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Women in African Agriculture: Integrating Women into Value Chains to Build a Stronger Sector



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Women in African Agriculture

Integrating Women into Value Chains to Build a Stronger Sector

Georgina Njiraini, Marther Ngigi, and Evelyn Baraké

Abstract

Women are under-acknowledged participants in Africa's agriculture and food sector, supplying a large share of the labour, but facing significant obstacles, including unequal access to land, traditional division of labour, restrictions on mobility, unequal educational attainment, financial exclusion, and gender norms. As a result, women are being constrained to lower productivity jobs and earning less than men. Their underrepresentation persists all along agricultural value chains. These inequalities translate into lower welfare outcomes for women in addition to inefficient productivity gaps with negative consequences for food security on the continent. Technical and institutional innovations in agricultural value chains must therefore be developed and implemented in a way that considers the particular constraints faced by women in agriculture in order to be fully effective and to avoid further solidifying gender roles and gaps. These could include suitable labour-saving technologies, financial innovations, mechanisms for collective action, and an improved access for women to extension services.

Keywords: women, gender, agriculture, value chains, productivity, inequality

JEL Codes: J16, Q00, Q13, Q15, Q16

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1 Introduction

Women are the backbone of the African rural economy and are key players in the food cycle, accounting for two thirds of the world's 600 million poor livestock keepers (World Bank, 2015; UNDP, 2016)). They are a major provider of labour, notably at the bottom of the value chain, where they contribute up to 40% of agricultural labour (Palacios-Lopez, Christiaensen & Kilic, 2017). Furthermore, rural African women work longer hours than men, especially when unpaid domestic labour is taken into account (World Bank, 2015).

Despite the important role played by women in the rural economy and in food production, their access to resources, services and opportunities is much lower than that of men (FAO, 2011; ActionAid, 2011; Quisumbing et al., 2014; World Bank, 2015, 2018; FAO, 2016). Gender norms, discriminatory beliefs and traditional household roles are major causes of this discrepancy. These limit their access to resources (DOSS, 2001; FAO, 2011) and their mobility, which constrains their access to a broader range of markets, and pose obstacles to their participation in institutional arrangements such as inter-village marketing or social groups (Pérez et al. 2014). All of these factors also disincentivize women from participating in value chains, or restrict their opportunities within them, meaning that women often miss out on the benefits associated with adding value (World Bank, 2015; FAO, 2016; IFC, 2016). Furthermore, the efforts of women are not rewarded equally to those of men, and they face insecure and often unsafe working conditions.

Not only do these gender norms translate into lower earnings for women, but they also result in lower productivity. For instance, when they are not head of the household, women are often seen as helpers rather than farmers in their own right and are therefore not targeted by productivity or earnings-increasing interventions, such as extension services (Farnworth & Kristjanson, 2013). Furthermore, because they systematically lack institutional support, women consistently invest less time and money into productivity-increasing technologies or strategies and improving their products. This creates a vicious cycle in which products produced and marketed by women fail to meet the market requirements in terms of quantity and quality, resulting in their further marginalization in value chains (Farnworth, 2011; Sebstad & Manfre, 2011; Lemma et al., 2016; UNDP, 2016). The cycle continues as women lack the incentives to upgrade along value chains, and remain unable to adjust to challenges such as climate variations, or take advantage of technological progress, changes in commercial orientation and global integration (Sebstad & Manfre, 2011).

Although the importance of revitalizing the agricultural sector in Africa has been recognized through various commitments made by governments and donors, the Food and Agriculture Organization (FAO) suggests that quicker and better results in agriculture will be achieved if the productive potential of women is maximized. The World Bank has established that reducing the gender gap in agricultural productivity lifts populations out of poverty, for example 238,000, 80,000, and 119,000 people in Malawi, Tanzania, and Uganda respectively in a given year (World Bank, 2015). According to further estimates, if women and men had similar access to productive resources along value chains, it would be possible to increase total agricultural output in developing countries, which, in turn, would reduce the number of hungry people in the world by about 12-17% (Farnworth, 2011; FAO, 2011; World Bank, 2015; UNDP, 2016).

The first section of this paper outlines the effect of gender norms on the productivity and incomes of women in the agricultural sectors of various African countries. The main challenges faced by women in value chains are outlined, including limited land rights, lower education levels and lower financial inclusion, as well as traditional division of labour in the household. These constraints are examined in turn, and their implications in terms of agricultural productivity and earnings are discussed. In the second section, the status of women in value chains is expanded upon, with examples of how gender norms concretely result in systematic marginalization of women in value chains, their concentration in different activities, and the types of technology they adopt. The third and final section discusses the

importance of applying a gendered-lens when developing and implementing technological and institutional innovations. Using examples of recorded initiatives, it makes recommendations on how to close the productivity and earning gender gap, and on how to deliver agricultural interventions that will reach women. These centre on developing female-friendly technological and financial innovation, increasing women's representation in collective action organizations, increasing the accessibility of extension services to women, and the overarching need to change the institutional and policy landscape to support these interventions.

