



Mainstreaming Gender in AET: Overcoming challenges through policies and practices

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Table of Contents

Introduction	1
Methods.....	2
Background data: Progress, but persistent challenges.....	4
General challenges women face in higher education	8
Economic: Poverty and preference to educate sons	8
Socio-cultural: Norms and expectations.....	10
Institutional: Infrastructure and environment.....	12
Agriculture-specific challenges	15
Perceptions of agriculture.....	15
Curriculum and pedagogy	19
Safety concerns.....	20
Pipeline: Girls under-represented in the sciences	22
Characteristics of success	23
Family support	23
Awareness of agriculture careers	25
Personal determination and confidence	27
Policies and Practices	28
Increase the number of women in university agricultural programs	30
Introduce gender sensitization at all levels	32
Address safety issues for women students.....	34
Create a supportive environment for women students	35
Improve perceptions and visibility of agricultural education and careers	38
Conclusions	40
References	42

Introduction

Women's education has a high positive impact on society and higher education can help empower women to enter social, economic and political roles in their communities and countries. While progress has been made in terms of access to education overall and higher education in particular, women continue to face specific challenges that limit their access to and success in higher education. Case studies from around the world reveal multiple gender issues that keep women out of higher education institutions and prevent them from graduating. This research builds from this existing literature, but looks specifically at gender issues within higher education *agricultural* programs.

Women farmers play a vital role in agriculture around the world, yet their roles are often invisible, and the contribution of women farmers to agriculture is overlooked in higher education agricultural curricula in most countries. Similarly, women students are underrepresented in higher education agricultural programs in most countries. Increasing the number of women in university agricultural programs as students, faculty, and high level administrators will improve the representation of women in important policy debates and decision-making processes in agriculture (Meinzen-Dick, Behrman, Menon, & Quisumbing, 2011). Providing women with opportunities for training and education in agriculture will ensure that women are helping to shape future agricultural innovation approaches and technologies. Women agricultural researchers and extension agents also bring new ideas and insights to the table and are more likely to pay attention to the issues that women small-holder farmers face in agriculture (World Bank, 2008).

A wide range of literature exists about gender issues in education from primary through tertiary¹, and there is a growing body of research on the specific challenges that girls and women face within higher education institutions in developing countries. However, less is known about the challenges (and opportunities) women and girls have specifically with university agricultural programs. The few studies conducted in this area found that cultural, economic, institutional, political, and social issues constrain women's participation in agricultural education and training (AET). A review of gender issues in agricultural education and extension conducted by the Food and Agriculture Organization of the United Nations (FAO) identified the following as some of the main explanations of women's low participation: women's lack of time due to household responsibilities, cultural norms that value education for boys over girls, and cycles of poverty in which families keep their daughters home to work or marry them early (Crowder, 1997). These constraints impact women's access to education

¹ See for example: OECD: <http://www.oecd.org/gender/>, Global Education Association: <http://www.genderandeducation.com/>, Gender and Education journal: <http://www.tandfonline.com/loi/cgee20#.VcOn08BVikol>.

overall, and channel fewer girls into higher education institutions. Important gender issues specific to higher education discussed in this paper relate to the curriculum, the institutional climate, safety concerns and access barriers.

Effective interventions that address gender disparities must target these multifaceted dimensions of society. This requires moving beyond parity, or merely numerical balance among men and women students and professionals, to a more complex concept of equality in which young men and women have equal access to quality schooling and opportunities, feel safe and supported in the school environment, and the curricula and approaches to teaching are not gender-biased (Aikman, Halai, & Rubagiza, 2011; UNESCO, 2003). This paper offers recommendations and good practices for accomplishing these goals within higher education agricultural programs. Although gender issues affect students, faculty and administrators, here we focus on the student experience.

The paper proceeds as follows. The introduction, methodology, and background data are presented in the first section. Section two discusses the general constraints that girls and women face in higher education and section three focuses on the specific challenges identified in HE agricultural programs. Section four describes the characteristics of successful young women students in AET. Section five provides recommendations and good practices for addressing gender issues and the last section presents conclusions.

Methods

This paper is the product of a literature review, a regional conference workshop in Mozambique, and interviews and focus groups conducted in four countries: South Sudan, Mozambique, Bangladesh and Cambodia. These countries were selected because they were sites where the Virginia Tech-led InnovATE program had activities or where researchers had access to the universities through other projects. This group of four countries also represents regions where there are the greatest gender disparities in higher education.

Interviews and focus groups were conducted with men and women students, faculty, and administrators in the four countries [Table 1]. Overall, 24 focus groups and 38 interviews were completed. The purpose of the interviews and focus groups is to add depth and meaning to the statistics and reports by including the voices, stories, hopes and challenges of men and women in agricultural higher education.

The focus groups were typically conducted with the students, while individual interviews were determined to be more appropriate for the faculty, administrators and agriculture professionals. In each country interviews and focus groups took place in one to three universities. The focus groups were typically composed of 5-10 students. Men and women students were separated in all the focus groups except for two focus groups in South Sudan which were mixed. All of the students were enrolled in agriculture-related bachelor's degree

programs. The focus groups and interviews were based on semi-structured questions and facilitated either by one of the authors or a local research assistant.

The conference workshop took place at the bi-annual RUFORUM (Regional Universities Forum for Capacity Building in Agriculture) conference in Maputo, Mozambique. Participants with experience or demonstrated interest in addressing gender issues in university agriculture programs were strategically invited. The participants included 29 people from seven countries (four men and 25 women). The purpose of the workshop was to share and develop a set of good practices for addressing gender issues and encouraging women in the agricultural sciences.

The number of interviews and focus groups conducted in each country varied depending on the time available, financial resources, and access to the universities. More research was conducted in Mozambique than any other country due to the lead author's experience in the country and the timing of the RUFORUM workshop in Maputo.

Additionally, in Mozambique, focus groups were conducted at two secondary schools. These focus groups were intended to understand gendered perceptions of agriculture, challenges faced in secondary school, as well as students' motivations and decision making processes about whether to continue their studies and what disciplines to pursue. In addition, interviews with several woman agricultural professionals were completed in Mozambique. These individuals all received AWARD (African Women in Agriculture Research and Development) fellowships and included women working at national agriculture research centers, NGOs, and other development organizations.

