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AgriGender *Journal of Gender, Agriculture and Food Security*

AgriGender 2019; **Volume 04, Issue 02**, 1–10, doi:10.19268/JGAFS.422019.1

Gender and agricultural extension: why a gender focus matters

Ileana I. Diaz[†*] & Dina Najjar[◇]

[†] *Department of Geography and Environmental Management, University of Waterloo, Waterloo, Ontario, Canada N2L 3G1.*
[◇] *International Center for Agricultural Research in the Dry Areas, Sustainable Intensification and Resilient Production Systems Program, Beirut, Lebanon 1108-2010.*

[*]Corresponding author. Email: idiaz@uwaterloo.ca

The long-term success of extension services is dependent upon addressing the underlying causes of gender inequality. However, gender analysis is often not included in the design and implementation of extension services. Our aim with this review is to highlight the importance of gender integration into agricultural extension programs in various parts of the world, to raise much needed awareness on the subject. We do not aim for an extensive literature review but rather seek to identify the harms caused by the exclusion of gender, make suggestions for how scholars and practitioners might include gender, and indicate some ways to move forward. Ultimately, gender transformative approaches should be pursued in the future as strategies that focus on the causes of inequality, rather than the symptoms.

Keywords: Agricultural Extension, Gender, Gender Transformative Approaches, Gender Inequality, Gender Analysis.

Introduction

Despite repeated concerns about a lack of gender analysis in agricultural extension programs, the problem still prevails (Percy 1999; 2005; World Bank 2009). Lambrecht, Vanlauwe, and Maertens (2016) state that gender continues to be "rarely considered in the literature on agricultural extension and technology adoption" (p. 2). Extension services must seek to challenge some of the practices which produce gender inequality if they are to be successful at increasing agricultural productivity in the long term, without increasing the resources used (Anandajayasekeram et al. 2008, p. 60; World Bank 2009). Some authors argue that extension services are a crucial way for the world's poorest people to adopt agricultural innovations, which in turn will address issues of poverty, hunger, and women's empowerment (Anandajayasekeram et al. 2008; Jafrey and Sulaimon 2013b; World Bank 2009).

This review was compiled from a broad search of the literature on gender and agricultural extension. The literature reviewed here is global in scope in order to attend to broad trends in the field and practice of agricultural extension. Our aim is to highlight the importance of gender integration into agricultural extension programs in various parts of the world, in order to raise much needed awareness on the subject. We do not aim for an extensive literature review, but rather to identify the harms of not including gender, highlight some of the ways gender could be included, and suggest pathways to move forward. We pay attention to extension design, content, approaches, and impact. We start this literature review with a highlight of the significance of gender to agricultural extension, then move to demonstrate how gender continues to be missing from the extension literature. We also discuss women's empowerment as it pertains to extension, the outcomes of different approaches to extension, and the implications for the content of extension programs. Finally, we conclude with a discussion of the elements which are still missing from conversations around gender and extension, as well as key themes which emerge from the literature.

Importance of gender to agricultural extension

It is crucial to attend to gender in agricultural extension because gendered inequalities contribute to global hunger and food insecurity (Njuki, Parkins, and Kaler 2016; World Bank 2009). Additionally, because extension services in general do not have an explicit focus on women and gender, they often do not recognize the important labor that women contribute to agriculture and structural conditions — such as their domestic roles — that can limit the types of training available to them (Anandajayasekeram et al. 2008). For example, a study in Uganda noted that residential training, or training which requires a large time commitment, might be incommensurable with childcare and other duties in the home (Anandajayasekeram et al. 2008, p. 57). Fur-

thermore, innovations designed to reduce labor and free up time can often increase women's labor burdens (Beuchelt and Badstue 2013). As such, the conditions of women's inequality will persist if gender is not integrated into agricultural extension, which will in turn limit the efficacy of extension specifically, and of development projects more generally.

Of concern to development organizations and policy makers is what factors influence the adoption of improved technologies positively or negatively (Ainembabazi and Mugisha 2014; Ragasa et al. 2013). Despite an ostensible acknowledgment of gender in many extension services, they often fail to meet or recognize the very different needs of men and women farmers, or the very different roles they may have in agriculture (Jafrey and Sulaiman 2013a). While women in agriculture have been quite extensively studied since the 1980s, extension services in developing countries are often not sensitive to gender or the specific needs and desires of women farmers (Jafrey and Sulaiman 2013a). In this instance, the ability to even articulate their needs and desires can be limited because of a lack of access to education and training (Jafrey and Sulaiman 2013a, p. 433). Despite the fact that agricultural extension services systemically neglect them, women are an integral part of agriculture in all developing countries and are often "the backbone" of the agricultural workforce, sometimes supplying the bulk of the labor required, and in other cases performing the most unappreciated, lowest-paid labor (Jafrey and Sulaiman 2013a, p. 470; Kabeer 2012, pp. 26–7). This neglect by extension services contributes to women's continued food and income insecurity.

