range of agricultural variables.

**Randomised Controlled Trials**

The strongest methodology to determine attribution between agriculture and nutrition would be to conduct a randomised controlled trial (RCT); however, this is difficult when studying agriculture. There is not much of a tradition of using these methods, at least for anything beyond yield; there are concerns about cross-contamination of treatment and control, and the causal chains between agriculture and nutrition are long and complex. Nevertheless, more experimentation with these methods in this domain would be welcome.

**Quasi-experimental econometric approaches**

This is the approach used by most economists to assess the links between agriculture and nutrition, using observational data. We discuss this here because most studies exploring the links between agriculture and nutrition cannot undertake RCTs. The main advantage of this approach is that cross-sectional data can be utilised effectively. The main drawback of this approach is the difficulty in distinguishing between association and causality—often instrumental variable methods will need to be used to distinguish between correlation and causation.

The starting point in this econometric approach is to specify and test a set of sequential (or recursive) equations that break down the relationship between agriculture and nutrition:

1. Agricultural profit = f (inputs, crop mix, technology, property rights, education of adults, women's relative status, community variables etc)
2. Household income = f (agricultural profit, crop mix, non-agricultural assets, education of adults, women's relative status, community variables etc)
3. Household food consumption = f (household income, education of adults, knowledge of nutrition, women's relative status, community variables etc)
4. Individual food consumption = f (household food consumption, gender, birth order, relation to head of household, education age, employment, etc)
5. Child under 3 years anthropometric indicators =f (individual and household food consumption, sanitation, water, women's relative status, access to good health services)

This cascading set of regressions can show how agricultural actions and contexts are related to income, food consumption and nutrition, controlling for other factors.

Tests can be run to establish whether the estimates reflect causality or association.

**Value Chain analysis**

Understanding how value chains operate is critical to establishing effective connections between agriculture and nutrition (Hawkes and Ruel, 2011). Post-farm value chain

linkages dictate the availability and prices of the range of food products, and thereby the diets of the larger population, and are thus critical to off-farm nutrition. In most cases, however, little consideration is given to such potential nutritional impacts, and thus whether value chains can deliver nutritious food to those who are undernourished or nutritionally deficient (LANSA, 2013).

IDS researchers have recently developed two tools with the Global Alliance for Improved Nutrition to strengthen the link between agriculture and nutrition: the first tool helps programme designers maximize the nutrition outcomes of agriculture projects; the second tool identifies strategies for involving the private sector along the value chain in delivering nutritious products to the populations most affected by undernutrition (Henson et al, 2013).

### *5.4 Understanding the factors explaining the strength of links*

Qualitative approaches will be required to unpack the reasons for the strengths of estimated links—do the estimates correspond with other types of evidence? What are the drivers of the strength—from within or outside the agricultural sphere?

There are too many qualitative methods to summarise here. A good survey of qualitative methods for use in practical settings is provided in 'A Guide to Using Qualitative Research Methodology', by MSF (2007).

### *5.5 Overall*

A menu of methods will need to be assembled to study the links between agriculture and nutrition.

TANDI (Box 6) and LANSA (Box 7) provide examples of a suite of methods used to address a similar set of issues in South Asia. AgriDiet will have to develop its own methods map to address its key questions.

## 6. Conclusions and Implications for AgriDiet

This paper points out some ways in which agricultural development can contribute to undernutrition reduction. Without increased contributions of agriculture, stunting rates will not decrease rapidly enough. The result will be more child deaths, poor child development and poor economic development.

Despite this need, agriculture's contribution to nutrition status improvement remains elusive. The potential is clear, but programmes designed without a focus on nutrition are less likely to improve it. By and large, the evaluations and assessments of the actual contribution of agriculture to nutrition have also been weak.

**Box 6: Methodology case study – TANDI (2012)**

The IFPRI led programme Tackling the Agriculture Nutrition Disconnect in India (TANDI) studied the pathways, exploring the nature and dynamics of agriculture-nutrition linkages in India and investigating options for leveraging agriculture for nutrition. As a country with good economic and agricultural growth, the consistently high rates of undernutrition continue to be a paradox. TANDI applies a multi-disciplinary approach to the research, using both quantitative and qualitative methodologies, including data analysis, political and stakeholder mapping, evidence reviews and stakeholder interviews.

