Workers package asparagus in Peru. The country is the largest exporter of fresh asparagus in the world. (UNIDO)

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Food Value Chains for Nutrition

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Introduction

Despite the UNDP's second Sustainable Development Goal of ending hunger and preventing malnutrition in all its forms by 2030 (see Chapter 1), the world actually saw an increase of chronically undernourished people in 2016, from 777 million to 815 million (FAO *et al*., 2017). Stunting affected 154.8 million and overweight affected 40.6 million children under 5 years of age in 2016 (UNICEF *et al*., 2017).

There continues to be a number of challenges in addressing malnutrition. These include a lack of access to nutritious foods, whether due to lack of infrastructure and markets in rural areas, or limited availability or resources to purchase more nutrients foods in both urban and rural areas. Climate change can also impact nutrition and health by contributing to yield losses or post-harvest exposure to pathogens, such as aflatoxins, due to lack of appropriate storage or transportation infrastructure. Food access can be further hindered by an unsupportive enabling environment that does not foster nutrition-targeted policies or incentives for businesses to improve nutrition.

One mechanism for bridging the food access gap is through the use of agricultural value chains that support the production and consumption of nutritious foods (Gelli *et al*., 2015; Allen and de Brauw, 2018; Ruel *et al*., 2017). By definition, value chains include all of the actors and processes involved in manufacturing a product (including conception and delivery to final consumers as well as disposal after use). Analysis of value chains considers where value is added to the product or actors along the chain, the roles and the interactions amongst them and the power they hold (Hawkes and Ruel, 2011). Inclusive value chains for nutrition take into account these interactions and determine entry points for interventions targeting the supply and demand of nutritious foods, as well as strategies and policies that can increase nutrition, increase the incomes of smallholders involved in different chains, reduce loss and waste or create a better enabling environment for nutrition (FAO, 2016).

Most comprehensive discussions of nutrition center on overall diets; value chain analysis, however, is by definition commodity-specific and may ignore food diversity. Prioritizing different facets of food value chains, diets, and nutrition thus involves many potential trade-offs, between delivering nutritious foods, climate-related impacts, and incentives for market-led business models. Nevertheless, interventions in food value chains for nutrition have the potential to address dietary patterns and the nutritional content of foods consumed by vulnerable populations. They can also address the rapid changes that are taking place in the food environment, which are affecting the structure of food value chains, and how particular foods are being produced, delivered, or consumed.

This chapter does not provide details on previous reviews of food value chains for nutrition that have been completed (e.g. Gelli *et al*., 2015; Allen and de Brauw, 2018; Ruel *et al*., 2017). It instead focuses on understanding the supply and demand aspects of food value chains and their relationship to nutrition using a food-systems perspective. It considers the collaborative roles of value chain actors, including producers, consumers, organizations, businesses, and the public sector. Finally, the chapter provides specific examples of interventions that have strived to put food value chains to work for nutrition and the lessons learned.

Why Value Chains?

Nutritious foods are the product of policies, distribution networks, infrastructure for storage, research and technology, information and awareness, and consumer preferences. A number of research studies have noted the failure of these systems to ensure access to nutritious foods due to lack of nutrition awareness, adequate infrastructure, or functioning markets (Maestre *et al*., 2017). Businesses trying to deliver nutritious products in low-income settings also face very specific challenges, including high costs of distribution, food quality requirements, and a lack of food safety regulations, and often require a supportive environment to overcome them.

As food systems change rapidly, understanding how to better leverage the market transformation happening in many countries (i.e. transitions to modern retail outlets and changes in preferences) to target nutrition-related outcomes will be necessary (Gómez and Ricketts, 2013; Popkin, 2014). Interventions that do not take this comprehensive approach risk missing

important constraints for long-term sustainability or a critical opportunity for development of food value chains that can support nutrition.

Value chain analysis has been used in rural development for many years (Gelli *et al.*, 2015). Value chain analysis focuses on the value added for different actors along the food chain, and the interactions among them. These actors have different levels of power, and include large companies, the public sector, civil society organizations, small and medium-sized enterprises (SMEs), and informal businesses. Changing value chains to support the production/supply and consumption of more nutritious foods requires shifting the incentives of these actors, reducing or distributing their risks, or changing the preferences and behavior of another set of actors: the consumers.

