



Leveraging agriculture for nutrition in South Asia: What do we know, and what have we learned?

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ABSTRACT

Despite significant improvements over recent decades, rates of undernutrition remain high in South Asia, with adverse impacts on morbidity and mortality. Overweight/obesity, among children and adults, is now an additional and major public health concern. While agriculture has the potential to improve nutrition through several pathways, this potential is currently not being realised in the region. The *Leveraging Agriculture for Nutrition in South Asia* (LANSA) research consortium (2012–2018) set out to improve understanding about how agriculture and related food policies and programs in South Asia (specifically in India, Bangladesh, Pakistan and Afghanistan) can be better conceptualised and implemented in order to enhance impacts on nutrition outcomes, especially those of young children and adolescent girls. This paper provides a snapshot of the agriculture-nutrition nexus in the region, outlines the pathways through which agriculture can influence nutrition outcomes, elaborates on the objectives of the LANSA research consortium within this context, and highlights the core findings of the six papers that form the body of this Special Issue. The paper ends with five key lessons that have emerged from this research, during this decade.

1. Background

In South Asia, the proportion of people living below the international poverty line (\$1.90 per day) has declined significantly in recent decades, from a little over 44 percent in 1990 (500 million people) to about 15 percent in 2013 (257 million people). India (21%), Bangladesh (15%), and Nepal (15%) drive these rates; with less than 10 percent of people living in poverty in Bhutan, Maldives, Pakistan, and Sri Lanka (World Bank, 2018a). Inequality in the region remains high. The Gini index of income distribution (ranging from 0 for perfect equality to 100 for perfect inequality) hovers between 31 in Pakistan to 39 in Sri Lanka (World Bank, 2018b). Life expectancy in the region ranges from a little over 52 years (Afghanistan) to nearly 70 (Maldives) (WHO, 2016) while under-five mortality rates per 1000 live births are down from 123 to 129 in 1990 to 43–52 in 2016 (UNICEF, 2018) (see Box 1 for definitions of terms used in this paper).

1.1. The nutrition situation

Globally, malnutrition is the largest single risk factor for the global burden of disease (IFPRI, 2016). One in three people are malnourished, virtually every country is significantly affected, and many countries are dealing with a “double burden” of dietary energy and micronutrient deficiencies co-existing with rising rates of overweight and obesity (Lim et al., 2012). Malnutrition (in some form) is a cause of 45 percent of all deaths of children under five years of age, amounting to over three million deaths each year (Black et al., 2013).

In South Asia, undernutrition rates have declined over the past few decades, but remain high. Just over 34 percent of children under five years of age are stunted (short for their age). Stunting rates have declined by nearly a third in the past two decades, but compared to other world regions, South Asia has by far the highest number of stunted children (61 million – more than one third of the global burden) (WHO/UNICEF/World Bank Group, 2017). Three of the six countries in the

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Box 1

Definitions of terms used in this paper.

- **Nutrition-sensitive** agricultural programmes are those that have specific nutrition goals and integrate nutrition interventions (e.g. behaviour change communications, distribution of micronutrient-fortified products, etc.) to achieve them (Ruel and Alderman, 2013). They may or may not also integrate other types of interventions from other sectors such as water, sanitation and hygiene (WASH) or health (e.g. immunization, promotion of use of health services, etc.).
- **Nutrition-specific** programs, on the other hand, address the immediate determinants of fetal and child nutrition and development – adequate food and nutrient intake, feeding, caregiving and parenting practices, and low burden of infectious disease (Ruel and Alderman, 2013, 2).
- We adopt the following definition of **food system**: “an interconnected web of activities, resources and people that extends across all domains involved in providing human nourishment and sustaining health, including production, processing, packaging, distribution, marketing, consumption and disposal of food” (Drewnowski et al., 2018).
- The United Nations High Level Panel of Experts on Food Security and Nutrition (HLPE) defines a **sustainable food system** as “a food system that ensures food security and nutrition for all in such a way that the economic, social and environmental bases to generate food security and nutrition of future generations are not compromised” (HLPE, 2017).
- We use the following definition of **enabling environments**: the “political and policy processes that build and sustain momentum for the effective implementation of actions that reduce undernutrition” (Gillespie et al. 2013, 553).

world with the highest number of stunted children – Bangladesh, India and Pakistan – are in South Asia (UNICEF, 2013). Compared to other regions, South Asia also has the highest rate of under-five child wasting (15%), with rates in some provinces in Afghanistan as high as 70 percent (Varkey et al., 2015), and in some districts up to 84% (Akseer et al., 2018a).

Alongside pervasive problems of undernutrition, the prevalence of overweight/obesity is rising dramatically across the world, with no country having yet succeeded in reversing this trend. Forty-two million children are overweight or obese, following a dramatic 47 percent rise in prevalence between 1980 and 2013 (Ng et al., 2014). Nearly 8 million of these children live in South Asia – again the highest number of any world region (WHO/UNICEF/World Bank Group, 2017). Obesity is increasing in both urban and rural settings, and across socio-economic levels, including the poorest, raising the risk of non-communicable diseases (NCDs), including type 2 diabetes, hypertension, dyslipidemia, and various cancers (Monteiro et al., 2007; NCD Risk, 2017).

1.2. The situation of agriculture

Agriculture continues to drive a significant share of the economy in these countries, making up between 17 and 25 percent of GDP in the region in 2013 (World Bank, 2018c). As of 2013, around half of the population was employed in the agricultural sector (44, 45, 47 and 58 percent respectively in Afghanistan, Pakistan, Bangladesh and India (CSO, 2016, Government of Pakistan, 2018; Government of Bangladesh, 2017, Government of India, 2018).

While there is increased interest in the role of agriculture for nutrition, the full potential of agriculture to reduce undernutrition is currently not being realised in the region for many reasons including volatile environmental and political conditions, and disconnects between agriculture and nutrition policy and practice (Balagamwala and Gazdar, 2013, Kadiyala et al., 2014). Major changes in agriculture have generated relatively small changes in nutrition in South Asia (Headey et al., 2012; Ecker et al., 2011).