Through summaries of the literature provided for each pathway the project team assess gaps and overlaps in surveys containing agriculture and nutrition data, on which future analyses could be built. They then investigate the inequities in nutrition status by caste and religion using data from the National Family Health Survey, and document the variation and changes in the sources of calorie intake across regions and by economic status among Indian households using the National Sample Surveys. Using India Human Development Survey (IHDS) data they examine the cross-sectional income-nutrition relationship (using anthropometric indicators) in India, disaggregated by rural/urban households and by agricultural/non-agricultural households. The authors also investigate the relationship between pre-school child undernutrition (stunting, and recovery from stunting) and the type of farming undertaken by the households to which the child belongs, and aim to obtain a more in-depth understanding of how macro-level agricultural growth and gender dynamics play out in a micro setting.

The final focus is an in-depth, structured analysis of inter-sectoral convergence to improve child undernutrition through applying a framework to policies in agriculture, health and nutrition. The framework posits that issues related to convergence must be worked out in relation to three major steps in the policy process: policy formulation, implementation, and monitoring/evaluation.

Source: IFPRI, 2012

This paper has summarised the state-of-the-art consensus in the literature about what to do to change this situation. In addition, we have included the idea that the process by which expectations are set for agriculture needs to be analysed, as do the micro incentives for changing behaviour within the agricultural sector.

The implications for AgriDiet are clear: be clear as to the aim of the research questions asked, let that drive methods choices while being pragmatic in the selection and application of methods within the limitations of available resources.

**Box 7: Methodology case study - LANSA (2013)**

The Leveraging Agriculture for Nutrition in South Asia (LANSA) programme is conducting multi-disciplinary research into how South Asian agriculture and related food policies and interventions can be designed and implemented to increase their impacts on nutrition, especially the nutritional status of children and adolescent girls. The research is focused around three core pillars, each addressing a key research question.

The research pillars and approaches are outlined below:

**Pillar 1 - How enabling is the wider context in linking agriculture and food systems to other determinants of nutritional status?**

1. Evidence Papers
2. Landscape Analysis of Nutrition and Agriculture in South Asia
3. Critical landscaping of nutrition programmes in the context of agricultural livelihoods
4. Convergence on nutrition in agricultural innovation systems
5. Agricultural determinants of malnutrition
6. Effect of the composition of agricultural income and non-food environment on household food consumption
7. The relative roles of agriculture sector and other variables in determining child nutrition outcomes in India
8. District level study with specific focus on districts with high burden of malnourishment; Case studies in selected locations
9. Women's empowerment in agriculture index and nutrition outcomes
10. Leveraging social protection to optimise nutrition impact of women's work in agriculture
11. Temporal and seasonal effects of unfavourable / fragile environments on agricultural productivity, household income, and food and nutrition security
12. Impact of women's empowerment on nutrition status of the children
13. Access to land and its impact on pathway between agriculture and nutrition

**Pillar 2 - How can the nutrition impacts of agriculture and agri-food value chains be enhanced through appropriate strategies and policies?**

1. Impact of farm credit on agricultural production and productivity, poverty reduction and nutritional outcomes
2. Analysing the impact of the Indian Public Distribution System (PDS) on dietary diversity and nutritional intake
3. Assessing the impact of agri-food and rural public investments on nutrition
4. Impact of crop diversification and agricultural policy support on dietary diversity and nutritional outcome
5. Review and comparative analysis of agri-food value-chain based interventions

**Pillar 3 - How strong is the evidence that agricultural interventions can be pro-nutrition?**

1. Farming Systems for Nutrition (FSN): A Feasibility Study
2. Impact of farming systems and nutrition knowledge on diet diversity and child malnutrition
3. Feasibility of integrating nutrition into an innovative digital agriculture peer-to-peer learning intervention
4. Impact of land grants to poor landless women on nutrition

## References


Adato, M. (2008) 'Integrating Survey and Ethnographic Methods to Evaluate Conditional Cash Transfer Programs', *IFPRI Discussion Paper* 810

Ainsworth, E. and McGrath, J. M. (2010) 'Direct Effects of Rising Atmospheric Carbon Dioxide and Ozone of Crop Yields'. *Global Change Research*: 109-13

Arimond, M., Hawkes, C., Ruel, M. T., Sifri, Z., Berti, P., R. Leroy, J. L., Low, J. W., Brown, L. R. & Frongillo, E. A. (2011) *Agricultural Interventions and Nutrition: Lessons from the Past and New Evidence*, FAO

Berti, P., Krasevec, J. and Fitzgerald, S. (2003) 'A Review of the Effectiveness of Agricultural Interventions in Improving Nutrition Outcomes', *Public Health Nutrition* 7: 599-609

Bhutta, Z. A., Das, J. K., Rizvi. A et al. The Lancet Nutrition Interventions Review Group, 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?', *Lancet* (13) 60996-4.

