Food and Agriculture Organization
of the United Nations

Agricultural value chains and social and environmental impacts: trends, challenges, and policy options

Background paper for
The State of Agricultural Commodity
Markets (SOCO) 2020

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Abstract

With the global population approaching 8 billion, the role of agricultural value chains (VCs) is increasingly important in ensuring sustainable and equitable food production. However, in developing countries, market failures can prevent small farmers from fully participating in domestic and global value chains, and issues related to climate change create further challenges. Moreover, greening policies and actions, as well as concerns regarding nutritional outcomes, add complexity to providing nutritious high-quality food to feed a growing population. In this context, it is critical to examine how markets can be shaped to be pro-poor and to reduce negative social and environmental externalities.

The current paper examines policies, institutional arrangements, and initiatives that target and affect different agricultural supply chain actors to improve environmental and social outcomes. Specifically, it reviews the non-economic consequences associated with the current operation and structure of global and domestic food value chains and identifies successful private and public strategies to shape food markets that foster non-economic benefits (social and environmental).

The paper provides key lessons and discusses policy implications on how markets can generate balanced economic objectives that also achieve desired nutritional, social, and environmental outcomes. It also highlights areas of future research to further understand the linkages between market forces shaping food value chains (FVCs) and non-economic outcomes.

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CHAPTER 1

Introduction

1 Introduction

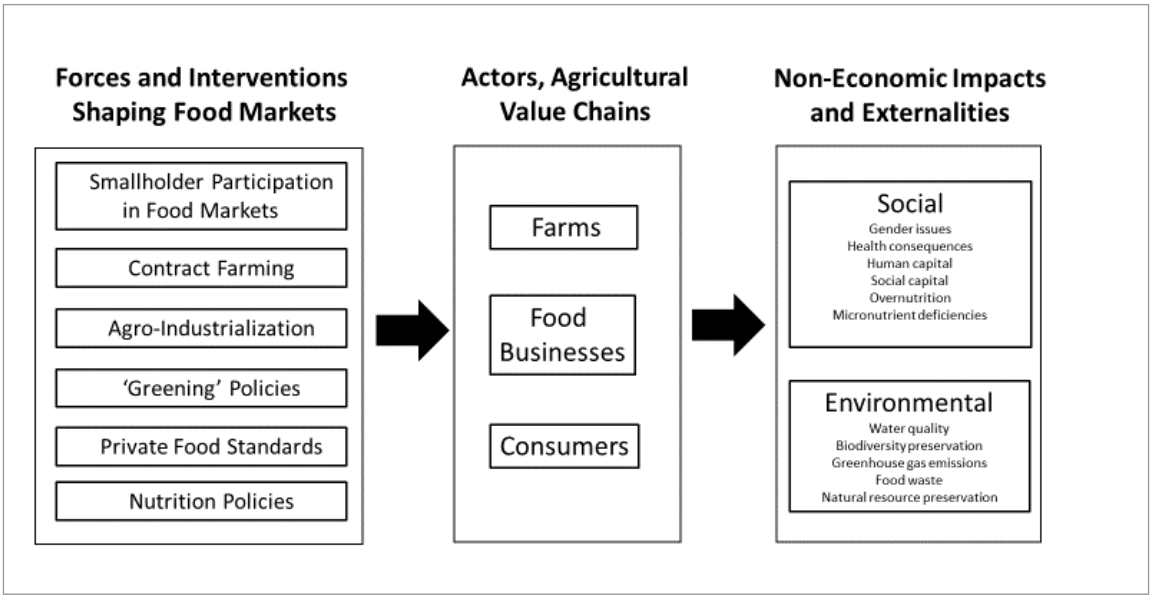
As the world's population approaches 8 billion and becomes more affluent, there is increased pressure on agricultural value chains to deliver sustainable food production, distribution, and consumption that simultaneously foster human wellbeing and preserves scarce natural resources (Gómez *et al.*, 2011; FAO, 2017a). As a result, there is renewed interest from policymakers, development institutions, civil society organizations, and private businesses in examining the role of food and agricultural markets in promoting sustainable growth that benefits people and the planet (FAO, 2017a; OECD–FAO, 2018). Agricultural value chains are undergoing profound transformations and are facing multiple environmental and social challenges. Many people are still excluded from participation in markets and balancing the demands on scarce natural resources (for example, land and water) has proven difficult. Changing diets and consumer preferences, and the reality of climate change, both add to the complexity of providing nutritious high-quality food to feed a growing population.

In this context, it is critical to examine how markets can be shaped to be more inclusive/pro-poor to reduce negative social and environmental externalities. In response, we examine policies, institutional arrangements, and initiatives that target and affect different agricultural supply chain actors to improve environmental and social outcomes. This contributes to identify appropriate interventions for the realization of the following non-economic objectives of the 2030 Agenda and its Sustainable Development Goals (SDGs) adopted by all United Nations (UN) member states in 2015: 2 (zero hunger), 3 (good health and well-being), 6 (clean water and sanitation), 7 (clean and affordable energy), 9 (industry, innovation, and infrastructure), 12 (responsible consumption and production), 13 (climate action), 14 (life below water), and 15 (life on land). A key issue here is whether food and agricultural markets can contribute to balance economic goals with non-economic outcomes such as promoting social wellbeing, improving nutrition, and preserving natural resources.

The objectives of this technical note are 1) to review the non-economic consequences associated with the current operation and structure of global and domestic food value chains; and 2) to identify successful private and public strategies to shape food markets that foster non-economic benefits (social and environmental).[1] The conceptual framework presented in Figure 1 illustrates our approach to examine non-economic consequences of agricultural value chains. First, we identify six forces and interventions shaping agricultural value chains: the need to incentivize smallholder farmer participation in food markets; contract farming as a means to reduce market failures; agro-industrialization and modernization of food distribution and retailing; 'greening' policies to address environmental externalities; private food standards designed to improve environmental and social performance; and policies to alleviate malnutrition. These forces affect the behaviour of different actors in the agricultural value chain including farmers, food businesses and consumers. In turn, these forces and interventions together with the response of food value chain actors, result in non-economic social and environmental impacts and externalities (both positive and negative). Social effects and externalities include health consequences, gender issues, as well as the formation of human and social capital. Environmental effects include externalities such as greenhouse gas (GHG) emissions, water pollution, biodiversity preservation, and food waste, among others. Nutritional effects include overnutrition and micronutrient malnutrition.

[1] This technical note does not address how shifts in production, both between regions and between sectors, can affect the environmental and social consequences of the forces shaping agricultural value chains.

Figure 1 Conceptual framework to examine non-economic impacts of agricultural value chains



Source: Author's creation based on the review of the literature.

This technical note is organized as follows. Each chapter considers one of the six forces and interventions shaping agricultural value chains. They are considered in order, focusing first on the effect on farmers, namely participation in food markets, contract farming, and agro-industrialization effects. Subsequently, we consider interventions beyond the farmgate, namely private food standards and 'greening' policies. Finally, we consider nutritional policies that affect primarily consumers. In each chapter, we focus on empirical evidence of social, environmental and nutritional impacts and externalities associated with the current configuration of food value chains and agri-food markets, highlighting the interaction between economic and non-economic outcomes.

The technical note also highlights five short case studies focusing on developed and developing countries. These cases analyse private actions and public policies affecting the achievement of non-economic sustainable outcomes in the food value chain. The first case assesses interventions to reduce CO_2 emissions in fresh produce supply chains, highlighting opportunities to improve environmental outcomes through post-harvest strategies. The second case considers payments for ecosystem services by a large food manufacturer to ensure clean water. This case illustrates that, under certain conditions, market forces can lead to desired non-economic outcomes without the need for public policy. The third case turns the attention to smallholder farmers in Colombia and the positive environmental and social outcomes associated with novel inclusive business models linking farmers to global markets based on product quality. The fourth examines the consequences of a sugar tax policy intervention in Mexico and the extent of its success in alleviating overweight and obesity. Finally, the fifth case focuses on successful strategies to reduce micronutrient malnutrition (often referred to as 'hidden hunger'), specifically on interventions to reduce iodine deficiencies.

The concluding section focuses on key lessons from the literature review and case studies. It includes a discussion of policy implications on how markets can generate balanced economic objectives that also achieve desired nutritional, social, and environmental outcomes. This section also highlights areas of future research to further understand the linkages between market forces shaping food value chains (FVCs) and non-economic outcomes.

CHAPTER 2

Agricultural Commercialization Among Smallholder Farmers In Developing Countries

2 Agricultural commercialization among smallholder farmers in developing countries

The agricultural sector of many developing countries continues to be dominated by small-scale production. Commercialization of smallholder subsistence farming is an integral part of economic growth and needed to feed a growing and increasingly urban population (Carletto *et al.*, 2017). Market participation among smallholder farmers is typically high, even among disadvantaged groups such as female-headed and particularly undercapitalized households (Carletto *et al.*, 2017). In other words, pure subsistence farming is the exception (Barrett, 2008). However, the degree of commercialization is often low; and most farmers sell food crops seasonally in local markets, implying relatively small profit margins (Carletto *et al.*, 2017; Pingali, 2001). Indeed, many small farmers in developing countries are stuck in a vicious cycle of small incomes (given the small marketable surplus), limited resources to purchase productivity-enhancing inputs, and, again, small marketable surplus and incomes. This vicious cycle can be difficult to break, especially in the face of market and government failures (for example, insufficient investments in public goods such as roads and infrastructure, limited access to pubic extension services and information, and weak credit and insurance markets) (Barrett, 2008). As a result, accessing higher-value markets and commercial production is often only feasible for larger, better-off farmers, increasing social inequality. In the worst case, marginalized poor might be made worse off in the process of agricultural commercialization. For example, pressure on communal land and natural resources might increase as market participation increases, potentially affecting particularly poor people disproportionally (Dawson *et al.*, 2019; Rasmussen *et al.*, 2018).

Given these distributional concerns, making markets – and particularly lucrative markets – work for poor farmers is a goal shared by policymakers across the developing world. Yet achieving this goal is typically difficult without addressing the aforementioned market and government failures. In what follows, we focus on those who have market access and achieved some degree of commercialization and summarize the available evidence on social and environmental effects of agricultural commercialization. We discuss private-sector-led institutional arrangements that can indeed help mitigate market imperfections (such as contract farming) in the subsequent chapter.