A market systems approach to categorize value chains for nutritious foods is a fitting way to address the complexities of food systems, since it can identify the root constraints to supply and demand for nutritious foods. Market systems perspectives analyze value chains as being central to the functioning of the market, but also go further to analyze other factors that support the value chain (e.g. roads, energy, information), as well as the rules (laws or social norms) that impact it. These elements all influence how value chains operate, yet many value chain analyses may fail to reflect them (Thorpe and Reed, 2016).

Value Chain Interventions for Increasing Supply and Demand – and Impacting Nutrition

To date, few value chain interventions have shown evidence of improving nutrition (Allen and de Brauw, 2018). Interventions in agricultural value chains have been found to impact production and, potentially, diet diversity, but there exists no evidence of impacts on stunting, for example, or the potential for interventions to scale up (Ruel *et al.*, 2017). Furthermore, evidence indicates that increased agricultural yields or increased income for farmers do not necessarily lead to improved nutrition outcomes (Ruel *et al.*, 2013). This is due to the multidisciplinary nature of the problem. Agricultural programs or policies that aim to improve nutritional status often require complementary initiatives designed specifically to improve nutrition, including, for example, targeting increased consumption of nutritious food (Ruel *et al.*, 2013; Pandey *et al.*, 2016). Issues relating to rapidly evolving food value chains, appearance of new actors within the chains, the inclusion of smallholders in these value chains, and the resulting impacts to nutrition are also still not well understood (Gómez and Ricketts, 2013; Popkin, 2014).

Though the evidence on the contribution of value chains to nutrition is still scant, there exist a number of case studies of interventions targeted to specific needs and gaps in value chains for nutritious products in particular settings (Hawkes and Ruel, 2011; Gelli *et al.*, 2015; Maestre *et al.*, 2017; Nisbett *et al.*, 2017). In recent years, for example, the evidence on the dissemination possibilities and acceptance of biofortified crops has solidified (Manda *et al.*, 2015; Low *et al.*, 2017; Murekezi *et al.*, 2017). Biofortification efforts have been successful in increasing farmers' adoption rates of crop varieties such as iron-fortified beans and millet, as well as vitamin A-fortified maize, cassava, and sweet potato in Asia and Africa. Scaling these varieties up for widespread adoption will require moving beyond a donor-driven effort to one that is accepted by local institutions and supported by accompanying policies and research for increased production efficiency (Bouis, 2012).

In Asia, the Leveraging Agriculture for Nutrition in South Asia (LANSA) program has evaluated the potential of various agri-food value chain pathways to deliver nutritious foods. These include: (i) a large-scale mandatory fortification program in Pakistan; (ii) a private-sector led voluntary fortification of products in Bangladesh and India; (iii) a public–private food distribution scheme in two states in India; and (iv) analyses of the dairy sectors in Pakistan, Bangladesh and Afghanistan (Maestre and Poole, 2018). These analyses show that value chain interventions to improve nutrition do not always achieve the desired results, often facing a combination of supply, distribution, marketing, and consumption challenges. The research finds that while there are multiple pathways to deliver nutritious foods to poor people, there are also important trade-offs when trying to align business goals and nutrition needs that are not yet well understood.

Promoting a diverse range of healthy and high-value foods, such as fruits, vegetables, legumes, and dairy, can also be an effective way of using value chains to promote nutrition. A recent randomized trial in Senegal leveraging a dairy value chain to distribute a locally produced micronutrient-fortified yogurt and promote optimal infant and young child feeding practices found that, compared with a control group that received only information, children exposed to the intervention had greater increases in hemoglobin concentration. Changes in anemia prevalence, however, were not statistically significant (Le Port *et al*., 2017). This is one of the first studies to evaluate the effectiveness of a nutrition-sensitive value chain intervention. The intervention itself aimed to improve nutrition among pre-school children living in a remote pastoralist population.

For value chain interventions to be successful in addressing food-related challenges, they must have a clear nutrition objective. Recent reviews of various countries in South Asia (Afghanistan, Bangladesh, India and Pakistan) mapping the pathways for agri-food value chain interventions showed that the majority of the value chain interventions in those countries had no specific nutrition outcomes, and within those that included them, nutrition was generally secondary to boosting incomes and employment (Maestre and Poole, 2018).