2 Gender norms, productivity, and income gaps

Gender norms are at the root of many institutionalized and systemic differences between men and women in the agricultural sector, which have far-reaching consequences in terms of productivity and earnings for these respective groups. Gender norms are a subset of social norms, which are defined as informal rules that dictate interactions between individuals and collective behaviours that shape how people behave and how people expect others to behave (Markel et al., 2016). Although gender norms are highly contextual and manifest themselves differently from region to region, there are broad patterns and systematic ways in which they create constraints for women. These constraints directly impact women's productivity and earnings. In this section, the main systematic constraints imposed upon women that impact their participation in the agricultural sector are addressed, namely unequal land rights, restrictions on mobility, traditional division of labour, unequal education attainment and literacy, and financial exclusion. The consequences of these obstacles are discussed in terms of productivity and earnings, and illustrated with specific regional examples, in order to paint a picture explaining women's status within the current agricultural system. Although they are discussed separately from one another, these factors are deeply interconnected and mutually reinforce one-another. It is only by understanding the root causes underlying differences in which men and women interact in the agricultural sector that we can develop effective interventions that appropriately target and benefit women specifically. A stronger understanding of gender roles¹ and relations², and how these interact with capacities to learn about, adopt, and benefit from agricultural innovations, is essential for enhancing innovations for sustainable and inclusive value chains and improving welfare outcomes for the whole population, and especially for women.

2.1 Unequal land rights

In much of Africa, women have fewer land rights than men, whether formally or because of informal, customary norms (Farnworth et al., 2013). Unequal land rights are one of the main causes of the productivity gap between men and women as land represents the most important input into agricultural production. Women-run plots are often smaller and less fertile than male-owned plots, which can lead women to engage in less efficient agricultural practices. Furthermore, land ownership is often a requirement for access to other economic assets and services, to participation in decision-making, and to holding positions of leadership in the community. This means that women, who have less access to land, have less power to change the system in a way to bring about a more equitable distribution of resources.

The share of land held by women differs between African countries (Table 1). While in Nigeria, only 4% of agricultural land area is held by women and 9% jointly with men, women's access to land is more equal in Malawi where they own 58% of agricultural land either alone or jointly together with men. In Kenya, an estimated 3% of women own a title deed, and 5% hold a joint title deed with a man (GoK, 2010). Without the inclusion of the wife's name on the deed, the woman risks losing her land in the event of separation or the death of her husband.

¹Are those behaviours, tasks and responsibilities that a society considers appropriate for men, women, boys and girls

²Are the ways in which a society defines rights, responsibilities and the identities of men and women in relation to one another

Table 1: Share of household agricultural land area held by women, men or jointly by both

Country (date)	Definition of ownership	Women	Men	Joint
Ethiopia (2011-12)	registered	15%	45%	39%
Malawi (2010-11)	Owned	40%	42%	18%
Niger (2011)	Owned	9%	62%	29%
Nigeria (2010)	Right to sell / use as collateral	4%	87%	9%
Tanzania (2010-11)	Owned	16%	44%	39%
Uganda (2009-10)	Owned	18%	34%	48%

(Doss et al., 2015)

In many countries, the lack of formal legal rights over land directly impacts women's agricultural productivity and earnings. This is particularly salient in inheritance practices; in Kenya, land is passed on to the son of the land owner, rather than to his widow (Ngigi et al., 2017), while in Zambia, land is seized by relatives of the diseased (Markel et al., 2016). In the Oromia coffee region of Ethiopia, women can only own land if they are the head of the household, putting married women at a disadvantage; although they provide labour, their lack of land rights precludes their membership in institutions such as cooperatives that would provide them with productivity and income-increasing services. A study by Goldstein and Udry (2008) showed that low productivity on female-run farms in Ghana can be explained by the fact that women continuously farm their plots, because they cannot take fallow breaks out of fear of losing their land. These insecure land rights also inhibit women from participating in value chains and investing in physical assets (Coles & Mitchell, 2011) or accessing credit, and they impair women's incentives, as shown in Ghana (Hill & Vigneri, 2014).

Although some countries have legal provisions that protect women's rights to land or have taken steps towards including such provisions, these are often not enforced. In other cases, women lack the legal knowledge of their rights to claim their rights (Lastarria-Cornhiel et al., 2014). This is the case in Ethiopia, where, although the formal legal system recognizes the equal rights of women, customary practices and social norms lead to allocation of smaller and less fertile land to female-headed households (Tura, 2014).

Secure land rights for women are not only desirable from an equity and social justice standpoint, but can also increase household income, agricultural productivity and lead to more environmentally sustainable farming practices. Secure land rights can enable women to rent out their land. A low cost, speedy, and transparent community land registration process in Tigray, Ethiopia enabled female-headed households to rent out their land, as they were more tenure secure (Quisumbing & Kumar, 2014). In Uganda, increasing women land owners' knowledge of their rights led to an increase in productivity-increasing soil conservation measures (Deininger et al., 2008). Unequal land rights can also have indirect effects on productivity. For example, in Ghana, smaller land sizes limit women from engaging in cash crop production, due to the need for economies of scale (Hill & Vigneri, 2014).

2.2 Traditional division of labour and restrictions on mobility

The gender segregation of sectors and tasks, the traditional division of labour, and expectations about time-use dictate what roles, responsibilities, and behaviours are acceptable for men and for women. These categorize roles and responsibilities as inherently feminine or masculine. Women are more likely to work as unpaid family labourers or as part-time workers in the formal sector to create time for care responsibilities. In Sub-Saharan Africa, women often carry the bulk of unremunerated work. This includes long hours collecting water or fuel, caring for children and sick family members, cleaning, preparing and processing food, and engaging in unpaid family labour on family farms and enterprises. In Sierra Leone, female farmers perceive that they are respected by the community or by family members first and foremost for being "good housewives" (World Bank, 2015). Household chores take

up women's time, which renders them unable to choose to allocate their time more efficiently to alternative productive and more remunerative activities.