Social effects

Theory and the extant literature suggest that those farm households that can move toward more market-oriented production typically obtain higher incomes. Theoretically, higher incomes from crop and livestock production could translate into improved household wellbeing, as households can afford better nutrition, healthcare, education, and productive assets and eventually move away from the farm sector (Dawson *et al.*, 2019; Pingali, 2001).

The available evidence, however, shows that the relationship between economic and social outcomes is often less clear-cut. In many rural societies, production and consumption decisions of farm households continue to be intertwined (Radchenko and Corral, 2017) and determined by traditional norms, gender-specific preferences, and the distribution of decision-making power within households (Doss, 2013).

Recent studies have looked at the relationship between agricultural commercialization and household nutrition with mixed results (Carletto *et al.*, 2017; Ogutu *et al.*, 2019; Radchenko and Corral, 2017). Mixed findings suggest that effects might vary across locations and different population segments (Radchenko and Corral, 2017). Carletto *et al.* (2017) uses representative

panel data from several African countries and thus presents results with the greatest external validity. They find that the correlation between agricultural commercialization (measured as the gross value of crop sales divided by the gross value of total crop production) and nutritional outcomes (anthropometric measures and food expenditures) is weak. Thus, an increase in farm income alone is not enough to enhance household nutrition (Radchenko and Corral, 2017). Why is this so, and which factors determine nutritional outcomes in light of agricultural commercialization?

Agricultural commercialization might affect household nutrition through different channels. A focus on cash crop production might reduce households' access to food and dietary diversity from their own farm production. For example, on-farm production diversity is commonly found to be associated with greater dietary diversity (Jones *et al.*, 2014; Sibhatu *et al.*, 2015), so that agricultural specialization might reduce dietary diversity. Yet higher household income might enable households to invest in farm activities, possibly increasing both cash and food crop yield and thereby also the quantities available for consumption and sales (Minten *et al.*, 2007; van den Broeck *et al.*, 2018).

Generally, however, channelling household resources away from subsistence crops toward commercial crops implies that a larger share of the foods consumed will be purchased rather than produced on their own farm (Ogutu *et al.*, 2019). Higher incomes can enable households to buy more foods (thus increasing energy intake), to buy more diverse foods (thus increasing dietary diversity and quality), or to invest in sanitation and healthcare (which are crucial determinants of nutritional outcomes especially in children) (Carletto *et al.*, 2017). Indeed, the relationship between incomes and demand for food diversity and quality is a well-known global pattern and particularly pronounced for animal-based foods. At the same time, however, consumption expenditures on processed and ultra-processed foods – which are typically rich in nutritionally-undesirable components such as trans fats, saturated fats, free sugars, and salt (Martínez Steele *et al.*, 2017) – are increasing, not only in affluent but also in developing countries (Popkin, 2014; Popkin and Reardon, 2018). Thus, whether it is advantageous from a nutrition perspective for a larger share of households' food consumption needs to be satisfied with purchased foods might depend on food preferences, knowledge, and local availability of different foods.

Nutritional outcomes of agricultural commercialization are also influenced by the type of crops grown, and by the gendered distribution of decision-making power (Carletto *et al.*, 2017). Income from cash crop production is often seasonal and earmarked for specific non-food investments so that higher annual incomes might not necessarily translate into better diets throughout the year (Duflo and Udry, 2004; Meemken *et al.*, 2017). It is also known that men and women spend money differently, with women having the tendency to make decisions that contribute more to child and household welfare and nutrition (Duflo and Udry, 2004; van den Broeck *et al.*, 2018). Similarly, in many rural societies, women and men have different tasks and responsibilities in agriculture, with cash crop production and marketing often being the domain of men (Njuki *et al.*, 2011; von Braun and Kennedy, 1994). In many societies, women tend to be responsible for food crops (for example, vegetables or staples), especially those that are not, or only partly, sold. Few crops can, however, be clearly classified as traditionally men's or women's crops (Doss, 2002). When the profitability of a particular crop changes (through the process of agricultural commercialization), men might take control of its production and marketing, reducing women's income and decision-making power (Chege *et al.*, 2015; Dolan, 2002; von Braun and Kennedy, 1994). Agricultural commercialization might thus exacerbate traditional gender roles and inequalities.

Environmental effects

In theory, agricultural commercialization can have a range of positive and negative environmental implications, depending on the context and technologies used (Pingali, 2001). Overall, however, there are trade-offs between environmental and socioeconomic goals, which tend to become more pressing in the light of agricultural commercialization (Rasmussen *et al.*, 2018). For instance, agricultural commercialization might lead to the overuse of natural resources such as water or land (Dawson *et al.*, 2019; Rasmussen *et al.*, 2018), although new technologies can potentially help handle limited resources more efficiently (Pingali, 2001). The latter is especially relevant, as access to technologies tends to improve in the process of commercialization.

Agricultural commercialization is often, but not always, associated with an increase in the use of purchased agrochemical inputs. Inputs such as chemical pesticides and fertilizers can lead to various environmental problems (pollution of water bodies, reduction of useful insects, declining soil fertility), and health hazards for humans, especially when not properly handled (Elahi *et al.*, 2019; Pingali, 2001). Unsafe use of agrochemicals is not uncommon in rural settings of developing countries as training, knowledge, and storage facilities are often poor or absent (Elahi *et al.*, 2019).

Yet agricultural intensification through modern inputs and technologies can help increase yields (output per area), thereby 'sparing' land for nature conservation. This point links to a recurrent and more general debate around 'land sharing' and 'land sparing' (see Green *et al.* (2005) and Tscharntke *et al.* (2012) for a more detailed discussion). Proponents of 'land sharing' suggest that land should be 'shared', that is, used simultaneously for food production and environmental conservation. For this purpose, agricultural production has to be – or become more – environmentally friendly. In contrast, proponents of 'land sparing' argue that some land should be 'spared' to preserve natural habitats. To maintain space for natural habitats, land-sparing-proponents argue, agricultural production has to be intensified to produce more food. Integrated (non-dichotomous) approaches of sustainable intensification (Duggan and Kochen, 2016; Koch *et al.*, 2019; Tscharntke *et al.*, 2012) are seen by many as a solution to overcome trade-offs between environmental and social goals. A recent review, however, shows that in reality it often proves difficult to generate win-win situations, especially when longer-term effects are considered (Rasmussen *et al.*, 2018).

CHAPTER 3

Contract farming

3 Contract farming

Contract farming is a pre-harvest agreement between farmers and buyers (for example, processors, exporters, wholesalers) that may specify the price, quantity, quality, and/or other production-related features of the product to be delivered (Otsuka *et al.*, 2016). Some authors differentiate between outgrower schemes (operated by governmental actors) and contract schemes (operated by private sector actors) (Glover and Kusterer, 1990).

Contract farming is commonly understood as a useful tool to mitigate prevalent market failures facing farmers in developing countries (Bellemare and Bloem, 2018; Grosh, 1994). Therefore, many governments in developing countries actively promote contract farming, including for example in India (Mishra *et al.*, 2018), Viet Nam (Ba *et al.*, 2019) and Ghana (Ragasa *et al.*, 2018). Although not a new phenomenon, contract farming has recently gained importance in light of the globalization and modernization of agri-food systems (Gómez *et al.*, 2011; Mergenthaler *et al.*, 2009; Reardon *et al.*, 2009). It is estimated that, today, less than 15 percent of farmers in African countries participate in contract farming (Oya, 2012).

A large body of literature analyzes the economic effects of smallholder participation in contract farming (Meemken and Bellemare, 2020). In most cases, contract farming was found to generate economic gains for smallholder households, as recent reviews summarize (Bellemare and Bloem, 2018; Otsuka *et al.*, 2016; Ton *et al.*, 2018; Wang *et al.*, 2014). Contract farming might affect household welfare via several channels. Contracts that specify the price, quantity, or quality of the products can reduce uncertainty around output prices and markets, facilitating planning and investments (Bellemare and Lim, 2018; Key and Runsten, 1999; Mishra *et al.*, 2018). Also, participation in contract farming is often associated with better access to training and information, credits, and farm inputs and technology. Better access to such services is often crucial in helping farmers increase yields and quality as well as adopt more profitable crops or varieties (Glover, 1984; Key and Runsten, 1999).

Despite overall positive findings, there are recurrent concerns regarding exploitative contract schemes where farmers are kept in a vicious cycle of indebtedness and dependency on contractors (Porter and Phillips-Howard, 1997; Ragasa *et al.*, 2018; Wendimu *et al.*, 2016). Indeed, recent cross-country evidence shows that contract farming is not unambiguously beneficial (Meemken and Bellemare, 2020). As for agricultural commercialization in general, there are concerns that contract farming might increase social inequality (Dolan, 2002) as the poorest share of farmers might lack the skills and resources needed to participate in contract schemes (see also subchapter on gender and contract farming).

Few studies have focused on social and environmental effects of contract farming. This holds especially for quantitative impact studies. The available studies are summarized below and support the finding that economic benefits may not necessarily translate into improved nutrition, education, or gender equality.

Nutrition

Available studies suggest that contract farming reduces the reported duration of households' hungry season (Bellemare and Novak, 2017) and households' expenditures on food (Mishra *et al.*, 2018), suggesting that contract farming improves not only incomes but also household nutrition. Yet the pathways remain poorly understood. Does contract farming improve nutrition

(only) because of the increased incomes and purchasing power? As discussed above, higher incomes do not always translate into improved food and nutrition security. Nutritional outcomes can depend crucially on the type of crop, seasonality of crop income, and gender roles.

Gender

Women farmers are much less likely to participate in contract farming (Porter and Phillips-Howard, 1997; Ragasa *et al.*, 2018). Women farmers are often disadvantaged in terms of access to information, services, resources, and markets, which might explain the gender gap in participation rates. Relatedly, companies typically target men because women do not hold official land titles (Dolan, 2002) or because crops are traditionally perceived as men's crops (Koczberski, 2007). Thus, companies might even issue contracts with men even in cases where women are plot managers. In cases where men are plot managers, contract farming can reinforce men's appropriation of women's and (children's) labour (Porter and Phillips-Howard, 1997). This is because contracted crops are often labour-intense (Barrientos *et al.*, 2003) and tend to increase the demand for activities that are considered female tasks (Raynolds, 2002). In sum, several qualitative studies suggest that contract farming might exacerbate traditional gender norms, generating disparities in access to inputs and services – further limiting women's options to engage in commercial crop production (Adams *et al.*, 2019; Koczberski, 2007).

