

Colliding paradigms and trade-offs: Agri-food systems and value chain interventions

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ABSTRACT

Managing trade-offs for 'do no harm' outcomes is central to achieving the Sustainable Development Goals (SDGs) and requires an understanding of impact processes within agri-food systems. However, agricultural programming continues to rely on single point interventions framed by earlier development paradigms at odds with the systemic change goals of the SDGs. The implications of these colliding paradigms are explored using an agri-food systems lens to highlight trade-offs in interventions for pro-poor value chains, nutrition-sensitive value chains and greening of value chains. Analysis reveals problematic assumptions and limited supporting evidence and points to conflicting logics and targets that require societal negotiations about goals and priorities. Steps are outlined to embed a 'do no harm' principle in intervention design and evaluation.

1. Introduction

Food production and consumption remain central to the global development agenda of poverty reduction, inclusive growth, and environmental sustainability (see e.g. Barrett, 2020; IPES-Food, 2020; FAO, 2019; United Nations, 2019). Tackling food-related issues is not a matter of a simple technological fix but requires fundamental changes in the way food production and consumption systems are orientated towards more equitable and sustainable outcomes (Maynard et al., 2027; Hall and Dijkman, 2019). However, tackling development challenges through the reorientation of food systems situates interventions in a complex social arena. It is an arena where trade-offs abound, and where choices about these trade-offs and resulting winners and losers are framed by value-based judgment calls and the political economy that shapes these (German et al., 2020; Zagonari, 2020). The framing of the United Nations Sustainable Development Goals (SDGs), and 'leave no one behind' and 'do no harm' sentiments of these, is a direct response to the recognition of this complexity of development challenges and the unbalanced outcomes of earlier development paradigms where these trade-offs were largely overlooked.

Yet, while the systemic framing of the SDGs paradigm explicitly demands that development policy better accounts for and manages trade-offs and synergies (Nilsson et al., 2016; Blanchard et al., 2017), the

mainstay of agriculture and food security programming continues to rely on single point interventions framed by earlier development paradigms, most notably value chain (VC) development, improved production technologies, and biofortified crops and foods. These interventions are rarely adequately embedded in the wider systemic context where trade-offs play out, generally offering linear solutions to complex development issues (Benton and Bailey, 2019). As a result, and despite good intentions, these types of interventions risk unexpected and perverse outcomes that may yet derail the 'do no harm' principle underlying the ambitions of the SDGs. Without being explicit about the inherent trade-offs in the food-money-environment complex, it will be difficult to identify ways of leveraging improved food security performance of the agri-food system (ibid.).

In this paper, we explore and illustrate these colliding paradigms of *systemic change goals* and fragmented *linear solution delivery*. Whilst our argument focuses mainly on sub-Saharan Africa where negative food system outcomes play out most significantly, leading to 250 million severely food insecure people (FAO et al., 2019) and lower farmer returns (Rapsomanikis, 2015) at the same time, we did not restrict this review to specific locations. To do this, we explore contradictions that arise from the co-existence of two increasingly prominent but disconnected agricultural research for development traditions that are emblematic of these two different development paradigms: VC

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approaches and agri-food system perspectives.

VC approaches are based on the assumption that the market economy can be managed for societal benefits, and that by changing VC structures and governance benefits can be redistribute across and between its actors (Kaplinky and Morris, 2001). The underlying objectives of VC interventions (VCIs) depend on prioritized goals of the implementer and the chain in focus. What is observed in practice is a plethora of parallel VCIs along the food to consumption continuum using different entry points and pursuing different and often conflicting objectives. For example, increasing farm incomes can make food commodities costlier for low income consumers, leading to the 'export' of more nutritious foods from the farming household to high income consumers (e.g. Ofstehage, 2012; Hall, 2016), or give primacy to sustainability at the expense of food availability and income considerations (e.g. Zagonari, 2020).

In contrast, an agri-food systems perspective seeks to guide the achievement of desirable outcomes explicitly by focusing on the emergent properties and functionality of deeply interconnected and complex food production and consumption systems where performance is understood in aggregate terms and at the system level (IPES-Food, 2015). Horton et al. (2017) have used this perspective to suggest an integrated agri-food system research agenda. The perspective has been embraced by the CGIAR and others (IPES-Food, 2015; CGIAR, 2015). However, in practice, there seems to be little engagement with the underpinning systemic change logics of the perspective, and the way it could be used to revisit and adapt intervention modalities such as VCIs and better align these to the societal level challenges of the SDGs. The Independent Science for Development Council (ISDC, 2020) of the CGIAR recently pointed towards the need to make trade-off and foresight analysis an integral part of an effective agenda towards reaching food, income and environmental goals.

The purpose of this paper is to address this gap and suggest some critical steps that are needed to help VCIs engage more explicitly with the trade-offs that are inevitably encountered when agri-food system scale outcomes are pursued. The paper does this by (i) using an agri-food systems lens to explore the trade-offs within the food-money-environment complex associated with three main types of VCIs: pro-poor value chains; nutrition-sensitive value chains; and greening of value chains, and (ii), by reviewing evidence of VC outcomes to stress test critical impact logic assumptions.