Table 1: Research conducted in each country

		Agriculture professionals		Faculty and administrators		University students		Secondary school students	
		Focus Group	Interview	Focus Group	Interview	Focus Group	Interview	Focus Group	Interview
Cambodia	Male				5	2			
	Female				6	2	1		
Bangladesh	Male				2				
	Female				2	1			
South Sudan	Male				9	2M 2			
	Female				2	1	1		
Mozambique	Male			1	3	2		3	
	Female	4		1	3	2	2	3	
Total by Gender	Male			1	19	6	2	3	
	Female	4		1	13	2M 6	4	3	
Total		4		2	32	14	6	6	

M=mixed men and women

Table 2: Universities visited in each country

Country	Name of university
Cambodia	Royal University of Agriculture (RUA), Phnom Penh University of Battambang (UBB), Battambang Prek Leap National College of Agriculture
Bangladesh	Bangabandhu Sheikh Mujibur Rahman Agricultural University (BSMRAU)
South Sudan	University of Juba, Juba Catholic University, Wau Dr. John Garang Memorial University of Science & Technology (JG-MUST), Bor
Mozambique	Eduardo Mondlane University (UEM), Maputo UniZambeze, Zambezia

A literature review was also conducted to provide a broader global perspective to ground the empirical data and to fill in gaps in the country level data. The literature review included journal articles, development reports, policy briefs and other “gray” literature examining gender issues in higher education institutions, with a focus on agricultural programs.

Background data: Progress, but persistent challenges

Significant progress has been achieved in eliminating gender disparities in primary and secondary school. Despite this, less than half of the countries with data available have achieved gender parity at both levels (UNESCO, 2015). In secondary schools the countries with the lowest girls’ enrollments fall mostly within sub-Saharan Africa and South and West Asia. In sub-Saharan Africa the ratio of girls to boys enrolled is 84 to 100; in South and West Asia this ratio is 93 to 100 (UNESCO, 2015). In Latin America and the Caribbean, by contrast, there are 107 girls for every 100 boys. Some countries have made remarkable progress, particularly at the primary school level. For example, in Cambodia in 2000, only 66 girls were enrolled for every 100 boys, but by 2010 gender parity at this level was achieved (UNESCO, 2015).

In terms of higher education, women’s enrollment rates have increased rapidly since the 1970’s. In most countries in North America, Europe, Latin America and the Caribbean, and Central Asia, women are now more likely to receive a higher education degree than men. The Arab States and East Asia and Pacific regions have also just reached the parity line after decades of steady growth in female enrolment (UNESCO, 2010). The two regions where women continue to be disadvantaged in access to higher education are South and West Asia and Sub-Saharan Africa (UNESCO, 2010). Overall participation in higher education is very low in both regions. The tertiary gross enrollment rate in South and West Asia for men is 14%, which is 1.3 times as high as that for women (11%). The higher education gross enrollment rate in sub-Saharan Africa for men is 7.3%, which is 1.5 times as high as that for women (4.8%) (UNESCO, 2010).

Women's enrollment in higher education corresponds with the national wealth of a country: in 31 of the poorest 34 countries men have higher tertiary participation rates than women (UNESCO, 2010). However, there is considerable variation within these countries by a household's income level. For example, in Niger and Guinea, approximately 70% of the poorest girls had never attended school – notably higher than the share of the poorest boys – compared with less than 20% of the richest boys (UNESCO, 2015). Thus, access to higher education is shaped not only by gender, but also by poverty, and in some cases also by ethnicity, location, or disability (UNESCO, 2010).

Interestingly, women are more likely to pursue master's degrees than men in most regions, but men account for 56% of those graduating from Ph.D. programs and 71% of all researchers (UNESCO, 2010). In all regions, except Latin America, women's participation declines at the Ph.D. level (2010). In developing countries, at the professional level, women only comprised about 20% of agricultural researchers from 1996-2003² (Beintema, 2006).

There are clear gender differences among higher education graduates by field of study. The majority of women students are enrolled in education, health and welfare, and humanities and arts. Education is the most popular field of study for women; in 2008 at least nine out of every ten education graduates were women (UNESCO, 2010). Women's participation is lowest in the fields of engineering, manufacturing, and construction as well as science and agriculture (UNESCO, 2010). Yet, even in developed countries, such as Germany, Japan, the United States, the United Kingdom and Switzerland, women account for just one-tenth to one-fifth of graduates, respectively, in these fields (UNESCO, 2010). On average, women make up less than 40% of students enrolled in tertiary agricultural science programs, and in many countries in Asia and Africa this percentage is below 25 (UNESCO, 2003; 2011).

Africa context

While data on gender and AET is lacking for many regions of the world, a significant number of studies and reviews have been conducted on this topic in sub-Saharan Africa. As of 2008, there were approximately 200 public universities in Africa and nearly one hundred programs in agriculture and natural resources management (Johanson, Saint, Ragasa & Pehu, 2008). Among universities in eastern, central and southern Africa, overall 25% of undergraduate agricultural students are women, a disparity that is even more evident at the postgraduate level where only about 16% of the graduate students are women (Kayoby, Kayondo, Anena, & Fuuna, 2010). Women's participation in African universities varied by country, with the lowest rates in Ethiopia (6%), Togo (9%), Niger (10%), and Burkina Faso (12%) and the highest rates in South Africa (32%), Mozambique (35%), and Botswana (41%) (Beintema & Di Marcantonio, 2009).

² Based on a dataset of 67 countries. See Beintema (2006) for a complete explanation of the sample.

Women made up only 20% of the academic staff of agriculture faculties among 11 universities surveyed in eastern, southern and central Africa (Kayoby et al., 2010). Within faculties and departments, women also are more likely to hold junior positions (Mangheni, Ekirikubinza-Tibatema, & Forsythe, 2010). Based on a study of 15 universities in Africa, only 14% of individuals in management positions are women (Beintema & Di Marcantonio, 2010).

