

**REVIEW ARTICLE**

## **Knowledge Gaps and Opportunities for Future Research on Ethiopian Food Security and Agriculture**

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### **ABSTRACT**

Research is needed to support informed decision making and evidence-based policies, programs and services. Research on food security and agriculture in Ethiopia has contributed to significant advances made over the last century. The volume of research produced in these areas is vast; in 2016, this amounted to hundreds of publications each week, on average. In this article, we present a short communication about the trends and knowledge gaps in the food security and agricultural research fields, highlighting opportunities for future research and thought leadership. Systematic reviews can assess and synthesize what is published, while reflections of those engaged in the research fields can help to identify what is not published, or under researched. Our objective is to direct researchers toward areas where information is crucially needed and where contributions to knowledge may have significant impact. We explore four knowledge gaps, specifically in the areas of contextualization, integration, synthesis and intersections.

**Keywords:** Ethiopia, Agriculture, Food Security, Research Trends, Knowledge Gaps

## INTRODUCTION

Large volumes of research are published on food security and agriculture in Ethiopia annually. Google Scholar provides insight into the volume: using the two keywords of food security and agriculture with Ethiopia identifies 30,130 publications for 2016 alone, an average of 580 per week. This simplistic search is not comprehensive, nor are all studies that were identified specific to Ethiopia (many papers reference Ethiopia as an example). The Google Scholar results, however, confirm the fact that there is a significant amount of research being done in Ethiopia, which differs from other countries, where the main challenge is an absence of research (Cochrane and Thornton, 2017). Systematic reviews can summarize and synthesize what has been published, which is not the objective here. This paper is best read as being a perspective-based short communication, rather than as a research article, as it draws upon experience working within these fields of research. We believe this is important because researchers cannot query for missing knowledge, thus critical appraisals, reflections and perspectives play an important role in identifying knowledge gaps.

While engaging in our roles as researchers, peer-reviewers, supervisors and practitioners, we have noticed research trends whereby some aspects are heavily covered and others neglected within the food security and agricultural research fields. This ought not be surprising, as research is not coordinated. In this short communication article, we present our perspective regarding knowledge gaps, exploring them not as weaknesses of research per se, but as opportunities moving forward. We focus on broad research areas, which we believe offer opportunities for future research. In so doing, we do not suggest that we have covered all gaps, nor that listed gaps equate with a complete absence of research. Our objective is to direct researchers toward areas where additional information is crucially needed and where contributions to knowledge may

have significant impact.<sup>1</sup> We focus on four issues: contextualization, integration, synthesis, and intersections. After addressing each of these research areas, we conclude with some final reflections on food security and agriculture research in Ethiopia.

### Contextualizing research

A large amount of information is available about food security and agriculture. Contextualizing that information is essential for informing more appropriate decision making, policy and practice, and includes a range of considerations, such as the scale at which decisions are made (federal, regional-state, zonal, district or *kebele*), the agro-ecology and livelihood practices, as well as the socio-cultural and political milieu and history. However, scientific and technically oriented works often lack contextualization from other fields. In general, there is a need to advance interdisciplinarity within research projects, lest the recommendations suggest that which is not feasible or inappropriate, based on evidence from other disciplines. In addition to the general need for greater contextualization, we highlight two specific contextual issues that require more evidence: (1) localized data on rainfall changes and future scenarios; and (2) dietary diversity and seasonality.

A knowledge gap that decision makers struggle with is a lack of localized trends of rainfall changes and future scenarios, particularly in light of climate change. Future scenario models are expanding in detail and the underlying datasets are increasing in number. It might therefore be assumed that overall accuracy is increasing. However, the inclusion of more data sets can result in greater uncertainty at the local level (Lutz et al, 2016), as projections are highly variable and are “based on coarse resolution and therefore limit their

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<sup>1</sup> This perspective article builds upon research opportunities identified in Cochrane (2017).

usefulness" (Kilroy, 2015: 777). For example, in Ethiopia, Handino (2014) finds that over the past decades the two rainy seasons have been impacted quite differently. One season shows increasing variability, as the literature suggests, while the other shows relative stability. Handino (2014) used seasonal averages, but much more research is needed to look into changes of rainfall onset, duration, variability and volume. These studies will help inform localized future scenario modeling and, therefore, decision makers in their priorities of adaptation planning, infrastructure needs, and agricultural extension services (e.g. crop changes). Furthermore, policies and programs need to be better informed by the localized nature of climate change impacts, if they are to be effective and sustainable. Generalizations based on regions (e.g. highlands or rift valley) provide limited insight into the specific ways in which climate change may affect smallholder farmer livelihoods in specific locations.