Commercialization via contract farming can, however, challenge traditional gender norms and tasks (Dolan, 2002). When women gain or retain control over generated income and their own labour, they may gain bargaining power (Dolan, 2002). Whether this holds true seems to depend largely on women's outside options (such as wage labour). Gender-sensitive policies by contracting companies might help strengthen rather than undermine women's bargaining power and role in commercial farming (Koczberski, 2007; Raynolds, 2002). This may include targeting women (that is, issue contracts with women whenever they are the plot managers) or schemes where companies directly pay temporal workers (an advance payment that is subtracted from farmers' final harvest revenues), including workers who are female household members. Such policies, however, seem to work best when they do not challenge men's traditional roles (Koczberski, 2007).

Environment

We are not aware of any study that particularly focuses on environmental effects of contract farming. While the evidence suggests that contract farming can increase the use of modern farm inputs (which could result in environmental harm if applied inappropriately), actual environmental effects remain unclear. Overall, environmental effects likely depend on the specific features of the contract scheme, contracted crop, knowledge and environmental consciousness of both farmers and contractors involved, as well as various other factors.

CHAPTER 4

Agro-industrialization: large scale investments, vertical integration, land grabbing, horticultural export markets, agro-processing, expansion of modern retail

4 Agro-industrialization: large scale investments, vertical integration, land grabbing, horticultural export markets, agro-processing, expansion of modern retail

Over the last decades, private sector (mostly foreign) investments in retail, processing, and vertically-integrated estate production have been gaining in importance – and have contributed to the ongoing transformation of the agri-food sector in many developing countries (Reardon and Timmer, 2012).

The proliferation of vertically-integrated estate production, in particular, has raised recurrent concerns that smallholder farmers, who still dominate the farm sector in most developing countries, might be excluded from participation in higher-value (export) chains, leading to further marginalization (Dolan and Humphrey, 2000; Osabuohien *et al.*, 2019; Reardon *et al.*, 2009). Yet vertical integration is also seen as an opportunity to promote investments in rural infrastructure (Narrod *et al.*, 2009) and employment generation – especially for disadvantaged population segments, who lack resources such as land to participate in export chains via product markets (van den Broeck and Maertens, 2016).

A special form of investment and large-scale farming, namely large-scale land acquisition, has provoked substantial controversy in light of the 2007–2008 spike in food prices, increasing demand for bioenergy, and persistently high levels of food insecurity in many countries that host foreign investors (Hufe and Heuermann, 2017; Maconachie, 2019). While opponents see such land purchases or leases for commercial agriculture as a form of neo-colonial exploitation that destroys the livelihoods of indigenous communities, proponents see opportunities to promote employment, technology transfer, and investments in underdeveloped rural areas (Johansson *et al.*, 2016; Maconachie, 2019; Osabuohien *et al.*, 2019). At least 47 million hectares are currently subject to such investments, mainly in Africa (Land Matrix, 2019). Aspects most commonly debated and studied in empirical studies include land rights, environmental implications, and employment effects (see also Hufe and Heuermann, (2017) for a recent review of the literature focusing specifically on large scale land acquisitions).

Empirical studies frequently highlight problems related to land expropriation, inappropriate compensation, and forced displacement of the local population in project areas, especially in countries where customary land rights are the dominant form of tenure (Hufe and Heuermann, 2017; Maconachie, 2019; Osabuohien *et al.*, 2019).

Recent studies have also explored environmental implications, finding that large-scale land acquisitions, which often involve water-demanding crops such as oil palm or sugarcane, increase the demand for and competition over freshwater resources (Breu *et al.*, 2016; Johansson *et al.*, 2016). There is also evidence for increased deforestation in areas subject to large-scale land acquisitions (Davis *et al.*, 2015).

Employment effects depend on various factors, including former land use, that is, what the land was used for prior to the land deal. Many land deals concern agricultural, pastoral, or forest land – and are thus associated with the loss of livelihoods (Nolte and Ostermeier, 2017). For a positive balance, the number of newly created jobs has to exceed the number of jobs lost. Some production schemes involve contract farming, and thus alternative income opportunities for some inhabitants within project areas (Nolte and Ostermeier, 2017). In terms of vertically-integrated estate production, the type of crop cultivated is decisive (Hamann, 2017; Nolte and

Ostermeier, 2017) since labour demand and the degree to which labour can be replaced by capital (implying different degrees of mechanization) is highly crop-specific (Deininger and Byerlee, 2011). Beyond production, agro-processing is typically labour-intensive and thus likely to generate new jobs (Nolte and Ostermeier, 2017).

Several studies have specifically focused on employment effects and worker welfare in labour-intensive sectors, including horticultural export production and the cut flower industry (Maertens *et al.*, 2012; Maertens and Swinnen, 2009; Staelens *et al.*, 2016; van den Broeck and Maertens, 2017). In these sectors, companies rely on hired labour for production, harvesting, washing, sorting, grading, and packaging (Colen *et al.*, 2012; van den Broeck *et al.*, 2017). Therefore, these sectors have been receiving substantial attention and support from policymakers and international donors (Maertens *et al.*, 2012; van den Broeck and Maertens, 2016).

Several studies suggest that the proliferation of horticultural export production has indeed contributed to employment generation (Maertens and Verhofstadt, 2013; van den Broeck *et al.*, 2017), affecting especially the poorest share of the rural population that cannot participate in export chains via product markets (van den Broeck and Maertens, 2016). Relatedly, most workers employed in this sector are women, with important implications for women's income and empowerment. Empirical studies suggest that women's income from off-farm employment in the horticultural sector promotes household nutrition (van den Broeck *et al.*, 2018), reduces fertility rates (van den Broeck and Maertens, 2015), and increases school enrolment (Maertens and Verhofstadt, 2013).

Implications for the quality of employment are more ambiguous (Barrientos *et al.*, 2003; Raynolds, 2014; Riisgaard, 2009). Women, migrant, and low-skilled workers are often employed in short-term, precarious, and exploitative conditions (Raynolds, 2014; Schuster and Maertens, 2016; van den Broeck *et al.*, 2016). Sustainability standards such as Fairtrade can potentially help enforce higher labour and environmental standards (Krumbiegel *et al.*, 2018), but are currently only affecting a small share of the total food production.

CHAPTER 5

Private food standards – A tool to regulate global agricultural trade?

5 Private food standards – A tool to regulate global agricultural trade?

The agricultural sector contributes to pressing environmental and social problems (FAO and ILO, 2007; Foley *et al.*, 2011). Governmental standards and policies to reduce such negative externalities are often absent or poorly enforced in developing countries. Similarly, enforcing high standards along global and increasingly complex supply chains involves various challenges (Swinnen, 2016). Sustainability standards such as Fairtrade, organic, UTZ and Rainforest Alliance, are designed to address ecological and ethical concerns, and they are often seen as a promising market-based tool to enforce standards where functioning governmental regulation mechanisms are absent (Blackman *et al.*, 2017; Tayleur *et al.*, 2017).

More than two-hundred sustainability standards exist (ITC, 2018a). The most important standards (in terms of popularity, market share, certified area, and number of producers) include Fairtrade, Organic, Rainforest Alliance, UTZ, 4C, GLOBALG.A.P., Roundtable on Sustainable Palm Oil (RSPO), Better Cotton Initiative, 4C, and Cotton Made in Africa (ITC, 2018; ITC, 2020). Sustainability standards are set by standard-setting bodies, including non-governmental organizations (NGOs) (for example,. Fairtrade International), private companies (for example, Starbucks), or multi-stakeholder initiates (for example, RSPO). Standard-specific rules can vary in terms of their details and stringency, but almost all sustainability standards address both social and environmental issues (see Dragusanu *et al.* (2014) for more details on Fairtrade; Seufert and Ramankutty (2017) and Meemken and Qaim (2018b) on organic standards; and ITC (2018a) and ITC. (2020) for a comparison of various standards).

The adoption of sustainability standards is voluntary for producers, so the basic principle is to incentivize and compensate producers to comply with standard-specific rules through higher output prices. Producer compliance is verified through certification and regular inspections by independent certification agencies (for example, FLOCERT for Fairtrade certification). Labels on the product signal to consumers that standard-specific rules were met, allowing consumers to make purchasing decisions in accordance with their ethical and political views. In other words, sustainability standards serve to link "rich consumers and poor producers" (Swinnen, 2016).

Consumer demand, as well as support for sustainability standards among development agencies, has been growing over the last decades. Consequently, the land area certified under sustainability standards, the production volumes, and the number of participating farmers has also been increasing steadily. This holds especially for tropical products such as coffee, cocoa, tea, palm oil, and cotton. For example, about 20–40 percent of the global coffee and cocoa area are certified (ITC, 2018).

Despite the rapid proliferation of sustainability standards, their effectiveness and impacts are controversially discussed in the media, general public, and among researchers (Dragusanu *et al.*, 2014; Meemken and Qaim, 2018b; de Janvry *et al.*, 2015). One concern is that the poorest share of farmers might be excluded because participation presupposes skills and resources (Lee *et al.*, 2012). Available studies typically show that undercapitalized farmers can in fact participate, but also that accessing certified markets is hardly possible without collective action and external support.[2]

2 While some standard-setting bodies (e.g., Fairtrade) are focusing more specifically on marginalized farmers than others (e.g., organic), support for certification is typically provided by development agencies (not by standard-setting bodies).

Most available studies that analysed whether participating farmers benefit economically from participation have had mixed results, as recent reviews and meta-analyses show (DeFries *et al.*, 2017; Meemken, 2019; Oya *et al.*, 2018). Mixed results are likely attributable to various context-specific factors, which are often not fully captured in individual studies (Sellare *et al.*, 2020; Meemken, 2019). On average, however, participating farmers are found to derive economic benefits. Economic benefits may translate into improvements in terms of other sustainability goals (Meemken *et al.*, 2017). Moreover, standards, given their social and environmental rules, can also affect outcomes such as child education, nutrition, gender equality, and environmental protection through various intended and unintended channels as we discuss below.

Child education

Available studies suggest that certification schemes such as Fairtrade increase investments in child education (Meemken *et al.*, 2017), the likelihood that children are enrolled in school (Arnould *et al.*, 2009; Becchetti *et al.*, 2013) and the duration of schooling (Gitter *et al.*, 2012; Meemken *et al.*, 2017).

Certification can affect children's educational opportunities and outcomes through several pathways. Investment in children's education tends to increase with income. Consequently, when households benefit economically from certification, covering education-related costs (such as school fees, tutorials, transport, or materials) becomes more viable. For instance, income from cash crops is often earmarked for larger investments, such as education, thus directly contributing to child education (Meemken *et al.*, 2017).