On the bright side, many, but not all, countries have experienced growing enrollments of women students and professional staff in agriculture (Beintema & Di Marcantonio, 2010; Forsythe et al., 2010). Data collected from 125 agricultural research and higher education institutions in 15 countries in Africa revealed that the gender gap among professionals in agricultural research and higher education is closing, with women accounting for nearly half of the capacity increase in agencies and institutions from 2000-01 to 2007-08 (Beintema & Di Marcantonio, 2010).

Other trends revealed by the extensive Agriculture Science and Technology Indicator (ASTI) survey include the concentration of women in fields that are related to life and social sciences rather than more technical, “hard science” fields (Beintema & Di Marcantonio, 2010). The proportion of women was highest in food and nutritional science (44%) and lowest in disciplines related to engineering, such as water and irrigation (8%), forestry (15%), and soil science (13%) (Beintema & Di Marcantonio, 2009).

The universities in Mozambique where empirical research was conducted had slightly higher than average participation of women. In contrast, in South Sudan the numbers were lower than average. Women made up between 17-47% of agriculture students at the University of Eduardo Mondlane (UEM) depending on the program in question. Among the faculty, 12 out of the 47 full time faculty were women (25%). The head of the rural engineering program is a woman, and another woman professor from agronomy acts as the head of the postgraduate department for all of the university. At UniZambeze, in central Mozambique, 30% of the students and 15% of the faculty were women.

Data from the Ministry of Education compiled from all universities in South Sudan, shows that women make up only 15% of agricultural students (Rahim, Christie, & Mullei, 2014). The two programs with the highest enrollment of women were Social Welfare/Social Administration and Nursing/Midwifery, both at 40% (Rahim et al., 2014). At the University of Juba in South Sudan out of total teaching staff of 294 people, 36 are female (12%). Women have even smaller numbers in the upper administration levels responsible for making strategic decisions and policies.

Asia context

Enrollment rates for higher education in East Asia nearly doubled between 1999 and 2005, with much of this increase attributed to China (UNESCO, 2008a). Less than one in ten eligible young people are enrolled in tertiary education in Cambodia and the Lao People's Democratic Republic, as compared to 22% in China, 43% in Thailand and 91% in the Republic of Korea. In most of the countries in the region more men are enrolled in tertiary education than women. In Cambodia, for example, the ratio of female to male enrollment is 0.46 (UNESCO, 2008a). However, gender disparities in the opposite direction, with more women enrolled than men, exist in Brunei, Malaysia, and the Philippines.

In South and West Asia, enrollment rates in tertiary education have increased by 62% from 1999 to 2005, but remain low with only 11% of the eligible age group enrolled (UNESCO, 2008b). Similarly, the average number of women participating in tertiary education has increased, but gender disparities persist. Afghanistan, Bangladesh, India, and Nepal all have ratios of female to male tertiary enrollment less than 0.70. On average, only one third of the teaching staff at the tertiary level in these regions is female, and less than one third of female students are enrolled in the sciences.

Among undergraduate students at Bangabandhu Sheikh Mujibur Rahman Agricultural University (BSMRAU), a slight majority of students admitted to the Agriculture program have historically been female. However, the proportion of women declines significantly at the graduate level. Based on records from 1991-2013 women were only 9% of master's students and 5% of Ph.D. students. In the last five years of the records (2008-2013) the numbers of women post graduates increased from 11% to 34%. Of the 147 teachers in Agriculture, Agricultural Economics, Fisheries, Veterinary Medicine and Animal Science Medicine and Animal Science, 14% are women. Of these 21 women faculty, four hold Ph.D. degrees while the rest have master's degrees. The women faculty are distributed across a range of departments and specialties including agricultural economics, agricultural extension & rural development, agroforestry, plant breeding & plant pathology, fisheries, and animal science & veterinary medicine.

In Cambodia, records from the three universities where interviews took place all showed that women students made up about 30% of the students enrolled in agricultural programs. At Prek Leap National College of Agriculture in Cambodia 35 of the 127 teachers in agronomy are women (28%). The gender disparity between higher and lower level faculty and administrator positions is quite pronounced. At the University of Battambang, for example, there are two tracks for faculty: 1) individuals come through civil service government channels, have a master's degree, and get a permanent position, or 2) contract staff are hired by the university and only have a bachelor's degree (often from the University of Battambang). All of the latter are women, while the former include some women at the level of administration, though none

in agriculture. At the Royal University of Agriculture, the Dean of Agricultural Technology and Management is a woman (though the only one among the 10 Deans of the university) and there are only three or four women Vice Deans out of a total of about 30.

General challenges women face in higher education

Many studies from around the world have investigated the challenges women face accessing higher education. These challenges can be broadly grouped into three general categories: economic, cultural and institutional. In practice these categories overlap, as this quote from a woman faculty member in South Sudan shows:

I think educated women or career women still face uphill problems in our society, where women are valued as the main source of wealth through dowries. A woman needs family support if she wants to pursue agriculture. I think women face some problems with the duration of study (5-7 years), and the possibility to get married, study fees, accommodations, studying science, dropping-out, and early marriages.

These issues will be broadly discussed in the following section with a focus on Cambodia, Bangladesh, South Sudan and Mozambique. A discussion of the agriculture-specific challenges will be reserved for section three.

Economic: Poverty and preference to educate sons

Poverty is perhaps the most significant constraint students in developing countries face in pursuing higher education. Before they have a chance to reach this level, many students in secondary and primary school are forced to drop out because their families cannot afford the school fees, uniforms, school supplies, or transportation costs. At the university level, the tuition costs, in addition to food and lodging, are prohibitive for most students regardless of their qualifications or gender. Agricultural programs often require field work and research that entails additional expenses. At UniZambeze in Mozambique, for example, one faculty member explained that many students drop out of the final stage of their program because they cannot finance their final project.

Household poverty affects both boys and girls, but has gender specific outcomes based on cultural norms. In sub-Saharan Africa research shows that the higher the socio-economic status of families, the more likely their children are to progress into higher education (Mangheni et al., 2010; UNESCO, 2010). This trend is especially strong for girls, as their lower enrolment and higher drop-out rates are directly related to economic status and poverty (Mangheni et al., 2010).