Due to a high level of dependency on rainfall in rural Ethiopia, information is crucial. A number of studies in Ethiopia have attempted to assess rainfall trends, yet these remain largely inconclusive (Cheung, Senay and Singh, 2008; Conway, Mould and Bewket, 2004; Rossell, 2014; Tilahun, 2006). Work at the Ethiopian Institute of Agricultural Research (EIAR) is also making efforts to advance knowledge on localized climate information, yet much more work is needed, particularly in providing information to farmers and pastoralists. Due to the topography of Ethiopia, downscaling international data has limited applicability, and regional studies are challenged by local variations of physical features and elevation, enabling generalizations but not the type or scale of data required by smallholder farmers. More localized studies are required to understand the impact that climate change will have on rainfall patterns with greater specificity, including new methodological approaches that provide accurate data for specific locales that are scalable. This kind of evidence will inform a range of other research questions, ranging from scientific studies of seed to developing appropriate policy.

In theory, the provision of weather forecasting information offers great opportunities to support Ethiopian smallholder farmers. However, the implementation of such initiatives has been challenged by a range of barriers beyond having accurate information, including the difficulties posed by diverse languages, literacy levels, and understandability of information (Fekete, 2015). Addressing these challenges requires research that supports innovative modalities of implementation. Researchers could take direction from successful pilot projects of this nature in other countries (e.g. Lobo, 2015) and from approaches for integrating traditional and scientific knowledges (e.g. Chang'a, Yanda and Ngana, 2010; Guthiga and Newsham, 2011; Kalanda-Joshua et al, 2011). The success of farmers accessing information using mobile phones and information boards by the Ethiopian Commodity Exchange provides insight into modalities that can work – but also the limitations, as many rural and remote farmers continue to be unable to access information via these routes. Addressing these challenges necessitates experimentation and flexibility to adjust to diverse contexts. As a result, one modality (e.g. mobile phones) may not be suitable in all places and for all people. Translating new knowledge into actionable information for farmers and pastoralists requires a different type of action oriented research. Successful models could also be applied to reduce the impacts of frost, pests, diseases, and invasive plants on agricultural livelihoods.

The second knowledge gap that emerges out of the contextual data is a limited amount of research on dietary diversity in relation to seasonality. Some research has been done (e.g. Hirvonen, Taffesse and Worku, 2015), which has shown significant fluctuation in dietary diversity based on season, but much more information is needed on how seasonality affects individuals, households and communities differently. The study conducted by Hirvonen, Taffesse and Worku (2015) presents averages, and does not differentiate community, intra-community or individual data to identify forms of social differentiation. The study also only focused

on a single year, and much more needs to be known about how dietary diversity fluctuates within a range of time scales. Future research may use the Household, Consumption and Expenditure data, collected by the Ethiopian Central Statistical Agency, to present quintile-based impacts of seasonality on dietary diversity over the long term. Additional, specific studies can shed light on the impact of seasonality on dietary diversity, particularly as it relates to food security and nutrition.

### **Land Tenure**

One aspect of contextualizing research in particular need of additional research is related to land tenure. Since the late 1990s, the government has been implementing a land certification program and this has had a range of positive impacts for smallholder farmers. The positive impact of improved tenure is important. However, more research is needed to assess if the high cost of the second phase of GIS-based certification will add significantly more value for smallholder farmers. One might argue that since the cost is not borne by smallholder farmers, it may not be of concern. However, there is an opportunity cost to consider relating to the programs and services farmers could have had, if such funding was made available for other activities, and thus cost-benefit and impact analyses are important to support evidence-based decision making.

More importantly, however, research needs to assess the processes and implementation to ensure that future land certification efforts address some of the ongoing challenges, particularly those related to land rights for pastoralists, commonly held property and women. In promoting improved land rights, legal shifts alone will be insufficient (Ossome, 2014). Legal reform established to-date has had limited impact on traditional norms and attitudes (Bezu and Holden, 2014; Tura, 2014). Ensuring that land certification and legal changes translate into more equitable and inclusive tenure shifts will involve changes to socio-cultural norms. Limited research, experimentation and programming experience is available about how these norms, which are often based on localized

socio-cultural and religious traditions, can be effectively transformed to ensure more equitable and inclusive land tenure. This is an important area for future research that will require detailed ethnographic studies to inform regional behavior change communication efforts and programming.