Within the agricultural sector, traditions and conventions often dictate which roles go to which gender, and traditionally female tasks and crops are generally lower wage and less profitable than those assigned to men. Activities such as ploughing and spraying are regarded as manly in some communities and rely entirely on male labour (World Bank, 2015). This can have negative impact on female-only households; in Malawi, women maize farmers required male labour for ploughing, but because they did not have male household members nor the cash required to hire labour, they ended up cultivating smaller plots, resulting in lower yields, and consequently put them at disadvantage in the maize supply chain (World Bank, 2015). Similarly, female-headed households in Ethiopia had lower yields because ploughing is considered a male chore. This contributed to a cycle of lower earnings, which in turn had repercussions on productivity and results in further marginalization (World Bank, 2015).

Extension services are also less accessible to women, as they may fail to consider women's long working hours on the farms and at their homes, which are likely to make their participation more challenging, especially when it involves travelling outside their homes and villages (FAO, 2011). As a consequence, women's output continues to lag behind due to unequal access to services and training (Lemma et al., 2016; FAO, 2011; UNDP, 2016).

In value chains, gender roles and expectations lead to the concentration of women in lower rungs, where they receive correspondingly lower earnings. Generally, men tend to be concentrated in higher remunerated contract farming segments of value chains by virtue of controlling the household land and labour division (FAO, 2010; FAO, 2016; IFC 2016). A recent FAO study in Kenyan and Ethiopian dairy value chain illustrates gendered patterns in workloads and employment trends in specific nodes in the chain; women mostly perform dairy production activities such as feeding and milking, and are excluded from the more profitable distribution and transportation nodes (Katothya, 2017). Milk is transported by young men travelling on bicycles or motorbikes, and the few women who do participate use donkeys or carts, which are slower modes of transportation that potentially compromise the quality of the milk (ibid). This is because transportation modes are also regulated by gender norms.

Women's mobility is restricted primarily by the norms that define women's role as one within the home to provide care, and by a perceived need to keep them safe (Markel et al., 2016). These gender norms can in fact exacerbate the problems that are used to justify their existence; lower participation and visibility by women engenders a culture in which those who do go out, whether to participate in markets or value chains, face gender-based violence and sexual harassment in the streets, especially during the early mornings and evenings. This results in women in male-headed households needing permission to travel to and even participate in trainings or study tours that could improve their entrepreneurship skills. Women's participation in such initiatives is further hindered by their need to find assistance in household care responsibilities for the time they are away. Other mobility-related barriers to market access include culturally unsuitable modes of transportation, lack of physical strength to load goods, and harassment by market officials (FAO, 2011; UNDP, 2016).

The implications of impeded mobility on earnings and productivity are many; lack of access to markets reduces women's potential earnings and ability to join, participate or fully benefit from membership in producer networks or organizations. Furthermore, women in male-headed households can miss out on opportunities which could increase their productivity and earnings.

2.3 Unequal educational attainment

Although the education gender gap has narrowed in recent years, it remains significant in Sub-Saharan Africa (FAO, 2011). The FAO reports that female heads of households have lower levels of human capital in comparison to their male counterparts (ibid.) Moreover, the number of women in research, science and technology remains low. This implies an educational bias disfavouring women. This gap in

literacy and educational attainment creates a vicious cycle, where women cannot receive further training or are excluded from extension services.

The gap in educational attainment has a direct impact on potential earnings, as lower level of education imply that women are likely to take up the lower skilled roles in value chains. Illiterate women are often unable to access management roles and are inhibited in their communication with market participants (Coles & Mitchell, 2011). This partially explains why women are concentrated in lower-paying jobs. In addition, lower literacy levels may inhibit women from engaging in better negotiation with value chain actors or accessing information necessary to support their decision-making, as information flows through a value chain are crucial for meeting the expectations of market and consumer demand (Farnworth, 2011).

Women with lower education levels than men are disadvantaged in their access to extension services, especially where a lot of reading and writing is involved. Due to lower literacy levels and educational attainment, women tend to be neglected by formal and informal technical vocational educational training programmes (TVET), as they generalize their target groups and reach out exclusively to men, who are also more accessible and visible in public (Hartl, 2009). Lower educational attainment also makes it more difficult to obtain and benefit from new information and extension on technological innovations. Evidence suggests that male farmers are in a better position to benefit from new knowledge, innovations, skills and technologies than women (Lemma et al., 2016; FAO, 2011; UNDP, 2016). Unfortunately, most of this information does not necessarily trickle down to women due to gender norms that inhibit female and male interactions in many societies. This can significantly further impact productivity, and shows how unequal educational attainment perpetuates the productivity differences in agriculture between men and women.

2.4 Financial exclusion

Financial products and services, such as savings, credit, financial education, and insurance and risk management schemes, are very important in agricultural production. These enable investments in agribusiness, increase producers' competitiveness, and allow farmers to invest in better technologies and capital to upgrade their production (FAO, 2011). However, women's access to these services is lower than that of men, and when the services are available, women are less likely to make use of them.