Alex (2013) argues that in comparison to men, women agricultural workers in Kerala, India are particularly marginalized under neoliberal economic policies that have deprioritized agriculture. In Kerala, agriculture has been on the decline — particularly the cultivation of rice — which has implications for women's livelihood and food security. As a result, "the decreasing contribution of agriculture to the national economy has taken its toll on availability of sustainable employment from agriculture", which women are most vulnerable to because they often lack control over resources (Alex 2013 p. 488). With less investment in agriculture, rural women are at an increasing disadvantage. Alex (2013, p. 494) argues that mechanization of rice production by collectives of women has been the most effective innovation in the area, because of a shortage of labor. This case study shows that the adoption of this innovation increased the capacities of the women farmers who participated and helped to diversify livelihoods in the Kerala region. Furthermore, the case proves that focusing innovations on women can be as successful as extension programs that target men; however, the empowerment of women requires more institutional changes and must be context-sensitive, taking into account the particular understandings that surround gender and incorporating approaches which seek to expand women's roles in agriculture.

There is evidence from around the world that, when women are the targets of extension services, the benefits are typically felt by both women and their children; yet, many women are trained in "home economics" rather than in more technical forms of agriculture because of gender biases (Anandajayasekeram et al. 2008, p. 57). If extension services are to be useful to women, they must take into account the unique social, cultural and economic contexts of women, and their implementation must be adjusted accordingly. For example, training programs might consider providing facilities or services for the care of children and washing or sleeping arrangements that are more private if overnight stays are required (Anandajayasekeram et al. 2008). As such, Jafrey and Sulaiman (2013b) argue that an "overhaul" of most extension services is necessary, so that they are more sensitive to issues of gender, including women's everyday needs and their increased vulnerability to poverty and hunger.

Farnworth and Colverson (2015) intervene in the discussion on gender and extension by positing that the interests of men and women in Sub-Saharan Africa do not have to be conceptualized in opposition to each other. They argue that because agriculture and farmers' social contexts are shaped by gender, so too are extension services. By focusing only on men's assets *versus* women's assets, we run the risk of overlooking what could be produced in collaboration. The authors contend that there is little use in increasing extension services if men and women are not equally empowered to access and make decisions about them (Farnworth and Colverson 2015). While there is consensus that more equitable gender relations increase productivity (Farnworth and Colverson 2015; FAO 2011), most extension services are still based on the assumption that household and farming operations are male-led. Farnworth and Colverson (2015, p. 21) argue that farms run as a "partnership between men and women" would be even more productive and could create other positive outcomes such as greater empowerment for men and women. The authors claim that most development literature is stuck in a "conceptual lock-in" and the design of extension services tend to entrench gendered notions about farming, thereby marginalizing and homogenizing the roles of women in farming, while ensuring that men are considered the primary farm laborers and decision-makers (Farnworth and Colverson 2015, pp. 22-7).

Similarly, in their work in South Kivu in the Democratic Republic of Congo, Lambrecht, Vanlauwe, and Maertens (2016) found that joint participation of male and female farmers leads to higher technology adoption of improved legume varieties, row planting, and mineral fertilizer. These three technologies seem to be better adopted when both male and female farmers participate in the programs (Lambrecht, Vanlauwe, and Maertens 2016, p. 2). Their findings suggest that targeting both genders within a household can make agricultural extension programs more cost effective; however they also find "that program participation has different implications for female farmers in male- versus female-headed households and has a larger impact on adoption in the latter case" (Lambrecht, Vanlauwe, and Maertens 2016, pp. 22-3). Moreover, "female program participation is more effective for certain types of technologies than for others" (Lambrecht, Vanlauwe, and Maertens 2016, p. 23). Making the argument that gender must be attended to with extension services, means that differences produced by gender must be acknowledged but not accepted as natural or inherent, as this can close off other possibilities for interventions such as collaborative approaches to extension services that involve all genders.