In many countries, when families can only afford to send one child they choose their son over their daughter. This was mentioned in Cambodia, South Sudan and Mozambique. As a young man in Cambodia commented:

If a family has four children, they send sons only. They think if the males stay home they will do nothing to help out but if daughter stays home she will help in the home (domestic work) or in the family farm work.

Girls are often pulled out of school to assist their mothers with housework or to attend to younger siblings. Depending on the economic context, girls or boys may leave school to earn income to support their family. In Cambodia a young man commented:

For women it is easier to work in factories, there are many factories near my home town. A girl can earn money and help earn money to send to her brother [to school]. Women are more easily hired than men in factories.

In many countries girls' education is not perceived to be a worthwhile investment because women leave their families after marriage, whereas men are expected to continue to provide for their parents (Mangheni et al., 2010). This is reflected in the quote by a woman faculty member in Sudan who describes this common sentiment from a parents' perspective: "Why should I invest in a girl since she's going to marry to another family, give birth to children, and those children be named after that family?" In addition, women in Mozambique and South Sudan spoke about the pressure on girls from poor families to get married early so that their families can receive their dowry and have one less mouth to feed.

Even if women are able to enter the university the overall lack of funding for higher education and absence of critical tools for learning such as well-equipped labs, libraries and field sites, may discourage students. These issues are vividly illustrated in the words of a woman student in South Sudan who talks about her difficulties trying to get an education during the civil war:

I have to avoid selecting very expensive courses, and instead choose courses that require fewer years of studying. It is difficult to save enough money to pay the university fees annually, and the economic situation has resulted in my studies lasting 7 years instead of 5 years. There is also now a reduced budget allocated to higher education in order to build hostels for both girls and boys, to maintain farms for field studies, as well as labs. Teachers do not receive salaries for long periods of time. The war has caused a lot of inconveniences, for example, no labs for practices, research centers, lack of a syllabus, and lack of some colleges at the university.

Socio-cultural: Norms and expectations

Socio-cultural norms often perpetuate negative assumptions, stereotypes and discourses about women in higher education that restrict their access and success (Acker, McBreen, & Taylor, 1998; Mangheni et al., 2010; Crowder, 1997). Socio-cultural norms dictate marriage age, decision making in the household, and family and society roles. Women's responsibilities for taking care of the house and watching the children are one of the main socio-cultural norms which limit their opportunities for education. Domestic chores and family obligations often leave women and girls with less time for homework and frequently cause them to miss school, with consequences for their overall achievement. Even when women live away from home, they are often expected to contribute to work in the house where they are lodged.

As one woman at the University of Battambang reported, balancing schoolwork and household can be very difficult:

[We] also have the problem [that women] have to work a lot more than men. [They] need to do everything in house: help mother, help with care of younger sister or brother, my mom or dad. If [there is a] problem in house, need to join with mother and father to solve it. Men have less care, if it is something he wants he does it. But women have to think a lot [more] about family than the men.

Not all girls are expected to carry the same burden of household chores. Some families shield their daughters from housework during their studies; and, in other families, boys' education is also limited by household responsibilities. Girls with the heaviest domestic burdens tend to be from small, poor families, where they are the only or the eldest girl. Higher income families can afford to hire household help and pay for all their children's school fees. In households without daughters old enough to help, sons will take over the household work, and in some places, boys may have different but equally arduous duties which keep them out of school, like herding cattle in South Sudan. In South Sudan, an estimated 19% of girls and 13% of boys are kept at home to help their parents with domestic and farm work (Rahim et al., 2014).

Married women with families typically have even more household responsibilities. As one woman student at the Catholic University in South Sudan reported:

It is hard to have a family and study. It has affected my exams results. I have less hours to learn compared with other male students. I have to manage my family, bring my two children to kindergarten and back, clean the house, shopping, preparing food after returning from school.

Socio-cultural roles can also limit women's decision making and power in the family. Men are considered to be the income earners, or as a woman in South Sudan described, the "pillars" of the household because they inherit everything and carry on the household name. As a young

man in South Sudan commented, “Men are well treated because they are the breadwinners, they manage household financially, because they are more highly educated than women.”

These perceptions and norms of male power and control may restrict women’s ability to make decisions about their future for themselves. Many girls grow up in families where they watch their mothers silently obey their fathers, and their brothers are given preference in terms of food, money for school, clothes, cell phones, and bicycles. These stereotypes and practices can hurt women’s confidence and prevent them from going after opportunities. As a man in South Sudan commented: “The cultural bias against women, and male chauvinism and patriarchal society of most South Sudanese makes these equal opportunities impossible to achieve.”

Women students at BSMRAU explained that religious views prevent many women from going outside the house and studying. In many societies, before marriage, a girl’s future depends on the support of her parents, and after marriage, a woman must have the blessing of her husband to pursue any opportunities. Several faculty members gave examples of students who had received scholarships, but were forced to turn them down when their husbands didn’t allow them to travel internationally.

Early marriage and pregnancy causes many girls to drop out of secondary school and higher education (Mangheni et al., 2010). Early marriage was a concern mentioned in all four countries, although it was often described as only a problem among rural and uneducated families. As mentioned earlier, early marriage can occur to lighten a family’s economic burden, to secure a daughter’s future, or provide her family with a marital gift. Arranged or forced marriages were specifically mentioned as an issue in South Sudan. In South Sudan, the dowry provided to the bride is an incentive to marry girls early and use the money to put boys in school.

Typically, when girls become pregnant they leave school out of embarrassment or because it is required by the school and then eventually drop out to care for their child. As a woman student at Eduardo Mondlane University in Mozambique explained:

There are factors that limit girls in comparison to boys. For example if I have a boyfriend and get pregnant I stay at home and he keeps going to school. There are many fathers here that are able to keep studying and their children stay at home with their family. For most girls they don’t have the conditions [familial support or money to hire someone] so if they get pregnant they stay home with the children.

Universities rarely have sufficient supportive services and policies for pregnant or married women students. This means that “women have to make a choice between pursuing higher degrees and establishing a stable family” (Mangheni et al., 2010). The lack of services for pregnant women and mothers may reflect negative attitudes and stereotypes about women

and lead to other discriminating behavior (Mangheni et al., 2010). Pregnancy is often considered a 'problem' by institutions, and women are blamed and told to be more responsible without similar treatment for men (Forsythe et al., 2010; Kayobyio et al., 2010; Mangheni et al., 2010). The support services needs for families are discussed in the following section.

