



Do not transform food systems on the backs of the rural poor

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Abstract

Even prior to COVID, there was a considerable push for food system transformation to achieve better nutrition and health as well as environmental and climate change outcomes. Recent years have seen a large number of high visibility and influential publications on food system transformation. Literature is emerging questioning the utility and scope of these analyses, particularly in terms of trade-offs among multiple objectives. We build on these critiques of emerging food system transformation approaches in our review of four recent and influential publications from the EAT-Lancet Commission, the IPCC, the World Resources Institute and the Food and Land Use Coalition. We argue that a major problem is the lack of explicit inclusion of the livelihoods of poor rural people in their modeling approaches and insufficient measures to ensure that the nature and scale of the envisioned changes will improve these livelihoods. Unless livelihoods and socioeconomic inclusion more broadly are brought to the center of such approaches, we very much risk transforming food systems to reach environmental and nutritional objectives on the backs of the rural poor.

Keywords Food system transformation · Rural poor · Small scale producers · Food system modeling

1 Introduction

The COVID-19 virus has spawned huge disruptions to economies, health systems and people's day to day lives around the world. The virus is raising concerns about the resilience of food systems as food supply chains are disrupted and the purchasing power of consumers is greatly reduced. It has also given rise to discussions of what the world will look like in its wake – will we go back to the old “normal” or does this

disruption offer the potential to make major transformations that address the problems of the old normal?

Reforming food systems – from food production through value chains to consumption—is certainly one area where in pre-COVID times there was already a considerable push for transformation. Much of the impetus for change arises from the huge and ever-increasing health and environmental costs imposed by current food system configurations. The food system globally generates up to 37% of global greenhouse gas emissions (Shukla et al., 2019). If the world continues along the current trajectory of emissions growth from agriculture, by 2050 the sector would generate 70% of the total allowable emissions to keep warming below 1.5 degrees (Searchinger et al., 2019). The food system is also failing in terms of delivering human health and nutritional outcomes. The latest, pre-COVID, figures indicate that globally 690 million people (8.9%) are hungry, nearly 2 billion (25%) experience moderate or severe food insecurity, 144 million children (21%) are stunted and 47 million (7%) are wasted (FAO et al., 2020). The key role of food systems in economic development and poverty reduction in developing countries is also a primary motivation for food system transformation, with much emphasis on the importance of increasing productivity in small-scale agriculture and efficiency in food value chains (Brouwer et al., 2020; Mausch et al., 2020).

In recent years there has been a plethora of high visibility and influential publications on food system

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transformation, increasing in the past two years in anticipation of the UN Food Systems Summit scheduled for September 2021. However, there has also been several recent papers questioning the utility and scope of the analyses and approaches articulated in these reports.

Brouwer et al. (2020) reviewed 32 major publications on food systems and found they could be classified by the food system component they focused upon (e.g. supply, midstream and demand) or at overall system level. They find the interactions between food system components and the tradeoffs they may entail are generally not well identified or analyzed. Herrero et al. (2017, 2021) identified the same problem in the analysis of the impacts of food system innovations, and Mausch et al. (2020) in the analysis of value chain interventions in agri-food systems. A common problem identified across all these publications is the presence of multiple narratives and assumptions about food systems which are often contradictory. In addition, the entry points and processes to induce transformative change are often missing (Brouwer et al., 2020) or based on outdated development paradigms (Mausch et al., 2020). One of the most persistent of the latter is the power of increasing productivity of small-scale farmers as a key pathway out of poverty, despite recent analyses indicating very limited potential in this regard (Harris, 2019; Harris & Orr, 2014).

In this paper, we build on these critiques of emerging food system transformation approaches arguing that a major problem is their lack of explicit attention to the livelihoods of poor rural people who will be affected by the nature and scale of the changes envisioned. These include the approximately 2.7 billion rural people who engage in small-scale food production and the currently over 1.1 billion people in moderate to extreme poverty living and working in agriculture (Castañeda et al., 2018; Woodhill et al., 2020), a number expected to increase with the continued effects of COVID-19. While the issues of equity and social inclusion are raised across many of the publications, they do not make explicit the potential impacts and tradeoffs that measures to improve nutritional and environmental outcomes may impose on rural livelihoods. For example, Brouwer et al. (2020) found that of the publications they screened “almost no attention given to backward linkages from healthier diets and the required adjustments in farm and production structure” (Brouwer et al., 2020 page 4). In their analysis of potential trade-offs in developing the CGIAR international agricultural research strategy, Antle and Valdivia (2021) argue that explicit analysis of trade-offs is needed to avoid inevitable tradeoffs and potential synergies across the CGIAR impact areas: nutrition and food security; poverty reduction, livelihoods, and jobs; gender equality, youth, and social inclusion; climate adaptation and greenhouse gas reduction; environmental health and biodiversity.