How extension services exclude on the basis of gender

Understanding the social context of communities when practicing development work is of the utmost importance; however, while gender is essential to understanding the context in which development is being implemented, it is often not adequately integrated. As a concept, an agricultural innovation system (AIS) seeks to integrate agricultural development with the political, social, and economic contexts where these agricultural innovations occur (Kingiri, 2013). Kingiri (2013, p. 536) argues that even though most literature on AIS has not been attuned to gender, AIS can open up new ways of integrating gender issues into agricultural innovation and extension, particularly because the framing of debates around gender and development do not take into account how complex and unique gender and gender roles are in any given context. Rather than approaching issues of development and innovation through gender analysis, Kingiri (2013, p. 535) suggests they should be approached as "gender learning". This also shifts the focus from empowering individual women, to increasing the capacity of the AIS to transform gender relations by creating more effective innovations. While there is a clear emphasis on measurability and standardization of processes when evaluating and designing development projects, scholars who propose alternative approaches to analyzing development also argue that these processes need to be attuned to cultural and geographic specificity if they are to be effective (Alkire et al. 2013; Birner et al. 2009; Higgins, Bond, and Kindorny 2014; Kristjanson et al. 2014; Meinzen-Dick et al. 2012; Njuki, Parkins, and Kaler 2016). The more complex a proposed measure or evaluation tool is, however, the harder it is to implement in practice, there is also a level of rigidity to standardization that can make some methods of evaluation much less attuned to specific contexts.

Through their research in rural Nicaragua, D'Excelle and Holvoet (2011) attempt to address a divide in the literature on gender, networks, and empowerment. In particular, they are interested in the "relation between gender and network formation" as well as the differences in men's and women's networks (D'Excelle and Holvoet 2011, p. 31). Despite the fact men and women experience and benefit from networks differently and some networks further entrench gender inequity, there is evidence that building social networks gives women increased control over resources. This is because gender also informs the kinds of networks an individual is able to create. One reason for the divergence in arguments regarding the benefits of network building in relation to gender, is that most studies do not analyze the same kinds of networks. Indeed, D'Excelle and Holvoet (2011) suggest the need to "consider social networks as the dependent rather than independent variable, and refrain from clumping together all types of networks under one heading" (p. 54). D'Excelle and Holvoet (2011) further argue that in Nicaragua, women tend to benefit from networking with men, yet most often, networks are gender-segregated because women are relegated to domestic and care work, and are less able to make far-reaching networks, or local networks with powerful individuals in the public sphere. As such, policies and programs which do not explicitly take the relationship between gender and geography into account can further entrench the power structures already in place with gendered networks.

Ragasa et al. (2013) are concerned with how gender differences affect access to agricultural extension services and how this equates to differences in technology adoption and agricultural productivity in Ethiopia. The Ethiopian government has invested massively in their extension system: They have the largest ratio of extension agents to farmers in the world (Ragasa et al. 2013, p. 7). The authors employed a cross sectional instrument variable regression method from 7,530 household surveys collected by the Central Statistics Agency (CSA) in four regions of the country. They found that male heads of households are more likely than female heads of households to be visited by, and to receive advice from development or extension agents (Ragasa et al. 2013). Their findings suggest that female heads of households and plot-managers are 10 percent less likely to get extension services than their male counterparts (Ragasa et al. 2013, p. 13). Since receiving advice from extension agents usually leads to the adoption of varied seeds and fertilizer for both genders, it is important to address the gendered differences in the provision of services.

The subtle ways in which women are excluded from extension services in the Middle East and North Africa (MENA) region highlight the importance of a gender-sensitive approach. While most of the literature in Sub-Saharan Africa shows that women and men have their own plots (for example, Farnworth and Colverson 2015; Najjar, Abubakar, and Alma 2016a), women in the MENA region often work on farms owned or managed by their male kin (Galie 2013; Najjar, Abdallah and Alma 2016b). Even though women are increasingly farming in the region due to male outmigration and limited financial gains from farming, they have limited decision-making power and visibility vis-à-vis extension and development programs (see Abdelali-Martini, Goldey, Jones, and Bailey 2003). As such, they are more vulnerable to being excluded from extension programs as helpers rather than farmers in their own right (Galie 2013; Najjar, Abdallah, and Alma 2016b).

Globally, the activities of extension services are often of limited use for women, who tend also to have more limited access to these services. According to Lamontagne-Godwin et al. (2017) there needs to be better understanding of how advice directed at women can be more effectively disseminated and applicable to women's lives. This is because women have had long-term barriers to accessing "extension advice, land, resources, agricultural inputs, and [...] professional opportunities" which has been one of the single most important restrictions on agricultural growth (Lamontagne-Godwin et al. 2017, p. 3). Agricultural innovations — including extension services — can be profoundly useful for impoverished farmers, and they may be especially useful to women because they can lessen the labor and time input of agriculture (Anandajayasekeram et al. 2008; Jafrey and Sulaimon 2013b). Despite the implementation of innovations, gender inequality — in the form of authority and profit over resources, access to services, and lack of opportunities — remains in agriculture. This is partly because extension services historically, have catered to and targeted men. The problem is compounded

by other forms of gender-based inequity, such as limited access to education, and land tenure systems which do not recognize or allow for women's ownership of land (Jafrey and Sulaiman 2013b). As such, agricultural innovations must be sensitive to gender. In this regard, some authors advocate for gender transformative approaches to development, which seek to challenge and modify existing social relations for development outcomes that are more equitable (Beuchelt and Badstue 2013; Farnworth and Colverson 2015; Hillenbrand et al. 2015; Kantor, Morgan, and Choudhury 2015; Njuki, Parkins, and Kaler 2016).