Improvements in food production and consumption do not always lead to improvements in nutrition and health outcomes. Globally, while there is some evidence of the impact of agricultural interventions on intermediary nutrition outcomes such as health and nutrition knowledge, production, consumption, and expenditure indicators, there is little evidence on the impact of agricultural interventions on final nutrition outcomes such as stunting, wasting, or micronutrient status, and very little evidence on the “pathways of impact” (Webb and Block, 2011, Berti et al., 2004, Leroy et al., 2008, Ruel and Alderman, 2013, van den Bold et al., 2013). Other factors such as poor sanitation, inadequate quality of health services, weak markets and political insecurity may attenuate the potential contribution of agriculture to nutritional improvement.

The global community, including national governments from the South Asian region, have made strong commitments to addressing malnutrition. In 2012, the World Health Assembly endorsed a

comprehensive implementation plan on maternal, infant and young child nutrition, which specified a set of six global nutrition targets for 2025, now extended to 2030. And in 2015, the 2030 Agenda for Sustainable Development launched seventeen Sustainable Development Goals (SDGs). Agriculture features prominently in the SDGs as a driver of poverty reduction, equity, food and nutrition security. SDG 2 aims to “end hunger, improve food security and improved nutrition, and promote sustainable agriculture” with one of its main targets (2.2) stating: “By 2030, end all forms of malnutrition, including achieving, by 2025, the internationally agreed targets on stunting and wasting in children under 5 years of age, and address the nutritional needs of adolescent girls, pregnant and lactating women and older persons”. Most of the other SDGs have implications for nutrition and vice versa, as detailed in the latest Global Nutrition Report (Development Initiatives, 2017).

The “disconnect” between agriculture and nutrition represents an opportunity, as well as a challenge. The SDGs provide the impetus and direction, while the multiple links between agriculture and nutrition (as we will show) suggest that agricultural policy and practice can be better designed and implemented to enhance nutrition and health benefits.

2. The Leveraging Agriculture for Nutrition in South Asia (LANSA) consortium

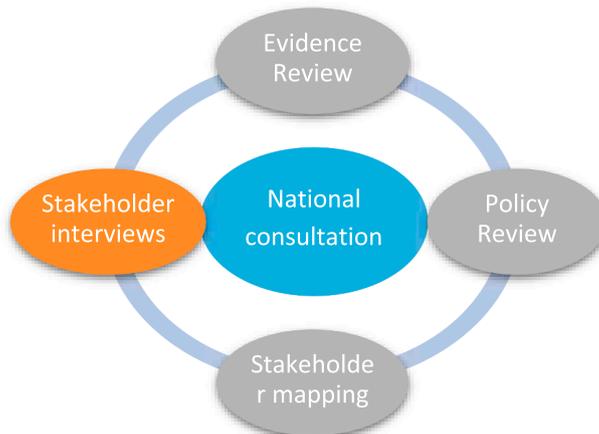
Against the backdrop of this challenge, the Leveraging Agriculture for Nutrition in South Asia (LANSA: www.lansasouthasia.org) research consortium was launched in 2012 with funding from the Department for International Development of the UK government (<https://www.gov.uk/government/organisations/department-for-international-development>). With six organizations, working together over a six-year period, LANSA set out to improve understanding of how South Asian agriculture and related food policies and interventions can be better designed and implemented to increase their impacts on nutrition outcomes, especially the nutritional status of children and adolescent girls. India, Pakistan, Bangladesh, and Afghanistan were the focal countries for this work.

LANSA’s research portfolio was intended to align with different levels of problem and (potential) solution – from the macro-level of enabling environments through to policies and value chains, and finally to ask questions about how to improve the nutritional impact of interventions. To this end, the work was structured around three broad research themes that were framed by the overarching research question they addressed:

- Pillar 1: How enabling is the wider context in linking agriculture and food systems to other determinants of nutritional status?
- Pillar 2: How can the nutrition impacts of agriculture and agri-food value chains be enhanced through appropriate policies and strategies?
- Pillar 3: How strong is the evidence that agriculture interventions can be pro-nutrition?

Box 2**Foundational process in setting LANSA's research agenda.**

Drawing on other research experiences and frameworks (Gillespie et al., 2013; Gillespie and van den Bold, 2015), LANSA adopted a stepwise, inclusive approach to its foundational work in the first two years, in which much of its work on enabling environments and governance was undertaken.



A first step involved undertaking a series of evidence reviews in which the strength of evidence along different agriculture-nutrition pathways was investigated (Kadiyala et al., 2014; Balagamwala and Gazdar, 2013; Yosef et al., 2015). Parallel to this (step two), a policy landscaping exercise identified and characterised key policies and large-scale programs relevant to the agriculture-nutrition nexus in the region. A third step involved a participatory group mapping of key stakeholder organizations using the NetMap methodology to identify networks and connections, with regard to influence, communications, financing and other relationships. In the fourth step, a sub-set of stakeholders (representing different types of organizations, at different levels) was selected for a series of interviews, structured according to a political economy analytical tool and interview protocol developed by the LANSA Pillar 1 team. The protocol was structured according to the three core domains of nutrition-relevant policy processes in the enabling environment framework (Gillespie et al., 2013) – namely, knowledge and evidence, politics and governance, and capacity and resources. Finally, the foundational work in the previous four steps (evidence reviews, policy landscaping, stakeholder mapping, political economy analyses) was critiqued/validated and discussed by key stakeholders in national consultations convened in Bangladesh, India, and Pakistan in April 2014, and in 2016 in Afghanistan. Future work of the CGIAR's Agriculture for Nutrition and Health (A4NH) research programme is building on LANSA's work, with similar approaches being adopted in sub-Saharan Africa.

In addition, gender, innovation systems and fragility formed three cross-cutting research themes. We also undertook a set of foundational activities, as shown in Box 2, in order better to contextualize the work, ensure its relevance and to begin a process of engagement with key actors. This process helped set LANSA's research agenda and contributed to shaping its research uptake strategy and capacity strengthening activities. Finally, there were two competitive calls for small grant studies in the region – the first relating to Pillar 1 in 2014 that supported four studies and the second focusing on Pillar 3 in 2015 that supported seven studies.

Studies under Pillar 1 investigated wider policy and institutional environments and their inter-relationship with the agriculture-nutrition nexus. Pillar 2 studies examined aspects of agriculture policy and strategy from production/pre-farmgate to the post-farmgate/consumer end. Work on post-farmgate agri-food value chains was undertaken across India, Pakistan and Bangladesh, following a common conceptual framework set out in Maestre et al. (2017), with emerging papers subsequently published as a special issue of the IDS Bulletin (Maestre and Poole, 2018; see Box 3). Work under Pillar 3 comprised a suite of formative and feasibility studies relating to agricultural interventions.