Success within value chains also requires that interventions alleviate specific dietary constraints that exist in a particular context by addressing the demand or supply for nutritious foods, or both, as seen in Fig. 3.1 (Gelli *et al*., 2015). Using such a typology can help frame the objectives of specific interventions as well as identify the indicators that can be used to measure outcomes (Gelli *et al*., 2015).

Value chain interventions to address low demand

Where there is low demand for nutritious foods, supporting consumer knowledge of a nutritious diet may be the primary objective of a value chain intervention. This approach was taken by Grameen Danone Foods Ltd (GDFL), a social enterprise set up to produce and distribute fortified yogurt to poor and nutritionally vulnerable children in Bangladesh. While the fortified yogurt has been proven to be effective at addressing malnutrition, the business still struggles to ensure that children consume the yogurt frequently enough (three times a week), and to secure the long-term sustainability of the company (Maestre and Poole, 2018).

In situations characterized by low demand, informational campaigns may also be needed

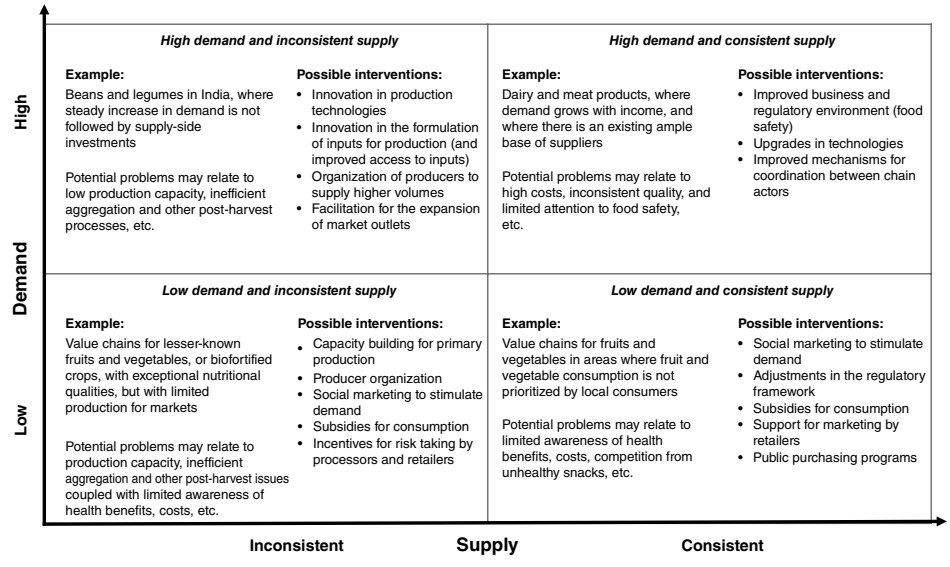

Fig. 3.1. Typologies characterizing value chain interventions (Gelli *et al*., 2015).

to support the development of stronger value chains for nutritious foods. Nutrient-dense foods can be credence goods, or goods for which it is hard for consumers to determine the value, since the 'extra' value addition from a nutrition perspective is not often visible and labeling efforts can result in additional costs (Thorpe and Reed, 2016). In regards to cost, value chain interventions must also consider the drivers of demand, including affordability and acceptability in particular contexts. Governments can use public policy to create public food distribution programs such as the Supplementary Nutrition Programme under the Integrated Child Development Services in India (Maestre and Poole, 2018). As mentioned earlier, this can create a challenge (particularly for low-income consumers) as value chain approaches must be economically viable to offer sustainable change in the supply and demand for nutritious products. Several rigorous evaluations of interventions in value chains to improve diets and nutrition are currently under way, including randomized trials of poultry (Gelli *et al.*, 2017) and dairy value chains (ANH, 2017), and of homegrown school feeding as a market development intervention for smallholders (Gelli *et al.*, 2016).

Value chain interventions to address low supply

In cases where there is demand but low supply of nutritious foods (Fig. 3.1), the objective may then shift to production. Value chain interventions would therefore focus on managing production-related risks, such as through drought- or heat-tolerant seeds, improved control of pests and loss, and irrigation, or on post-harvest processes or other infrastructure for storage or transportation (e.g. cold chain technology). Nutrient-dense crops such as vegetables and animal-source foods are perishable products that can quickly spoil; post-harvest technology can increase the supply of nutritious foods in areas where infrastructure constraints lead to high levels of loss (Allen *et al.*, 2016). Infrastructure to increase distribution is also critical.