However, when crop production becomes more profitable as a result of certification, the demand for child labour may increase, and thus also the opportunity cost of sending children to school. Most standards involve strict rules on child labour and involve trainings and awareness campaigns that highlight the benefits of education and hazards associated with child labour (Gitter *et al.*, 2012; Meemken *et al.*, 2017). Yet not all standards include rules on child labour. This holds for organic standards, which prohibit the use of chemical farm inputs, often leading to higher demand for manual labour. While organic standards might thus increase demand for child labour, they might, at the same time, reduce particularly harmful forms of child labour (such as unprotected application of hazardous pesticides). The effects of organic standards on (the most harmful forms of) child labour have not been analysed empirically.

Certification is often associated with investments in social infrastructure. This holds especially for Fairtrade, where a certain share of the profit is reserved for community investments (Dragusanu *et al.*, 2014). In terms of education, this may include investments in physical school infrastructure, school materials, or educational scholarships. Such investments can make it more affordable for parents to send their children to school (Bacon *et al.*, 2008) even if they do not directly participate in certification programmes themselves.

Gender equality

Standards may affect individual household members in different ways, depending on their roles in crop production, control over income, and decision-making power. Certified crops are often traditional cash crops and thus the domain of men. When certification increases the profitability of traditional cash crops, existing gender roles and inequalities might be reinforced or exacerbated.

Some standards (for example, Fairtrade and UTZ) involve specific gender and non-discrimination policies that might help promote women's status and reduce prevalent gender disparities

in access to information, inputs, and services. For example, some standards require farmer organizations to promote and document female participation in regular agricultural trainings, to implement workshops that raise awareness on gender issues, or to offer services that specifically target disadvantaged groups such as women (Meemken and Qaim, 2018a).

Standards involve various rules that may increase demand for labour, and especially for activities that are, in many societies, traditionally considered female activities. For example, a ban of chemical pesticides (under organic standards) might increase demand for manual labour for weeding; and quality requirements (several standards) might increase the time input for careful harvesting and post-harvest handling (Lyon *et al.*, 2010; Meemken and Qaim, 2018b). However, the overall effect on women's workload, the gendered distribution of work, and women's employment opportunities (for example, on other certified farms) seem to be context-specific and variable over time (for example, labour-saving technology might be introduced) (Bolwig, 2012; Lyon *et al.*, 2010; Ruben and Fort, 2012).

Nutrition

The effects of standards on nutrition are mixed and not yet well understood. As discussed earlier, an increase in household income (through certification) can allow households to buy more and/or more nutritious food, especially when women gain or maintain control over cash income (Chiputwa and Qaim, 2016). However, income from cash crop production is often seasonal and earmarked for specific non-food investments, so that higher annual incomes might not translate into better diets throughout the year (Duflo and Udry, 2004; Meemken *et al.*, 2017). Relatedly, standards and certification involve trainings, workshops, and awareness campaigns on various topics – but typically not on nutrition. Thus, standards are unlikely to change food preferences and nutrition-related knowledge (Meemken *et al.*, 2017).

Environmental effects

Standards vary in terms of their specific environmental rules but typically promote environmentally-friendly practices (such as soil erosion measures, use of organic fertilizers and pesticides, agroforestry and share trees) and regulate the use of practices that might cause environmental harm (such as overuse of chemical pesticides and fertilizers, treatment and disposal of waste and harmful substances).

Most studies find that standards increase the use of environmentally friendly practices and reduce the use of practices that might cause environmental harm (Blackman and Naranjo, 2012; Ibanez and Blackman, 2016; Giuliani *et al.*, 2017). Various studies also suggest that standards can prevent deforestation and increase forest density and diversity (Haggar *et al.*, 2017; Miteva *et al.*, 2015; Rueda *et al.*, 2015; Takahashi and Todo, 2017). Emerging business models in global commodity trading, primarily coffee and cocoa, in which farmers and sellers develop long-term partnerships based on product quality, can simultaneously achieve economic, environmental and social benefits. Box 1 below examines the case of the Relationship Coffee Model (RCM) in Colombia and its environmental impacts. (See Box 1)

Despite overall promising findings, there are some caveats. Environmental effects seem to vary across locations (Haggar *et al.*, 2017) and cannot be confirmed by all studies (Vanderhaegen *et al.*, 2018). Another common concern is that farmers who already employ environmentally friendly farming practices might self-select into certification (Blackman and Naranjo, 2012), meaning that current studies might overestimate the environmental effect of standards.

Another caveat is that most available studies focus on farm-level effects due to data limitations (exceptions include Miteva *et al.*, 2015; Rueda *et al.*, 2015; Smith *et al.*, 2019). Disregarding landscape-wide effects can be problematic especially when considering standards that promote extensive forms of agricultural production (such as organic, which typically leads to lower yields per unit of land). The question whether land should be "shared" or "spared" is also relevant in the context of organic farming in developed countries, where the average organic-conventional yield gap is quite large (see Meemken and Qaim (2018b) for a detailed review and discussion). In developing counties, the current yield gaps are much smaller. Additionally, effects of standards on crop yields other than organic are typically smaller – if not positive (as most standards do not ban chemical inputs).

Box 1 Relationship Coffee Model for Smallholder Farmers in Colombia

Relationship Coffee Model (RCM) is a long-term partnership between coffee buyers and smallholder coffee producers based on product quality. RCM is a business model where smallholders work closely with stakeholders of the value chain including roasters, importers, and buyers, and focus on producing coffee for specialty markets. Smallholders receive training on best agricultural practices that foster sustainability, risk management, quality assurance, and business management (Porter and Kramer, 2011). Under RCM, traceability systems from origin to warehouse are implemented to foster transparency and to monitor product quality (Sustainable Harvest, 2017). Smallholder coffee farmers participating in the RCM, benefit by receiving price premiums based on the cupping quality of the product. Coffee quality is affected by the quality of the inputs, which include production technology and environmental factors. Producing high quality coffee is a key requirement to participate in the RCM. If smallholders meet the minimum quality standards, this business model has the potential to affect smallholders' human and social capital as well as environmental and biodiversity outcomes.

One widely touted strategy under the RCM model is to produce more coffee under forest canopy, which is known as "shade-grown coffee" (Hernandez Aguilera et al., 2019). Shade-grown coffee is believed to support multiple ecosystem services, including climate change adaptation, increasing pest control by birds, and production of food and other products of economic value produced by shade trees. Moreover, shade-grown coffee beans tend to be of higher quality and, thereby, may be associated with quality-related price premiums.

Previous research shows that RCM and similar business partnership models improve economic outcomes of farmers and of other supply chain participants. A related question is: Are there additional non-economic impacts associated with participation on the RCM? In a study to determine the non-economic effects of RCM participation among smallholder farmers in Colombia, Hernandez-Aguilera et al. (2018) compared RCM participants to non-participants in several economic, social and environmental outcomes. To carry out the analysis the authors collected data from smallholder producers in the regions of Cauca and Antioquia, including soil chemical composition, biodiversity indicators, production and marketing practices, bird diversity and abundance, and coffee quality assessed by a trained coffee grader, among other data.

Results suggest that smallholder participation in RCM is associated with desired environmental, technological, and socio-economic outcomes (Hernandez-Aguilera et al., 2019). For example, the study shows that RCM farms exhibit higher tree diversity. Higher tree diversity and canopy, in turn, is associated with superior soil health and improved coffee quality (Elder et al., 2014; Rappole and King, 2003). Tree diversity also contributes to nitrogen fixation, minimizing the dependence on synthetic fertilizers. Moreover, tree diversity decreases nutrient leaching and forest fragmentation (Carvalho, 2006; Mendez et al., 2009, Wezel et al., 2014). In addition, higher tree density can increase diet quality of smallholder farmers, and provide habitat for insectivorous birds, fostering natural pest control services (Hernandez-Aguilera et al., 2019).

The study also finds that RCM growers followed more sustainable resource management practices than non-participants. Water usage was lower in RCM producers than non-RCM producers. Water is mostly used in the coffee berry fermentation process. A larger proportion of RCM producers used organic fertilizers and applied organic fumigation against coffee rust (Hernandez-Aguilera et al., 2019) than did non-participants. Overall, the study underscores that emerging business models to integrate smallholder farmers into global markets based on product quality can positively affect human capital, natural resource management, and biodiversity.

CHAPTER 6

Greening policies and actions

6 Greening policies and actions

The concept of green growth refers to economic growth with minimal environmental damage and resource use. Green growth has been recognized as a priority by many multilateral institutions including the United Nations (UNEP, 2011), the World Bank (World Bank, 2012), and the OECD (OECD, 2011). These institutions have developed policy recommendations to support green growth, but they have not been widely adopted or enforced in many countries (OECD, 2015b). The need for green policies and actions are the result of market failures in addressing pollution and depletion of natural resources (Jaffe *et al.*, 2005). At the farm level, for example, green agricultural growth often considers incentives to adopt sustainable intensification of production practices, which aims at improving productivity sustainably, by minimizing the impact on scarce resources such as water, energy, and land (Legg, 2017). Other policies include applying comprehensive strategies to increase the productivity of production resources along the food value chain; ensuring that markets provide the right signals to implement sustainable production, processing, and distribution practices; establish and enforce well-defined property rights (OECD, 2011).

Examples of green policies and actions include interventions promoting the adoption of green technologies, limiting greenhouse gas emissions, incentivizing waste usage in production activities, minimizing the use of synthetic fertilizers and pesticides, encouraging material recycling and the use of biodegradable packaging, facilitating adoption of renewable energy sources, and supporting reforestation initiatives, among others. Mechanisms to implement such policies often require internalizing environmental externalities (for example, having food business pay for pollution caused by them). Such policies require nuanced cost-benefit analyses of the externalities for priority setting, as well as the political commitment and the creation of a market for natural resources and pollution rights (Tietenberg, 2003; Legg, 2017).

Green policies and actions are also the result of consumer demand for sustainable practices in food production and distribution. Public awareness campaigns play an important role in educating and sensitizing consumers about the products they buy and the social responsibility of food producers and distributors. For example, the globally growing concern about the carbon footprint on our daily activities is due to the increased awareness of the possible devastating consequences of climate change (Saad, 2019; Halady and Rao, 2010), especially among educated people (Lee *et al.*, 2015).