According to one quantitative study, women are less likely to access formal financial banking services in Botswana, Kenya, Malawi, Namibia, Rwanda, Tanzania, South Africa, and Uganda (Aterido et al., 2013). The gender gap in financial inclusion is measured at 11% in Kenya, 9% in Tanzania, 15% in Uganda and 13% in Nigeria, with men in Namibia and Rwanda additionally having more access to informal financial services than women (ibid). In Ghana, only 50% of women have formal bank accounts, and are faced with additional limits in their borrowing for farming (Sebstad & Manfre, 2011). Other recent studies show that fewer women have accounts and use mobile money than men in Rwanda, Côte d'Ivoire, Kenya, Tanzania, Uganda, and Nigeria (GSMA, 2015). Controlling for robustness, female-owned firms are shown to be more credit-constrained than male-owned firms (Aterido et al., 2013). Evidence further shows that women farmers and entrepreneurs rely on inter-chain funding or informal financial mechanisms, such as group-based approaches, which prevents women from investing in technologies, innovations or upgrading in value chains requiring heavy investment (Aterido et al., 2013; Ngigi et al., 2017).

There are several reasons explaining the gender gap in financial services, which include supply-side barriers, regulatory and institutional barriers, and societal barriers (GSMA, 2015; AFI, 2017). Aside from formal barriers and discriminatory laws, rules and regulations, many of the obstacles contributing to the access gap to financial services are factors that have been mentioned in the previous subsections; collateral requirements can be prohibitive, since women have less access to resources (FAO, 2011; Sebstad & Manfre, 2011; Aterido 2013; GSMA 2015), constraints on the time and mobility of women

hinder their access to institutions if they are situated further away (Quisumbing et al., 2010), and a lack of financial education can result in women not knowing about the availability and appropriateness of different financial services for their needs and how to manage their finances (Sebstad & Manfre, 2011). Furthermore, women often have little to no savings as a result of lower wages and because they spend a higher percentage of their earnings on household health, food, and education (Rubin & Manfre, 2014; Saulière, 2011).

There are also differences in the means of payments between men and women, with women preferring cash transactions. For example, in the Ghanaian citrus value chain, women prefer cash payments in full at pick up, since this reduces non-payment and fosters income autonomy (Sebstad & Manfre, 2011).

This is not necessarily by choice, as non-cash payments are often the result of institutional arrangements that disfavour women, for example as contracts can only be made in the name of head of household, as is the case in Ghana, or the arrangement depends on the head of a producer organization, who is most likely male (Sebstad & Manfre, 2011).

The financial exclusion of women has long-term impacts on their income; value chain finance can help small-scale producers integrate into higher-value markets or move up the chain (Miller & Jones, 2010), and access to financial services catalyses the uptake of innovations and technologies that are essential for participating in value chains (FAO, 2011). Furthermore, financial services, such as agricultural insurance, enable producers to hedge themselves against risk. There is, however, a lack of literature on how gender affects agricultural insurance uptake, specifically. One study using a randomized field experiment in Senegal and Burkina Faso shows that female farm managers were less likely to buy agricultural insurance, instead choosing to save the money for emergency purposes because of the lifecycle risk associated with childcare and fertility faced by women (Clara, 2015). Lower use of formal risk-management tools can result in lower productivity, since women would choose not to invest in riskier but higher productivity technologies on their plots, or use traditional risk-management methods that trade off risk for yield.

Bridging this gap in access to finance can have positive returns in terms of human capital. Access to and control of financial services by women has been linked to higher human capital in the form of family food consumption, children's health, nutrition, education, clothing, and the overall wellbeing of the family (Farnsworth, 2011; Njuki et al., 2011; FAO, 2015).

2.5 The impact of gender norms on women's participation in the agricultural sector

Evidently, gender norms have far reaching impact on women's earnings and productivity, and these effects further compound one another, perpetuating women's marginalization in value chains. Women systematically have lower access to productive resources and are constrained in their decision-making. The factors listed above are not exhaustive, nor are they mutually exclusive. Social norms that designate the man as having decision-maker power over the use of household resources limit women's choices (Markel et al., 2016). Social norms dictating women's roles and restricting their mobility can shrink their network and social capital, with consequences for representation in cooperatives and associations.

Further examples of the type of obstacles women face are the inability to afford permits to participate in markets, the time constraints inhibiting women from identifying the best prices for inputs, marital conflicts within the household that prevent women from buying land in their own name, women's lower bargaining power, and the tendency of men to take over as women's enterprises become more profitable (Markel et al., 2016; FAO, 2011; UNDP, 2016). Lower incomes pervasively preclude women from making the required investments to participate in higher-value markets. In Malawi, women have been found to face difficulties growing cash crops such as tobacco or improved maize, since these required expensive inputs for which they did not have the funds nor were they able to obtain credit or

guaranteed repayment (World Bank, 2015). Extension services have even been observed to bypass women because women often lack the complementary resources, such as land and finances, required to stimulate the technology adoption process (Meinzen-Dick et al., 2011).

Gender norms influence the provision of extension services. According to the FAO (2011), only 15% of extension personnel were women in a 97 country study of extension organizations using gender disaggregated data. Moreover, only 5% of the extension services were targeted directly at women. Male extension agents mainly target men in the household on the assumption that information will be shared with the female family members, which was shown to rarely be the case. In Ghana and Ethiopia, female farmers had lower access to extension services compared with male farmers, since they were not regarded as agricultural decision-makers (World Bank & IFPRI, 2010). As individual visits by extension agents remain the dominant mode of extension service delivery, one possible way to correct for this gap is to increase the number of female extension agents and train them to reach out to women specifically, as they are likely to be more sensitive to the particular challenges faced by women. This is particularly important in cultures that discourage women-men interactions.