To make our case regarding the lack of explicit attention to the livelihoods of poor rural people, we focus on three recent and influential publications on food systems transformation: the EAT Lancet Commission (Willett et al., 2019), the World Resources Report (Searchinger et al., 2019), and the Food and Land Use Coalition (FOLU, 2019) as well as the special report from the Intergovernmental Panel on Climate Change and Land that has chapters devoted to food security and food system interactions (Shukla et al., 2019). These four reports come from different points of view, modelling approaches and key objectives focused upon, and their recommendations vary in terms of priorities. Yet, as Table 1 shows, there is a consensus at the global level in the recommendations for improving nutritional and environmental objectives of food systems. These include reducing meat consumption in conjunction with enhancing the consumption of fruits, vegetables, pulses and nuts, while reducing/stopping conversion of land to agricultural production and reducing plus improving the management of inputs to agricultural production systems. As the EAT-Lancet commission notes: “A large body of work has emerged on the environmental impacts of various diets, with most studies concluding that a diet rich in plant-based foods and with fewer animal source foods confers both improved health and environmental benefits.” (Willett et al., 2019, pp. 449). The consistency between the nutritional and environmental perspectives indicates a high potential for “win-win” on health and environmental outcomes in food system transformation.

However, as with many of the reports on food system transformation, there is more emphasis on the major changes needed in food production, value chains and production and less focus on the people whose livelihoods drive and depend on that system. In many cases, producers, small-scale or otherwise, are not considered in the underlying models. In order to avoid solving planetary problems on the backs of poor rural men and women who play a central role in the production, processing and marketing of food around the world, explicit consideration of how food systems transformations affect the potential for inclusive growth is needed.

We first look at the role that food systems play in the livelihoods of the rural poor, and the constraints and barriers that the rural poor face. Next, we take a closer look at how the four recent papers and their underlying models address the synergies between socioeconomic inclusion and environmental and nutrition objectives. We then identify three main actions needed to ensure that food systems transformations are inclusive and equitable. The last section concludes.

2 Improving livelihoods of the rural poor

Poverty has a rural face. As of 2017, about 9.2 percent of the global population lived in extreme poverty, using the \$1.90 a day poverty line. Using the \$3.20 a day line results in 24

Table 1 Consensus on nutritional and environmental outcomes in food system transformation

	EAT-Lancet	IPCC Land report	WRI	FOLU
Dietary recommendations	<ul style="list-style-type: none"> *diversity of plant-based foods *low amounts of animal sourced foods and saturated fats *small amounts of refined grains and highly processed foods 	<ul style="list-style-type: none"> *High in coarse grains, pulses, fruits, vegetables nuts and seed *low in energy intensive animal sources *apply a carbohydrate threshold 	<ul style="list-style-type: none"> *moderate ruminant meat consumption * Shift towards healthier sustainable diets including pulses, soy, vegetables and fruit * reduce food waste 	<ul style="list-style-type: none"> *Predominantly plant-based diets, *More fruits, vegetables, whole grains, legumes and nuts *limited consumption of salt, sugar and saturated fats *little consumption of ultra-processed foods
Environmental management recommendations	<ul style="list-style-type: none"> *use no additional land *safeguard existing biodiversity *reduce consumptive water use *substantially reduce nitrogen and phosphorus pollution *produce zero carbon dioxide emissions *no further increase of methane and nitrous oxide emissions 	<ul style="list-style-type: none"> *increase soil organic matter by increasing no-till, perennial crops, erosion control, agroforestry *reduction of nitrous oxide emissions from fertilizer use *reduction of methane emissions from paddy rice *reduce deforestation * Controlled grazing and rangeland management 	<ul style="list-style-type: none"> *limit cropland expansion *reforest abandoned, unused lands *conserve/restore peatlands *improve wild fisheries management *improve manure/fertilizer management *adopt emission-reducing rice *focus on realistic options to sequester carbon in soils 	<ul style="list-style-type: none"> *practices that regenerate soil *reduce synthetic fertilizers and pesticides *increase agrobiodiversity *reduce negative impacts on freshwater and the ocean