The research questions and cross-cut themes collectively form the basis of the six papers that follow in this special issue. LANSA's work is contextualised with regard to evidence and experience gleaned from other actors over the period 2012–17. Papers 2, 3 and 4 address the questions under research pillars 1, 2 and 3 respectively and papers 5, 6 and 7 address the cross-cutting themes of gender, innovation systems and fragility respectively.

3. Conceptualizing the links

In recent years, one particular framework, developed initially for the TANDI (*Tackling the Agriculture-Nutrition Disconnect in India*) project led by IFPRI, further adapted by LANSA, and shown in Fig. 1, has been found to be useful to conceptualize pathways through which the

agriculture sector may impact nutrition outcomes (Kadiyala et al., 2014; Gillespie et al., 2012; Headey et al., 2012). This framework and its various pathways forms the conceptual basis for much of the research conducted under LANSA and is referred to in many of the papers in this Special Issue. Six pathways linking agriculture and nutrition are highlighted and numbered in this framework, as follows:

- **Pathway 1: Agriculture as a source of food for household consumption:** the most direct pathway by which household agricultural production translates into consumption (via crops cultivated by the household).
- **Pathway 2: Agriculture as a source of income for food and nonfood expenditures:** agriculture generates income (via wages earned or through sale of food produced) and expenditure on nutrition-enhancing goods and services (including health, education, and social services).
- **Pathway 3: Effects of agriculture policy and food prices on food consumption:** this link involves a range of supply-and-demand factors that affect food prices, which in turn affect purchasing power of net buyers.
- **Pathway 4: Effects of women's employment in agriculture on intra-household decision making and resource allocation:** agricultural labour conditions can influence the empowerment of women and thus their control over nutrition-relevant resources and decision making, particularly regarding food and healthcare.
- **Pathway 5: Effects of women's employment in agriculture on childcare and child feeding:** relates to the challenges that heavy and prolonged female workloads in agriculture present to ensuring adequate care for young children.
- **Pathway 6: Effects of women's employment in agriculture on their own nutritional and health status:** relates to the hazards and energy-intensive nature of agricultural labor and effects on maternal nutritional and health status.

Box 3

Being realistic about the contribution of private businesses to public nutrition objectives.

Considering the overwhelming contribution of the private sector to food and nutrition, it is logical –and consistent with the SDGs – to look to agri-food businesses to support the pro-nutrition agenda. SDG 17 implies so. In LANSA we used a value chain approach to address two questions:

1. What are the existing (or potential) agri-food value chain pathways to deliver nutritious foods from agriculture to nutritionally vulnerable consumers?
2. What public and private actions are needed to strengthen the impacts of these agri-food value chains on nutrition in South Asia?

The value chain research examined three types of interventions and initiatives, published elsewhere (Maestre and Poole, 2018): (a) production, processing/fortification and distribution, (b) novel foods initiatives of the private sector, and (c) experiences of other types of partnerships. Summarising lessons from the case studies, we drew the following conclusions:

- First, business policies are unstable and strategies change for various reasons. These include changing local, national and international market conditions, new regulations and incentives, and importantly, changes in the firm’s mission and strategy, possibly resulting from a new CEO, or shareholder pressure resulting, for example, from concerns about a loss of brand identity.
- Then, while the marketing ‘reach’ of major food and beverage multinationals is almost ubiquitous, for most firms and in many markets there are genuine challenges in reaching the ‘bottom of the pyramid’. Poorer consumers do not have purchasing power that creates an attractive business proposition, and are sometimes physically and culturally remote. The private sector alone is unlikely to address the demands of otherwise unprofitable markets.
- Thus, most economic activity occurs within small firms and local markets, not major multinationals. These firms constitute a numerous but ‘missing middle’, and cannot be targeted directly through global initiatives (such as GAIN, SUN and ATNI). The potential nutritional impact far exceeds individual firm responses in respect of ‘corporate nutrition responsibility’.
- Intervention to mould the industry culture therefore has to be indirect, through a regulatory incentive and control environment, with appropriate monitoring and sanctions that are difficult to implement. Public-private partnerships (PPPs) can be effective but because of the potential misalignment of objectives over time, long-term agreements and monitoring have to be put in place to ensure that such initiatives are sustainable. PPPs need formal commitments, monitoring and enforcement. Supporting and upscaling successful projects directed towards the poorest in conditions of a weak state and weak markets require a long-term perspective on small and medium enterprise (SME) sustainability.

Finally, there is a set of context-specific factors which will determine the nature and success of agri-food policies for nutrition. These depend, inter alia, on: the capacity of state organisations along many dimensions; multisectoral engagement with agri-nutrition policy and the strength of advocacy and mechanisms for accountability; adequate business incentives; responsible lead firms; and responsible advertising in a pro-nutrition agri-food industry culture.

4. Approach and method

For this Special Issue we first identified a series of cross-sectoral research questions, spanning the agriculture-nutrition agenda, that addressed major research areas under the LANSA research pillars as well as the cross-cutting themes. We then set out to review the available literature published during the life of the LANSA programme (2012–2018) to answer our research questions, incorporating LANSA research findings when appropriate. These reviews, restricted to research conducted in Afghanistan, Bangladesh, India, Nepal and Pakistan, provided an opportunity to synthesise the totality of the

available evidence from the region.