Women's empowerment and agricultural extension

Sensitivity to gender also includes studying how gender can affect the attainment of empowerment. While women's empowerment has often been an overarching goal of development work more generally, in practice and particularly in agricultural extension, gender has not always been at the forefront of analysis (Alkire et al. 2013, p. 71). Even though women contribute greatly to agriculture in all developing countries, their efforts are often devalued or go unrecognized, because of existing gender biases within communities and in development organizations (Anandajayasekeram et al. 2008, p. 56). Feminist and gender scholars have contributed to the field of development studies by highlighting the kinds of gendered power relationships and structures which can limit women's economic capacities (Kabeer 2012). This kind of scholarship also highlights that while increased gender equality is a worthy end in its own right, it also contributes to positive development outcomes overall (Kabeer 2012, pp. 4–5).

Scholars have also found that fast-growing economies can exacerbate gendered inequities — such as barriers to education and employment — because the focus is on growth and productivity rather than equity (Beuchelt and Badstue 2013; Kabeer 2012). Control over resources can often remain unequal, leaving women and children most vulnerable to the effects of development programs that do not integrate gender into their design. Scholars argue that the improvement to human experiences, rather than increased income and productivity, should be the end goal of development because the benefits of innovations are not always evenly distributed and may even exacerbate inequalities (Beuchelt and Badstue 2013; Kabeer 2012). Several authors have noted that in development projects (such as agricultural extension) immense emphasis is placed on the ability to achieve specific and measurable outcomes and for all aspects of the project to be analyzed and evaluated in a standardized way (Alkire et al. 2013; Birner et al. 2009; Kristjanson et al. 2014; Meinzen-Dick et al. 2012). When gender inequality or women's empowerment in agriculture become part of a development program, this can create some difficulty if it is not measurable and comparable (Alkire et al. 2013). Since empowerment is so complex, comprising of multiple dimensions, it can be difficult to measure. The consequence was, that prior to the development of an index measuring issues that affect women in agriculture, or in rural areas more generally, empowerment has historically been excluded from rural development programs (Alkire et al. 2013, p. 89).

The Women's Empowerment in Agriculture Index (WEAI) "measures the empowerment, agency, and inclusion of women in the agricultural sector" (Alkire et al. 2013, p. 71). The WEAI is made up of two sub-indexes and multiple indicators, because high achievement in one area is not enough to substantively alter a woman's life conditions. Instead, "empowerment in agriculture occurs when a woman has adequate achievements across a set of different conditions… she needs the joint distribution of advantages to exceed some threshold" (Alkire et al. 2013, p. 75). The index can be used to analyze empowerment generally and to locate which area(s) of empowerment are most lacking in a given context, allowing policy makers to target development in the corresponding domain of empowerment. The gender of the facilitator can also be an important part of the context. It is widely believed that women in Sub-Saharan Africa prefer working with women extension agents (Ezumah and Di Domenico 1995; Due, Magayane, and Temu 1997; Percy 1999; Shibanda and Seru 2002). Ezumah and Di Domenico (1995), Percy (1999), Shibanda and Seru (2002), among others, recommend increasing the number of female extension agents to overcome cultural barriers in communication between male extensionists and female farmers.

Galie (2013) focused on tracking changes in empowerment through the adoption of a Participatory Plant Breeding (PPB) program, as articulated by women farmers in Syria. The indicators of empowerment were selected in collaboration with the 12 study participants (all women farmers) and included: "'recognition of women as farmers'; 'access to opportunities' (such as the PPB); 'access to and control of productive resources', particularly seed and information; and 'decision-making' about agronomic management" (Galie 2013, p. 203). Recognition that women can be farmers is a key issue because taking women's roles in agriculture seriously can help them to become key players in extension programs. Galie (2013) argues that empowerment is a "self-determining process" and that the "empowerment of women farmers is increasingly important in countries where the feminization of agricultural labour is making women farmers key participants in the agricultural development of small-scale farming" (p. 197).