percent of the world's population living in poverty (World Bank, 2020). About 80 per cent of the extreme poor, and 75 percent of the moderate poor, live in rural areas. Of these, 76 percent and 60 percent of rural workers, respectively, are in agriculture (Castañeda et al., 2018). The World Bank estimates that COVID-19 could push an additional 119 million to 124 million people into extreme poverty in 2020 and between 143 to 163 million in 2021 (Lakner et al., 2021) worsening income inequality (Lakner et al., 2020).

The rural poor depend on food systems for livelihoods. Up to 4.5 billion people globally depend on food systems for their household livelihoods, at least in part, including employment in food value chains, the self-employed and family labor, and those in informal, migrant and seasonal wage labor (United Nations, 2020). For example, in West Africa, the food system accounts for 66% of total employment, of which almost 80% in agriculture itself, 15 percent in food marketing and 5 percent in food processing (Allen et al., 2018). There is considerable diversity in agriculture production-based livelihoods, ranging from pastoralists to mixed livestock and crop producers and small-scale fishing operations. About 40 percent of the rural extreme poor live in forests and savannahs (FAO, 2018). About 85 percent of pastoralists and 75 percent of agro-pastoralists live below

the extreme poverty line (De Haan, 2016). Farming systems, farms and farmers are incredibly diverse (Giller et al., 2020). Small farms of less than 2 hectares account for 84 percent of all farms worldwide (Lowder et al., 2019).

Despite the heterogeneity of livelihoods, poor, small-scale agricultural producers share several common characteristics in terms of barriers and constraints to economic activity across a wide range of food systems. These households have generally low levels of agricultural productivity (IFAD, 2016), diversified income sources including non-farm activities (Barrett et al., 2001; Davis et al., 2010, 2017; Reardon et al., 2007), high exposure to risks to production as well as household income and consumption (FAO, 2016), low levels of access to information, services and productive assets (FAO, 2014; Zezza et al., 2011), face pervasive multiple market failure (Arslan et al., 2020) and increasing dependence on markets for household food consumption (AGRA, 2019; Barrett et al., 2019; Frelat et al., 2016; Reardon, 2015; Zezza et al., 2011).

Gender and ethnicity are important factors in rural poverty. Women make up about 37 percent of the world's agricultural labor force with considerable range between regions and countries (ILO, 2020a). Women face gender specific constraints in accessing productive resources, particularly

in terms of asset ownership and land rights (Deere & Doss, 2006; Doss et al., 2014) and access to inputs, technology and services (Doss, 2001; Doss & Morris, 2000; Peterman et al., 2014; Waddington et al., 2014), as well as higher time commitments to tasks that are essential for family survival such as gathering wood and water and child care. These factors lead to significantly lower productivity levels compared with men (Deere & Doss, 2006; O'Sullivan et al., 2014) and worse outcomes in food security (Brown et al., 2019) and poverty (World Bank, 2018).

While making up around 6 percent of the global population, indigenous peoples manage or have tenure rights over a quarter of the world's land surface and about 40% of all terrestrial protected areas and ecologically intact landscapes (Garnett et al., 2018). Over 20 percent of carbon stored in tropical forests lies within indigenous territories (Environmental Defense Fund & Woods Hole Research Center, 2015). Almost three quarters of the world's 476 million Indigenous Peoples live in rural areas, and are primarily engaged in agricultural related activities. Globally, in rural areas, indigenous peoples are more than twice as likely to be in extreme poverty compared to their non-indigenous counterparts (ILO, 2020b) and face systematic political, economic, and social marginalization.

Vulnerability to climate change and depletion/degradation of natural resources by small-scale producers is widespread. Albeit with considerable variation between locations, climate change increases risks to agricultural production through its effect on increasing the frequency and magnitude of extreme events. Hansen et al. (2018) identify a growing body of evidence linking climate risks to rural poverty through loss of productive assets and disincentives to invest. In addition, the degradation and depletion of land and water resources is making the achievement of agricultural productivity increases much more difficult (Barbier & Hochard, 2018).