In contrast to many previous cross-sectoral reviews in agriculture-nutrition we elected to conduct systematic reviews, or at the very least rigorous reviews (Hagen-Zanker and Mallet, 2013) where possible. Despite the inherent difficulties of conducting cross-sectoral systematic reviews (Dangour et al., 2013), the rationale for systematic reviews is clear and well accepted at least in the biomedical community (Mulrow, 1994), and increasingly so in other research communities. There are many reasons why systematic reviews are scientifically superior to ordinary reviews. First, by conducting pre-specified searches of multiple databases and having clearly defined inclusion criteria systematic

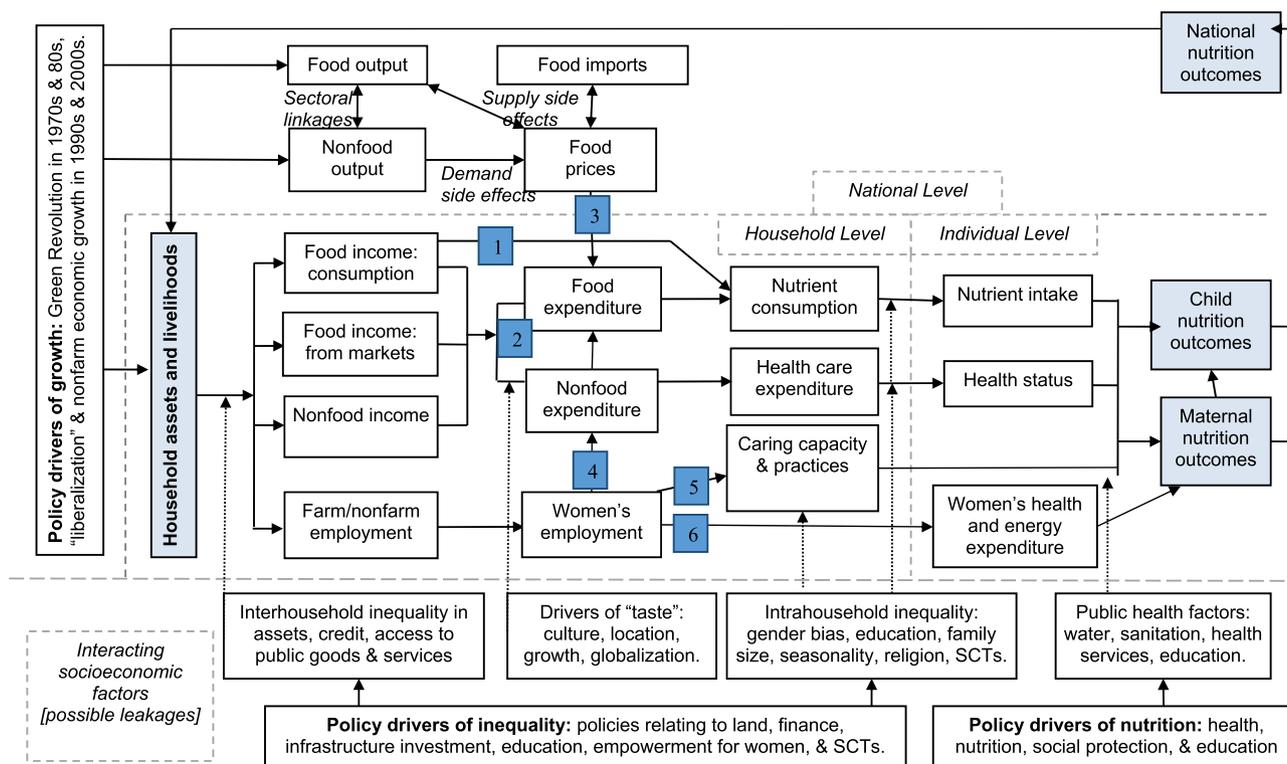


Fig. 1. Pathways and links between agricultural livelihoods and nutrition outcomes (Kadiyala et al., 2014; Gillespie et al., 2012; Headey et al., 2012).

reviews are designed transparently to identify, in a replicable manner, all relevant literature addressing the primary research questions. Second, by including the totality of available (peer-reviewed, published) evidence the generalisability of any particular finding can be assessed i.e. by including diverse studies, the consistency of findings across different settings can be evaluated. Third, by combining evidence across transparently-selected studies the statistical power and the precision of any effect estimates is increased.

In this Special Issue we have produced a series of state-of-the-art reviews based on the totality of the latest available evidence for researchers and policy makers. Five of the six main papers in this Special Issue (Papers 2–5 and 7) follow systematic or rigorous review procedures. Paper 6 took a different review approach as the evidence on the innovation cross-cut does not yet lend itself to rigorous review.

In this introductory paper to the Special Issue, we first provide a summary of the main findings from the six papers. We then distil five key lessons that we have drawn out of the reviews and the LANSAs programme – relating to enabling environments, the need for a systems approach, the challenge of trade-offs, implementation gaps, impact metrics and the importance of context.

5. Overview of findings

5.1. Nutrition and governance of agri-food systems

Politics is the starting point for this synthesis of main findings on the agriculture-nutrition nexus in South Asia. Political decisions shape policy processes and institutional arrangements that govern the structure and operation of the agri-food system and the downstream effects on nutrition outcomes (Gillespie et al., 2018). Of particular importance are the mechanisms, processes, institutions and capacities whereby administrative, economic and political authority is exercised among citizens and groups in respect of their rights and responsibilities.

Governance of the agri-food system is driven by political commitment, power/authority, policy coherence, accountability, capacity, leadership, data and knowledge. Political leadership for better nutrition – a core pillar of governance – must bridge the disciplinary and organisational barriers between agriculture and nutrition. For governance to be positive for nutrition, it needs to support integrated or aligned policies for agriculture and nutrition, and it should encompass links with other nutrition-relevant sectors such as health, water and sanitation, social welfare, gender, education, employment, and infrastructure.

The second paper in this special issue also highlights the importance of political commitment that actually delivers against SMART (“specific, measurable, achievable, relevant and time-bound”) objectives. Policy coherence applies to horizontal (cross-sectoral) and vertical (national to grassroots) axes. It usually requires the resolution of potentially conflicting sectoral policies/priorities among multiple stakeholder communities and organisations, and a clear assignment of responsibilities at national and subnational levels. Similarly, accountability mechanisms should be in place at all levels, including at community level where nutritionally-vulnerable target groups live.

The dimensions of governance are elusive in South Asia: setting the scene for the papers that follow, Gillespie et al. (2018) acknowledge the inadequacy of nutrition-relevant data, the frailty of wider knowledge systems, and the consequent difficulty in formulating and implementing appropriate policies. Even given appropriate policies, human, financial and other resources constraints commonly limit the best plans and programmes. Governance requires human capacity strengthening at all administrative levels, especially in devolved contexts; resources (human and other), need skilled management, effective and entrepreneurial leadership, as well as champions to encourage, cajole, direct and demand action from stakeholders. Securing, managing and scaling up budgets and investment in human resources for nutrition and agriculture are critical tasks.