The analysis reveals numerous problematic impact logic assumptions that lead to trade-offs within the agri-food system, such as the assumed compartmentalization of the markets the poor rely on for food from the markets the poor rely on for income. Of equal worry is that the published studies reviewed in this paper suggest that there is limited and ambiguous evidence of the impact effectiveness of VCIs, suggesting that many key VC assumptions remain untested and unchallenged. A central theme in the suggested ways forward is a closer connection between research and policy actors to systematically generate evidence, assess options to redesign agri-food systems, and empower new business models. For this an evidence base that makes trade-offs explicit is required if a 'do no harm' principle is to be embedded in intervention design and implementation. This is also critical in driving a more transparent development paradigm where choices about trade-offs and thereby winners and losers are discussed openly and honestly.

2. Beyond the production domain: The rise of agri-food systems perspectives

There is growing recognition that many food-related phenomena such as food security, over- and undernutrition or rural poverty are not governed by simple, linear cause-effect relationships. For example, recent analyses have started to question the ability of agricultural investments alone to tackle nutrition and points to the multitude of drivers and factors that condition nutrition and health outcomes (Gillespie et al., 2018; Bhavani and Rampal, 2018). There are numerous cases

where well-meaning food policy initiatives such as ensuring low food prices for urban consumers caused perverse outcomes where farmers adopt environmentally damaging practices like high chemical input use or expansion into forest lands (Qureshi et al., 2015; Horton, 2017). Benton and Bailly (2019) argue that a narrow food security policy focus on productivity gains reduces the efficiency of the overall food system through the externalization of environmental costs and are thus not a suitable entry point. Meynard et al. (2017) similarly point out that sustainability cannot be tackled by dealing with farming systems or food consumption issues in isolation, but rather needs to be addressed in a coupled, systemic way that recognizes the dynamics of the interlocking elements.

A recurrent feature of these debates is the recognition that the most pressing global food and agriculture development concerns are highly interlinked challenges that need to be understood within the framing of the agri-food system in order to effect change (FAO, 2017; Horton et al., 2017; Caron et al., 2018; Glover and Poole, 2019; Hall and Dijkman, 2019). This growing recognition is also reflected in the increasing adoption of this terminology in the agriculture research for development arena, including the international agricultural research centers of the CGIAR (see e.g. ISDC, 2020, <https://www.cgiar.org/research/research-portfolio/>).

For the purpose of this paper, an agri-food system is defined as an interconnected web of activities, resources, and people that extends across all domains involved in providing nourishment and sustaining health. These systems are complex with multiple feedback mechanisms operating simultaneously at multiple levels of scale (from global to local) and time (particularly with respect to the timing of outcomes). The organization of agri-food systems reflects and responds to social, cultural, political, economic, health and environmental conditions where outcomes are influenced by a complex set of institutional and regulatory frameworks (IPES-Food, 2015; Grubinger et al., 2010). See Fig. 1 for a schematic representation. These same interlocking issues create significant path dependencies in the outcomes that agri-food systems currently deliver (Dury et al., 2019). Powerful, incumbent market players are usually reluctant to pioneer disruptive business models that could redirect the agri-food system toward new goals such as such sustainability for fear of losing market share (Christensen et al., 2015).

The value of this perspective is that it (i) captures the broad scope of elements and interactions and socio-political settings within which food and agriculture interventions are embedded, (ii) helps articulate theories of change that draw on complex systems thinking, and in doing so, challenges impact and scaling assumptions of single point food system interventions, (iii) provides a way to think about the overall directionality of change at the system scale rather than impacts associated with a specific intervention, and (iv) reveals the role of dominant players in setting and maintaining the goals and values of the agri-food system. Horton et al. (2017) outline an integrated agri-food system research agenda that explores the implications of this. Their core argument is that it remains important to explore different domains of activity in the food system – farming and technology, or business and value chains. However, they argue that the inevitable trade-offs and their causes are an inherent property of these complex systems, and hence need to be simultaneously explored. Specifically, there is a need to explore coupled themes of research that (i) analyze whole system outcomes to track aggregate system performance, and (ii) analyze ethical, legal and political tensions in agri-food systems that influence types and distribution of outcomes for different stakeholders.

It is in this way that an agri-food system perspective could contribute to refocusing research and intervention planning and evaluation of the performance at a system scale and the ability of the system to deliver balanced societal outcomes – adequate and healthy diets, profits for farmers and businesses, and a healthy and sustainable planet. This contrasts with other food policy interventions that rely on a narrow focus on the efficiency of individual levers within that system, such as

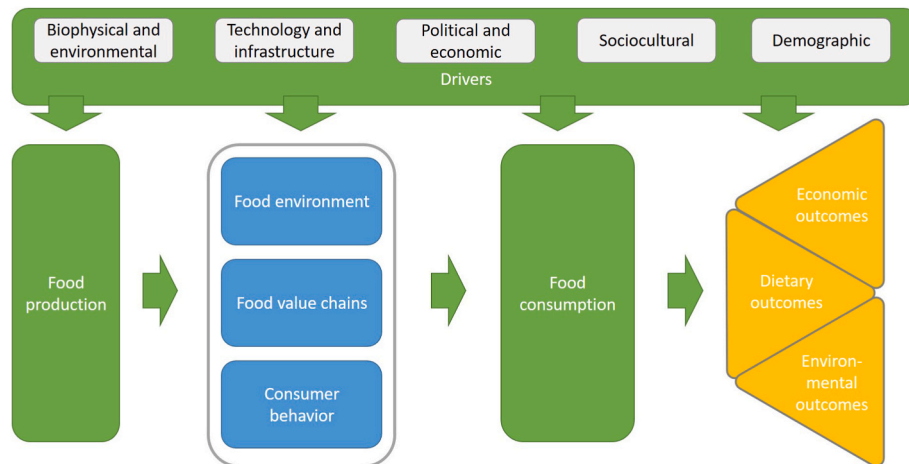


Fig. 1. A agri-food system schematic. (Own presentation based on IFPRI, 2020).