Implementation of green policies should recognize the specific context in which they are implemented, the temporal trade-offs between the costs and benefits, and the distributional effects. Although the effects of green policies on the environment can vary depending on local conditions, there is consensus in the scientific community that if green policies are not adopted, future economic growth will be constrained by resource depletion, increasing the risk of food shortages in future years (OECD, 2011). Moreover, possible trade-offs between achieving green growth and poverty reduction should be addressed, especially in developing countries, to avoid disproportionate burdens on the poor to comply with green growth policies, including smallholder farmers and low-income urban people (Dercon, 2014). The economic and non-economic benefits of adopting green policies and actions are typically materialized in the long term. Therefore, short term costs must be offset by maximizing synergies and economic and non-economic benefits (Hallegatte *et al.*, 2011).

Below we discuss selected examples of non-economic social and environmental effects of green policies and actions applied to agricultural production, rural and urban households, and businesses in the food value chain.

Social effects

The benefits of adopting green policies and investing in green technologies can generate positive social externalities such as skill development, industry-wide learning, and agglomeration effects (Rodrik, 2015). As green policies are implemented, it is expected that demand for green jobs will increase. These jobs require highly skilled labour. Research in the United States of America that includes agriculture and food-related industries suggests that green jobs require higher levels of human capital (namely, formal education, experience, job training) than non-green occupations (Consoli *et al.*, 2016). In addition, a stronger environmental focus implies that food and agricultural businesses increase demand for workers specialized with green skills (Vona *et al.*, 2018). Investment in environmentally sustainable technologies is expected to improve the competitiveness of economies, even if compared to scenarios comparing them to non-environmentally sustainable technologies. (Constantini and Mazzanti, 2012; BIS, 2013). A drawback to promoting green policies is that the growth of green industries, including food and agriculture, may be accompanied by a contraction in other industries, posing challenges for unskilled labour not prepared to work in green business occupations (Jänicke, 2012). Nevertheless, green policies do not have to harm overall employment if appropriate education and training programmes are established to prepare workers for labour demand in the future and labour markets function well (OECD, 2017).

Health effects

Green policies and actions that foster biodiversity also support a more diverse diet for poor farmers (Fanzo *et al.*, 2013). Toledo and Burlingame (2006) argue that biodiversity management is a critical component of sustainable agriculture practices and approaches to alleviate malnutrition. Nevertheless, empirical evidence shows that these links are not strong. In a study on poor smallholder farm households in Indonesia, Kenya, Ethiopia, and Malawi, Sibhatu *et al.* (2015) found that agricultural production diversity contributed to better nutrition in some cases, but not all. The authors conclude that emphasizing market access is a more effective tool than promoting production diversity to improve nutrition. Koppmair *et al.* (2017) found that farm production diversity and dietary diversity in rural households in Malawi are positively related, but the effect is small.

Green policies and actions in food value chains also affect human health directly by lowering exposure to pollutants and indirectly by changes in behaviour. The indirect effects are discussed next. Policies to reduce greenhouse emissions in agricultural production, where 10 percent of global greenhouse gas emissions originate, could have positive benefits to human health. Limiting livestock production, and consequently decreasing animal-based products consumption among high consumption people, could decrease the rate of ischemic heart disease (Friel *et al.*, 2009). Reforestation and more access to green space are important for the physical and mental health of people. Better air quality, physical activity, and lower stress are three ways in which green spaces improve human health and wellbeing (Hartig *et al.*, 2014). Public green spaces close to housing and schools decrease stress and may foster resilience in children (Van den Berg, *et al.*, 2010; Wells and Evans, 2003).

Greenhouse gas emissions (GHGs)

Cap and trade policies have been used to create market mechanisms to regulate the amount of

greenhouse gas emissions, but they are in general difficult to implement and regulate. However, once implemented, familiarity with this policy would make it easier to introduce more trading markets, including in food value chains (Tietenberg, 2003). For example, the European Union Emissions Trading System has contributed to reducing greenhouse gas emissions in the region (Borghesi *et al.*, 2016), but it does not cover food and agriculture.

Carbon taxes on food consumption are considered an effective policy intervention to reduce greenhouse gas emissions (Briggs *et al.*, 2013; Edjabou and Smed, 2013; Säll and Gren, 2015; Wirsenius *et al.*, 2011). Wirsenius *et al.* (2011) show that European countries could reduce CO_2-eq if a GHG weighted tax equivalent to EUR 60 per tonne CO_2-eq were imposed on animal food products. Edjabou and Smed (2013) found that imposing CO_2-eq consumption taxes on 23 different foods could reduce emissions by 10.4–19.4 percent. Säll and Gren (2015) extended the work of Wirsenius *et al.* (2011) and found that imposing a tax on all meat and dairy products decreased emissions of GHG, nitrogen, ammonia, and phosphorus from the livestock sector by up to 12 percent. Box 2 examines the impact of a CO_2 tax on food in Spain on diet quality and on greenhouse gas emissions.

Environmental supply chain management has been found to be an effective way to reduce environmental impact, pollution, and waste (Sen, 2009; Soda *et al.*, 2015). Specific actions include green logistics management, including reduction in emissions, waste, and pollution from logistics activities (Lai and Wong, 2012); sustainable transport options, including alternative transport modes, reduction of transport time, use of electric vehicles and of more sustainable refrigerated trucks (Robèrt *et al.*, 2017; Zeimpekis *et al.*, 2018); reduced packaging and use of sustainable packaging made of recycled materials (Zailani *et al.*, 2012); and green purchasing, in which buyers specify green attributes in the products and restrict environmentally hazardous materials (Zailani *et al.*, 2012).

Box 2 Using Pigouvian taxes on food consumption in Spain to reduce CO_2 emissions

Reducing emissions of greenhouse gases (GHG) produced by agricultural value chains can contribute significantly to combat global warming. Agricultural production alone contributes 11 percent of total GHG emissions worldwide (WRI, 2019). Reductions in GHG emissions from agricultural value chains are possible through supply and demand-side interventions (Hedenus et al., 2014). Applying Pigouvian taxes on the consumption of foods with excessive carbon footprint is a promising mechanism to effectively reduce GHG emissions (Burchell and Lightfoot, 2001). Pigouvian taxes are levied on products that produce negative externalities in order to internalize the social cost associated with the production and distribution of those products. Many countries have successfully implemented Pigouvian taxes to decrease consumption of products high saturated fat, sugary carbonated soft drinks, cigarettes, and energy-dense foods (Dogbe and Gil, 2018).

Dogbe and Gil, (2018) examined the potential effects of applying a Pigouvian tax on foods based on their CO2 footprint for the region of Catalonia, Spain. The study employed household food scanner data to estimate demand for food product categories with different levels of carbon footprint. Food products were aggregated into 16 categories and their demand price elasticities were estimated using an Exact Affine Stone Index model (Lewbel and Pendakur, 2009). The study considered a compensated CO2 tax in which taxes are imposed only on meat and dairy products, as animal products have carbon footprints, and the tax revenues are used to subsidize the production of low carbon footprint foods. In the simulation, CO2 taxes that reached the European Union GHG reduction objectives by 2050 were simulated in order to examine impacts on consumption, change in GHG emissions, and welfare effects. The per kilogram taxes to achieve GHG reduction goals are EUR 3.78 for beef, veal and lamb; EUR 1.16 for pork; EUR 1.18 for poultry, eggs and other fresh meats; EUR 0.3 for milk; EUR 1.64 for cheese; EUR 1.08 for processed meat products; and EUR 2.5 for composite dishes.

The study found that prices would decrease by 23 percent, 19 percent and 12 percent for grains, vegetables and fruits, and plant-based fats, respectively. In contrast, price increases are estimated to be 44 percent for beef, 33 percent for poultry and eggs, 22 percent for milk and cheese, 20 percent for plant-based fats, and up to 55 percent for animal and vegetable composite dishes.

The study estimated that CO2 equivalent emissions per person would decrease by 6.4 percent. In addition, the taxes affected dietary composition, specifically decreasing consumption of animal products. Total caloric intake decreased a modest 0.2 percent. Consumption of lipids and proteins decreased by 2.0 percent and 5.6 percent, respectively; while consumption of carbohydrates increased by 4.3 percent, all under the compensated tax scenario. The simulation showed that meeting the European Union GHG reduction targets could be achieved without a significant change in consumer welfare.

The study argues that imposing a compensated Pigouvian tax on food consumption according to product-specific carbon footprint and using those tax revenues to subsidize consumption of low CO2 emission foods can be effective to reach the European Union CO2 emission goals by 2050. The authors conclude that a revenue-neutral tax policy (i.e. a compensated tax mechanism) is a plausible strategy to achieve CO2 emission reduction objectives with minimal effect on consumer welfare while improving diet quality.

Biodiversity

Preservation of biodiversity is closely related to agricultural production activities linking farmers to markets, and this relationship can be either positive or negative (Donald *et al.*, 2001; OECD, 2011). Research suggests that certain agricultural practices foster biodiversity. These practices include land sparing, agroforestry, and reduction of agrochemicals that affect non-target organisms, among others (Fisher *et al.*, 2008; Green *et al.*, 2005). Research suggests that land sparing approaches that seek for high agricultural productivity based on monoculture production systems can enhance market participation while decreasing the need to convert intact habitats into farmland (Green *et al.*, 2005). Recommended policies to foster biodiversity include transfer payments to farmers that protect biodiversity, strengthen rules for land use, limit the use of synthetic fertilizers and pesticides, taxes on agricultural inputs that are damaging to the environment, and subsidize technology adoption.

Protected areas are the most common biodiversity conservation instruments used in developing countries (Miteva *et al.*, 2012). They restricts human access and use of natural resources and therefore restrict the expansion of farmland. Phalan *et al.* (2011) show that land sparing initiatives, combined with interventions to increase agricultural yields are successful in achieving the dual

goal of enhancing farmer market participation and biodiversity conservation simultaneously. Kremen and Merenlender (2018) report that agroforestry, silvopastoral agricultural systems, diversified farming, and ecosystem-based forest management are effective biodiversity-based management techniques that help maintain biodiversity, provide habitat connectivity, and provide resilience to weather events while improving yields and enhancing food security.

Natural Resources

Policies to conserve natural resources include taxes, regulations, fines, trading schemes for natural resources rights, and subsidies. Trading schemes of resource rights have been widely used to limit resource extraction and pollution emission to sustainable levels. This policy instrument aims at correcting negative externalities of overproduction. Individual transferable extraction quotas are commonly used in fisheries around the world, providing incentives for conservation (OECD, 2011). Successful implementation of individual transferable quotas needs to establish clear property rights, effective monitoring, and enforcement (Grafton, 1996). However, one criticism of individual transferable quotas is that they focus on maximizing economic benefits rather than natural conservation (Sumaila, 2010).