5.2. Nutrition and agricultural inputs

Considering the scale of investments made in agricultural research and development, Shankar et al. (2018), in the third paper, argue that the empirical evidence on the impacts on diets and nutrition is neither abundant nor clear. This in turn justifies their analysis of the pathways from agricultural assets and input supplies to nutrition outcomes, and the tradeoffs between primary production and nutrition objectives. In the South Asian context, like other analyses in this issue, they explore the framework of agriculture-nutrition impact pathways shown in Fig. 1. Reviewing observational studies, they focus on the fundamental assets and key inputs to agricultural production by rural households. The review focuses on land and livestock assets and the Green Revolution set of productivity-enhancing inputs in the form of irrigation, seed and agrochemicals. They assess the extent to which effective linkages between assets and inputs to better nutrition outcomes have been established. The review unpacks the complexity of the relationships among key factors within pathways, and comments on the significance of agricultural intensification and the tradeoffs with health and nutrition.

They find that associations of agricultural assets and inputs with farm household nutrition are largely null, except for the case of livestock production. The lack of association of land access and ownership with nutrition outcomes is most striking, suggesting that changes in ownership and land size on their own are unlikely to have any particular effect on nutrition. The review suggests that intensification of production is positively associated with household food security, but further impacts on nutrition are opaque. The trade-offs between productivity improvements such as the use of agrochemicals and the hazards from inhalation, absorption and direct ingestion of toxins are under-researched, although general health impacts likely swamp the effects on nutrition. At least there was strong evidence in Afghanistan, where rain-fed agriculture is relatively unproductive, that the availability of irrigation was positively associated with dietary diversity.

For livestock, ownership was more convincingly associated positively with nutrition through both pathways of own-consumption of nutrient-rich foods, particularly dairy products, and income-generation leading to better diets through market access. There was also good evidence from Afghanistan that higher sheep ownership and mutton consumption was associated with lower levels of anaemia among adult women.

Of the studies reviewed, two methodological tendencies were apparent: a lack of causal identification of specific asset and input variables and precise linkages to nutrition; and a focus on associations of asset and input variables with intermediate nutrition outcomes (such as dietary change) rather than with final nutrition outcomes (such as child growth). Overall, impact pathways for assets and inputs were found to be more complex than allowed for in research designs, and therefore evidence for impacts on nutrition outcomes was indeterminate.

5.3. Nutrition and agricultural interventions

Intervention studies have become popular in the agriculture-nutrition nexus. The fourth paper of this special issue is a timely update and synthesis of the rapidly growing literature on the impact of household-level interventions in agriculture on nutrition outcomes (Bird et al., 2018). The review assesses the strength of the available evidence of impacts of home gardens with or without integrated poultry provision and training; provision of, and training in, livestock rearing; and aquaculture on intermediate and final nutrition outcomes. Previous reviews have found little robust evidence of an impact (e.g. Ruel and Alderman, 2013).

The review identified consistent evidence that interventions in agriculture improved several measures of diet and dietary quality (intermediate nutrition outcomes) but found no evidence that these interventions were able to improve final nutrition outcomes such as child

growth. As noted in previous reviews there remains much to be done to improve the methodological rigour of intervention studies in agriculture for nutrition and the review identifies research method strengthening as an important area for cross-sectoral innovation. Intervention studies conducted or commissioned under LANSAs have shown innovation (in content, context and geography) and may contribute to the future evidence base.

The economic and environmental sustainability of these commonly delivered interventions in agriculture are serious pending questions and the potential for unintended negative impacts on women's workload and childcare of these interventions have to-date been poorly studied. The challenge of scaling-up trials in order to leverage positive impacts of small-scale interventions at larger scale has received scant attention. Again, the complexity of impact pathways qualifies the explanatory power of the studies reviewed.

5.4. Nutrition and women's agricultural work

In the fifth paper, Rao et al. (2018) take up the challenge of deepening our understanding of women's roles in agriculture and nutrition and review the relationship between women's agricultural work and time burdens, and the nutrition of vulnerable groups. They also locate their study within the Fig. 1 framework and concentrate on the pathways concerning women's decisionmaking power over (food and health) consumption and expenditure and women's status; (pathway 4), employment, time and caregiving practices (pathway 5); and women's own health and nutritional status (pathway 6).

Like Bird et al. (2018), they identify the complexities of women's roles and highlight the need for conceptual development of the impact pathways as well as the need for methodological development to elucidate robust and causal relationships within the gender impact pathways. They also note that seasonality impinges on women's roles. They argue that gender issues concern men as well as women and must be placed within a social context that is diverse in terms not just of gender and age, but also of class, status, life opportunities, and within diverse ecological and cultural contexts.

The importance of pathways 4 and 5 was evident from the reviews and from LANSAs work generally. However, outcomes were indeterminate because of 'context specificities', meaning 'the agricultural system, as well as to the positionality of women with respect to economic class and social hierarchy'. Of the context specificities, they found that those of major importance are the nature of women's agricultural work (including different cropping patterns), household socioeconomics, labour conditions, and household child-rearing capacities. They recognise that the pathways are interdependent, confounding simplistic causal hypotheses. Consequently, the research reviewed did not provide high quality evidence nor generalizable findings for policy making.

Nevertheless, an emerging view is that maternal health and well-being is the principal pathway (6) whereby child nutrition might be affected, particularly during a seasonal 'time-squeeze' and changing female labour patterns as a consequence of male outmigration. An outcome is that women's economic roles can be impoverishing rather than empowering. They propose an alternative framework in which women's agricultural work is seen as a key factor that mediates the relationship between household characteristics such as food insecurity, income poverty, economic class, and social status including ethnicity/caste on the one hand, and child and maternal nutrition outcomes on the other. They find that in-depth qualitative research provides essential insights to complement large-scale quantitative assessments in understanding causality in this relationship. A key conclusion of LANSAs research on the gendered pathways is that women's agricultural work remains unrecognised, undervalued and underpaid in South Asia, and that formal recognition of women's agricultural activities as work in the law, data collection and policymaking will be a good starting point for strengthening positive linkages between agriculture and nutrition improvement.