Kabeer (2012) notes that some economic activities seem to produce more empowering results for women than others, with formal wage work outside the home having the most potential to transform unequal gender relations. This is also the type of work that is usually least available to women (Kabeer 2012, p. 50). Agricultural work is often not considered the most empowering work; for instance, the Millennium Development Goals (MDGs) advocated for an increase in non-agricultural employment for women, particularly because agricultural wage labor (which is differentiated from farm ownership) is some of the lowest paid, least valued, least desirable work for women (Kabeer 2012, pp. 26–7). Simply being employed in non-agricultural work, however, does not necessarily mean that women are employed in long-term, meaningful work. In fact, women are more likely than men to be employed in precarious or exploitative work (Kabeer 2012, p. 15). Economic growth must be approached with an explicit understanding that it is not inherently beneficial for all

actors and should be complemented with policies that address gendered economic inequality. Peterman et al. (2011) emphasize that an understanding of the unequal control in decision making processes and material resources should be the foundation of new development programs and research, and that gender should "be integrated in agricultural programs and research within the context of regional ecological and biophysical needs, as well as regional cultural differences" (p. 24).

Hillenbrand et al. (2015) conclude that indicators of gender transformative change in livelihood and agriculture needs to be context specific. However, rather than suggesting rigid parameters, or universal indicators, the authors propose a set of guidelines to measure gender transformative change for practitioners and development organizations including: examining organizational structures and training, creating understandings that gender-transformative change is not a technical process but rather a political one, using participatory action-oriented research methodologies with gender-analysis to develop context-specific indicators, being open to organizational change as new information arises, developing relationships and partnerships outside of the organization, and ensuring transparency and accountability (Hillenbrand et al. 2015, pp. 47–50). They further argue that women's empowerment and transformative change cannot be considered an individual responsibility, but should be taken on as a collective duty, achieved through political action and engagement (Hillenbrand et al. 2015, p. 5). One important critique that they raise is how the "mainstreaming" of women's empowerment, particularly in the form of the MDGs, reflects neoliberal political and economic values (Hillenbrand et al. 2015). This makes individuals responsible for their own empowerment, while leaving the larger political, social, and economic contexts — as well as the institutions responsible for gender inequality — intact. Most literature on agricultural extension is focused on productivity, and even that which does include a gendered analysis often focuses on simply examining gendered relationships (for example unequal power relations between women and men) rather than on transforming them.

Different extension approaches and their gender implications

While most developing countries are reliant on small-scale agriculture, its productivity has not increased worldwide (Anandajayasekeram et al. 2008). This is further compounded by the limits of finite resources such as land and water (Anandajayasekeram et al. 2008, p. 30). Approaches to extension services have shifted dramatically over time from mainly top-down, to more pluralistic, to approaches which also focus on entrepreneurship rather than only transfer of technologies (Pretty 2002; Mudege et al. 2015). Nonetheless, some argue that top-down approaches still prevail in Sub-Saharan Africa (Mudege et al. 2015; Spaling, Montes, and Sinclair 2011). Anandajayasekeram et al. (2008) argue that extension services worldwide should focus on increasing farmer knowledge and observation skills, so that farmers come to see some unsustainable agricultural practices as untenable, while also being able to monitor their own progress. Also of importance is integrating farmer and Indigenous knowledges and practices (2008, p. 37).

Hillenbrand et al. (2015) argue that gender transformative approaches should stress the importance of examining and addressing the structures and unequal power relations which produce gender inequality. As such, "gender transformative approaches aim to move beyond individual self-improvement among women and toward transforming the power dynamics and structures that serve to reinforce gendered inequalities" (Hillenbrand et al. 2015, p. 5). Of particular importance to gender transformative change is questioning and challenging "internalized belief systems and closely held identities... entrenched institutionalized structures, and... everyday habits and relationships that may be caring as well as unequal" (Hillenbrand et al. 2015, p. 6). For instance, Mudege et al. (2016) found that gender and cultural norms determine farmer access to information as "some men regard themselves as representatives of their households during training and... extension officers reinforce these views by using biased training recruitment methods" (p. 291). Furthermore, gender norms related to decisions made in the household impact the ability of women to access training opportunities and information (Mudege et al. 2016).

Spielman, Davis, and Negash (2011) propose that using an innovation systems framework analysis "can contribute to addressing the discrepancy between the changes in policies, actors, and relationships, on the one hand; and [agricultural] productivity on the other" (p. 196). Most of Ethiopia's population (approximately 80 percent) is rural and lives in widespread poverty (Spielman, Davis, and Negash, 2011, p. 198). There are extreme land shortages, severe droughts, variable rainfall, and declining soil fertility. Their findings suggest a "need to further explore policies and programs that create more space for market and civil society to participate in smallholder innovation networks and improve welfare", while a second one supports "incorporating rigorous applications of social network analysis into innovation systems theory" for the purpose of better understanding if smallholders are adopting innovations (Spielman, Davis, and Negash 2011, pp. 208–10). Meanwhile, Kantor, Morgan, and Choudhury (2015) argue that gender transformative approaches should be incorporated into agricultural research for development (AR4D), so that AR4D can better respond to the specific needs and contexts of the people who most need it. Since AR4D "seeks to bring together analysis, action, and change across multiple levels of spatial, economic, and social organization", the authors argue that it is already amenable to addressing gender inequality (Kantor, Morgan, and Choudhury 2015, p. 295).