Black, R.E., Victora, C. G., Walker, S.P. et al, the Maternal and Child Nutrition Study Group (2013) 'Maternal and Child Undernutrition and Overweight in Low-income and Middle-income Countries', *Lancet* (13) 60937-X.

Claudia Ringler, Tingju Zhu, Ximing Cai, Jawoo Koo and Dingbao Wang (2010), 'Climate Change Impacts on Food Security in Sub-Saharan Africa. Insights from Comprehensive Climate Change Scenarios', *IFPRI Discussion Paper* 01042

Committee on World Food Security (2012) Report 3, 'Food Security and Climate Change', *High Level Panel of Experts on Food Security and Nutrition*, Rome

DHS (Demographic and Health Surveys) accessed online on 13/02/2013 at: http://www.measuredhs.com/

FAO (2009) 'High Level Expert Forum - How to Feed the World in 2050', Agricultural Development Economics Division, Economic and Social Development Department, Italy

FAO (2011) *The State of Food Insecurity in the World*, Rome: FAO

FAO / CFS (2012) *Global Trends and Future Challenges for the Work of the Organization*, Rome: FAO

FAO (2013) *The State of Food and Agriculture*, Rome: FAO

Mushi, V.E (2006-2013) 'National Aquaculture Sector Overview. United Republic of Tanzania. National Aquaculture Sector Overview Fact Sheets', FAO Fisheries and Aquaculture Department [online]. Rome. Updated 23 January 2006. [Cited 29 April 2013]

Gillespie, S., Harris, J. and Kadiyala, S. (2012) 'The Agriculture-Nutrition Disconnect in India: What Do We know?', *IFPRI Discussion Paper* 01187, Poverty, Health, and Nutrition Division

UK Government Office for Science (2011) *The Future of Food and Farming*. Final Project Report. London

Hawkes, C. and Ruel, M. (2011) *Value Chains for Nutrition, Background paper for the conference Leveraging Agriculture for Improving Nutrition and Health*, organised by IFPRI, New Delhi, February 2011.

Hawkes, C., Turner, R. & Waage, J. (2012) *Current and Planned Research On Agriculture For Improved Nutrition: A Mapping And A Gap Analysis*, LCIRAH

Henson, S; Humphrey, J; McClafferty B. (2013), 'Linking Nutritious Agriculture by Design: A tool for Program Planning', *GAIN-IDS Discussion Paper*

Herforth A, (2012) *Synthesis of Guiding Principles on Agriculture Programming for Nutrition*, FAO

Horton, R, ed (2008) *Maternal and Child Undernutrition*, The Lancet

Horton, S. and Steckel, R. H. (2013) 'Malnutrition. Global Economic Losses Attributable to Malnutrition 1900 – 2000 and Projections to 2050', *The Economics of Human Challenges*, ed B. Lomborg, Cambridge University Press.

Hotz C, Loechl C, Lubowa A, et al (2012) *Introduction of β Carotene-rich Orange Sweet Potato in Rural Uganda Resulted in Increased Vitamin A intakes among Children and Women and Improved Vitamin A Status among Children, J Nutr* 142: 1871–80.

Kadiyala, S. Gillespie, S., and Thorat, S. (2012) *Tackling the Agriculture-Nutrition Disconnect in India*, Washington: IFPRI.

Solomon, S., Qin, D., Manning, M., Chen, Z., Marquis., Avery, K. B., Tignor, M., and Miller, H. L. (2007) *The Physical Science Basis. Contribution of working group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change*, IPCC (Intergovernmental Panel on Climate Change), Cambridge and New York: Cambridge University Press.