In addition to the unaddressed challenges, the first phase of paper-based land certification is now encountering new difficulties. As Ege (2017) has pointed out, land certification improved land tenure security for some, but when viewed from a broader rights perspective, including possession, renting and latent rights, the certification has also created tenure insecurities. Furthermore, there is a potential to lose the gains that were obtained with the paper-based land certificate system as the certificates are not updated due to death and inheritance. Many farmers have not updated their titles, and thus the tenure situation is returning to the pre-certificate stage of uncertainty. Research is required to assess the factors (farmer interest, government processes, disincentives and transparency) that will ensure the land certification system is accurate and maintained. There are options to engage with land tenure outside of the land certification scheme, however given the large amount of investment made into land certification, it appears this will continue to be the main means through which issues of tenure are handled in the near future. In this sub-section we have highlighted land tenure as a key area for research, however we recognize that not all issues have been included; rather we highlight those which have the potential to have significant impact on decision making and policy.

### **Integrating knowledges**

The majority of research utilizes the approach of compartmentalizing components of smallholder farmer lives and livelihoods, as if they can be analyzed in isolation. The problem takes various forms; it may be that health influences agricultural practices (e.g. Ersado et al, 2004), but the interactions are not considered, or that intervention effectiveness is affected by other activities, not the ones being assessed (e.g. Segers et al, 2008). The way research is

designed and how concepts are measured can make important factors invisible. For example, data collection may ask about economics, land and inputs but not about political pressures or motivations. Similarly, the way surveys are typically used renders important details invisible, such as the differences in the way inputs are used, for which crops and why. Commonly, findings present generalized data on variables, such as fertilizer or improved seed use. However, farmers do not engage with these variables uniformly or consistently. Much more research is needed to gain a detailed understanding of smallholder farmer practices and decisions. More generally, nearly all research conducted in the food security space would be strengthened by more explicit discussions of the assumed pathways of change and greater critical reflexivity on potential biases and the role of unknown factors.

Participatory and co-produced approaches undertaken in Ethiopia (e.g. Cochrane, 2017a, 2017b) have shown how new questions, measures and metrics can be identified when community members themselves co-create the research questions, data collection tools, and support the analysis of the results. In order to fully assess the added value of these approaches, more studies are needed to analyze the differences in design and process, as well as in analysis and findings. These critical studies will help reflect on the *status quo* of research in rural areas, and in doing so will facilitate the identification of where, when and why participatory and co-production approaches should be utilized, and when not. Such research could build on existing frameworks, such as that developed by Hulbert and Gupta (2015), which provides a decision-making model for assessing in what situations, for which questions, and to address what challenges participation is well suited, and for which it is not. It can also build on significant learning made with regard to how to engage in collaborative, trans-disciplinary research (Cochrane et al, 2017). In addition, there is a need to move beyond household level studies. Future applications of participatory methodologies are needed to better understand intra-household dynamics. Where they exist,

these approaches and analyses have often integrated the sex disaggregation of data and a gender analysis. In addition to this, other forms of inequality and social vulnerability need to be taken into account, such as ability, age, ethnicity, religion, health status, and relationship type (e.g. grandparent of extended family member).

### Synthesis

The available literature on Ethiopian food security and agriculture is significant, and at times overwhelming. In many areas, sufficient knowledge exists, but there are few systematic reviews that have brought together the volumes of literature to summarize, critically appraise and synthesize findings. One of the most important needs within these fields of research is regular systematic reviews and syntheses that bring together findings - potentially on an annual basis. Having critical appraisals and syntheses of knowledge will support informed decision making, by making large amount of evidence more accessible, and will improve research, by advancing the collective state of knowledge. Without reviews of this nature, there may be duplication of research efforts that do not advance the state of knowledge nor build upon existing knowledge. Journals covering Ethiopian agriculture and food security can publish such review and synthesis papers, following the model set by other journals, such as the regularly published Progress Reports in the journal Progress in Human Geography.

One of the challenges with systematic reviews, however, is that they tend to be thematic, and we do not yet have a model for how diverse themes can effectively be synthesized and integrated into broader reviews. This area of methodological research requires experimentation and testing, and we anticipate some trial and error will be required - effective modalities will not only bring findings together, but do so in an integrated way such that researchers from diverse disciplines find the reviews accurate and useful. Furthermore, within such integrated reviews it is necessary to find methods to link agriculture with other fields of research, such as health and nutrition, as well as with water,

sanitation and hygiene, and be influenced by political science and anthropology. In the era of big data, the question is not necessarily what we know, but how we analyze, synthesize and integrate – this is a space where researchers studying Ethiopian food security and agriculture can contribute to their fields, as well as the broader research community, in developing methods to support interdisciplinary and integrated systematic reviews.