3 Current status of women in agriculture in Sub-Saharan Africa

As outlined in the previous section, women are highly constrained by social norms and discrimination in their participation in the agricultural sector and in value chains. This impacts the ways in which they operate within the agricultural sector. The following section aims to give an overview of this reality and of its society-wide effects. Women's roles in value chains, and patterns of technology adoption are specifically outlined. This is important, as development, governmental and research organizations often implicitly assume the behaviour of male farmers to be the norm. This hidden assumption can further marginalize women, and lead to ineffective interventions that at best, do not help women, and at worse, have a negative impact on their productivity, income or further marginalize them.

3.1 Marginalization in value chains

Women experience higher entry barriers to value chains especially due to their lack of control on productive resources which are essential for up-scaling from subsistence to marketed output. Where women do participate in value chains, it is often either as wage labourers in the production and post-harvest processing stages, or they are concentrated in certain nodes of the chain that require low-skilled labour, such as packaging (FAO, 2010, 2016; IFC, 2016). In the Kenyan horticultural sector for example, women do 70 to 80% of packaging, labelling and bar coding work (ILO, 2009). Similarly, a recent study by the global Centre for Food System Innovation shows that in the pigeon peas and cereal value chains in Malawi, minimum resource requirements keep women in retailing and labour-intensive local processing (seed selection, seed planting, harvesting, storage, winnowing, and cooking), whereas men dominate as the large-scale buyers and processors (Me-Nsope & Larkins, 2015)

The marginalization of women in agricultural value chains represents a key challenge with broad implications for food security and economic performance. In most countries in Sub-Saharan Africa, innovation uptake is low and value chains are underdeveloped and underperforming (World Bank, 2015). The gender gap in access to and control over productive assets and opportunities stifles agricultural innovations and weakens the development of value chains, and thus is a contributing factor to the underperformance of the African agricultural sector (FAO, 2011; World Bank, 2015; FAO, 2016).³ There is increasing evidence that empowering and investing in rural women significantly raises productivity, decreases hunger and malnutrition and improves rural livelihoods for entire populations (Farnworth, 2011; FAO, 2011; World Bank, 2015; UNDP, 2016).

The negative impacts of this marginalization can also be felt in terms of women's long-term health and well-being. Women often work seasonal contracts which do not come with social protection schemes. In South Africa, 69% of women are temporary workers, while in Tanzania, women in flower farms are mainly casual workers. This creates avenues for abuse, including violence and sexual harassment. In Kenya's cut flower industry, female workers reported that male supervisors often demand sexual favours in exchange for employment benefits and job security, and any refusal led to immediate dismissal, despite firms' codes of conduct forbidding such actions (Poulson, 2016). Evidence further

³Agricultural productivity remains dismal, undermining Africa's overall productivity and food security. The sector's productivity in Africa considerably lags other developing regions and, unlike other regions, Africa has not benefited from the green revolution. In spite of its vast natural resources, including a huge expanse of arable land, Africa has the highest incidence of undernourishment (estimated at almost one in four persons) worldwide. Africa imports food staples valued at about US\$25 billion annually, essentially because food production, supply, and consumption systems are not functioning optimally. The level of value addition and crop processing of agricultural commodities is low and post-harvest losses in sub-Saharan Africa average 30% of total production, meaning that the region loses over US\$4 billion each year (World Bank, 2015).

suggests that women experience higher occupational safety risks than men, due to their concentration in certain nodes of the value chain. For example, health risks associated with crop production and labour-intensive livestock rearing include back pains and pelvic problems (Poulson, 2016). In the horticultural industry, women are predominantly involved in the production and processing nodes, and therefore have high levels of exposure to agrochemicals and toxic products. In the agro-processing sector, women reported higher rates of arthritis, colds and chest problems due to the long hours worked in cold rooms (Poulson, 2016). Women are doubly disadvantaged, being at higher risk of contracting health conditions while facing less secure employment, resulting in a risk of termination without remuneration when they become too unwell to work (Ulrich, 2014). Furthermore, women who lack formal employment contracts do not benefit from firms' health insurance and have to bear the costs of medical services associated with occupational illness themselves (Poulson, 2016).

Underrepresentation in cooperatives and in leadership and governance of value chains compounds the marginalization of women within value chains (FAO, 2011; IFC, 2016). Cooperatives and other group-based organisations increase farmers' incomes and productivity by helping establish bargaining power, creating avenues to share and acquire assets, building farmer capacity and providing access to markets (IFC, 2016). In some value chains such as the milk value chain, women are excluded by restrictive membership criteria, for example requirements to show ownership of assets, or needing to be considered head of household (Katothya, 2017). This also extends to groups governing the management of essential resources. For example, women in Ghana were unable to participate in water user groups, since membership was precluded on land ownership or being head of household. This has an impact on water pricing, which is unfavourable to women, as it is often calculated based on men's incomes (Green & Baden, 1994). The consequences of this exclusion are visible in the numbers; women make up a majority in agricultural cooperatives in Kenya and Malawi, yet their representation is very low in management and leadership positions are rare in Kenyan dairy (Me-Nsope & Larkins, 2015; Katothya, 2017), and in Ethiopia, they make up only 20% of cooperative in spite of their making up 50% of farmers in the country (IFC, 2016).

3.2 Women and adoption of technology and agricultural innovations

Innovating and adopting new technologies along the value chain are strategies for enhancing competitiveness and addressing changing market demands and consumer expectations. However, due to the constraints specific to women farmers that have been covered in the first section, the rate at which women adopt technology is lower than that of men. Furthermore, women adopt different types of technology than men, and the ways in which they adopt them differ systematically from that of their male counterparts.