Gender is foundational to how individuals understand themselves, their capabilities, what is expected of them, what resources they can access, as well as how organizations and institutions structure resources, opportunities, and access to them (Kantor, Morgan, and Choudhury 2015). Therefore, Kantor, Morgan, and Choudhury (2015) advocate that a gender-based approach to the social aspects of AR4D is crucial to understanding and addressing the inequalities that can occur in agriculture and development. For instance, Beuchelt and Badstue (2013) note that global agricultural productivity is not the cause of

hunger and malnutrition, and therefore development initiatives need to take human development and food security into account. They argue that despite increased global agricultural productivity and a global food supply that is sufficient to feed its population, nearly 900 million people go hungry and two billion people are malnourished (Beuchelt and Badstue 2013, p. 709). Highly productive farms may not produce the most nutritious, diverse, or environmentally friendly food. Technological innovations have therefore been adopted to address environmental and nutritional concerns in agriculture, but these approaches are not inherently sensitive to issues of existing social inequities, such as gender-based inequities (Beuchelt and Badstue 2013, p. 710). As Njuki, Parkins, and Kaler (2016) argue, the "existing research methods and evaluation tools are not yet up to the task" of addressing gender inequality, including evaluation of agricultural extension programs (p. 288).

Quisumbing and Pandolfelli (2010) found that the most promising approaches to creating agricultural innovation include: continuing efforts to strengthen women's land rights and investing in education and schooling; promoting divisible technologies or smaller input packages that are more affordable and opportunities for groups to achieve economies of scale; adaptation of program design or service delivery to client needs; considering interactions among inputs rather than treating each input in isolation; and taking gender roles into account when designing and implementing projects (pp. 8–9). In addition, a number of issues stood out as making innovation adoption difficult for poor women farmers, such as a lack of rigorous evaluation of approaches and gender impacts, lack of exploration of alternative designs and delivery mechanisms, meeting women's diverse needs, and sensitivity to culture and context which take into account country-specific gendered policies and programs (Quisumbing and Pandolfelli 2010). While the actual quality of the advice may be hard to assess given the difficulties in determining technical accuracy, affordability, and available practices, Lamontagne-Godwin et al. (2017) propose measuring its quality in relation to health services and human and animal health systems. This means that the overall state of human and animal health can indicate the quality of advice given, because higher-quality advice should result in better health for people and animals in a given system.

Davis et al. (2012) argue that extension services are "critical" for addressing rural poverty since they involve farmers in agricultural knowledge systems. They focus on farmer field schools (FFS), as "a participatory method of learning, technology adaptation, and dissemination", where farmers conduct research, problem solve, and suggest solutions (Davis et al. 2012, p. 402). FFSs encourage farmers to develop their own leadership and decision-making skills, making this approach different from more traditional, top-down approaches to extension services. Davis et al. (2012) found that FFSs increased productivity and incomes significantly more for women than for men, inferring that men already have larger land holdings and greater access to education. As such, FFSs can ensure that extension services are relevant to women. Meanwhile, Szonyi and Blum (2012) found that extension services are lagging in relation to meeting the goals of zero hunger initiatives in developing countries (p. 1). They created "an extension investment model (EIM) based on socio-economic macro indicators (poverty/undernourishment, access to information and population density) and a method to define estimates for cost increases related to climate change" (Szonyi and Blum 2012, p. 1). This suggests that investment targets for agricultural research, as well as extension investment, will continue to increase in the millions by 2025 (Szonyi and Blum 2012). The EIM model would benefit from explicit engagement with gender, because gendered power dynamics are inherent to the indicators used in the model. For example, access to information is mediated by gendered factors such as the extent to which a person can engage in the public sphere.

Research design is as affected by gender relations as the phenomena being studied. Mayoux (1995) argues that inequalities influence activities, resources, and the frameworks of participatory research. There can be many barriers to women's participation in these projects, which stem from gendered inequalities, and these projects can often fail to live up to their expectations because women continue to be marginalized, even in organizations that include a mix of genders and that emphasize the participation of all members (Mayoux 1995, p. 6). Tensions that arise from agricultural extension participatory research may be a result of ideas about common priorities and consensus that do not adequately consider the context, case by case differences, or the different needs of men and women.