Institutional: Infrastructure and environment

The institutional environment in higher education is often unsupportive of girls and women (Kayobyio et al., 2010; Mangheni et al., 2010). Universities have largely been male dominated and are typically not sensitive to the needs of women (FAWE, 2015). The presumed norm of a university student is a healthy heterosexual male, and there is no concern for the different needs of those groups who fall outside this norm. Academic success depends on students feeling comfortable, safe and confident in the school environment. The institutional environment includes everything from curriculum, infrastructure, and policies, to the campus culture and attitudes of professors and the student body. Girls and women may feel unsafe, discouraged, or marginalized in an unsupportive university environment.

Basic infrastructure such as housing and latrines is often not designed with the needs of girls and women in mind. Without access to safe water and clean and reliable latrines, many girls feel uncomfortable at school or decide to stay home during their monthly periods (FAWE, 2015; Mangheni et al., 2010). The poor conditions or lack of latrines, coupled with menstrual pain and a lack of understanding from teachers about their needs causes women a lot of discomfort and suffering, which means they are less engaged in learning (Sommer, 2010). In the secondary schools in Mozambique, girls explained that the toilets were often very unsanitary, and some students returned home at lunch just to use their own toilets. While the effects of improper menstrual hygiene management facilities have focused primarily on secondary schools, these issues are also relevant in higher education and likely affect the comfort and performance of women at the university.

The lack of campus housing for women in higher education institutions also limits their access to education. Many students attend universities distant from their homes and need safe and affordable housing near campus. Most campuses lack an adequate number of dorm rooms to accommodate all the students who need housing. In both universities in South Sudan and at UniZambeze there were no dorms for either male or female students. On-campus housing is especially limited for graduate students and students with families (Mangheni et al., 2010). Without on-campus housing, women need to find a place to stay for themselves, which is often prohibitively expensive and could also put them in a potentially unsafe situation.

There are often more dorm rooms available for boys and men, and they also have fewer cultural restrictions about where they can live. For example, in South Sudan, men said that they can stay with distant relatives, but women are more limited; their families distrust the strange

environment and worry that their daughters will misbehave or face sexual harassment. In Cambodia, dorms are more important for women because boys and men can stay in pagodas (a place of worship and religious living for Buddhists).

Other aspects of women friendly infrastructure at higher education institutions include child care facilities, adequate campus lighting, and safe, inexpensive and reliable transportation. In Mozambique, women complained about the lack of lighting at night and also the early and late courses that forced them to walk across campus and seek public transportation in the dark. There were no child care facilities at any of the universities included in this study, which poses great difficulties, as well, for women faculty members with young children. Policies, such as age limitations for joining graduate programs, may also limit women's participation. In South Sudan some universities have enforced age limits of 30 years, which restrict women who often enter school after starting their families (Rahim et al., 2014).

The institutional environment also includes attitudes, practices and behaviors. As one Mozambican woman faculty member explained, even with good policies and facilities, mindsets and institutional change are much slower to change. Gender discrimination may be overt and direct, but is more commonly subtle and deeply embedded in the institutional and societal culture. It may be so pervasive that it is not recognized and is seen as cultural or as being natural (Mangheni et al., 2010; Morley, 2006). In five countries in Africa, Morley (2006) shows how gender discrimination in universities results in "the exclusion of women from career development opportunities, gender-insensitive pedagogical processes, prejudice about women's academic abilities and intellectual authority, poor equality policy implementation and backlash and stigmatization in relation to affirmative action programs" (p.543).

Most of the men and women students and faculty members interviewed initially balked at the idea that there was any discrimination in their university, but as the interview progressed they gave many examples of practices and policies that disadvantaged women. For example, women spoke of subtle jokes or inappropriate sexual remarks made by male lecturers or students that made them feel uncomfortable and isolated. Other studies document faculty reacting intolerantly towards pregnant students or women students who they consider are dressed provocatively (Acker et al., 1998; Forsythe et al., 2010; Mangheni et al., 2010).

Teacher's expectations and personal biases can be reflected in the way they teach and interact with students. Research in China suggests that teachers' expectations are one of the strongest predictors of secondary school enrolment for girls (Lewis & Lockheed, 2006). Pedagogical practices may also make girls uncomfortable. For example, many young women lack the confidence to speak in public (due to cultural and social norms), and the question and answer methods of teaching that are dominant in most universities limit their participation (FAWE,

2015). Finally, curriculum and course materials may portray girls and women “stereotypically or in a demeaning manner that misrepresents the diversity among girls and women in society” (UNESCO, 2010).

Sexual harassment is one of the most obvious forms of discrimination which contributes to irregular attendance, poor performance and low self-esteem for women (FAWE, 2015; Mangheni et al., 2010). Documentation of verbal and physical sexual harassment is more common in secondary schools, but also exists in university environments. Many of the 2014 RUFORUM workshop participants noted that sexual harassment is the norm; all agreed they had been the recipients of sexual harassment both as students and faculty members. However, the levels of gender-based violence are not well known due to non-reporting as a result of fears of victimization, punishment or ridicule (FAWE, 2015).

In the secondary schools in Mozambique every group of school girls interviewed gave examples of their peers who were approached by male professors for sex in exchange for good grades. As one young girl explains:

I have suffered a sexual advance from a professor when I was in 11th grade math. The professor suggested that I have sex with him in order to pass math, but I refused, and said that I would prefer to fail than go to bed with him. The professor asked me instead for 1000 mtz. I said that I didn't have this because I don't work. I don't know how it happened, but when I looked at the results it said that I passed. They said the professor was just married.

Women students may also have less-developed support networks at the university. Women often lack the same networks that men have for getting help with their homework or accessing opportunities. In many cultures it is considered inappropriate for a girl to approach her male professor for help alone. As a man who serves as a faculty member in Cambodia explained, he has to be very careful in the way he interacts with young women at the university and cannot meet with them individually like he does with the male students or people will call him a “playboy.”