5.5. Innovation and nutrition-sensitive food systems

We have noted the advances in food security over recent decades, especially in the case of South Asia. The Green Revolution, resulting from improved inputs of seeds, agrochemicals and irrigation led to better food security through increased productivity of staple crops for tens of millions of people in Asia. This process of technological innovation is examined by Glover and Poole (2018) in the sixth paper. Their critique is that socio-technological change such as the development and dissemination of innovative technologies is path-dependent, and not necessarily 'loaded with a positive value'. Fundamentally, 'innovation' is not the result of technological determinism but of human agency, making value-laden choices about social, technical, economic and political change.

They argue that the Green Revolution innovations targeted increased yields of starchy staple foods that benefited better-off rural farmers in more-favoured regions and resulted in multiple consumption and income effects in the wider populations. Innovation strategies of the public sector in traditional micronutrient-rich crops such as millets and pulses, dietary diversity, (bio)fortification and micronutrient malnutrition have mostly lagged behind the private investments in food manufacturing, processing and distribution that have contributed to rising levels of obesity and non-communicable diseases.

The values underlying innovation need exposing through use of the framing concept 'responsible research and innovation' (RRI). Investments to promote innovation in agriculture, nutrition and associated sectors should take into account the 'three Ds': its *direction*, its *distribution*, and its *diversity*: this means evaluating the strategies and objectives of investment and innovation; assessing their impacts on different 'winner' and 'loser' groups throughout food value chains; and identifying the demands for innovation in more diverse agri-food systems. The SDG approach however does not yet contemplate the global institutional architecture required to achieve a concerted multi-stakeholder organisation and commitment, and innovative governance, particularly concerning the role of the private sector in nutrition-sensitive agribusiness.

5.6. State capacity and agriculture-nutrition linkages in fragile contexts

In concluding the issue, we return to politics and governance in the final paper. Gupte and Longhurst (2018) consider how effective governance and policy change can be cultivated in a multistakeholder environment. They reiterate the positive relationship between state capacity and development, and stress the challenges and implications for shaping and governing agriculture-nutrition pathways, policy and practice in the fragile contexts which characterise many parts of South Asia. Their rigorous review of state capacity in agri-food and nutrition systems of developing countries draws on global experience. First, they note the importance of political will for governance at national and sub-national levels, highlighting (a) a state's macro political capacity and commitment and (b) micro-level capacity and in particular households' resilience and management of assets such as livestock. They note the significance of territorial differences in both macro- and micro-governance. Weak intersectoral coordination is a prominent element of mis-performance, while best practice is exemplified in certain instances by the UN system (FAO, WFP, OCHA clusters).

Secondly, they find that nutrition-specific opportunities are missed where participation by non-state stakeholders is limited and research is partial and poorly communicated to policy makers. This situation is common for nutritious but under-exploited genetic resources and the associated local or traditional knowledge, both of which are often in the domain of women rather than men. Finally, the creation of effective platforms for scientific knowledge management is another common capacity constraint that can be overcome by consortia involving national research organisations, international development and finance organisations, philanthropic foundations and international donors.

6. Emerging lessons

We conclude this introductory paper, by highlighting five major lessons that have emerged from this work.

a. The enabling environment, and the need for a systems approach

In order to understand the role of agriculture in contributing to reductions in malnutrition in all its forms, we need to look well beyond the agriculture sector. Recent research, including studies reported in this issue, has shed light on the importance of political, policy and institutional environments for enabling and sustaining progress on nutrition.

nutrition, there is a wider awareness of the need to understand and analyse the key drivers and domains of these systems. This evolution has been described in a review (Kanter et al., 2015) and it is reflected in adaptations to conceptual frameworks (e.g. the 2016 Foresight report of the Global Panel on Agriculture, Food Systems and Nutrition, and the 2017 report of the HLPE shown in Fig. 2 below), as well as in policy discourse (e.g. the UN Decade of Action on Nutrition process). Such a systems approach is also key for understanding interfaces with health and environmental systems (including the influences of climate change), and for highlighting the relevance of the agri-food systems for a range of SDGs.

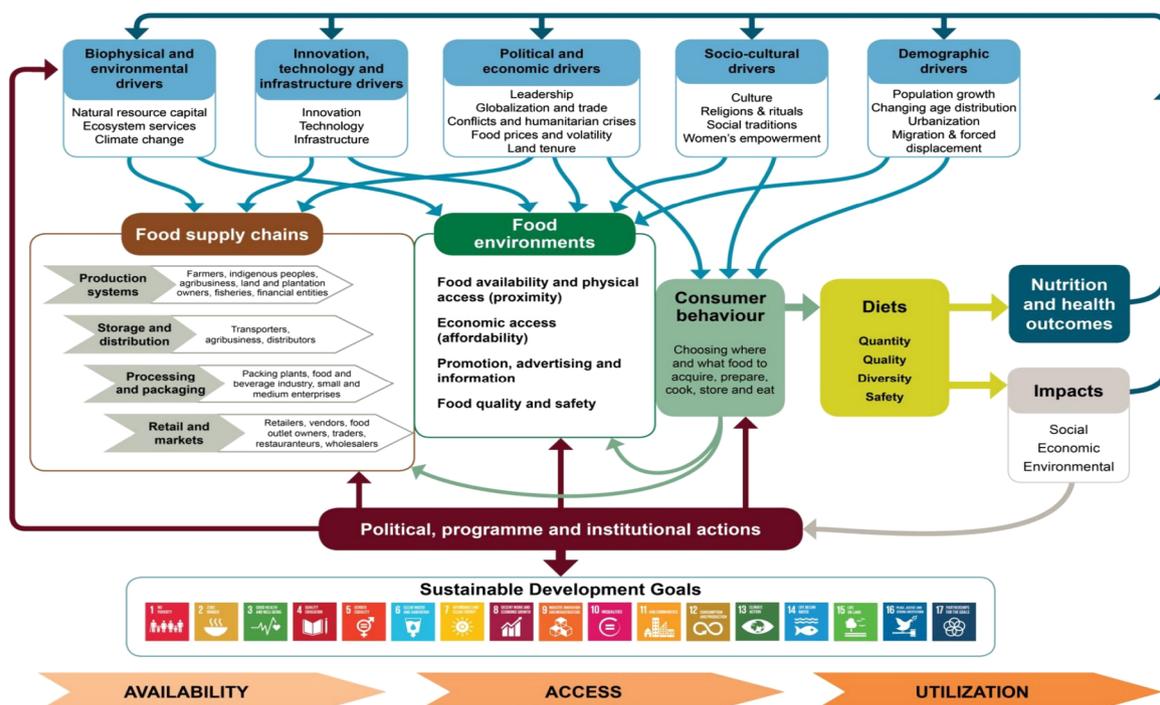


Fig. 2. Conceptual framework of food systems for diets and nutrition.