Peterman et al. (2014) observe a consistent finding in Sub-Saharan Africa: male farmers have higher input use than female farmers across different types of inputs and technologies, but the extent of the disparity depends on whether models control for background factors and whether gender indicators are considered in the analysis. For instance, while many female-headed households lag behind in terms of fertilizer applications, the real underlying limiting factors are lack of credit and cash, which relates to the gender gap in financial inclusivity (Quisumbing, Pandolfelli, Brook, & Brook, 2010).

Women often adopt alternative low-cost technologies that require fewer resources but are potentially less efficient and more labour intensive. For instance, rather than using fertilizer, women adopt low-cost biomass transfer approaches, including biological nitrogen fixation (BNF) technologies through agroforestry innovations or grain legumes, and green manure (Verma, 2001). However, even these approaches require land rights, especially agroforestry-related innovations (Kiptot & Franzel, 2011), or they increase women's workloads and time constraints (especially in cases where there are shortages of male labour). One study found that in Zimbabwe, men could more easily adopt new maize varieties, because they tended to be more financially stable and had better access to marketing institutions than female farmers (Bourdillon et al., 2007). The latter opted instead for open pollination varieties (ibid).

Similarly, in Ghana, lack of access to complementary inputs, particularly of land and extension services, led to women planting fewer new maize varieties than men (Green & Baden, 1994). Given the fact that women do not have the same access to resources as men, as seen in the first section of this paper, investing in the necessary assets to plant a new variety is a large challenge. This challenge extends to irrigation projects and interventions that require large capital investments in terms of land.

This same gap in access to finance and resources presents a challenge in helping women invest in the necessary technologies to upgrade along the value chain. Innovative post-harvest technologies are essential in enabling sustainable value chains and reducing post-harvest waste and losses. This, in turn improves food security for all (Mediterra, 2016). In East Africa, men adopt high-cost metal silos that require heavy investments while women adopt low-cost hermetic bags (super grain bags) in post-harvest management of cereals (Nzioki & Kandiwa, 2015). Women lead innovations along the value chains of traditional high value crops, such as cassava, indigenous vegetables, sorghum and sweet potatoes, through value addition and packaging (Nzioki & Kandiwa, 2015). This can in itself be problematic, as there is some evidence showing that technologies that increase the productivity and profitability of land may encourage men back to farming and reduce women's access to land and other assets especially where institutions are lacking to support women's land rights (FAO, 2011).

Women's lower technology adoption rates are also linked to the method of delivery. In the absence of gender-sensitive approaches to input and service delivery, the women-specific constraints to technology uptake will persist. For instance, the initial Effective Grain Storage Project (EGSP) in Kenya initially targeted male farmers. This, unsurprisingly, led to low adoption rates by female farmers (Nzioki & Kandiwa, 2015). Other programs may not target only men, but a specific crop whose production is male-dominated. In Malawi, fertilizer subsidies were given to maize growers only, rather than to smallholder farmers. Since the majority of women in farming fall under the category of smallholders, not many were helped by this programme. More rigorous and gendered baseline surveys at the household and community level are therefore needed prior to the introduction of new technologies, as will be discussed in the next section. This will help better understand the potential effects of the new technologies and innovations on the target population (Quisumbing et al., 2010).

Women also tend to have differing priorities, which results in the adoption of a different set of technologies. In Kenya, women plant fruit orchards as agroforestry systems that diversify sources of livelihood and boost food security in the household (Ngigi et al., 2017). In Malawi, because of gender behaviour and preferences, women grow pigeon pea varieties that meet their consumption needs in terms of taste, colour and shorter cooking time. Women's uptake of high-yielding varieties is therefore lower than men's, because the latter consider primarily the marketability of the variety (Me-Nsope & Larkins, 2015). It is therefore always important to consider women's diverse livelihood strategies and their local contexts to ensure that they benefit from any kind of innovations (Quisumbing et al., 2010). However, most research in agriculture and development has failed to consult end users, especially women farmers (Bourdillon et al., 2007). Consequently, many improved varieties do not consider women's needs, preferences, and resources, including their unique nutritional needs that call for micronutrient fortified crops (ibid).

4 Towards a woman-friendly African agricultural sector

Dismantling the obstacles that perpetrate women's systematic marginalization in the agricultural value chains of Africa will require a multi-pronged approach that considers the specific cultural context of each region and addresses the most limiting factors first. These limiting factors can include legal and regulatory discrimination, financial exclusion, limited access to markets, and a lack of education and training. Any strategy aimed at tackling one or more limiting factors will require a mix of technological and institutional innovations, policy change, and better data collection, monitoring and evaluation on issues of gender in research on agricultural value chains.

Several small-scale interventions and innovations have been documented that have demonstrably benefited women in the sector. These can serve as a starting point for further research into understanding what works and what does not, and they can be replicated and tweaked across the continent. Most importantly, they prove that when the potential gains are so large, even small interventions can have a large overall effect on welfare. This section gives an overview of the kinds of technical, financial and institutional innovations that have been piloted and the type of large-scale institutional shifts needed for these interventions to succeed in different contexts across the continent.

4.1 Introduction of labour-saving technologies

Labour-saving technologies targeting unpaid, traditionally female tasks are one solution to tackling the constraints placed on women's time. The newly freed up time puts women in a better position to diversify their income sources, allows them to climb higher in value chains, provides better childcare and potentially increases their rest and leisure time (Quisumbing et al., 2010).