productivity, VCs, pricing policy and other incentives. The agri-food system perspective highlights the way these different levers work together as a collective whole, points to the need to address systemic failures that lead to perverse outcomes, and reveals the trade-offs that are inherent and often difficult to assess. With this in mind, we will next review the value chain perspective, experiences, and underlying assumptions.

3. Current value chain interventions within the agri-food system: colliding paradigms of assumptions, rationales, and trade-offs

3.1. Value chain interventions in theory and practice

Value chain interventions have become key tools for international development organizations to reduce poverty and generate economic growth. Whilst initial VCIs predominantly focused on economic development, such as improving income of smallholders and generating employment (GTZ, 2007), other development considerations were subsequently added to the framework, most notably gender (Mayoux and Mackie, 2008), nutrition and food security (Hawkes and Ruel, 2011; Ruel and Alderman, 2013), and, to a lesser extent, environmental sustainability (FAO, 2015). As an analytical framework, the VC concept serves as a way to explore the actors, structures, and dynamics of VCs, focusing on the positioning of chain actors, the linkages between chain actors, the distribution of value-added along the chain, and opportunities for upgrading.

In practice, the scope of VCI takes different forms. One set of interventions concentrates on the structural issues of the multi-scalar nature of VCs. These interventions provide a combination of micro-, meso-, and macro-level support, which focus not only on individual nodes of the chain, but also on the governance structures and institutional environments within which VCs are embedded (Ponte and Sturgeon, 2014; Kaplan et al., 2016). A second set of VCI focuses on firm-centric approaches that promote leading private sector actors and their direct environment (UNIDO, 2011; FAO, 2013; Kaplan et al., 2016). Both sets of interventions aim to establish or enhance vertical and horizontal linkages along the VC to achieve economic and/or social development objectives. Interventions attempt to incorporate, to varying degrees, different VC actors such as producers, traders, processors, distributors, retailers, and consumers, whilst improving the terms of VC participation for a selected group. Development actors focus largely on linking small-scale producers to national, regional, and/or global markets by enhancing VC and market efficiency and facilitating the flow of information and resources along the VC (Humphrey and Navas-Alemán, 2010).

Across the food-money-environment complex, VCI by international development organizations and practitioners can generally be classified into three main approaches. First, the most-widely and longest in use, is the ‘pro-poor value chain’ approach which reflects an understanding that market integration for poor farmers or input and service providers can be achieved by reducing the barriers to enter markets (UNIDO, 2011). Second, ‘nutrition-sensitive value chain’ approaches have gained increased popularity attempting to improve nutritional outcomes along with promoting increases in incomes for smallholders by alleviating constraints in the supply or demand of foods (De la Peña and Garrett, 2018). Third and most recently, the ‘greening of value chains’ approach has received increased interest, particularly in response to climate change and sustainability challenges (De Marchi et al., 2013; FAO, 2015).

3.2. Value chain interventions within the agri-food system: A framework

As discussed above, the agri-food system perspective draws attention to the dynamic relationships between multiple elements of demand and supply that operate within the system and the drivers and consequences of these. When viewed at the aggregate system level, crucial trade-offs are revealed. This also provides a lens to revisit the validity of underlying assumptions in the VCI described above. To explore the way the VC perspective collides with a systemic understanding of agri-food dynamics, Fig. 1 provides a framework to unpack the money-food environment trade-off complex. In this schematic, the logics of pro-poor VCI and nutrition-sensitive VCI map onto the money-food trade-off, while the logics of pro-poor VCI and greening of VCI map onto the money-environment trade-off.

Within the money-food complex, the farmer interacts with the market and the aim of most interventions is to maximize returns of farmers and/or to maximize food supply to assure food security. On the other side of this complex, the consumer interacts with the market and interventions aim to minimize the costs of nutritious foods and/or maximize the overall food supply. Similarly, within the money-environment complex, the aim is not only to maximize farmers’ returns, but also to maximize the sustainability of production and consumption of sustainable food (products), while at the same time trying to minimize the costs of these environmentally friendly foods (see Fig. 2).

Ultimately, the three type of VCI can be mapped onto the SDGs. The fundamental goal of pro-poor VCI is SDG 1 ‘No Poverty’; nutrition-sensitive VCI targeted goal is SDG 2 ‘Zero Hunger’; and greening VCI are directed toward SDG 12 ‘Responsible Consumption and Production’. There are some obvious tensions among and within these approaches which we will outline and analyze in more detail.