Kawarazuka, N. (2010) 'The Contribution of Fish Intake, Aquaculture, and Small-scale Fisheries to Improving Food and Nutrition Security: A Literature Review', *The WorldFish Center Working Paper* 2106, Penang, Malaysia: The WorldFish Center

LANSA RPC (2013) Revised inception report. Dr Prakash Shetty (CEO)

Leroy JL, Ruel M, Verhofstadt E, Olney D (2008). 'The Micronutrient Impact of Multisectoral Programs Focusing on Nutrition: Examples from Conditional Cash Transfer, Microcredit with Education, and Agricultural Programs'. Accessed online on 30/06/2013 at http://www.micronutrientforum.org/innocenti/Leroy-et-al-MNF-Indirect-Selected-Review_FINAL.PDF

Masset, E., Haddad, L., Cornelius, A. and Isaza-Castro, J. (2011) *A Systematic Review of Agricultural Interventions that Aim to Improve Nutritional Status of Children*, London: EPPI Centre, Social Science Research Unit, Institute of Education, University of London

Marsland, N., Wilson, I., Abeyasekera, S. & Kleih, U. (2000) 'A Methodological Framework for Combining Quantitative and Qualitative Survey Methods'. The Social and Economic Development Department, Natural Resources Institute and the Statistical Services Centre, The University of Reading

MSF (2007) 'A Guide to Using Qualitative Research Methodology'. Accessed online on 23.06.2013 at: http://fieldresearch.msf.org/msf/bitstream/10144/84230/1/Qualitative%20research%20methodology.pdf

Olney DK, Talukder A, Iannotti LL, Ruel MT, Quinn V (2009), 'Assessing Impact and Impact Pathways of a Homestead Food Production Program on Household and Child Nutrition in Cambodia', *Food Nutr Bull*; 30:355–69

De la Peña, R. and Hughes, J. (2007) 'Improving Vegetable Productivity in a Variable and Changing Climate', *Journal of SAT Agricultural Research* 4 (1): 1-22.

Ringler, C., Zhu, T., Cai, X., Koo, J. & Wang, D. (2010) 'Climate Change Impacts on Food Security in Sub-Saharan Africa: Insights from Comprehensive Climate Change Scenarios', *IFPRI Discussion Paper* 1042. Washington, DC: IFPRI

Ruel, M. (2001) *Can Food-Based Strategies Help Reduce Vitamin A and Iron Deficiencies? A Review of Recent Evidence.* Washington, D.C.: IFPRI

Ruel, M., Alderman, H., the Maternal and Child Nutrition Study Group (2013) Nutrition-sensitive Interventions and Programmes, *The Lancet* (13)60843-0.

Stevens, G. A., Finucane, M. M., Paciorek, C. J., Flaxman, S. R., White, R. A., Donner, A. J. & Ezzati, M. (2012) 'Trends in Mild, Moderate, and Severe Stunting and Underweight, and Progress towards MDG 1 in 141 Developing Countries: A Systematic Analysis of Population Representative Data', *The Lancet*.

United Nations (2013) Department of Economic and Social Affairs. Populations Division. Population Estimates and Projections Section. Accessed online on 15/04/2013 at www.unpopulation.org

UNICEF (2013). Progress for Children: A World Fit for Children Statistical Review. Accessed online on 19.04.2013 at http://www.unicef.org/progressforchildren/2007n6/index_41505.htm

Victoria, C., Adair, L., Fall, C., Hallal, P., Martorell, R., Richter, L. and Singh Sachdev, H. (2008) 'Maternal and child Undernutrition: Consequences for Adult Health and Human Capital', *The Lancet* Vol. 371

Webb, P. and Kennedy, E. (2012) 'Impacts of Agriculture on Nutrition: Nature of the Evidence and Research Gaps'. *Nutrition CRSP Research Briefing Paper* 4

WHO, *Micronutrient Deficiencies*, accessed online on 22/03/2013 at: http://www.who.int/nutrition/topics/en

World Bank (2006) *Repositioning Nutrition as Central to Development: A Strategy for Large-scale Action.* Washington, D.C. International Bank for Reconstruction and Development/The World Bank.

World Bank (2007) From Agriculture to Nutrition: Pathways, Synergies and Outcomes. Report No. 40196-GLB. The World Bank - Agriculture and rural development department

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