Growth in agricultural productivity and returns are a pathway out of poverty for only a limited share of small-scale producers (Harris, 2019; Harris & Orr, 2014). Woodhill et al. (2020) note that while the estimated 558 million small-scale producers under 20 hectares produced 70 percent of food consumed in low and middle income countries, most was produced by farms between 1 and 20 hectares, who represent 26 percent of the farms under 20 hectares. This group has potential for viable commercial agricultural activity. Farms with less than 1 hectare make up 72 percent of the farms under 20 hectares but provide only a marginal contribution to food supply. These have much less potential for commercialization as a pathway out of poverty.

Even for small-scale producers with potential, gaining and maintaining access to markets is increasingly difficult within modernizing food systems. While transition to more formalized markets with large-scale players can bring better

prices and increased access to insurance, inputs and credit, it can also lead to excessive consolidation and market power (Sitko et al., 2018). Rural producers are not necessarily the main beneficiaries of increased demand in either urban or rural areas. Lengthening and consolidating food chains, including globalized food chains are increasingly emerging and these can displace domestic rural suppliers. Small farm size, structural barriers, and power imbalances limit the participation of small-scale producers in modern food markets and global value chains. The significant fixed costs required to participate in these value chains are often beyond their reach (FAO, 2020).

Employment in food value chains provides livelihoods for the majority of the rural poor, who may be left behind under different scenarios of value chain development (Mausch et al., 2020). Employment in food value chains ranges from agricultural wage workers, to small food processing and trading entrepreneurs and wage work in large scale and commercialized operations. Food chains in developing countries are currently undergoing major changes, with a large increase of non-staple food and processed foods. While these changes imply the growth of employment in agricultural value chain activities in initial stages, a process whereby capital investments in labor saving technologies in the storage, processing, packing and transport sectors is also being observed in several locations, particularly Asia (FAO, 2017). The future wellbeing of many of today's rural poor resides ultimately on creation of higher value jobs within this sector.

3 Addressing rural livelihoods: reports and models of food system transformation for nutrition and climate change objectives

The historical experience with agricultural and rural transformation for poverty reduction indicates that agricultural and rural transformation have been and are likely to remain a primary driver of economic growth and poverty reduction for a majority of the world's poor people (Christiansen & Martin, 2018; de Janvry & Sadoulet, 2020; FAO, 2017; IFAD, 2016; Johnston & Mellor, 1961; Timmer, 1988; World Bank, 2007). However, this experience also indicates the need to *transform* the nature of agricultural and rural transformation – e.g. make radical changes in the approach to transformation for poverty reduction so as to move away from the past approaches that focused primarily on agricultural productivity growth of a few key crops and generated high levels of negative environmental and nutritional externalities as well as insufficient inclusion of marginalized groups (FAO, 2019; HLPE, 2019; Pretty, 2018). This suggests that the starting point for food system transformation is to build synergies between social inclusion, environmental

and nutritional objectives into the process with direct and deliberate actions. How is this addressed by the four recent reports? Table 2 presents a brief summary of the reports and in this section a few key insights are noted based on a review of the papers and their underlying models.

First, objectives for transforming food systems either ignore inclusion or, explicitly or implicitly, include a hierarchy of objectives in which inclusion is not the primary or even secondary objective. The EAT-Lancet report provides a clear indication that its focus is on diet and sustainability with much less reference to inclusion (Willett et al., 2019). The other three reports note the importance of food security (IPCC and FOLU) and poverty/inclusion (WRR and FOLU), though the treatment of food security and poverty varies significantly across studies and food security is principally seen as an issue of consumption rather than of production (FOLU, 2019; Searchinger et al., 2019; Shukla et al., 2019). The reports generally prioritize climate change, particularly around keeping within 1.5–2 degree global temperature change, with health and nutrition the secondary objective making food security and poverty a tertiary concern. This is critical since it ends up being reflected in policy advice. The questions answered become, for example, how can poverty and food security be addressed while staying within planetary boundaries? An alternative view could be that the primary objective is to end food insecurity. If this is the key objective, the question might be rephrased to state, what is the minimum level of global temperature increase for a world free of food insecurity or poverty?