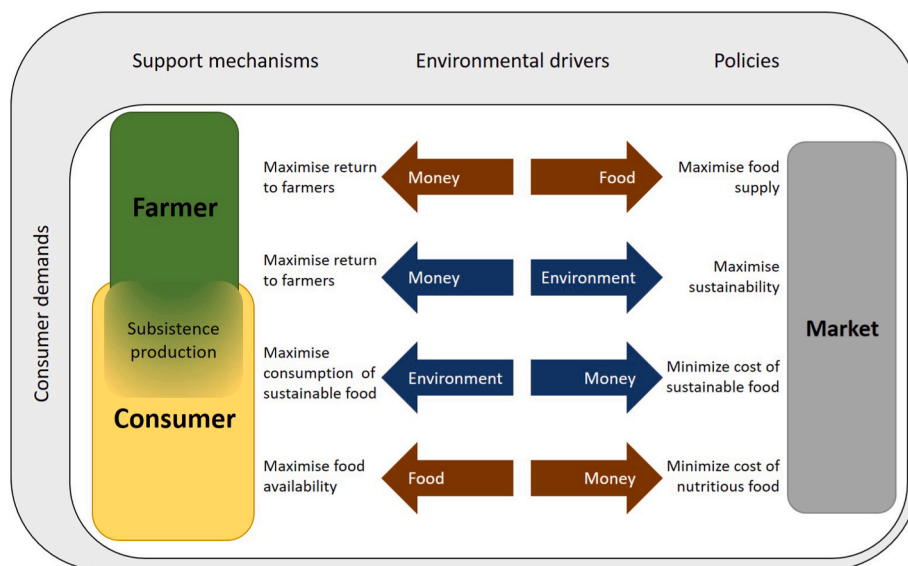


Fig. 2. VCI narrative within the agri-food system. Own presentation.

3.3. Trade-offs within the main value chain outcome logics

3.3.1. Money to reach 'No Poverty' – pro-poor value chains

There are two main avenues for increasing farmer incomes: higher prices per unit of production, and increased number of units of production with current input levels. Nested within these two overarching approaches, different entry points are typically used. Pro-poor value chain interventions often focus on cash crops and/or niche markets that exhibit higher entry barriers but are assumed to result in higher returns to farmers due to higher market prices compared to staple foods (Seville et al., 2011). In addition, pro-poor VCIs often focus on increasing the share of value-added for the target groups (ibid.). The key underlying assumptions are that smallholder farmers lack the bargaining power resulting in lower prices or unfavorable terms of business (Mitchell et al., 2009). Moreover, it is assumed that poor producers lack the financial resources and capacities to upgrade into higher-value added markets, legitimizing the increased involvement of buyers into production management and marketing decisions through contract farming (Seville et al., 2011; Mitchell et al., 2009).

The problem with raising producer prices is that higher prices must be paid by someone. For cases where consumers are willing and able to pay these prices, standards such as Fairtrade are thought to result in a net benefit to producers (Mitchell et al., 2009). However, this in turn most often creates costs for producers such as increased dependency on and bargaining power of buyers, standing in contradiction to the assumed benefit of increasing bargaining power through contract farming. Additionally, when the products are consumed by a wide range of consumers (staple crops), increasing the bargaining power of the producer may lead to higher consumer prices and in turn could cause adverse nutritional outcomes for poorer segments of the consumers, negatively affecting the 'Zero Hunger' goal. Therefore, many VCIs working through this logic also try to address efficiency gains along the VC to keep consumer prices stable. A commonly applied approach is the 'cutting out the middleman' strategy. This has immediate effects for the middlemen, but also for other actors along the chain. Middlemen provide services which need to be taken over by other actors for which smallholder farmers typically do not have financial means. The role of middlemen is often absorbed by actors higher up the chain (e.g. processors), reaping the benefits instead of the targeted 'poor'.

Contract farming aims to ensure markets for the poor by formally linking smallholders to buyers, smallholders are expected to receive higher and more stable incomes. They are meant to provide a secure and

potentially high-value market outlet. Trading and marketing are taken over by the contracting company, which may not equally share the additional surplus with the contracted farmers (IFAD, 2019). It also creates dependencies for farmers which may be exploited, or have other drawbacks that farmers may not be willing to take. In many cases contract farming aims at upgrading of product quality to increase returns. Here, price premiums are required to create the necessary investment incentives for standard compliance. While this system works in chains, where willing consumers are available, it is unlikely to work for localized staple crop VCIs. Higher prices will exclude poorer consumer segments and thus have likely ramifications for the nutritionally vulnerable populations that are likely to revert to low quality produce. For example, increasing quality by controlling toxic levels of aflatoxin in maize flour increases consumer prices of safer maize flour. Poorer consumers are less able to afford the increased prices and are hence exposed to greater levels of aflatoxin (Hoffmann and Moser, 2017). GlobalGAP is one example of a standard required to export to lucrative European vegetable markets. Similarly to Fairtrade, the price premiums are typically paid by wealthier consumers in the global North. Interventions are typically encouraging and supporting smallholder farmers to form groups – a requirement for certification. However, the investment hurdle is still high and break-even horizons are long, leaving many poor farmers unable or unwilling to comply (Mausch et al., 2009). In general, many assessments of standard compliance have highlighted that poorer producers are less likely to be able to comply, may experience reduced agency and motivation, and thereby the 'pro-poor' goals are rarely achieved using this avenue (Humphrey and Navas-Alemán, 2010; Kaplan et al., 2016; Vellema, 2016; Ogutu et al., 2020).