In Ethiopia, the Feed the Future's sustainable intensification innovations lab has developed labour-saving technologies targeted at women. This includes the "pail lifter" that reduces the time women spend fetching water while reducing water contamination, and a type of drip irrigation system that led to "healthy harvests of onions, garlic and tomatoes from previously unproductive fields" (USAID, 2016). Another USAID/Feed the Future-funded project helped a local farmer in Tanzania scale up the production of a labour-saving handheld rice weeder (USAID, 2016). These types of innovations are especially helpful to women because they target historically gendered tasks (e.g. fetching water, hand-weeding) and enable women to make better use of their limited resources (e.g. low-quality land).

However, cultural norms and gender roles must be considered when introducing a labour-saving technology. In one instance, the introduction of a pedal-powered rice thresher in Nigeria failed because it exposed women's thighs or required them to wear trousers (FAO, 2011). Furthermore, the returns to labour-saving technologies may not be captured by women, notably when they have no control over the increased returns for their saved labour (Cecelski, 1995).

Labour-saving technologies can also be developed for value chains and activities that are traditionally women-dominated. In an ideal scenario, increasing the productivity of these activities or crops can lead to higher quality and/or quantity products for the same amount of labour or less, leading to increased income for the women engaged in this activity. However, it is also possible that in some cases, labour-saving technology will lower the need for low-skilled labour, reducing employment opportunities for women and putting downward pressure on wages for low-skilled work in the labour market at large. Furthermore, without proper measures in place to ensure that women are in control of the technology and are represented in the institutions governing the distribution and marketing of these products, an increase in the lucrativeness of a women-dominated value-chain could incentivize men to crowd women out of that market. These concerns underscore the need for a holistic approach that targets all the factors limiting women's productivity and incomes in any given context.

4.2 Technology-driven financial innovation

One key way that helps women capture the returns to any gains made in productivity is to ensure they have some measure of control over their finances. Mobile money transfers are an innovative way to reduce transaction costs (travel costs, time) and can potentially be harnessed to close the gender gap in financial services in Africa (GSMA, 2015). The savings in time spent travelling and waiting on cash transfers can translate into real financial returns. In Niger, a study showed that farmers were able to spend the time saved by mobile cash transfers during the agricultural planting season on farming activities (Aker et al., 2016). Mobile technology can increase the access to financial services for women facing limiting mobility constraints and have the potential to render transactions safer. Considering women often operate in the cash-based informal sector, the ability to limit the amount of cash on themselves or in their businesses reduces their chance of being a target for theft.

The privacy afforded by mobile transfers can also increase women's financial autonomy by rendering any transfers or income less noticeable to family members. This effect was documented in Niger after an unconditional monetary transfer program was implemented in 96 villages following a drought. Transfers were made manually and via a mobile platform, with women as the primary beneficiaries. Women in households who received mobile transfers were found to use the money to cultivate marginal cash crops, increasing their income and participation in the workforce (Aker et al, 2016).

Mobile and technology-driven financial services can also provide an alternative path to credit-worthiness for women who lack collateral. The traceability of digital transactions can serve as a record of high repayment rates and help women build up a credit history, and eventually help them raise capital for larger endeavours (World Bank, 2015). AgrInfo, a technological start-up and winner of CTA's 2013 Eastern Africa AgriHack talent program uses GIS technology to deliver farm data to financial service provider (World Bank, 2015). This is another potential tech-driven alternative for women with limited access to collateral and lacking land deeds to access financial services.

The extent of the potential of digital finance to benefit women is of course contingent on women having access to the technology hosting the platform. Therefore, in order to realize this potential, gaps in ownership to mobile phones, legal barriers preventing women from accessing mobile services, low financial and technological literacy and male-dominated technological design are all challenges that should be addressed concurrently.

4.3 Harnessing the power of collective action

There is a long history of women in Sub-Saharan Africa using grassroots informal organizations to pool resources together in order to help individual members achieve their goal, a notable example being rotating savings and credit associations (Baden, 2014). Women who participate in these (often women-only) groups benefit in a number of ways, including increased access to credit, financing, inputs and knowledge, and they are also a space for women, particularly those of limited means and opportunity, to develop technical and leadership skills and gain confidence (Baden, 2013).

However, women in Sub-Saharan Africa are largely underrepresented in larger formalized cooperatives and producer associations, and most notably in their leadership. These larger "top-down" cooperatives are historically male-dominated, having been established in the colonial and post-colonial eras to market tropical export commodities (e.g. cotton, tobacco, cocoa, and coffee) (Wanyama et al., 2009).

Large cooperatives and associations impart many advantages on their members, notably much better access to credit, inputs, and markets, and they are a political force that can exert power on the agricultural sector of entire regions. They can also provide valuable services to producers such as grading products and sourcing information. They have been shown to increase women smallholders' access to credit and market information, and the training and access to improved technologies raises the quality and quantity of production (Baden, 2013). In Tanzania, the vegetable production of women

who joined collective action groups had a 95% higher monetary value than the production of non-members and earned almost 70% more than comparable non-members. In Mali and Ethiopia, this figure was found to be 80% (Baden, 2013). Increasing rates of female participation in these larger organizations should therefore be prioritized.

The way to advance the goal of increasing women membership rates is highly context-specific. In some cases, female-only cooperatives are more successful, such as in high-value domestic markets for traditionally women-dominated products and sectors requiring few land assets (Baden, 2014). This prevents men from taking-over control of a female-dominated value chain once commercial opportunities begin to grow. Developing skills and confidence through membership in women-only groups can also be a gateway towards developing the skills to effectively navigate membership in mixed groups that provide better access to resources, network, and transports (Baden, 2013).