Such a focus on enabling environments takes account of nutrition's inherent multisectorality. To maximize the contribution of agriculture, we need to understand the ways in which the agriculture sector links to other sectors (especially health and social protection), and the ways in which it relates to national development frameworks, and implementation realities. Other sector specialists need to be engaged in the policy dialogue and design of interventions, including health, social welfare, gender, infrastructure, communications, education, environment, business, etc. Agriculture-nutrition linkages are likely to be enhanced where simultaneous efforts are made to strengthen the nutrition-sensitivity of other sectoral actions, including water, sanitation, and hygiene (WASH), food safety, hygiene and waste management, and other health interventions.

The political challenge in fragile or 'disabling' environments is huge (Poole et al., forthcoming). In Bangladesh, Pakistan and Afghanistan, low levels of health of vulnerable groups have been linked with key structural and contextual weaknesses: poor governance, conflict, and low female empowerment (Akseer et al., 2018b).

Realization of the importance of enabling environments, and their relationships with food/value chains and with consumer behaviors, has led to a growing emphasis on systems, not sectors *per se*. Indeed, the last six years (the period of review for the papers in this series) has seen a significant evolution in the conceptualization of agri-food systems. In order to identify promising entry points and impact pathways for

b. Trade-offs and unintended consequences

The various pathways from agriculture as a source of food production and livelihood, to nutrition outcomes, as depicted in Figs. 1 and 2, do not operate in isolation – they overlap and interact. They may also generate trade-offs in household decision making – for example with regard to the role of women in agriculture (see Box 4). If a rise in the demand for female agricultural labour is not matched by enhanced decision-making power and control of household resources (including time), both women and children's nutritional status may suffer, as discussed in Rao et al. (2018).

Another trade-off may occur in the decision to rear livestock, for example. Studies have documented clear potential benefits to nutrition, but also highlighted health and nutrition risks associated with exposure to livestock and chicken faeces, especially for young children. Care of livestock such as shepherding may conflict with children's education and hence life opportunities. More work is needed to better understand these risks in order, ultimately, to find ways to avoid or mitigate them. Time- and labour-saving technologies may reduce drudgery of work carried out by women, but do they actually benefit if they lack control over their labour or regarding production decisions? Evidence on the nutrition implications of such interventions is not clear-cut (Johnston et al., 2015); more evidence is needed from different contexts to strengthen the positive and minimize the negative consequences.

Box 4

Insights from LANSA research on women in agriculture and nutrition.

Research in India and Pakistan examined issues around women's work in agriculture and nutrition. Qualitative research taking contextual specificities and variations into account attempted to better understand and unpack the drivers of nutrition outcomes that are missed by large quantitative surveys, as discussed in Rao et al. (in press). Key findings include the following:

- Women who undertake crop-related activity are not compensated adequately for their energy expenditure; they also have less time and energy to look after their children.
- Research in India found evidence of a significant decline in women's body mass index (BMI) in the lean agricultural season when periods of intense work coincide with the dearth of food.
- Association of agricultural work during pregnancy with poor maternal and early infancy nutritional status was an important finding in Pakistan
- Particular caste/ethnic groups are more affected by time and work pressures compared to others and are worse off nutritionally

Based on the findings, a set of recommendations have been made for recognition of women's economic contribution in agriculture; gender-sensitive agriculture policy; addressing and redistributing the care deficit; reducing women's time burden, and expanding their choices.

LANSA has been effective in raising the issue of women's work/women workers in agriculture and its links with nutrition in the South Asia region. The issue is already part of the recommendations of the statutory body on women's status in Pakistan, and finds expression in the election manifesto of a major political party contesting the 2018 general elections in the country. LANSA research is also cited in the upcoming annual Progress of the World's Women Report of the UN.

c. Words and actions

The *Stories of Change* studies in Nepal, Odisha (India), and Bangladesh (Cunningham et al., 2017, Kohli et al., 2017, Nisbett et al., 2017a, 2017b; Nisbett and Barnett, 2017), described in the second paper of this Issue, show that translating high-level political attention into action and impact on the ground requires strong political commitment, coordination across sectors at different levels, adequate knowledge about nutrition, data, capacity, leadership and adequate finance. We found a clear positive trend in terms of horizontal coherence – that is, political attention to nutrition-sensitive agriculture that was manifested in more nutrition-relevant policy statements, and in more high-level, cross-sectoral discourse on nutrition.

Commitment and coherence look fine on paper, but they are hollow words unless they lead to large-scale implementation. Herein lies the next big challenge – how to match actions to words? (see Box 5).

Sectors are clearly 'speaking to each other' more about nutrition in these countries and there have been significant improvements in terms of political leadership on nutrition, effective framing of evidence, and institutionalization of coordination mechanisms. But effective translation of such gains into implementation of coordinated programs remains a challenge. Vertical coherence (from the national to community level) is lagging. Multiple and interrelated policies and coordinating structures can be baffling in their managerial complexity, as in Afghanistan. Limited accountability (reflected in a lack of clarity on roles and responsibilities) in this case translates to stasis and "business as usual". Further, the *Stories of Change* studies emphasize that improvements in nutrition come from a variety of sectors, with changes in nutrition-sensitive drivers – including in WASH, access to health care, and agricultural production and diversification - explaining much of the improvements in nutrition over time, especially in Bangladesh and Nepal.

d. Defining success

What do we mean by "leveraging agriculture for nutrition" and

what constitutes progress? Is it even realistic to track, delineate and attribute changes in child anthropometry to changes in agriculture policy and practice, given the long chain and multiple mediating variables, and the relatively short time frames of evaluations (see Fig. 1). In a recent paper, Herforth and Ballard (2016) state: "[t]he evidence base for impact of agriculture on nutrition is bounded by what is measured". Reviews have highlighted the following limitations: (i) lack of rigorous evaluations (i.e. adequate sample size, appropriate comparison groups), (ii) few interventions targeted to the first 1000 days (window of opportunity for impacting child nutrition), (iii) weak design and implementation in terms of programs' nutrition-sensitivity (such as use of food expenditure or household calorie consumption as indicators but no use of anthropometry or dietary diversity indicators). They raise the question – what is appropriate and feasible regarding agriculture's impact on nutrition? Is it reasonable to expect impacts on stunting, and to be able to attribute such effects to an agricultural intervention? They call for a wider array of indicators to capture change along impact pathways, such as women's empowerment, food and health environments, and dietary quality. In a recent review, Ruel et al. (2018) concur – questioning whether a high quality of operations, implementation, and monitoring can be maintained for such complex, multisectoral programmes, and whether successful scale-up is achievable.