In Mozambique, a young woman describes some of the reasons that women students don't have the same academic support as men do:

For the boys the situation is very easy because they generally have friends who have the ability to give them these explanations. They also have the financial support of their parents. It is difficult for girls to understand the material in class, they must go to find other information, but this is not simple, it is difficult.

As this quote illustrates, girls often do not have the same support from their parents and may also lack a strong peer support group because of their lower numbers and heavy workload outside of school.

Agriculture-specific challenges

This section looks at the gender-based challenges in higher education *agricultural* programs that were identified by research participants. It focuses on four themes: perceptions of agriculture, curriculum and pedagogy, safety concerns, and pipeline/access issues.

Perceptions of agriculture

In developing countries, agriculture often has a negative connotation because it is associated with rural life, poverty, hard work, and tradition (Acker et al., 1998; Forsythe et al., 2010; Kayoby et al., 2010; Mangheni et al., 2010; South African Agriculture Forestry and Fisheries Department, 2008). This perception affects men as well as women. In four sub-Saharan African countries Forsythe et al. (2010) found that agriculture was not perceived as a viable career option. Many students end up in agricultural disciplines only when they are not admitted to their first choice. As the following quote from a young man in South Sudan shows, students may be teased for choosing agricultural studies:

Yes, people say things like because of our weak performance at school levels we only made to get admission in Agriculture College. They used to say, these [agriculture] are such easy things, why didn't you selected medicine to study instead. Or they say 'you are just dump [trash].'

Another man from South Sudan shares a similar experience, "Yes, people say bad things, they say that agriculture is peasant job and our forefathers have been doing it since time immemorial." In these quotes it is clear that agriculture is associated with primary farm production, without considering the other jobs along the value chain such as input suppliers, lab researchers, agricultural economists, hydrologists, and agricultural policy makers that young people may be more excited to pursue.

These perceptions of agriculture are not gender neutral and can be especially discouraging to girls and women. Agriculture is perceived to be a masculine discipline, and women are not believed to have the physical, mental and social capabilities to succeed (Mangheni et al., 2010; World Bank, 2008). The narrow idea that agriculture is an activity that involves heavy physical labor in rural areas discourages students, and especially girls from studying it (South African Agriculture Forestry and Fisheries Department, 2008). As a young man in Mozambique explains:

In people's heads there is a perception that agriculture happens in the *mata* (field). They don't like to work in the campo, with sun, with *enxadas* (hoes) this is what people imagine. People don't have good information when they apply, this is why girls refuse. These are conceptions that people have that impact where they apply.

Parents may not want their daughters to take up agriculture due to the misconception that it is difficult subject for women, offers limited opportunities for employment and is not economically competitive compared to other courses (Kayoby et al., 2010; Mangheni et al., 2010).

Cultural beliefs and roles may also keep women out of agriculture. As a woman student in Cambodia commented, "There is a cultural belief that women should stay home and prepare for the children, and men should go to field to do hard work." Women are not perceived to have the strength to do the hard physical work that agriculture demands. In the interviews and focus groups, men were more likely to say that agriculture is a man's discipline because it demands heavy work. While women acknowledged this perception, some also questioned whether it was true. One young woman at RUA in Cambodia said:

They believe woman is the weaker sex. I did an experiment and they told me the job needed a lot of strength.... They still believe we are weak so we should not do things that require strength. So when I do it, they (men/boys) are still discouraging, but sometimes they also help.

This perception of women's weakness exists despite the fact that in most countries, women do a significant amount of farming in addition to the arduous work of fetching water and firewood, cooking, and caring for the children. Some responses from South Sudan may help explain this apparent contradiction.

Professionally it [agriculture] is majority for men because it needs degree, where women are not able to have. But traditionally or formally at home women are the backbone of agriculture.

This statement from a male administrator makes a distinction between women's "traditional" roles in subsistence agriculture, in contrast to men's roles in "professional agriculture." Women's contributions to agriculture and food production are rendered invisible in this dichotomy (World Bank, 2008). One man who was an administrator in Cambodia commented that "in some remote areas it [agriculture] is still considered to be only for men, although women do all the work after men prepare the land." There is a saying in South Sudan that "when women cultivate land, the soil loses its fertility or quality easily, and becomes less fruitful" (Rahim et al., 2014). This saying has a powerful connotation, although it is more a reflection of women's lack of access to information, inputs and good land, than a lack of

capacity (Rahim 2014). Women's overall lower access to these critical assets can also discourage women from pursuing agriculture careers.

Within agricultural programs, women are more likely to select courses that are perceived to correspond to their gender roles and are more socially-oriented (Mangheni et al., 2010). For example, at Sokoine University of Agriculture (SUA), more women take Home Economics and Human Nutrition (78%) and Food Science and Technology (47%), which may reflect perceived responsibilities of women in family wellbeing. In contrast, men at SUA are more likely to take agricultural engineering (95%) or Agronomy (89%), reflecting men's preference in courses with greater emphasis on technology or fieldwork (Mangheni et al., 2010).

In Cambodia, several respondents explained that women can do certain jobs in agriculture, such as growing vegetables, working with small insects and pest management, analyzing tissue culture, but they were not suited for driving tractors, preparing land, making compost, or spraying pesticides. This list illustrates what appears to be a somewhat arbitrary distinction between heavy "masculine" work and delicate "feminine" work.

These ideas are often associated with disparaging or paternalistic comments of what women are capable of, which confine them to a narrow set of career options, as the quote below from a male administrator in Cambodia illustrates:

I think they [girls/women] have to choose a profession that is suitable for them like doing tedious work like tissue culture that can be done by female students but field work working with rice, soybean or upland crops should be done by man students. We have to orient their careers. Females should do that and men should do that so females would not have problems. Think about job market, they will face a lot of obstacles if they choose the inappropriate career.

Perceptions of beauty and femininity also play into these conceptions of agriculture. In Cambodia, where light skin is highly valued, women do not want to be working under the sun. As a young woman explained:

It is normal to hear bad things about students who study agriculture. Especially for girls. They say why didn't you choose banking or accounting...If you study agriculture, being in the sun makes your skin dark, it is a dirty place, and you will become ugly. Families with a beautiful daughter don't want them to study.