Previous research on agricultural value chains for nutrition has focused on different mechanisms through which profitability could be ensured, such as through contracts or improving infrastructure to reduce loss. Working through producers' organizations or providing contracts can be used to shift production to more nutritious crops among smallholder farmers and provide the infrastructure to bring them to the market, increasing incomes. For example, in Senegal, giving women control over contracts to produce and deliver fortified milk products during the dry season showed success (Le Port *et al.*, 2017). Another intervention in Kenya aimed to increase participation in supermarket channels for vegetables, and showed improved calorie and micronutrient consumption due to increases in income and crop production diversity (Chege *et al.*, 2015). Unfortunately, when the added revenue fell under the control of men, the effect on nutrition decreased (Chege *et al.*, 2015).

Cross-sectoral considerations

Influencing value chains to support better nutrition also involves the need to account for complex and confounding factors, including sanitation, water access and quality, women's empowerment, and education, requiring nutrition-related interventions to be multifaceted and adaptive. As the above examples demonstrate, the role of gender in food value chains for nutrition is especially important. Women are typically the caregivers and more likely to spend household resources on health and nutrition (Kumar *et al.*, 2018) (see Chapter 6). However, as key actors within value chains, women also tend to be chronically disempowered, further weakening a key impact pathway between agriculture and nutrition (Rao *et al.*, 2017). Therefore, the role of women in supporting value chains for nutrition should be central, and further research on household dynamics and gender relations with regards to nutrition and caring practices is needed.

Market-based Strategies and the Private Sector

As mentioned previously, interventions in food value chains that work through markets can be potentially more sustainable and scalable in

comparison with targeted nutrition-focused interventions. Market access is a critical component of many agriculture–nutrition interventions. For example, a study in Malawi found that farm-production diversity is positively associated with dietary diversity; however, the association is less significant than that for access to markets for purchasing or selling food (Koppmair *et al*., 2017). Proximity to markets can allow higher economic access (through increased incomes from selling production) and physical access to nutritious foods (increased variety of foods available). Similarly, in Ethiopia, increased nutrition knowledge has also been shown to be associated with diet diversity, but this impact is constrained in households with low market access (Hirvonen *et al*., 2017).

A number of studies have called for more interaction with the private sector to support value chains for nutritious foods. The role of the private sector in nutrition has long been debated. There are many who are suspicious of engaging the private sector in any nutrition intervention or policy given incentives (Hoddinott *et al*., 2015). Bridging the incentives of the public and private sectors has indeed proven difficult (Maestre and Poole, 2018). Opponents also argue that businesses are key contributors to overnutrition and the 'nutrition transition' (Popkin, 1998), with households having less time to cook, and companies producing more processed foods, leading to an increased intake of calories from sugars and fats, and to the double burden of under- and overnutrition at individual, household and national levels (Popkin *et al*., 2012; Kleinert and Horton, 2015). At the same time, many others call for a better understanding of the role of markets and the private sector in nutrition to potentially better shape outcomes (Gillespie *et al*., 2013; Ruel *et al*., 2013).

Private sector engagement in nutrition occurs in multiple ways, both positive and negative, partly dependent on the structure of the value chain. Agri-food value chains may be short and simple or long and complex, and, as mentioned, often involve different types of actors across one region or multiple countries, of different sizes. One common approach to leveraging public and private resources is public–private partnerships. An example is a partnership between Nutreal Ltd and a Uganda-based research institute to improve production, processing, nutrition retention, and pest management practices of actors involved in the bean supply chain (Hawkes and Ruel, 2011). At a larger scale, the creation of both the Scaling Up Nutrition (SUN) movement and the Global Alliance for Improved Nutrition (GAIN) are good examples of the development of multi-stakeholder platforms to leverage public and private resources to tackle malnutrition.

Nevertheless, there are still limited assessments for which it is possible to clearly delineate the potential role of the private sector, and its benefits and challenges for value chains for nutritious foods (Hoddinott *et al*., 2015). Examples of public–private partnerships involving procurement for social protection programs, like school meals, are currently being examined rigorously (Gelli *et al*., 2016). A key issue that has arisen in these programs involves the coordination effort required to maintain alignment between the incentives for the different stakeholders in the chain and the public sector priorities.