Given the implications of the above avenues aiming at creating pro-poor VCIs through increased prices, raising productivity may offer a solution. Increased productivity by an individual will certainly allow for increased income if production is profitable in the first place. However, the incentives for smallholder farmers to increase productivity through intensification are very limited as the income from farming activities is often a minor share of the overall household income, returns are low and aspirations may focus elsewhere (Gassner et al., 2019; Mausch et al., 2018; Harris and Orr, 2014; Shilomboleni et al., 2020). Additionally, if many farmers would start intensifying, then the market would face significantly increased supply and therefore respond through lower prices that may quickly negate the gains of the initial intensification effort of producers – yet this would have positive effects for net consumers and likely benefit the 'Zero Hunger' goal.

3.3.2. Food to reach 'Zero Hunger' – nutrition-sensitive value chains

The number of nutrition-sensitive value chain interventions have increased dramatically as evidence about the nutrition transition in developing countries has emerged, indicating the increased consumption of foods of high fat and sugar resulting in the dual burden of malnutrition (Hawkes, 2006). Interventions are often targeted at the four dimensions of food consumption and diet quality, namely improving the availability, affordability, access, and quality of nutritious foods (Hawkes and Ruel, 2011). Key assumptions underlying these interventions are that unhealthy foods are often cheaper and more convenient. Interventions therefore aim at either changing relative prices or increased consumer awareness of the nutritional quality of foods to increase consumption while assuring availability and access (Hawkes, 2006; Hawkes and Ruel, 2012). The educational route also implies that consumers are only willing to pay a higher price for healthier foods if they can validate the nutritional quality of the product (De la Peña and Garrett, 2018).

Nutrition-sensitive value chains tend to target two groups: smallholder farmers to increase their incomes and allow them to spend more on food, or consumers to enhance their nutritional outcomes by making (healthy) food more affordable or accessible. Some agencies are treating these separately (e.g. USAID, 2019), while others increasingly recognize the need to integrate approach towards supporting both groups (e.g. IFAD, 2014). Prices for quality food items are currently too expensive for low-income consumers with an estimated 1.58 billion people globally not able to afford the EAT Lancet reference diet (Hirvonen et al., 2020). Therefore, the poorest and most nutritionally in need segments of the population rely on the cheapest food options and will only consume more nutritious foods if they become price competitive. It is important to highlight here that farming households hold an ambiguous positioning within the value chain that is often overlooked. They are both producers and consumers of food. In fact, their role shifts and changes depending on the types of foods to be purchased, seasons, and external shocks.

Two critical trade-offs emerge for some domains of nutrition-sensitive value chain interventions. Firstly, interventions focusing on the (urban) market pathway can counter the 'No Poverty' target as price decreases of nutritious foods translate into lower farm incomes. This also undermines farming households' ability to purchase nutritious food items and may just shift malnutrition from urban to rural areas. Bringing prices down (in the absence of policy interventions like subsidies) can be achieved through increased volumes supplied and the subsequent reduction of unit prices. This in turn negatively affects producers' incomes or forces them to venture into other crops that attract better prices. The second trade-off is seen in interventions focusing on the farmer income pathway to enable them to purchase more nutritious foods. These interventions are likely to increase consumer prices and undermine the 'Zero Hunger' goal. Again, increased prices for food are the critical connection. Therefore, nutrition-sensitive VCs are often undermining 'No Poverty' or simply shift nutritional deficits from one group to another.

3.3.3. Environment to reach 'responsible consumption and production' – greening of value chains

The emergence of the greening of value chains approach has received more attention as a response to climate change and sustainability challenges (De Marchi et al., 2013; FAO, 2015). Development actors are increasingly aware that unsustainable business practices along food VCs, such as mono-cropping and high input usage, need to be reduced to achieve sustainable development (Knaepen et al., 2017). This led to the emergence of greening value chain approaches (De Marchi et al., 2013; FAO, 2015). The key underlying assumptions are that VC actors often continue to exploit the short-term profits of unsustainable business practices as the benefits of the internalization of such costs remains unclear (Knaepen et al., 2017). It is assumed that this is often based on government regulations, expenditure, and policies that do not set the right incentives to reduce emissions and enhance resource use efficiency

(FAO, 2015). These interventions often assume that poor producers do not have the financial resources and capacity to upgrade into greener production processes and/or products to comply with sustainability standards that need better coordination with buyers through, for instance, contract farming (FAO, 2015; Springer-Heinze, 2018) – likely leading again to bargaining power imbalances.

Achieving responsible consumption and production requires not only making production processes and management systems more environmentally focused, but also ensuring profitability of producers, traders, or distributors. Once more, investments in cash, labor or knowledge are required. Poorer smallholders may not be able to make such investments due to a lack of capital or awareness of the negative effects of their production practices such as the overuse of chemical inputs. Increased prices can overcome the initial hurdle providing incentives for smallholders to take the risks involved in upgrading. Alternatively, public and private compensations for positive externalities such as carbon credits, subsidies, or direct public investments can provide incentives. However, even if support mechanisms facilitate smallholders to produce in 'greener' ways by changing to crops such as drought-resistant legumes to reduce water extraction, returns to farmers may be lower and undermine the 'No Poverty' goal. In addition, consumer prices are likely to increase to compensate for the support and undermine 'Zero Hunger' for produce consumed by poorer consumer segments. Dercon (2012) argues that the costs of greening of VCs accruing to poor consumers are likely to outweigh the benefits through significant negative implications on nutrition. Once more, the most vulnerable (poor urban consumers and poor rural producers) might not be able to benefit from these interventions. Similarly, Zagonari (2020) points out that environmental sustainability is not worth pursuing economically but possibly for its societal value.