Water is a critical resource for agricultural and livestock production. Unpredictable weather patterns and water pollution add to the urgency of pricing water for agricultural production, while competing with household demand. Water use efficiency in agriculture can be enhanced by increasing yields per unit of water used in production, reduce losses to unusable sinks, and relocate water to high priority uses (Howell, 2001), some of which require government intervention and technology improvement. Overuse of water in agricultural production is the result of mispricing, but pricing water rights is complicated (Johansson *et al.*, 2002). In certain instances, however, Payments for Ecosystem Services (PES) for water can work without the need for public policies. Box 3 below examines the case of a PES market mechanism that has been successful in reducing the levels of contaminants in an aquifer in North-Eastern France.

Box 3 Payment for ecosystem services (PES) by Vittel in North Eastern France

Vittel, which is owned by Nestlé Waters, developed and implemented Payment for Ecosystem Services (PES) to reduce the levels of contaminants in an aquifer in North Eastern France. This aquifer is the source of the mineral water 'Vittel' marketed by Nestle, one of the company's top-selling bottled waters. The quality of the source water must meet certain standards to be labelled 'Vittel'. These standards are regulated by the French legislation. For instance, to be labelled 'Vittel', the water cannot contain more than 4.5 mg of nitrates per litre and must not contain pesticide residues. If the mineral concentration changes, the product cannot be called 'natural mineral water'. French regulations regarding the production of mineral water are quite strict. No treatment is permitted for 'natural mineral water', except for procedures to eliminate unstable elements such as iron and manganese. Water stability must be achieved naturally. Because of these regulations, Vittel water quality is constantly being monitored (Perrot-Maitre, 2006).

Agricultural intensification upstream posed a risk of source contamination to Vittel water. This agricultural intensification started in the 1980s, when traditional hay-based cattle ranching operations were being replaced by corn-based operations. Intensive fertilizer used in the corn-based production system created leaching of fertilizers into the aquifer, raising the levels of nitrates and jeopardizing Vittel's water business.

Since no water treatment was allowed by the legislation, the best solution to eliminate increasing levels of nitrate in the water was to incentivize farmers upstream to change their production practices. In 1989, Vittel and the French National Agronomic Institute launched a research programme to understand the relationship between agricultural activity and nitrate pollution; to identify actions to lower the nitrate content to desirable levels; and to identify incentives for farmers to change their production practices. The incentives were developed in collaboration and consultation with the farmers operating upstream. These incentives included long term contracts (up to 30 years); abolition of debt linked to land acquisition; a subsidy of about EUR 200 per hectare, per year over five years to guarantee income during the transition period; up to EUR150 000 per farm to cover the cost of new equipment and building modernization; free labour to apply compost in the fields; and free technical assistance including introduction to new social and professional networks. It was decided that PESs were not conditional on the nitrate levels since it was too difficult to assess the nitrates contribution of each farm. Payments were contingent on new farm investments and the costs to switch production systems.

The PES programme was successful in decreasing nitrate levels in the aquifer. All 26 farms in the area adopted the new farming production system, changing 1 700 hectares of corn into grasslands and 92 percent of the sub-basin being protected (Wunder and Wertz-Kanounnikoff, 2009). This success was the result of many studies and complex negotiations. Based on this experience, more private companies (such as Du Pont, Nestlé South Africa, Unilever) are looking into PES to improve river basin management activities (Perrot-Maitre, 2004).

This case exemplifies the incentives and scientific knowledge that are very important for the successful implementation of PES programmes. A business case for the implementation of a PES programme can be achieved if the value of the ecological service provided (in this case, ensuring clean water) is sufficiently higher than the costs of providing the ecosystem service (Wunder and Wertz-Kanounnikoff, 2009). It is important to note that the French National Agronomic Institute, a governmental agency, played a key role in the success of this initiative. In addition, achieving this level of coordination between private and public institutions has proven difficult to orchestrate, highlighting the challenges in aligning incentives for the private provision on ecosystem services. and performance in Northern Ghana. African Journal of Agricultural and Resource Economics, 14(4), pp.292-309; Technoserve. 2010. TechnoServe to Boost Farmer Incomes Through Development of Soy Industry in Southern Africa. TechnoServe, 26 August 2010. http://www.technoserve.org/press-room/detail/technoserve-to-boost-farmer-incomes-through-development-of-soy-industry-in. [Accessed June 2018]

Developing water trading rights is difficult and controversial in many regions. A case-by-case policy must be assessed (Grafton *et al.*, 2011). Factors to consider when implementing a resource trading market include heterogeneity of resource users. For instance, when water users in an area demand the water at the same time and for the same crops, no trade may occur (Nieuwoudt and Armitage, 2004). The success of trade in water use rights depends on user diversification among other factors. Successful water markets are rare. Among developing countries, only Chile has implemented a successful water market that is positively associated with the growth of agricultural exports of this country to global markets (Hadjigeorgalis, 2009; Tietenberg, 2003).

Effective use of resource conservation practices in agriculture depends on effective technology transfer. Arslan *et al.* (2014) found that extension services and rainfall variability (that is, increased production risk), are the strongest determinants of adopting minimum soil disturbance techniques and crop rotations. Payments for conservation agricultural practices, like no-tillage and crop rotations, can increase adoption rates of these practices (Wu *et al.*, 2004).

Disincentives on detrimental activities to natural resources, such as fines, regulations, and taxes, are easily implemented, making them the most applied policy instrument in conservation (Börner and Vosti, 2013). Subsidies and transfer payments for adopting conservation practices are also used in many countries. Disincentives have been successful in reducing deforestation in parts of the Brazilian Amazon (Borner and Vosti, 2013). The benefits of incentives to promote conservation depend on the local context and the specific policy design (Lambin *et al.*, 2014).

CHAPTER 7

Food value chains (FVCs) and nutritional outcomes

7 Food value chains (FVCs) and nutritional outcomes

The increase of global per capita food consumption since the green revolution has been a remarkable achievement. Increased agricultural productivity and rapid economic growth are the primary factors causing the average person today to consume about 25 percent more calories than five decades ago (FAO, 2019). However, undernourishment is still an important problem in both developed and developing countries, affecting over 821 million people worldwide in 2017 (FAO, 2017b). Meanwhile, two other forms of malnutrition, namely, micronutrient deficiencies and overnutrition, pose serious public health concerns. Micronutrient deficiency still affects about 2 billion people (FAO, 2013) and may result in chronic conditions such as cardiovascular disease and cognitive impairment (Tulchinsky, 2010; Gómez and Ricketts, 2013). Overnutrition (which leads to overweight and obesity) has become a public health problem in many low- and high-income countries. In this section we focus primarily on food value chain interventions aimed at alleviating micronutrient deficiencies and overnutrition, focusing on consumers.

Overnutrition

Globally, the proportion of people that are overweight and obese (BMI>25 and >30, respectively) increased from 21.5 percent in 1975 to 38.9 percent in 2016 (WHO 2018b). Health problems linked to overweight and obesity include cardiovascular diseases, diabetes, hypertension, osteoarthritis, and some cancers, often leading to premature death (Wilson *et al.*, 2002; WHO, 2018b; Stuckler and Nestle, 2012; Mendonça *et al.*, 2016; Fiolet *et al.*, 2018). In addition, consumption of processed foods during childhood can create dietary habits that persist through adulthood, which could worsen overnutrition-related problems in the future (Nicklaus and Remy, 2013). Overnutrition, therefore, has been characterized as an epidemic in both developed and developing countries (Popkin, 2015).

Traditionally, overnutrition has been an issue in developed countries. However, as developing countries increase living standards and become more urbanized, diets tend to include more processed foods rich in fats and sugars. Widespread availability of processed foods has been associated with the global spread of modern supermarkets (Gómez and Ricketts, 2013). Processed foods offer certain advantages including longer shelf life, inexpensive distribution costs, low retail price, improved palatability and taste and increased convenience (Stuckler and Nestle, 2012; Moodie *et al.*, 2013; Gómez and Ricketts, 2013).

Processed foods include products with a large variation in ingredients, making it difficult to classify them as 'healthy' or 'unhealthy'. Therefore, they have been further categorized by their degree of processing. For example, the popular NOVA classification includes four categories (Moubarac, 2014 FAO, 2015; Monteiro *et al.*, 2016): minimally processed (such as squeezed fruits); processed culinary ingredients (such as plants oils, animal fats); processed foods (such as canned or bottled vegetable preserves, bacon); and ultra-processed foods (ULP) (such as energy-dense foods with high levels of free sugars, salt, and fat).

Food value chain interventions addressing overnutrition focus primarily on curbing ultra-processed foods, as their proportion of the total energy intake is generally used as an indicator of dietary quality (Marrón-Ponce, *et al.*, 2019). There is solid evidence that these foods have gradually displaced unprocessed and minimally processed foods globally (Monteiro *et al.*, 2018; Solberg *et al.*, 2015; Juul *et al.*, 2018; DeVogli *et al.*, 2014; Stuckler *et al.*, 2012; Juul and Hemmingsson, 2015). Global sales of ultra-processed foods increased by 43 percent from 2000 to 2013. Sales of ultra-

processed foods in developing countries are still lower than in their developed counterparts but are growing faster, with increases in Asia and the Pacific (115 percent), the Middle East and Africa (71 percent), and Latin America (48 percent) from 2000 to 2013 (Moubarac, 2015).

Several intervention priorities have been identified to reverse the obesity epidemic and non-communicable diseases associated to the consumption of ultra-processed foods (Royo-Bordonada *et al.*, 2019; Just, 2017), including 1) curbing supply of ultra-processed food and beverages via taxation; 2) regulation of food advertising, particularly aimed at children; 3) promoting consumption of unprocessed foods such as fruit and vegetables; 4) a better interpretative front label in processed and ultra-processed foods; 5) 'nudging' (positive reinforcement and indirect suggestions as ways to influence the behaviour and decision making of consumers); and 6) incentivizing the reformulation of processed foods.