Women studying agriculture often have to be resilient in response to criticism from family, neighbors and peers as one woman student in Cambodia recounts:

I have heard some teachers and some students say, "Why do women study agriculture? It is very hard." I always reply, "It is not hard, it is very interesting, why do you think women cannot do it?" People think I am gay because I want to do things like the men.

Single women (and their families) also worry about their marriage prospects if they are working in rural areas. The length of agricultural studies (at least five years in South Sudan) also caused women students in the country to worry about finding a husband and starting a family before they were too old.

Many educated women say they prefer to work in air-conditioned offices in the city. A good education is seen as a pathway for leaving rural agricultural work and enjoying a life with more comforts. As a woman student in Mozambique commented, “with the modernization of Mozambique many women have been given equality. Many girls go into accounting, managing offices, medicine, many aren’t interested in agriculture.” In this quote, agriculture is associated with past traditions, and modernization is associated with equality and opportunities outside of agriculture. This perception was also found in other countries (South African Agriculture Forestry and Fisheries Department, 2008).

One woman student in Mozambique commented that these gendered perceptions of agriculture may be slowly changing:

There is still that idea that there are jobs for women and jobs for men, for example agriculture and forest are thought to be for men. But I think that now people are starting to realize that it is not like that...I believe that this idea is reducing.

In Bangladesh, respondents also commented that among educated groups the idea that agriculture is only for men is decreasing.

The RUFORUM 2010 study found that the misconception of agriculture as a career for men was associated with poor marketing of agricultural careers; poor visibility of successful role models; lack of recognition of agricultural sciences as a potentially attractive career; and little encouragement by parents/guardians for their daughters to study science (Kayoby et al., 2010). Agricultural work is often given to children as punishment in schools, and not associated with science, potentially attractive careers, income generation or entrepreneurial opportunities (Kayoby et al., 2010). There are few role models for young students in the various fields of agriculture and science (researchers, academicians, entrepreneurs) (Kayoby et al., 2010). In most secondary schools there is little career guidance, and students are not aware of opportunities in AET (South African Agriculture Forestry and Fisheries Department, 2008). Furthermore, the marketing of agricultural courses may also reinforce the myth that agriculture is a male discipline. As Kayoby et al. (2010) found “the pictures used in brochures and reports to promote the science faculties often portray tractors, people taking samples from animals and heavy equipment.”

Another discouraging factor is that a large number of learners who have diplomas and degrees in agriculture are, for a variety of reasons, unable to find jobs (South African Agriculture Forestry and Fisheries Department, 2008). Students and faculty members in South Sudan spoke with the greatest frustration about high rates of unemployment for university graduates. They explained that finding a job often depends on having the right connections to government. Two women also told stories about being asked to provide sexual favors to secure employment. Gender discrimination in employment is common in agricultural fields in many countries (Karl, 1998).

Curriculum and pedagogy

Agricultural curriculum and pedagogy is often gender-biased, reflecting the underlying values of the institution and wider society (Kayoby et al., 2010; Mangheni et al., 2010). Negative bias has been found in teacher attitudes toward female students as well as in textbooks in curricula (Mangheni et al., 2010; UNESCO, 2008c). Images of women in textbooks and the media may present women in household roles, perpetuating gender stereotypes that can limit girls' achievement in the sciences (Mangheni et al., 2010). Curriculum may not devote any attention to the roles women play in agricultural production and rural development (Crowder, 1997). A review of gender issues in AET institutions in Africa by the World Bank revealed that curricula often fail to address topics such as nutrition or hygiene that are particularly important to women farmers.

Course activities may also conform to stereotypical gender roles. As Forsythe et al. (2010) found in four African countries, the tasks assigned to students for practical field experience can be highly gendered and may exclude women from participating in the hands-on and field-based activities. Many students in Mozambique expressed concern that they were not learning the practical skills they needed to succeed in farming, in part, due to the lack of relevant field and laboratory equipment.

Students also have few opportunities to learn about the importance of gender within agriculture and extension services, and lack the capacity to analyze the needs of men and women and address them with appropriate programs (Kayoby et al., 2010). Most university agriculture programs do not have a specific course on gender and agriculture. Some courses such as rural development, extension services, and community development may contain elements of gender analysis, but these are typically offered as electives, rather than required. Women's Studies programs are usually located in other faculties/colleges outside of the agricultural colleges and there is little crossing over of students taking courses outside of their college.

Gender is incorporated into AET curricula at BSMRAU through a graduate course entitled “Gender Issues and Youth Programs in Agriculture,” which is offered by the Agricultural Extension and Rural Development Department. This department also offers Rural Development at the undergraduate level, which addresses gender as one of many topics in a general overview of the subject. In addition, students and faculty agree that courses should address gender or that there should be seminars and workshops to increase gender awareness.

In South Sudan gender is not directly addressed in any agricultural courses. However, it is a subject in Rural Community Development, sociology and social anthropology (Rahim et al., 2014). In Mozambique gender is mentioned in several courses and is a larger part of a rural extension course.

In Cambodia, the University of Battambang offers a course on gender, although it is not specifically related to agriculture. Likewise, an elective short course on gender and some student-organized workshops on gender issues are available at the Royal University of Agriculture, but no course addresses gender issues in agriculture specifically. Men and women students and administrators both expressed interest in such additions to AET curricula and even suggested making it required. However, some male students said that a course addressing gender and agriculture would be unnecessary, “because all of the people already know that both men and women need to discuss together. [We] don’t need a course to tell us that.” A woman administrator also commented that such a course is unnecessary because male and female students already have the same opportunities.

Perceptions that there are no constraints for women in AET institutions, or that adding a gender perspective to AET curricula is unnecessary, present potential challenges to increasing gender equality in higher education and AET (Van Houweling, 2014). The possibilities for integrating gender into the curriculum may be constrained by 1) a lack of appropriate models for agriculture education, 2) the lack of introductory and basic undergraduate level textbooks, 3) the lack of faculty with the appropriate training to conduct the classes (Price, 2000).