3.4. Weak assumptions and likely trade-offs

Are these trade-off concerns reflected in evidence of value chain impacts? Surprisingly, considering the popularity of VC-focused development projects, rigorous impact evaluations of VCs are rare. This is partly due to the complexity of VCs, which makes attribution of outcomes to the intervention difficult (Ton et al., 2010). Commonly, impacts of VCs are not systematically documented, but rather rely on qualitative data and anecdotal evidence. This is not dismissing such evidence. Nevertheless, rigorous evaluations techniques using quantitative or mixed-methods would be needed to assess and fully understand the impact of VCs on relevant development objectives (ibid.).

Worryingly, the most comprehensive review of the topic currently available is by Humphrey and Navas-Alemán (2010), covering 30 VCs, which finds that the poorest often do not benefit from such interventions. Despite being a decade old, more recent evidence on specific VCs find broadly similar results. A systematic evaluation of the German development portfolio of agricultural VCs finds that successful participation in VCs depends on a minimum level of resources available to farmers, concluding that ultra-poor households are unable to benefit (Kaplan et al., 2016; Devaux et al., 2018). Other studies on specific VCs find a positive, but moderate impact on producer incomes, yet no significant impact on food security (Herrmann et al., 2018; Ebata and Huettel, 2019). Qualitative evidence attributes the lack of impact on the poorest segments to structural issues outside the influence of VCs, such as insecurity or limited ability to enforce land tenure rights (Donovan and Poole, 2014). The limited evidence on the impact of VCs further questions the underlying theories of change and impact pathways.

Therefore, donors, researchers and practitioners in international development interested in achieving global food security should reassess existing approaches and intervention entry points. The recognition of the different yet closely connected avenues for both food insecure producers and consumers needs to play a more central role. Two critical challenges can be identified which shape the future design and implementation of VCs. First, it is now widely recognized that quality diets

are largely unaffordable to the poor (Hirvonen et al., 2020), questioning the net effects of pro-poor VCIs for reaching ‘Zero Hunger’. Second, small farmers are not competitive in an increasingly global market (Fanzo et al., 2020), raising concerns over the long-term sustainability of their contributions to global food security. Consequently, we argue that the underlying assumptions of VCIs are currently unfit to address these challenges and trade-offs among poverty reduction, nutrition and food security, and environmental sustainability.

Instead, distinct yet connected solutions that address the functioning of the agri-food system itself are more suitable (Horton et al., 2019). Given the likely trade-offs, one needs to evaluate the different entry points along the production-consumption continuum, and explicitly consider the underlying assumptions and effects beyond the immediate target group. In fact, all three VCI types have their own internal linear logics that side-step potentially problematic assumptions that become apparent through an agri-food systems lens.

Table 1 provides a summary of our review. It highlights potentially problematic assumptions inherent in the VCI logic currently prevalent in the agriculture for development sector as well as likely trade-offs within the agri-food system.

4. Discussion: Towards a ‘do no harm’ agenda

The review of VC logics and the assessment of trade-offs through an agri-food system lens reveal several important insights towards new and more constructive ways to improve the functioning of agri-food systems for a variety of Sustainable Development Goals. A critical examination of the main logics of three popular VCIs reveals problematic assumptions

and likely resulting trade-offs when viewed from an agri-food systems perspective and across the main intervention avenues. Broadly, pro-poor VCIs target high value, non-staple markets and high-income consumers, i.e. it compartmentalizes the markets the poor rely on for food from the markets the poor rely on for income. Greening of VCIs assume that VC actors including farmers will forgo profitability in the interest of sustainability, although it does acknowledge that regulation and other markets incentives will be required. Nutrition-sensitive VCIs assume that consumers are willing and able to pay more for healthier food.

Common to all three VCIs is the increasing focus on private sector actors for implementation, assuming this approach will sustain development outcomes beyond the project lifecycle. Indeed, major companies are committing to contributing to SDG targets as a response to pressure exerted by their customers or investors and avenues to support SDG achievements appear to be identified (Fanzo et al., 2020). However, as of to-date, there has been no systematic impact assessment of the role of the private sector to effectively contribute to SDG outcomes. Instead, system level assessment reveals the possible incompatibility and underlying tensions of a private sector-led approach to reach the SDGs. In the absence of policy changes at local and global levels, which fundamentally challenge and alter the structure of business incentives, market-based interventions will be insufficient to attain impact at scale and reach the poorest and most vulnerable. As Alston (2020, p.19) points out for the goal of ‘Zero Poverty’: “Ever-greater reliance on the private sector to defeat global poverty, whether through PPPs [public-private partnerships] or philanthropy, is a blind alley. Businesses are not motivated, managed, empowered, or incentivized to perform many of the essential public functions being systematically

Table 1
VC for development – an overview of entry points and problematic assumptions.