Most research on such interventions focuses on taxes on ultra-processed foods. There is evidence that taxes on sugar-sweetened beverages (SSB) have been successful in decreasing SSB consumption in various countries. A meta-analysis focusing on the United States of America, Mexico, France, and Brazil found that higher prices of SSB caused by taxes are associated with lower demand for SSB (Escobar *et al.*, 2013). Moreover, the study finds that consumers substitute SSB with healthier beverage alternatives such as milk and fruit juice (see Box 4 for a detailed description of the Mexican case). This literature shows that taxes on ultra-processed foods can be effective in alleviating overweight and obesity (Marten *et al.*, 2018; Mytton *et al.*, 2014; Powell and Chaloupka, 2009). Dharmasena and Capps (2012) estimated that a 20 percent tax on SSB would correspond to an average body weight reduction between 1.54 and 2.55 lbs. per year. Taxes on SSB and other energy-dense foods have faced opposition from the industry (Du *et al.*, 2018). Some critics state that the tax burden has a disproportionate impact on the poor, affect the industry and job creation (Stafford, 2012), while others mention that obesity is a multidimensional problem and that markets will correct the externalities (Koplan and Brownell, 2010).

While taxation appears to be effective in addressing overnutrition, evidence of the effects of education and advertising to promote consumption of healthier foods is mixed. For instance, Block *et al.* (2010) found that education interventions had no effect in decreasing sales of SSB, whereas increasing SSB price by 1 percent led to a decrease in consumption by 0.74 percent. Generic advertising interventions to increase consumption of fruit and vegetables have been implemented in many countries (for example, 5 A Day campaign in the United Kingdom of Great Britain and Northern Ireland, Go for 2&5® campaign in Australia, 5–10 A Day campaign in Canada, and Fruit and Veggies—More Matters in the United States of America) but their effects on nutrition are unclear (McLaughlin *et al.*, 2014).

Nudging has been used to influence consumers to adopting healthier food choices (Just, 2017). Following the status quo bias – where the default option is likely to be chosen – the provision of a healthy food choice as a default can increase its consumption. For instance, when low-fat milk is given as the default option children are more likely to choose it (CSPI, 2011). Private establishments have followed this idea and have offered healthy choices as the default option in their children's meals, for instance, low-fat milk and fruit instead of juices and fried potatoes as side dishes (CSPI, 2011; Wootan, 2012).

Restaurant menus can be used as a nudging tool to make consumers choose healthier foods by showing caloric content and ingredient values (such as fat, sugar, and salt content) (Lehner *et al.*, 2016); however, displaying this information in a menu may be impractical (Filimonau and Krivcova, 2017). Crino *et al.* (2015) suggest that interventions that limit the energy content and

portion size of processed foods are effective in reducing overweight and obesity.

Food labels provide important nutritional information to influence consumer choices. Despite food labels being a cost-effective and trusted method of conveying nutrition information to consumers (Campos *et al.*, 2011), food labels are often underutilized (Miller and Cassady, 2015). Nutrition label use is associated with nutrition knowledge (Miller and Cassady, 2015; Campos *et al.*, 2011), and nutrition knowledge has been associated with a healthier diet and lower likelihood of being obese (Bonaccio *et al.*, 2013). However, the impact of food label information on consumer behaviour remains controversial (Volkova and Mhurchu, 2015). In general, consumers prefer health claims when making purchasing decisions because they are short and succinct. Consumers may believe that health claims are approved by the government and are reliable (Williams, 2005). The use of health claims has been shown to improve the quality of dietary choices (Williams, 2005); however, health claims can be misleading and confusing (Hasler, 2008) and may have little impact on consumers' evaluation (Garretson and Burton, 2000).

Box 4 Sugar-sweetened beverages tax intervention in Mexico

Obesity in Mexico has been a serious public health problem across all age groups for many years. In 2006, the prevalence of overweight and obesity in Mexico among children aged 12 or less was 32.5 percent, while that of adolescents was 33 percent (Olaiz et al., 2006; Abúndez et al., 2006). The prevalence of overweight and obese adults is about 70 percent while the prevalence of obese only adults is about 35 percent (Colchero et al., 2016, Gutierrez et al., 2012).

Health problems associated with childhood obesity include hypertension and hyperlipidaemia. Overweight and obese children are more likely to become overweight and obese adults, resulting in the development of cardiovascular diseases and diabetes at a younger age (Sahoo et al., 2015). Mexico has the highest prevalence of hospitalizations due to diabetes among all OECD countries (OECD, 2015), and diabetes is the third leading cause of death in Mexico (IHME, 2017). Overnutrition and the associated diseases are a cause of public health concerns as a result.

The prevalence of overweight and obesity in Mexico has been attributed to high consumption of sugar-sweetened beverages (Barquera et al., 2008). Mexico has exhibited one of the highest per capita consumption rates of sugar-sweetened beverages in the world for many years. Sugar intake accounts for 12.5 percent of total daily dietary energy intake (Sánchez-Pimienta et al., 2016). This is high compared to the World Health Organization's (WHO) recommendation of less than 10 percent (WHO, 2015). Furthermore, about 70 percent of sugar intake of Mexicans comes from sugar-sweetened beverages (Aburto et al., 2016). Reducing the amount of sugar-sweetened beverage consumption became a natural starting point for policies to reduce overweight and obesity in the country.

In response, in 2013 the Mexican government approved an excise tax on sugar-sweetened beverages and a sales tax on certain energy-dense foods with the goal of reducing the prevalence of overweight and obesity in the country. The excise tax on sugar-sweetened beverages came into effect January 1, 2014 with intense opposition from the Mexican food and beverage manufacturers. This tax consisted of 1 Mexican peso per litre of sugar-sweetened beverage, which corresponds to approximately a 10 percent tax (Colchero et al., 2016). The policy stipulated that the excise tax was going to be adjusted annually based on the inflation index.

Colchero et al. (2016) carried out a detailed assessment of this policy intervention, intended to alleviate overnutrition and its adverse health consequences. The study found that although this tax was placed on beverage manufacturers, the tax burden was almost entirely passed on to consumers. The study estimated that the excise tax on sugar-sweetened beverages in Mexico resulted in a reduction in sugar-sweetened beverage consumption by 6 percent in the months after the tax was effective. In December 2014, after one year of implementation, the drop in consumption was estimated at 12 percent. Poor households had the largest decrease in consumption of sugar-sweetened beverages by 17.4 percent. At the same time, the study found that consumption of non-sweetened beverages increased by 4 percent in that year.

After the successful Mexican experience taxing sugar-sweetened beverages to reduce consumption, other countries facing challenges to curb overweight and obesity trends have implemented similar policies. For instance, in 2017 six cities in the United States of America implemented taxation schemes on sugar-sweetened beverages. Countries such as Saudi Arabia and the United

Arab Emirates implemented the highest taxes on sugar-sweetened beverages to date.

Environmental effects of processed foods

There is no doubt that food processing has positive economic impacts in terms of value addition and employment generation, among others. Nevertheless, processed foods also generate pollution and waste during the production process, transportation, and post-consumption, particularly of plastics (Cuéllar and Webber, 2010). While plastics prolong shelf life of food products and thus reduce waste, a study on anthropogenic debris in Brazil estimated that 90 percent of all plastic materials found were from food-related products (Andrades *et al.*, 2016). A similar study found that packaging materials, especially for food, comprised about 55 percent of total marine debris found on Sri Lankan beaches. Microplastics have been found in Antarctic waters and most likely originated from other regions (Waller *et al.*, 2017). Plastic pollution in developing countries is expected to grow as the consumption of ultra-processed foods continues to increase. Single-use plastic bags are often considered a collateral product of food purchases and constitute a major plastic pollutant globally even though policies to reduce single-use plastic bag use have been implemented in many countries (Xanthos and Walker, 2017). To our knowledge, except for policies to curb single-use items, no other interventions have been considered to reduce plastic pollution related to processed foods.

Micronutrient malnutrition

Micronutrient malnutrition refers to deficiencies in vitamins and minerals critical to good health and is the outcome of a combination of poor dietary composition and disease. There are many essential micronutrients but only Vitamin A, iron, and iodine deficiencies are routinely monitored globally. Vitamin A deficiency (VAD) impairs proper growth and increases vulnerability to infections (Holick and Chen, 2008). VAD affected over 135 million children under five in 2007, a prevalence of about 31 percent (UNSCN, 2010). Vitamin A deficiency affected nearly one-third of children aged 6 to 59 months in 2013, particularly sub-Saharan Africa (48 percent) and South Asia (44 percent) (WHO, 2018a). Half of the world's anaemia cases, which affects about a third of the population, are caused by iron deficiency (Lopez *et al.*, 2016). It is a major and global public health problem that affects maternal and child mortality, physical performance, and referral to health-care professionals.

Given the high incidence levels of micronutrient deficiencies, policymakers and development institutions have devised a variety of interventions at different segments of the supply chains. Interventions to correct micronutrient deficiencies often include providing supplements to target groups and educating on their use; fortifying commercial foods during production/distribution activities; promoting dietary diversification; and investing in the development of biofortified foods.

Commercial micronutrient fortification of foods is perhaps the most effective intervention to alleviate micronutrient deficiencies. Such intervention has been successfully implemented by regulators for more than a hundred years (Tulchinsky, 2010; Park *et al.*, 2000; Scrimshaw, 2007). Iodine fortification of table salt, although suggested 1917, was first introduced in Switzerland in 1923 as a means to prevent goitre and cretinism. This fortification became a critical public health measure by the WHO afterwards (Andersson *et al.*, 2007). It has been shown that commercial food fortification with iron, iodine, and zinc provides significant economic benefits at low costs particularly when there is a convenient food vehicle and where processing is more centralized (Horton, 2006). Box 5 describes the case of salt fortification with iodine to address iodine deficiencies. Even though food fortification is effective in delivering micronutrients, it remains a political issue as dietary intake recommendations are continuously being re-evaluated, affecting quantity of micronutrient requirements. Factors that affect food fortification include potentially

higher processing costs, limiting consumer's choice, and the risks of micronutrient overdose. These factors have been mentioned as reasons for the delay in fortifying flour with folic acid in the European Union (Tulchinsky, 2010).

Another popular strategy to alleviate micronutrient deficiencies when commercial fortification of foods is not an option, is to provide supplements to target populations at their homes, these are often subsidized by the government (de Pee *et al.*, 2013; Schauer and Zlotkin 2003). For instance, the powder 'Sprinkles' is popular in several African countries. It is distributed for free by the government and can be sprinkled and mixed with meals (Gupta, 2018; Zlotkin *et al.*, 2003; Lung'aho and Glahn, 2009). However, critics of these programmes argue that they may not be well accepted. For instance, in a group of women of childbearing age, less than a third took folic acid supplements when provided to them. Moreover, people often neglected to add the fortified powder to their meals, potentially due to the lack of awareness about the importance of micronutrients (Suchdev *et al.*, 2013). Mora (2002) demonstrates that supplements that do not alter the organoleptic characteristics of meals have a higher probability of being used by households.