Second, the model underlying these reports fail to incorporate producers of any kind making it difficult to address the myriad of constraints and market failures faced by small-scale producers. Three of the reports (EAT-Lancet, WRR and FOLU) use simulation models to draw many of their conclusions. yet in none of the models (IMPACT, GlobalAgri-WRR and GLOBIOM, respectively) are farmers incorporated since they rely on crop systems as the basis for the model. As such, it is not possible to observe effects on livelihoods, in general, and the impact of policy proposal on small-scale, poorer producers in particular. WRR tries to overcome this limitation by augmenting the modelling with a careful literature review. FOLU goes further and uses the World Bank's Shockwave model to address inclusion as measured by estimated poverty impacts of climate change and the Hidden Cost model to look at health impacts of climate change. The IPCC does not have an underlying model, but addresses food security through a literature review. When the models do include people, the focus tends to be on consumers rather than producers. A consumer perspective is critical to analyze food security as well as nutrition, and access requires safe and nutritious food be available and affordable for poorer segments of society. But consumers need to generate income to eat the nutritious diets and

producers are key to the success of any attempt to transform food systems.

Third, there is limited discussion on how productivity and livelihood objectives can be achieved under changes to food system posed in the reports and what they would imply for the rural poor. The IPCC report does look at this literature to a degree, but focusing mostly on climate adaptation and mitigation. The FOLU study is the most specific in terms of measures to ensure resilience of rural populations under food system transformation. These include increasing productivity investments in rural areas and expanding safety nets to generate new and more productive employment opportunities and safeguarding food security. While this analysis addresses the issue of rural livelihoods in the process of transformation, it fails to fully articulate the specificities that arise in dealing with the livelihoods of the rural poor and how these may interact with major dynamic processes food system transformation would set off.

Finally, the research, modeling and discourse on food system transformation including in these four reports, is taking place at a global level, based on global level analyses. However, the drivers and impacts of food system transformation are context specific and thus moving from global to national or local analyses is needed. Likewise, the nature of the tradeoffs that will arise between inclusivity, environment and nutrition are very much dependent on local context. In a recent study, Kim et al. (2020) found huge differences in the impacts of GHG emissions from changing diets across different countries. A country specific analysis revealed that adopting either a low or no red meat diet reduced GHG and water footprints in 47 and 57% of the studies countries respectively – although the average net effect was an increase. They found that of the 140 individual countries examined in the study, most—including those identified as having the most GHG- and water intensive diets—have been vastly underrepresented in the literature. Similar variation across countries in the potential tradeoffs between inclusivity and environmental or nutritional benefits would not be surprising.

4 Improving rural livelihoods in transforming food systems: what will it take?

With the emerging concerns around nutritional and environmental considerations and the calls for broader food system transformation as articulated in the four highlighted reports, the question is: Will transforming food systems to improve their nutritional and environmental performance lead to improving rural livelihoods? Or will the processes put in place to transform food systems delivery of nutrition and environmental benefits bypass or actually harm rural

Table 2 Producers in reports linked to food system transformation

Paper	Stated objectives	Methods	Treatment of producers	Treatment of consumers
EAT-Lancet Commission, <i>Food in the Anthropocene: The Eat-Lancet Commission on healthy diets and sustainable food systems</i>	Scientific based targets for a healthy reference diet and six earth system processes (climate change, nitrogen cycling, phosphorous cycling, freshwater use, biodiversity loss, land-system change)	Diverse models. IFPRI IMPACT model primary food system model with production incorporated	Producers not included in the analysis or discussed	Considered through overall dietary requirements and implications. No distributional considerations
IPCC, <i>Climate change and land</i>	Addresses greenhouse gas fluxes in land-based ecosystems, land use and sustainable land management in relation to climate change adaptation and mitigation, desertification, land degradation and food security	Literature review with level of confidence on evidence and agreement on conclusions noted as relevant	Producer livelihoods discussed in light of climate change considerations with links between production and climate change impacts and the potential for adaptation and mitigation highlighted. Importance of productivity gains noted	Consumer demand for food commodities and link to climate change noted. Reduction in food security resulting from climate change impact on production noted
World Resources Report, <i>Creating a Sustainable Food Future</i>	Achieving a sustainable food future by meeting growing demands for food, avoiding deforestation, and reforesting or restoring abandoned and unproductive land—and in ways that help stabilize the climate, promote economic development, and reduce poverty	GlobalAgri-WRR model complemented with literature review	Producers not included with model, which is based on farming systems	Diets of consumers are including but no distributional consequences. Argue that poverty impacts are mostly through keeping food prices low
The Food and Land Use Coalition, <i>Growing Better: Ten Critical Transitions to Transform Food and Land Use</i>	A reform agenda for food and land use that results in better environmental outcomes, better human health, more inclusive development and significantly improved food security	IIASA GLOBIOM model with Shockwaves and Hidden costs models and complementary analysis	Producers are not considered in GLOBIOM but results fed into Shockwave which includes producers but no behavioral response to policy changes	Dietary factors considered as are broader effects on consumers through Hidden Cost model fed through other models