Using examples from other goods and service sectors, Thorpe and Reed (2016) demonstrated the use of a market-systems approach in identifying constraints to food value chains for nutrition. They noted the importance of consumer information to understand (and value) particular product characteristics, the motivations of value chain actors, and meet the constraints using innovations along the value chain (including product redesign and marketing, co-financing to share risk, overcoming information gaps, and adaptive management). It is also important to consider the informal sector in design and implementation in order to provide nutritious and safe food for rural and low-income populations as well as urban and higher-income groups (Robinson and Yoshida, 2016).

Maestre *et al*. (2017) developed a framework that illustrates the distribution–consumption linkage between the different levels in the food chain from nutrient requirements, through product demand and supply, new product development, firm strategy, the industry or market environment and the distribution systems, and consumption of nutritious foods by vulnerable population groups. They identified three core routes to link different value chain actors, markets and households: changes in food supply, changes in food demand, and changes within

the value chain. In this framework, the final outcome is a value chain that delivers nutrient-rich food that, at the point of consumption, is nutritious, safe and consumed in adequate quantities. This outcome will be the result of the nutritious food value chain being sustainable, coordinated and offering incentives to ensure viable business models to the actors who integrate it as well as meeting consumer requirements such as affordability, availability, acceptability, safety, and nutrition awareness. Overall, these supply-and-demand requirements would be affected not only by the value chain actors but also by the consumer and the broader macroeconomic context in which the chain operates. It then becomes relevant for policy-makers and other stakeholders to understand the enabling environment where the chain operates, as well as both the opportunities and the limitations to what the private sector can contribute alone.

There are scant examples of policies aimed at improving the nutrition aims and performance of value chains. Regardless, several countries have begun to put value chain-based approaches into practice. A number of partnerships are ongoing or under development to evaluate mechanisms of addressing the double burden of malnutrition, including the consultative research program, Agriculture for Nutrition and Health (A4NH), a partnership between IFPRI and CGIAR, to evaluate the impact of food prices on obesity and overweight in Latin America. In addition, new research program, Food Industries for People and Planet (FIPP), was launched in 2018 by IFPRI and will focus on all components of the agri-food value chain to increase access to nutritious foods for the global population.

Conclusions

Despite global goals to decrease malnutrition, there remain many challenges in providing access to a nutritious diet for all. Food value chains for nutrition have been the focus of a number of reviews but evidence of their impacts remains limited. Using a systems perspective to look at markets and the role of the private sector in nutrition includes not only the complex relations between multiple actors and trade-offs between often competing objectives, but also the supporting environment in terms of infrastructure (e.g. roads, energy) and the guiding laws and social norms.

Building effective linkages in any value chain that can successfully deliver nutritious foods will require initiatives on multiple fronts, starting with clear nutrition goals (Hawkes and Ruel, 2011). Any policy or intervention must improve the nutritional status of the population, while at the same time providing incentives and capabilities or enforcing regulation to support all types of businesses in overcoming challenges associated with delivering nutritious food. Inevitably, there will be trade-offs in the process. For example, reaching remote rural areas may increase distribution costs, or ensuring that products are safe may require better enforcement of regulations, potentially making the final product less affordable for vulnerable people or less profitable for the business. This is especially true in developing countries where populations are increasingly being impacted by poor diets resulting in the coexistence of both undernourishment and overweight.

The informal sector and local SMEs feature prominently in a majority of food value chains in developing countries, and engaging with them will be critical for long-term sustainability. To be able to tackle the triple burden of malnutrition, the public sector will need to play a key role and establish clear nutrition objectives. Nutrition continues to be a high priority on many government agendas, but given the multiple sectors involved in food value chains, miscommunication regarding the needs and roles of particular actors is prevalent and more care is needed to design context-specific interventions (Warren and Frongillo, 2017). There is also a need to better understand and capitalize on the market transformation that is underway in many countries to better target nutrition-related outcomes by shifting incentives, reducing risk, and changing consumer preferences and behavior. Companies are limited in what they can achieve within the market environment. In order to design and implement effective policies and strategies around value chains, policy-makers need to create an enabling institutional environment, so that they can better shape value chains to deliver nutritious products in a sustainable way, leveraging the capabilities and willingness of all stakeholders involved. With a clear public sector goal, and ensuring that actors work together, these policies can become more sustainable and successful.

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