Home fortification initiatives often include educational programmes to underscore the importance of micronutrients in diets. Research suggests that consumer education programmes (primarily through maternal educational programmes through the public health service system) have modest success in alleviating micronutrient deficiencies, but there is consensus that such educational programmes should continue (Tulchinsky, 2010; Mora, 2002). However, such programmes can become costly when the target population is spread in distant locations, when the population is large, and when there are variations in the language and culture of the target population (Mora, 2002). More research should be conducted to devise effective ways to deliver such educational programmes, perhaps through the use of information technology.

Biofortification is an effective method to deliver deficit micronutrients to a large population in a sustainable way, especially in developing countries where commercial food fortification may not be feasible (Miller and Welch, 2013). Biofortification programmes are being conducted globally through interdisciplinary collaborations to fortify important staples crops consumed around the world, specifically with provitamin A, iron and zinc (Miller and Welch, 2013). Miller and Welch (2013) noted three principles for the success of biofortification programmes: biofortified crops must be profitable to farmers to adopt; consumption of biofortified foods must improve nutritional health of the target consumers; and, farmers must adopt the biofortified crops and most consumers must accept and consume the biofortified crops in sufficient quantities to improve their nutritional health. Some examples of biofortification programmes include Golden Rice, iron-enriched rice, and orange flesh sweet potato (OFSP). It is estimated that Golden Rice consumption could prevent 40 000 children's deaths in India per year (Qaim, 2010). Consumption of OFSP has been shown to be effective at alleviating vitamin A deficiency among target populations in Uganda (Hotz *et al.*, 2012). Iron biofortified rice was also successful in improving iron levels among women in the Philippines (Beard *et al.*, 2007). The adoption of biofortified crops is slow and subject to opposition. The primary impediments to their adoption are property rights, public acceptance, and government regulations including safety issues. These obstacles make biofortified crops expensive and time-consuming to develop and release to the public (Miller and Welch, 2013).

Box 5 Interventions to reduce iodine deficiencies

One of the most successful micronutrient interventions globally has been the fortification of iodine in table salt to prevent and reduce goitre prevalence. Iodine deficiency often results in severe health problems related to neurocognitive impairment, goitre, short stature, deaf-mutism, and hypothyroidism resulting in cretinism (Leung et al., 2012). Iodine deficiency in the uterus and soon after birth can even create brain damage (Politi, 2010) and has been estimated to lower average IQ by 13.5 points (Bleichrodt and Born, 1994). According to the World Health Organization (WHO), iodine deficiency is the most prevalent cause of brain damage in the world (WHO, 2019).

The association between iodine deficiency and goitre was first observed in 1813. Soon afterwards, in the 1820s Jean Baptiste Boussingault observed that goitre was more prevalent in areas where the salt consumed was low in iodine, recommending that salt, rich in iodine be used instead of purified salt. The ideas of Boussingault were first applied in Switzerland in 1922 when the country introduced iodized salt. At that time, almost 100 percent of schoolchildren in Switzerland had goitre. In 1930, eight years after the introduction of iodized salt, no more endemic cretins were born and no children were diagnosed with goitre (Bürgi et al., 1990).

The first trial in the United States of America to administer supplemental iodine to schoolchildren with goitre was conducted in 1916 by David Marine, and the prevalence of goitre in the sample was 56 percent (Marine and Kimball, 1917). Iodine fortification in salt in Michigan began in 1924 as a voluntary action to reduce the incidence of goitre (Dwyer et al., 2015). The intervention helped reduce goitre incidence from 33 percent to 2.6 percent across an area known as the 'goitre belt' from 1924 to 1935. This is a region spreading from the northwest of the United States of America, to Western New York State, including the Great Lakes, where the soil and water are iodine deficient, and consequently the food produced there is also iodine deficient.

The World Health Organization (WHO) was at the front of a global campaign in the1980s to eliminate iodine deficiency disorders through promoting the use of iodized salt. Iodized salt is very cheap to produce and to distribute since virtually everyone consumes table salt. The cost to iodize salt is about USD 0.05 per person, per year. The WHO and other international institutions have promoted the establishment of national salt iodization programmes around the world and currently about 66 percent of all households worldwide have access to iodized salt (WHO, 2019).

Despite the WHO efforts to promote the production of iodized salt, 54 countries are still iodine deficient at various levels (WHO, 2019). For example, it is estimated that total goitre prevalence in the world is about 15 percent, ranging from 4.7 percent in the United States of America to 28.3 percent in Africa (Andersson et al., 2004). Globally, the number of people still affected by goitre is estimated at 187 million (Vos et al., 2012). Although iodine fortification of salt has been proven an effective, low-cost strategy to alleviate this type of micronutrient deficiencies, there are still many people who have not benefited yet from this food-value chain intervention.n after harvest, they can sell the rest of their harvest either to the Big Ajar Enterprise or in other markets.

CHAPTER 8

Conclusions and key lessons

8 Conclusions and key lessons

There is increased interest among policymakers and multilateral development organizations in promoting sustainable economic growth of the food sector that encompass non-economic social, environmental benefits for all. In this context, it is critical to examine how food and agricultural markets as well as policies and institutions, can shape markets to better contribute towards the realization of non-economic outcomes of the 2030 Agenda and the United Nations Sustainable Development Goals. To systematically examine these issues, this technical note reviewed the current evidence on non-economic consequences associated with how domestic and global food value chains function today. The note also highlighted selected cases of successful private and public strategies shaping food markets that foster non-economic benefits, including social and environmental outcomes.

The conclusion section underscores key lessons from the literature review and the case studies conducted. The key lessons are intended to highlight the policy implications of how markets can generate balanced economic objectives to achieve positive social and environmental outcomes. They also propose promising areas for future research to increase our understanding of the linkages between market forces shaping food value chains and non-economic outcomes. Selected key lessons from the literature review and from the cases studies can be summarized as follows:

Overall, this analysis suggests that a narrow focus on economic outcomes yields incomplete assessments of appropriate evaluation of food value chain performance. All topics and case studies considered in this study indicate that economic outcomes are intertwined with environmental and social outcomes. Moreover, these links are complex, and it is difficult to assess all the complementarities on trade offs among multidimensional outcomes. For example, evidence suggests smallholder agricultural commercialization increases farm incomes. However, the impacts on environmental and nutritional outcomes are more ambiguous. Moreover, agricultural commercialization may cause increased pressure on land, further marginalizing the poorest farmers. Initiatives to integrate farmers into markets should anticipate possible non-economic outcomes, both positive and negative, to devise strategies aimed at minimizing negative consequences and fostering the positive ones.

A large body of literature suggests that contract farming increases smallholder farmers' incomes. Yet a common finding is also that participation typically requires certain investments and skills, thus leading to the exclusion of marginalized individuals and groups, such as women farmers. In certain cases, pro-poor, gender-sensitive targeting and support might help reduce barriers to participation. Social and environmental effects of contract farming are much less well-studied and thus remain poorly understood. Available studies vary greatly in terms of their methodological approaches and rigor. The main challenge facing quantitative impact studies is to identify causal effects, which is inherently difficult using observational cross-sectional data. More research with greater internal and external validity is needed.

Private actions and interventions in which economic incentives align with non-economic outcomes can foster creative business models that benefit food value chain participants and the environment. For example, the Relationship Coffee

Model (RCM) of Colombian coffee farmers appears to generate positive economic, social and environmental outcomes. This is because of increased demand for high-quality specialty coffees, which requires the utilization of sustainable production and business practices. Likewise, the Vittel water case suggests that payments for ecosystem services can work in the case of common resources (such as clean water) critical to sustain a value chain. A shared characteristic of these two cases is the recognition of non-economic outcomes associated with food value chains. Therefore, research supporting a better understanding of non-economic outcomes of food production and distribution activities can help identify opportunities to leverage synergies between economic and non-economic outcomes in other contexts.

Private food standards can serve as a tool to address environmental and social problems where governmental regulations are weak or poorly enforced. Yet studies looking at the effects of standards on issues such as child education, household nutrition, or environmentally friendly farming also show that effects can vary greatly across different standards and contexts. Results are also difficult to generalize given prevalent study designs, which mainly rely on case studies from specific locations. More research is needed to better understand the conditions under which producers and the environmental benefit from the adoption of standards. While standards have substantially gained in importance in some sectors such as coffee, cocoa, tea, palm oil, and some fruits and vegetables, they remain less important for the vast share of agricultural produce and agri-food trade.

The overweight and obesity epidemic can be considered a market failure that warrants public policy intervention. Although the literature has proposed a variety of interventions to reduce overnutrition (for example, promoting healthy eating, restricting advertising, nudging, food labels, ingredient reformulation, etc.), taxes on energy-dense foods rich in fats and sugars appears to be the most effective intervention to reduce the consumption of these foods. Meanwhile, market forces work so that consumption of unhealthy foods is substituted with healthier foods. The case of a sugar tax policy intervention in Mexico appears to be successful, and many countries are following its example and are implementing taxes on foods rich in fats and sugars. Yet, rigorous longitudinal studies must be conducted to evaluate the impact of such policies in reducing the incidence of overweight and obesity.

Food value chain interventions to improve non-economic outcomes generally focus on farm level strategies or on modifying consumer behaviour. In contrast, interventions in postharvest activities have received less attention. However, curbing CO2 emissions in fresh produce supply chains via improved refrigeration technology and transport mode, together with improvements in supply chain management strategies, can improve environmental impacts with little impact on supply chains costs. Public policies may play a key role here, by providing appropriate labour force (re-) training so that workers in postharvest activities can gain the skills necessary to benefit from better-paid jobs.

Public policy appears to be the most effective strategy to alleviate micronutrient deficiencies via mandated micronutrient fortification of commercial foods. The iodine fortification case suggests that key elements of a successful fortification programme include 1) low fortification costs; and 2) wide availability of the fortified commodity which is common and affordable in diets. Efforts of the Global Alliance for Improved

Nutrition (GAIN) in putting micronutrients into basic food (flour, salt, oil, soy sauce, etc.) in multiple developing countries follow these principles and are effective in curbing micronutrient deficiencies.

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