Agri-food system	Theme	Typical entry logics (impact pathway visions)	Potentially problematic assumptions	Potential trade-offs
Agricultural production system	Greening VC Producer-facing interventions	<ul style="list-style-type: none"> Internalizing negative externalities Capturing positive externalities Certification and labeling Sustainable production and business practices Sustainable intensification 	<ul style="list-style-type: none"> Present bias can be overcome by ‘right’ public sector incentives Interest in sustainable production/consumption Public and private sector interest in positive change Zero sum technological upgrading options 	<ul style="list-style-type: none"> Costs to small farmers/someone must (be willing) pay Increase in cost of production and therefore product Competitiveness of green VC (increased prices) Potentially negative effects on food prices and thereby nutrition Inherent trade-offs in breeding traits (e.g. lower inputs use tends to come with a yield penalty)
	Pro-poor VC Producer-facing interventions	<ul style="list-style-type: none"> Leveraging private sector Increase bargaining power of small actors Strengthening response to changing market demand Institutional arrangements/governance Linking small farmers to (more) markets Contract farming 	<ul style="list-style-type: none"> Private sector is interested in societal outcomes Groups can function effectively Reliable and exploitable markets for small farmers are available Redistribution of benefits from richer to poorer value chain actors is feasible and wanted Markets can benefit the poor Smallholders are competitive 	<ul style="list-style-type: none"> Higher consumer prices Increased prices for farmers make produce unaffordable for other poor consumers ‘Lock in’ to contract farming schemes with little upgrading options In the long run, intensification at scale results in lower consumer prices and lower returns to farmers
Consumption system	Nutrition-sensitive VC Mostly consumer-facing interventions	<ul style="list-style-type: none"> Labeling and certification Health education/messaging/campaigns Biofortification Private sector upgrading for food safety Producers are also consumers 	<ul style="list-style-type: none"> Increased consumer awareness about nutritional quality results in increased consumption of healthier foods Unhealthy products can be removed from circulation Production of nutritious food does not automatically translate into a nutritious product and thereby not always lead to nutritional benefits for consumers Healthy options are consumed by wealthier consumers while poorer consumers consume less nutritious options 	<ul style="list-style-type: none"> Higher incomes to farmers to increase ability to purchase more nutritious food result in higher consumer prices, making these foods less available to poor consumers Unhealthy food items would be consumed through other channels Making nutritious food available at a low cost will translate into lower returns to farmers Private sector not necessarily interested in nutrition Crowding out of natural solutions by biofortification Producers are often selling higher value produce and resort to lower nutrition produce for home consumption

outsourced to them. This trend represents an abdication of responsibility by governments and international organizations.”

Based on our review, similar arguments can be made for the goal of ‘Zero Hunger’. Additional avenues that complement VCIs and business-led development strategies are required. Success stories tend to be based on regulation rather than fine-tuning VCs. Taxation of sugary drinks in Mexico to combat obesity (Colchero et al., 2017) or biofortification to address micronutrient deficiencies (Bouis and Saltzman, 2017) despite concerns of crowding out natural solutions. Interventions like these recognize to some extent the flawed incentive structure of the private sector but do not address the structural problems that lead to the adverse outcomes in the first place. Research also needs to embrace this integrated perspective across multiple disciplines (Herrero et al., 2020) to work towards contextual solutions (Fanzo et al., 2020). Taking global food security as a “moral imperative” (Fanzo et al., 2020, p. 6), some solutions can be found. Fairtrade for example is essentially a voluntary redistribution mechanism that raises incomes of participating producers which is paid for by consumers that are willing and able to afford it. However, this system is unlikely to work for foods consumed by poorer consumer segments like staple crops.

Currently, there is little evidence that instruments other than policies and regulation are able to tackle food system imbalances. Coupling these problematic findings with the thin evidence of positive impacts of VCIs raises further doubts that VCs on their own are the appropriate entry point. The impacts on the poor are at best ambiguous and in some cases can disenfranchise them further – due to perverse price/access issues or by reinforcing power and control in value chains.

To achieve a ‘do no harm’ outcome, we believe that VC and other development interventions need to fully embrace an agri-food systems perspective that makes trade-offs transparent and deals with them proactively. A pathway forward not only requires an evidence base of how these trade-offs are playing out, but also requires resolving a deeper pragmatic question in food security policy of how to reconcile public goals and private sector strategies. The following steps could help advance this across an interconnected research and policy agenda.

4.1. A stronger evidence base

Our review suggests that there is insufficient evidence and understanding of the way dynamic interactions between VCs and the agri-food system mediate food-money-environment outcomes for different people. Causal relationships between action and outcome and the trade-offs that these imply remain unclear, unacknowledged, and untested. Given this lack of a sound evidence-based foundation, intervention assumptions will remain fraught with inconsistencies, and trade-offs will be obscured. Taking the CGIAR as one example, it was recognized that trade-off analysis coupled with foresight analysis needs to be streamlined through the system to better understand the intersection between multiple SDG level impact areas (ISDC, 2020). As Horton et al. (2017) argue, this evidence base needs to emerge from a new agri-food system agenda that couples the evaluation of individual food system intervention domains with modeling of system-level outcomes and a deeper understanding of the political economy and ethical dimensions of these systems. This would provide critically important information towards redesigning policy support mechanisms.