The challenge of synthesis highlights a related, broader research shortcoming of ensuring that the volumes of findings support more informed decision making and practice. In order to ensure that results support evidence-based decision making in planning, policy and programming, much more needs to be invested in translation, communication, networking and brokering. In summary, greater efforts are needed to ensure research moves beyond researchers, and that it influences policies, practices and services. Enacting or influencing change is neither easy nor straightforward. Young has (2008) called for more explicit funding, capacity building and activity devoted to knowledge translation and brokering, as researchers cannot be expected to have, or acquire, the skills required to effectively communicate findings for non-academic audiences and identify the key stakeholders to communicate with. Some organizations, such as the International Food Policy Research Center (IFPRI) in Ethiopia, have made efforts to ensure their research is available (open access forms of all publications), accessible to different audiences (published as books, journal articles and briefs), and that they are engaged with relevant decision makers. However, the typical modality of research (publishing academic articles) requires revisiting lest the volumes of published work prove irrelevant for decision makers, and do not support more informed policies, programs and services.

### **Intersections**

We know very little about how farmers interact with multiple, sometimes contradictory, messages about what they ought to do, and how. It might be assumed that since almost all support for smallholder

farmers in Ethiopia comes via the governmental extension system that the messages provided to smallholder farmers would corroborate and be consistent. This is not always the case. For example, the Ethiopian Biodiversity Institute seeks to maintain and support genetic diversity, including supporting the establishment of seed banks to preserve and supply local seed. On the other hand, development agents strongly encourage the adoption of improved seed varieties, often in opposition to locally maintained varieties. Furthermore, some government supported agencies focuses upon ‘high priority’ crops (primarily export oriented cereals), such as the Agricultural Transformation Agency, while crops that have higher yields and are of greater importance for smallholder food security, such as enset, are subject to limited research and extension support. In other instances, different branches of the same department might take opposing perspectives on issues, such as zero-grazing policies being supported by natural resource management personnel while crop scientists do not agree, highlighting the unanticipated effects of weeds and pests. In yet other instances, international partners change the national or regional focus, at least for the duration of partnerships. For example, one of the largest partners for agricultural extension in Benishangul Gumuz regional state supported extension services but would not support the promotion of fertilizers (instead promoting small-scale composting systems). Many donors have supported the advancement of sustainable land management throughout Ethiopia, yet reduced and controlled grazing in communal areas can run counter to livestock promotional activities and livestock extension messaging, particularly in areas where grazing land is insufficient. These are but a few contemporary examples, many more could be given regarding the changes of what has been promoted within agricultural extension services throughout the decades of its operation.

It remains unclear how farmers interpret and navigate these diverse messages, and to what extent one program may influence (non)adoption in others. At least one study in Ethiopia (Segers et al, 2008) has shown

that programs do interact with one another something which almost always goes unnoticed or unnoted. The complexity of change in practice and the interrelationship of apparently unrelated advocacy (and other action) is an area that requires much more research. At present, only anecdotes and specific case studies shed light on the potential influences such relationships may play. This is an area where future research can provide important evidence, methodologically and as research findings. Studies of this nature will also help ensure that activities in the agricultural and food security realms are aligned and will support the strengthening of policy coherence.

## CONCLUSION

Ethiopia has made significant progress in reducing the negative impacts of drought, in improving agricultural production, and in supporting smallholder farmers to strengthen their agricultural livelihoods (Dorosh and Rashid, 2012; FAO, 2014; Rahmato, Pankhurst and van Uffelen, 2013). Research from across the disciplines has supported the generation of new knowledge, and the integration of evidence into policies, practices and services. In this article, we have identified and described what we perceive as knowledge gaps, which we have presented as opportunities for areas where future research could have significant impact, and where researchers could become key thought leaders. Our focus has been on issues related to contextualizing and integrating research, on research synthesis, and for better understanding intersections between activities.

We do not claim to have covered all areas where more knowledge is needed within food security and agriculture in Ethiopia. Emerging research has begun to fill the knowledge gaps we identified, such as systematic reviews of literature that provide summarized and synthesized knowledge about what is known. While these reviews summarize what is published, they do not highlight what is missing. Thus, we believe that broad, perspective style articles similar to this one, which reflect on the trends of research and highlight

knowledge gaps, are important because they add perspectives about what is missing and/or needed. The objective of this short communication article is exactly that: to highlight crucial knowledge gaps, to encourage reflection on the trends of research, and to inspire creativity and innovation to support the advancement of food security and agricultural research in Ethiopia.

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