Development agencies, particularly those doing research-for-development, face increasing pressure to demonstrate that there is a clear link between research, agricultural extension, and long-term, substantive development outcomes (Kristjanson et al. 2014). Kristjanson et al. (2014) argue that social learning approaches might facilitate making this link clearer. Social learning approaches can take many forms, but essentially are collaborative processes that involve multiple actors with different stakes in the development process, and can include initiatives such as farmer field schools, or community-based management. A larger, more robust body of evidence needs to be built in order to assess the efficacy and efficiency of social learning approaches and to understand how they relate to the adoption of innovations (Kristjanson et al. 2014). As such, the authors argue that organizations engaging in social learning approaches should employ a standardized framework of documentation and assessment, so that a larger body of evidence can be built to understand this approach to agricultural development.

Since extension services are usually designed with a male subject in mind, Farnworth and Colverson (2015) propose a "gender transformative extension and advisory facilitation system" (GT-EAFS) — which they define as a model for creating extension services that will address the needs of women and ultimately shift gendered power relations — to reach the ultimate goal of gender equality (p. 27). In order for GT-EAFS to work, underlying systems of power have to be challenged, which is why many extension services fail to address gender inequality. Farnworth and Colverson (2015) argue that "an extension and advisory facilitation system (as opposed to a service) is required" because it is based on creating knowledge *with* farmers rather than disseminating knowledge *to* them (p. 28). As such, combining existing innovative approaches to gender and agricultural

extension, such as working with existing social structures in order to transform them, and in particular, including men in the process to develop collaborative relations, can help create effective approaches to a gender-transformative extension and advisory facilitation system.

Implications for the content of extension services

Aimed at standardizing how gender is understood in development, Meinzen-Dick et al. (2012) propose mapping the patterns of gender roles as they occur in a given context in order to understand the different realities of access, control, and ownership of agricultural resources. This in turn can increase the efficacy of agricultural policy interventions, by making information more easily accessible. They propose a systemic collection of data to map gendered farm management systems (Meinzen-Dick et al. 2012). Premised on the importance of "the role of agriculture for pro-poor development" in order to ensure farmer livelihoods and food security, Birner et al. (2009) propose a framework for analyzing agricultural advisory services (p. 342). Ultimately, they are concerned with understanding which agricultural advisory services work best in a given context so that policy makers can "identify the combination of reform approaches that best fit the situation under consideration" (Birner et al. 2009, p. 343). In order for policy makers to achieve the "best fit" Birner et al. (2009) created a conceptual framework for the design and assessment of agricultural advisory services, which is designed to take into account contextual factors and to be responsive to farmer needs and requests (pp. 343–4). Despite calls by some analysists to include only measurable goals, Higgins, Bond, and Kindornay (2014) argue that that norm setting — referring to "political decisions" about what is important to prioritize — will be important if post-2015 frameworks are to address important, but often not easily measurable goals, such as promoting gender equality (p. 39).

Extension programs and gender

Lamontagne-Godwin et al. (2017) use data from a program called Plantwise (plantwise.org) which is used as a central data base on plant clinic networks to give farmers advice on factors affecting a given crop in Ghana and Sri Lanka. Information from Plantwise is extracted to determine whether the advice given to male and female farmers by "plant doctors" — a name given to extension workers at plant clinics — differs in any way based on gender. It was found that in Ghana 80 percent of advice directed at women farmers and 81 percent directed at men farmers was accepted. In Sri Lanka, 76 percent of recommendations made by the plant doctors to men and 68 percent of the recommendations made to women were accepted (Lamontagne-Godwin et al. 2017, p. 7). Findings suggest a "significant difference between accepted recommendations, where a farmer was able to use and implement the advice of the plant doctor for Ghanaian and Sri Lankan men farmers, and also for Ghanaian and Sri Lankan women farmers (men: p = .003 ¡ .05; women p = .05)" (Lamontagne-Godwin et al. 2017, p. 7). Male farmers accepted 100 percent of male plant doctors' advice and 90 percent of advice from female plant doctors. Female farmers' main issue with the advice was the impracticality of the recommendations, as they were too costly and did not fully address their issues.

In Malawi, potatoes are highly valued as a key crop for both male and female farmers (Mudege et al. 2016). Potato farming provides a diversification opportunity for women in the country, and with strong extension initiatives has the potential to be gender-transformative as more and more women harvest the male dominated crop (Mudege et al. 2016, p. 3). Unfortunately, extension is greatly constrained in Malawi and there is a shortage of agricultural extension agents. Adopting a social relations approach, Mudege et al. (2016) explored how gender relations influence the use of seed technologies, access to technical information, and training. The authors conducted 35 focus groups as well as individual interviews in two districts — Dedza and Ntcheau — in Malawi in 2013. A total of 350 farmers and four extension agents participated in this research. They also collected data on training offered, recruitment methods, and opportunities and constraints for training. They argue that extension should be designed to address social advantages and disadvantages, because when social relations are the focus of extension, it is more likely that extension services will be more empowering for women (Mudege et al. 2016).