In value chains and production which requires a mix of traditionally male and female labour and where interests are aligned, mixed groups may be more successful and provide women with better opportunities. This is contingent on having a structure that amplifies the voices of women, encourages female leadership, and ensures proper forums are in place for their concerns to be aired and addressed (Baden, 2013). Some mixed groups that have been the object of study have evolved from women-only groups, as women benefited from the membership of men who would take on hard physical work, reading and writing tasks (where female illiteracy is high), while women did labour-intensive tasks and often took leadership positions (Baden, 2013).

Membership in collective action organizations has demonstrated potential to empower women in the agricultural sector, however extra care must be taken to ensure all women have access to these opportunities. Currently, membership favours older women with fewer household responsibilities and higher value assets. More flexible membership criteria (in terms of land holdings, literacy, fees, allowance of dual household membership, exclusion of unmarried women, etc.) will be required to increase the participation of younger married and unmarried women of different social strata (Baden, 2013). The support of men is also important in bringing about change, whether it be allowing their wives to take part, taking on household tasks or providing access to the necessary resources for meaningful participation (Baden, 2013). Strengthening the links between traditionally female-dominated informal groups and larger collective action groups can also provide a stepladder for women to graduate to these associations, provide a blue-print for smaller organizations to grow into formal collectives, and facilitate access to information and resources to more marginalized women participating in the informal groups (Baden, 2013).

4.4 Increasing women's access to extension services

Extension services can provide more women-friendly services by considering specific local conditions when tailoring their communication strategy. In some cases, couples training can help women access more information and develop their skills. In the Duga district in Ethiopia, couples training in poultry and livestock management practices helped women improve bird nutrition and hygiene, while men acquired more knowledge on the production of poultry. This platform enabled women to be equipped with better technology and production techniques, while informing men about a type of production traditionally viewed as female (Lemma et al., 2016). Couples training can also foster a shared understanding of household decision-making and help men view their wives as a collaborator on production and management decisions (ibid).

Extension agents can also target women by disseminating information and providing trainings in gathering places and events where women will be present. In smallholder livestock value chains in Ethiopia, a combination of spouse training, mentoring at the household level, field days and tours for women was used to improve women's access to extension services. These initiative increased extension agents' awareness of women's roles in value chains and their willingness to better incorporate them (Lemma et al., 2016).

Communication can also be made more effective when delivered via women extension officers. In Kenya, women farmers were more receptive to women extension officers, increasing their likelihood of engaging in coffee production, and network effects resulted in their knowledge being transmitted to other female farmers (Quisumbing et al., 2010). Evidently, the supply of female extension service agents is also dependent on creating an educational environment that creates opportunities for women to receive the necessary training. Where educational infrastructure is lacking, women can be trained using a more grassroots approach with successful outcomes. In Mozambique, women messengers were trained to deliver training on sustainable land management, which demonstrably increased women's knowledge of micro catchment farming techniques and adoption of the technology in the region (Kondylis, Muelle, Sheriff & Zhu, 2014).

The bottom line is that extension service delivery should fit into women's schedules, considering their household tasks and time commitments. It should also be designed in such a way as to be accessible to women of lower education levels, and capitalize on the transmission of information via social networks (Quisumbing et al., 2010).

4.5 Policy and institutional change

Creating lasting change to empower women working in agricultural value chains will require institutional shifts to ensure that the societal power structures do not work against the types of innovations and interventions listed above.

Policy shifts should address social norms, notably those around land-ownership and financial exclusion that represent some of the strongest limiting factors for women producers in Africa. Women require buy-in and support policy makers and service providers who recognize their contributions and potential in order to fully participate in agricultural value chains. This calls for enormous efforts and a holistic approach to identify context-specific challenges and opportunities for women.

A gendered lens must also be applied consistently to agricultural research in Africa. A lack of gender-differentiated data that is both credible and objective perpetuates financial institutions, extension service providers and other agricultural value-chain actors from understanding the particular needs of women producers and actors in value chains (GSMA, 2015; AFI, 2017). Research should further focus on gender sensitive innovation designs and implementation in addition to promoting gender sensitive monitoring and evaluation of value chain interventions.

Although collecting gender-disaggregated data at all rungs of the value chain is essential, a gender-responsive approach is also necessary in analysing that data in order to gather meaningful information. A within-household approach can provide meaningful insight into the interplay of male and female household members. Different econometric approaches can also be deployed for data analysis depending on the study's objective and the type of data collected. For instance, non-parametric matching procedures are applicable to gender-wage gap analyses when we assume that men and women do not possess similar characteristics (Ñopo, Daza, & Ramos, 2011). Sample-selection methods such as the Heckman two-step estimator can address selection bias in gender-differentiated value chain analyses (Heckman & Navarro-Lozano, 2004). And where a mix methods approach is applied with a focus on quantitative analytical research, a deductive approach is appropriate to analyse, interpret and supplement quantitative information.

5 Conclusion

Working together and given the right opportunities for capacity-building and empowerment, women can form a strong force to challenge and disrupt the social norms that are stacked against them. They can do so through collective action, ascending to leadership positions in institutions at different levels of the value chain, through employment and by developing skills and capacities. As women participate meaningfully in different segments of value chains in larger numbers, there will be a shift in productiveness and earning potential. This, in turn, can empower women to have more autonomy over their earnings and increase their bargaining power at the household and community levels. Importantly, increasing the visibility of women in agriculture and promoting female leadership can influence other women to challenge social relations and norms, creating a larger shift in the African agriculture sector's ecosystem, and create positive knock-on effects, increasing rates of technology and innovation adoption among women.

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