livelihoods? Since poor nutrition and environmental degradation are major problems for the rural poor, improvements in these two aspects can potentially be a positive force in improving the livelihoods of the rural poor along with the overall performance of the food system, but does not guarantee it.

In this section, building on the literature, we propose three main actions needed to ensure that food system transformations are inclusive and equitable.

4.1 Govern food systems to ensure social inclusion and environmental justice concepts into the design of measures to address negative externalities on food systems

Reducing the negative environment and nutritional externalities from current food systems is a key entry point for a large share of the proposals for transforming food systems. This requires changes in policies, regulations and institutions – all of which have distributional impacts, creating winners and losers. Many of the losers of current policy proposals coming out of the analysis of food system transformation to achieve sustainability and nutritional objectives are likely to be poor rural women and men engaged in food production or value chains. Ensuring that these people will not bear the burden of eliminating externalities requires a governance approach that explicitly accounts for imbalances in bargaining power. The concepts and framing of Environmental Justice are useful in identifying relevant models and mechanisms. The framework calls for justice not only in the distribution of costs and benefits of actions, but also procedural justice requiring fair and equitable decision-making processes as well as recognitional justice which is recognizing that differences exist in evaluating problems, their causes and solutions (Menton et al., 2020; Schlosberg, 2007).

For example, reducing and even reversing land use change for the expansion of agricultural production is a high priority for reducing GHG emissions to meet a 1.5 or even 2 degree maximum level of global warming. Reducing deforestation could be quite beneficial to the approximately 1 to 2 billion people (depending on the definition) dependent on forests for some part of their livelihoods, many of whom are among the extreme poor (FAO & UNEP, 2020). However, it could also be quite detrimental to the livelihoods of rural poor people who depend on clearing new lands for their livelihoods—an estimated 33 percent of deforestation comes from local subsistence agriculture (Hosonuma et al., 2012). Miyamoto (2020) found that poverty was a major driver of deforestation in Malaysia and Indonesia, and that conversion to agricultural lands could be a viable poverty reduction strategy. Paying farmers to reduce deforestation and forest degradation shifts the cost of eliminating the externality to

the beneficiaries, whereas fining and imposing criminal penalties on farmers who deforest places the cost on the source.

Procedural justice is based on enhancing the agency of stakeholders – particularly those with lower levels of bargaining power. in decision-making processes (Menton et al., 2020). Procedural justice is related to the fairness of the process of decision-making as perceived by stakeholders, as compared with the fairness of the outcomes that distributional justice entails. Thorpe (2018) found that the governance arrangements and their effectiveness in generating procedural justice was key in determining the ability of public–private partnerships in agricultural value chains to engage smallholder farmers in participating and benefiting. The key governance features that generated procedural justice were: the existence of bilateral communication channels between farmers and food firms (regular and direct opportunities to meet and discuss), transparency of decisions affecting smallholders, the presence of conflict resolution mechanisms, informal long term agreements (e.g. establishment of food handling/processing facilities) and countervailing power of smallholder farmers (by organizing into groups).