Jafrey and Sulaiman (2013a) argue that "demand-led gender-sensitive approaches" for rural women need to be developed. They propose a 'New Consultative Design Process' (NCDP) for the implementation of extension services to women farmers (Jafrey and Sulaiman 2013a). The NCDP is different, because rather than designing extension services with a top-down, donor-focused approach, extension services would be designed based on data collected in a three-stage process which focuses on the feedback and networks of women farmers (Jafrey and Sulaiman 2013a, p. 473). The authors conducted a pilot study of the NCDP process in three areas of rural India, which were assessed through participatory group interviews. They found that current interventions aimed at women are "subsidy and input focused", which does not provide the proper support or education for women to adopt them; furthermore, the interventions tend to be "supply-led" rather than "demand-driven", which means that women are not receiving the interventions they articulated were most necessary (Jafrey and Sulaiman 2013a, p. 479). Current interventions were also found to benefit more well-off women farmers, leaving poorer women further marginalized. In contrast, the NCDP approach allows for feedback from various stakeholders, helping to ensure that more women can benefit from extension services that they actually want and need (Jafrey and Sulaiman, 2013a).

Kantor, Morgan, and Choudhury (2015) conducted fieldwork in Bangladesh, to explore how gender affected adoption of aquaculture innovation, and how (or if) adopting innovations affected power dynamics and relationships. Findings were based on focus groups and in-depth interviews with adopters of innovations and other key informants. AR4D tends to focus on "innovation, learning, and action processes", however, the authors note that "while there is increasing agreement that gender and social inequalities matter to agricultural development outcomes, there is less consensus around how to intervene in the sector to address these

inequalities" (Kantor, Morgan, and Choudhury 2015, p. 294–5). Since AR4D "seeks to bring together analysis, action, and change across multiple levels of spatial, economic, and social organization", (Kantor, Morgan, and Choudhury 2015, p. 295), the authors argue that it is already amenable to addressing gender inequality. Yet, financial or time constraints, as well as a lack of capacity to perform gender-based analysis, can limit gender-transformative approaches. It remains crucial to address the actual causes of gender-based inequality, rather than simply the effects of inequality. For example, in the research of Kantor, Morgan, and Choudhury (2015), the fish-cage aquaculture was targeted at women, but many women's husbands ultimately decided whether or not their wives could continue with the training necessary to implement the innovation. Thus, the authors argue that without meaningful shifts in the social system itself, the distribution of the benefits of AR4D will remain unequal. In these cases, gender-transformative approaches are necessary because they address gender inequality at its roots.

Conclusion and recommendations

As has been illustrated above, a gender focus is crucial for achieving and maintaining effective agricultural extension programming. Although men have typically been the assumed targets of, and tend to benefit most from extension services, women play a vital role in agriculture throughout the developing world, often contributing the bulk of agricultural labor. Women's labor is often misunderstood, undervalued and deeply informed by the gender roles in their homes and communities. It is precisely because gender underpins every aspect of daily life that extension services must be attentive to gender, or risk exacerbating existing inequality. There are numerous methodological approaches that can be considered and adopted in order to ensure that gender is integrated into extension services, which has been outlined above. The literature reviewed here also points to the variety of cases, situations and projects that require a gender focus, highlighting the importance of understanding local context and practices and how they influence gendered outcomes.

While there is a tension between some of the more traditional, measurable, program-based approaches and approaches which stress political, systemic change, there is a consensus in the literature included here regarding the urgent need to make gender a central concern of agricultural extension services. Though it is important not to disregard projects that may be able to improve the immediate conditions of women's lives, there must be a greater focus on changing the conditions which produce unequal conditions of women's lives in the first place. These findings above indicate that gender transformative approaches are deeply important to meaningful adoption of innovation and extension services moving forward. As such, we recommend that greater attention be paid to gender-transformative approaches, because they focus on the causes rather than the symptoms of inequality. We also contend that while the social conditions that create gendered inequality must be identified, analyzed and transformed, further research must also interrogate the ways in which binary understandings of gender are naturalized and institutionalized in development projects. In other words, future work on gender transformative approaches must also seek to transform how we conceptualize gender itself.

Acknowledgements

This work was supported by the Consultative Group for International Agricultural Research (CGIAR) Research Programs Wheat and Dryland Cereals [grant number 100230] and The German Development Agency [grant number 200158].

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