4.2. More rigorous assumption development and testing

Theory of Change (ToC) is now a commonly used intervention planning tool. However, a ToC exercise is only as good as the theory that backs its assumptions and the rigor of its constructing and testing. Therefore, any intervention should be thoroughly analyzed ex-ante within the wider framework of the agri-food system and carefully assessed to make potential trade-offs transparent, particularly those that affect vulnerable populations who are often poor consumers and producers. This is necessary to reveal and work with the complex impact

pathways that arise from the web of interactions and feedbacks within the broader agri-food system (Maestre et al., 2017). Any negative effects need to be evaluated with respect to their acceptability from the societal perspective (Nilsson et al., 2016; Blanchard et al., 2017). If these are negatively impacting on other prioritized societal goals, then the intervention needs to be reconsidered, redesigned or mitigation measures need to be taken. These could be subsidies, support in upgrades of production, cash transfers for consumers, general regulation, taxes aiming at redistribution, or direct public investments into green products and solutions. Monitoring and evaluation methods need to be adjusted to provide the required evidence beyond the target groups, and need to contribute to developing ToCs and their assumptions which can account for the complexity in food systems. This will require adaptive programming rather than rigorous pursuit of initially outlined targets and activities. The close coordination of such efforts with policy from local to global level will remain a likely critical success factor.

4.3. Coupling value chain interventions with public policy interventions

Like a number of other recent reviews (see e.g. Gillespie et al., 2018; German et al., 2020), our analysis calls into question the ability of market-based interventions to tackle societal challenges which are in fact an artifact of the way agri-food systems function and the societal ‘services’ these deliver. Of course, the market is a key institution within the agri-food system, but without regulation and other support and incentives it is unlikely to voluntarily distribute benefits of growth equitably and in line with the SDGs (Boresllion et al., 2020). For VCIs to become an effective instrument in progressing the sustainable development agenda, a much stronger coupling with wider policy levers is needed. For example, Tewes-Gradi et al. (2013) highlight three public policy entry points to create a more inclusive role for businesses in value chains: (i) Enabling companies to enter low-income markets; (ii) encouraging companies to invest in these markets; and (iii) empowering poor people to engage with companies. The ‘do no harm’ principle not only recognizes the proactive role of public policy, but also suggests that public policy needs to assume a more sentinel position in the agri-food system, being alert to the divergence between development ambitions and market-mediated outcomes.

4.4. Empowering new business models

Private businesses across the world are facing increasing public pressure to change their business models and incorporate societal outcomes into their typically profit focused targets (Fanzo et al., 2020). While there is little to no evidence on the impacts of this transition available (ibid.), it offers opportunities for collaborative efforts between research and business to explore how these are changing the agri-food system and where business and public interests are aligned or conflicting (Hall and Kelly, 2017). Developing, for example, sustainability or social inclusion metrics and standards for the private sector can be one way of helping new types of private businesses to respond to and capitalize on emerging consumer values aligned to the SDGs (Cohen et al., 2014). This type of collaboration could empower frontrunner market players to help disrupt dominate business models (Christensen et al., 2015) and reorient the agri-food system more widely towards societal goals. This may be an important pathway for ensuring ‘no harm’ in countries with less regulatory politics. It also provides a test case to better understand how to reconcile public goals and private sector strategies.

4.5. Capacity to formulate systemic agri-food interventions

An agri-food system perspective is still at its formative stage. A key pathway to achieving global food security, while not undermining other societal goals, could be to better harness this perspective in ex-ante and ex-post assessments and base the design of interventions and policies on

those results. However, this demands a much stronger capability in both intervention planning and in policy formulation. Currently, critical decision makers in research, policy and business are neither adequately equipped with this capability nor are they properly supported by science, relying on tools and perspectives from the less complex times of the mid-20th century (Hipel et al., 2015). A clear need emerges to move beyond commodity centric visions and entry points and combine VC approaches with systems thinking, political economy and governance perspectives into a practical 'do no harm' research and policy framework. This could be a first step to help decision makers work effectively within the agri-food system perspective.

5. Conclusion

As value chains are part of complex social systems, it may be unattainable to design individual, bounded interventions to achieve aggregate gains within the food-money-environment complex. Given that any intervention implies some trade-offs, we believe it is time to make these trade-offs explicit and discuss them openly and honestly. The weighing of the positive and negative consequences of interventions involves judgment calls over societal goals that affect different targets, groups of people, regions, or any number of other segments within the system. Because of the societal nature of goals like 'Zero Poverty', 'Zero Hunger', 'Responsible Consumption and Production', a discussion about the trade-offs we are willing to accept at the societal level are ever more urgent. Is the pursuit of 'Zero Poverty' worthwhile sacrificing some degree of environmental damage? Are we willing to afford giving up some environmental targets to achieve 'Zero Hunger'? Are societies in the higher income countries ready to give up some luxuries, wealth and power to be redistributed to allow the catching up of lower income countries? Is global food security the moral imperative and worth sacrificing progress towards e.g. 'Zero Poverty'? There is a need for a much broader societal debate locally as well as globally to define the goals in relation to acceptable trade-offs and mitigation measures and the resulting question on who can and should shoulder the costs. This debate should also be at the core of discussions towards global food security as the goal is at the heart of these difficult choices to be made. We also believe a system-level view on these questions will reveal options for mitigation as well as synergies that can be exploited. We argue that the fundamental principle should always be 'do no harm' while trying to ensure that smaller adjustments have the desired effects. If we are upfront about the trade-offs we accept and why, we will generate and add to the micro narratives that may eventually reveal the systemic constraints. This trickle of evidence will lead to broader understanding and may push decision makers towards considering more systemic changes in the future.

Declaration of competing interest

The authors have no conflict of interests.

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