4.2 Ensure that improving livelihoods of the rural poor is integrated into proposed approaches for food system transformation

The actual opportunities for the rural poor to benefit from any aspect of food system transformation is quite context specific reflecting local market conditions and constraints, which means a process of looking for specific entry points for improving livelihoods is needed. Such processes are often already in place in many contexts – in the rural poverty reduction and agricultural development strategies of countries. These need to be revisited in light of the broader agenda of food system transformation and its multiple objectives. So, for example, strategies to increase agricultural production may need to be revised to better consider the nutritional and environmental externalities.

Small-scale producers can potentially help meet the demand for fruits and vegetables in a transformed food system. According to the Glopan (2020) report, small-scale producers have an important role to play in “specialised producers of nutrient-rich foods, particularly through horticulture (for which huge scale-economies matter relatively less)” (page 79). Small-scale producers may have a comparative advantage in certain types of fruits and vegetable production, particularly where there are high labor use and low capital requirements. Linking small-scale producers to emerging high-value markets in fruits and vegetable (Ogutu et al., 2020) and in sustainable certification (Meemken, 2020) have had some success in raising incomes and improving farmer wellbeing.

However, the ability of small-scale producers to take advantage of the increased emphasis on fruits and vegetables depends the nature of the relevant international, urban or local markets and quality standards and marketing arrangements (such as contracts vs spot markets). Fruit and vegetables are generally perishable and highly knowledge intensive and higher risk. They often require startup capital to enter and the ability to withstand major price swings. An analysis from Ethiopia indicated that access to adequate capital, poor infrastructure and lack of training are key barriers to the participation of the poor in the benefits of value chain transformation (Asfaw et al., 2017). Using data from Zambia, Hichaambwa et al. (2015) find that proximity to markets, lagged farm assets, land size, and access to household labor were all determinates of participation in horticulture markets.

Significantly more understanding is required about which farmers in what contexts are meeting this demand or could potentially meet the demand with the right combination of policies and investment (Woodhill et al., 2020) and whether these actions would be sufficient to eventually translate into inclusive food systems.

In terms of improving forest management in the overall context of food system transformation, community forest approaches are a potential way of addressing barriers faced by small-scale, local and indigenous communities. It has been proposed as an approach to combine the goals of environmental conservation with economic development and natural resource rights. However, evidence has indicated the frequent presence of tradeoffs. Based on a global meta-analysis, Hajjar et al. (2020) find substantial socioeconomic and environmental tradeoffs in the impact of community forestry management, particularly characterized by improving environmental conditions and a reduction in local forest access and resource rights. Moreover, half of the studies which indicated increases in income also indicated that benefit sharing within communities had become less equitable. While biophysical conditions, local institutions (particularly de facto rights), and intervention and user group characteristics (particularly smaller groups) were associated with better outcomes, where resource rights were increased both environmental and incomes tended to improve as well, suggesting the importance of a rights-based approach.

The key issue here is to ensure that processes identifying the key barriers poor rural people face in participating in and benefitting from food system transformation are in place, as well as mechanisms to help overcome such barriers. The approach needs to be broad, addressing the multiple market failures and structural inequalities faced by small scale male and female producers. As part of dynamic process of transformation, technologies and approaches to food processing and marketing that enhance labor value and create employment need to be developed. A process of sustainable and

inclusive food systems transformation needs to address historic inequalities in access to, and secure tenure of, land and water. Similarly, the process must ensure investment in and access to the underlying basics for inclusive development: rural infrastructure (roads, electricity, connectivity, water and sanitation) and human capital development, including universal access to education, health, social protection and skills development.

4.3 Make explicit the prominent differences between countries and food systems in generating negative externalities and the impacts of reducing them

Much of the literature on food system transformation focuses at a global level and proposes measures to reduce negative externalities using global measures of impact – e.g. the amount of GHG emissions that can be eliminated through changes in diets or land use change. This approach can be somewhat misleading since the source of negative externalities are radically different across different food systems. Even when the reports do include differentiated analysis, oftentimes the main message is the need to impose a constraint on current food system operations that will have significantly different impacts between rich and poor countries and people.