Given our findings, we also align with this emerging consensus. We find strong evidence for links between production and dietary diversity (influenced by markets), the importance of livestock and for role of women in agriculture. Agriculture can clearly do a lot more in terms of strengthening access to and consumption of high-quality diets, and strengthening women's agency with respect to agriculture can have beneficial impacts on nutrition. These are important ends in themselves, but also critical milestones along pathways to impact on nutrition outcomes. Improving diets for all household members is a much more logical, reasonable, and achievable goal for agriculture than addressing childhood stunting, and it is equally important for global development (Ruel et al., 2018; Global Panel on Agriculture and Food Systems for Nutrition, 2016; Herforth and Ballard, 2016).

Box 5

From research to policy action.

LANSA has attempted to strengthen links from research to action via an emphasis on research uptake at multiple levels from policy makers to the rural communities. An example from India is provided here.

Emerging evidence from the Farming System for Nutrition (FSN) study in Odisha and Maharashtra States in India, points to improved household dietary diversity resulting from a broad-ranging agricultural intervention. Farm men and women from the study villages have emerged as spokespersons at different forums and there is evidence of uptake of the approach in neighbouring villages not covered by the study. The M.S. Swaminathan Research Foundation (MSSRF) has received funding support for advocacy of the approach in four States of the country including in Odisha and Maharashtra. The agriculture budget of Odisha State for 2018–19 has for the first time used the term 'nutrition sensitive agriculture interventions'. The government of Odisha sanctioned funding to MSSRF in June 2018 to cover more villages under the FSN approach.

A meeting jointly with the National Institute for Transforming India (NITI Aayog) in January 2018 recommended setting up of FSN models in Krishi Vigyan Kendras (KVK) across the country and mandated the Indian Council of Agricultural Research (ICAR) to take action. The Maharashtra Council of Agriculture Education and Research (MCAER) convened a meeting of the four-member agriculture universities in Maharashtra to discuss uptake of the FSN approach. Subsequently, a workshop by ICAR-ATARI in April 2018 brought together KVKs from Maharashtra and Gujarat to plan demonstrations of the FSN model on their campuses. The Vice President of India reaffirmed the government's support for nutrition-sensitive agriculture while inaugurating a national consultation on leveraging agriculture for nutrition at the MSSRF in 29 July 2018.

e. Context matters

There is much heterogeneity in the conditions that determine the potential and actual effects of agricultural inputs, processes and activities on nutrition outcomes. Context matters. Market access, for example, affects the nature and strength of the association between production and consumption. Production diversity tends to be a stronger driver of dietary diversity where access to markets is limited. Universal diversification of production may not always be an appropriate goal – in some contexts, commercialization may be more effective in improving nutrition through improved incomes. Many other social, cultural, political, environmental and economic contextual factors and processes are important in conditioning associations between agriculture and nutrition outcomes and the uptake of, response to, and nutrition impacts of agriculture programs (Fiorella et al., 2016; Herforth and Ballard, 2016).

As with agriculture *per se*, geography matters for agriculture-nutrition links too. Quite different findings emerged from analysis of the terai and uplands in Nepal (Shankar et al., 2018), and between districts and provinces in Afghanistan (Akseer et al., 2018a), for example. Similarly, state-level responses in India vary not only according to agro-ecological capital and cultural differences within and between states, but also institutions, human capital and political makeup (Cavatorta et al., 2015). Future work may therefore need to generate typologies and build a library of context-specific evidence.

7. Conclusions

To attain Sustainable Development Goal 2 and to contribute to other SDGs, significant changes are needed in agriculture and food systems. Leveraging agri-food systems for nutrition implies a shift from the status quo, from “business as usual”. It entails change – to policies, programmes and/or interventions. For this change to lead to impact, it needs to be undertaken systematically, and not in a piecemeal or ad hoc fashion. It will require a) the strengthening of institutional and policy environments (including accountability systems) to enable agriculture and food systems to support nutrition goals, b) modifying the design, location and/or implementation of agri-food system interventions to enhance their effects on nutrition outcomes, and c) developing capacity and leadership to use and demand appropriate evidence to improve decision-making to this end.

Agriculture can do a lot more as driver of nutritional change, but it needs to work in harmony with other sectors to maximize its impacts on nutrition. Social protection, for example, can protect the nutrition and health of impoverished smallholders as they struggle with seasonality and the inevitability of climate shocks and stresses on production and distribution systems and infrastructure. Improved WASH can amplify nutritional benefits of agricultural programs and policies aimed at improving diets by reducing disease and enhancing nutrient absorption. And linkages between local agricultural production and school feeding (linked with educational retention) could generate win-win benefits: income for small producers and their families, and nutrition and cognitive gains (and likely future income) for school-age children. The universality and interconnectedness of the SDGs reflect the need for multisectoral solutions to development challenges, like malnutrition.

The research reported here primarily examines undernutrition, which – despite some progress – remains a major challenge in the region. Meanwhile, the accelerating nutrition transition in South Asia is leading to rising rates of overweight/obesity, that are driving increases in non-communicable diseases. These two faces of malnutrition – co-existing in communities and households, across the region – provide another rationale for a systemic, cross-sectoral approach to address drivers in a comprehensive manner.

Finally, we re-emphasize the need to focus on implementation and impact – to match the new language appearing in policy statements and high-level declarations of intent with improved actions on the ground

that will benefit millions of nutritionally-vulnerable households throughout the region.

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Competing interests

All authors state that they have no competing interests to declare.

Appendix A. Supplementary material

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.foodpol.2018.10.012>.

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