Take the case of inorganic nitrogen fertilizer use, where a major reduction in its use is being called for to reduce GHG emissions and also pollution of waterways. Gerten et al. (2020) analyzes the impacts of imposing restrictions on agricultural production systems in order to avoid compromising planetary boundaries for four biophysical processes, including nitrogen flows associated with fertilizer use. They find that imposing constraints to stay within planetary boundaries without any change to current production systems would result in a major decrease in global food supplies. However, under a scenario where agricultural production is redistributed globally to better match environmental constraints and opportunities, and sustainable intensification applied, food production levels do not decline, but actually increase. Nitrogen use from fertilizer would have to be restricted to meet the constraint in China, India, US Midwest, some parts of Europe and Brazil, while there are opportunities to expand fertilizer use via increasing nitrogen use efficiency and/or application in areas of limited risk of runoff in some parts of sub-Saharan Africa, US West and Mexico, Northeast Brazil, Bangladesh, and Indonesia.

The main message around nitrogen fertilizer use in the food system transformation discourse is the need for reducing use, whereas reducing inequality in access and use of fertilizer while increasing its effective use for everyone is actually the more relevant message for inclusive and equitable food system transformation.

Reducing meat consumption, particularly red meat, is another recommendation in food system transformation, which also has potentially large distributional implications. In general, rural poor people, particularly women and infants, face severe nutritional constraints which animal sourced food can supply. According to the Global Panel on Agriculture for Food Systems and Nutrition (2016), infants, children, adolescents and women of reproductive age living in low-income contexts will find it extremely hard to meet nutrient requirements in the absence of animal sourced foods. At the same time, some groups in low-income contexts are consuming levels of these foods in excess of recommended levels, as are consumers in middle and high-income countries. Thus, improving food systems performance on nutrition requires increases of animal-sourced foods for rural poor people, particularly women and children, and reductions for higher income people in poor and rich countries.

Reallocating the effects of constraints from richer to poorer areas is thus a key factor determining the overall impact of food system transformation on the rural poor. While this issue is raised in several of the key reports on food system transformation, it is not clear how the redistribution of constraints could be implemented and monitored in practice. Certainly, we cannot expect that such a redistribution would actually occur without stringent measures to ensure it. We need to move from global conceptualization and modeling to national and local, making explicit the challenges of sustainability and nutrition at these levels while considering the implications for livelihoods.

5 Conclusion—moving forward

The arguments to transform food systems to achieve better nutritional and environmental outcomes are compelling. The major changes proposed by key reports with respect to agricultural land use, production systems and dietary choices, as well as the emphasis on increasing resource use efficiency, limiting agricultural extensification, and reducing consumption of meat-based products are reasonable starting points for discussion.

However, the analysis presented above suggests that the rural poor could be made worse off from a proposed food system transformation aimed at improving nutritional and environmental outcomes, unless explicit actions are taken to ensure that the constraints they face are addressed. Without taking any specific measures to include small-scale producers, or consider the implications for nonfarm self-employment and wage labor along the food chain, it is quite possible the changes will have a major negative impact on the process of agricultural and rural transformation for poverty reduction. We could very well end up with a perverse situation where the people who are the least responsible for the problem of

climate change are those that bear biggest cost in terms of foregone opportunities.

The success of food system transformation based on scientific analysis requires a broader perspective that incorporate producers of different sizes, facing a heterogeneous set of constraints that may vary by social and economic dimensions, including gender and ethnicity, and the importance of the food system as a source of livelihoods for the majority of the world's poor. Recent papers note the importance of inclusivity, rural livelihoods and social justice in food system transformation (Barrett et al., 2020; Benammour et al., 2021; Woodhill et al., 2020). But until the scientific analysis and food system models fully incorporate rural producers and the distributional effects on rural livelihoods in any analysis, these models will continue to draw policy implications which may be harmful to the poorest producers.

What are the concrete leverage points needed to ensure inclusivity of the rural poor in food system transformation? Overall, the main issue is putting inclusivity front and center in the agenda on food system transformation. This requires going beyond add-on and secondary efforts in conceptualizing and modelling food systems, but rather a fundamental integration of actions in food system transformation processes to promote inclusion in a manner that enables the rural poor to participate and overcome unequal power relations-win. We cannot rely solely on actions that shield the rural poor from the negative effects of transformative changes, such as social assistance measures, but rather investment and incentives for the transformative changes that facilitate sustainable livelihoods. This requires stronger voice and agency by the rural poor, their communities and organizations in research and innovation and in the development of policies and strategies aimed at transforming food systems.

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