Safety concerns

Women might encounter unsafe situations on campus and during agriculture field work. A review of gender issues in AET institutions in Africa by the World Bank revealed many universities lack adequate facilities for women to live and to ensure their safety (Johanson, Saint, Ragasa, & Pehu, 2007). As discussed earlier, university campuses often lack adequate lighting at night, private and secure latrines, on campus housing, and reliable transportation, all of which affect the safety of students. Abuse and sexual harassment is particularly feared when women travel to and from school, live away from home, attend classes with mostly boys, or study under male instructors (Karl, 1998; Mangheni et al., 2010).

Spending time in rural and isolated areas is often necessary for agricultural professionals or for fieldwork in AET programs. Many girls and women are steered away from agricultural education because of safety and security concerns associated with this work. Parents want to protect their daughters and fear them working in remote areas. The preoccupation with safety was strongest in Cambodia, but mentioned in all countries where interviews were conducted.

As one woman student in Cambodia reported,

A big problem that my parents worry about for me is about security for the girl. They worry for men too, but men can take care of themselves. Men rape girls, girls do not rape men. If a girl is raped, she feels so ashamed, and if people know, they don't pity her but look down on her. Also family honor would be destroyed too. Authorities don't worry either; they say the solution is to marry with that man, finish the case. A lot of cases are solved by this solution.

Families fear that their daughter's future could be destroyed if she is raped or takes up a lover before marriage. The mention of family honor above shows that these are not individual choices; if a woman is raped, her whole family will suffer the repercussions. Most Cambodian girls and women are still under pressure of tradition; if something happens to her, her future would be destroyed.

Arranged marriages are often negotiated based on the purity of the woman, and one of parents' main concerns is to protect their daughters' honor. In South Sudan a young man said that:

Families use their daughters as main sources of wealth, like 'banks', they go for early marriages to avoid losing dowry, because if girls became pregnant, men will not pay dowry, it will be like a loss.

Perceptions of safety are often based as much on fear, cultural norms, and historical violence than on imminent threats to personal safety. A male administrator in Cambodia explained that safety concerns and a "culture" about protecting girls and women prevents them from working in remote areas, "although it may not be really unsafe." The experiences of a few women living on their own in Cambodia show that it is possible to live safely and the dangers may be more in the heads of their parents than in reality.

It is particularly difficult for women from the city to work in rural areas and there is often a general fear among urbanites about the dangerous countryside (Van Houweling, 2014). As one girl at a secondary school in the capital of Mozambique explained, "I would like to do an agriculture class, but I am not certain about a career because I am scared of working in the rural areas." Woman faculty members interviewed were also concerned about safety and the lack of

lodging in remote rural locations. One woman lecturer noted that this is not an issue for women from the rural areas, but that the male family members in Dhaka would not approve of their daughters and wives working in remote areas because they would be working and staying alone.

Safe housing in rural areas and transportation is a real concern for women. Separate housing for male and female students and faculty members for fieldwork is rare, and these conditions make this work unacceptable for most women. Many women also do not feel comfortable riding the motorbikes that are often needed to access remote areas. As some faculty members commented it costs more for women students to do fieldwork because they must travel in teams and commute to the site everyday due to the lack of housing.

At BSMRAU in Bangladesh, students perceive the primary gender-based constraints in AET to be related to conservative ideas and religious views that women should not work in remote areas or study and should stay in the house instead. In all countries, there was some social stigma associated with women taking trips to remote areas alone with men who are not their husbands. Women may also be prevented from traveling away from home by their husbands. As a woman faculty member in Sudan said:

For example if the lady got married and the husband is not very much supportive he—they may create some, you know, some scenarios that could make you feel it's not good for me to go...

Women may also prefer to stay close to their families, as the quote from another woman faculty member in South Sudan shows:

We would like to work in the field as an extension services, but, we afraid we might face problem with the family. When you have a family with young children, we prefer to stay closer to our babies. This is their right and our right.

Pipeline: Girls under-represented in the sciences

Secondary school experiences shape the interests and prospects for men and women at the university level. Girls are often underrepresented in secondary school and may be more likely to drop out due to cultural norms, early marriage, pregnancy and poverty. In South Sudan, more than 70% of secondary school students are boys, one of the highest gender disparities in secondary education (Rahim et al., 2014). Furthermore, girls are often steered away from courses and careers in the sciences (World Bank, 2008). Therefore, there are fewer girls qualified to enter the university, and science and agricultural courses in particular. Girls may also be seen as less qualified for university agriculture programs because they are often less

advanced in formal languages of instruction and may also lack the technical knowledge and practical experiences acquired through working in agriculture.

Societal norms are based on boys' assumed natural affinity for the sciences, while arts and the humanities are considered to be more suitable for girls. These gender ideologies are perpetuated by families and educational institutions resulting in the low participation of girls in sciences and agriculture (Forsythe et al., 2010; Martineau, 1997; UNESCO, 2010). Although girls often make the choices of which fields to study themselves, they are influenced by subtle or not so subtle pressures from teachers, parents and society in general (Karl, 1998; Mangheni et al., 2010).

In many secondary schools, students have to select a course of study in their final years. For example, in Mozambique, students in upper secondary school choose to follow one of two tracks: 1) philosophy, literature, geography, Portuguese, and history, or 2) biology and chemistry, engineering, physics, design, and math. Most of the girls choose the first track, while most of the boys choose the second. The girls interviewed explained that they were either scared of the science subjects, not as good at these courses, or simply preferred other disciplines such as medicine, law, and accounting. Some of the boys' explanations of this division included disparaging comments, saying that girls are lazy or do not want to work hard. In the opinion of a woman faculty member in Mozambique:

In terms of opportunities I think that they are equal, but there are many women who are scared to enter these courses and that is why there aren't enough women. They avoid courses that have a lot of math, physics, they think that these courses are for men and go to the courses of literature.

This pattern is common in other secondary schools where girls are more likely to select the 'arts and humanities' stream, while boys are drawn to the 'science' stream (Mangheni et al., 2010; UNESCO, 2010; World Bank, 2008).

Characteristics of success

Although women face challenges in AET programs, we also spoke with many inspiring women who have found great success in higher education agricultural programs. What enabled these women to succeed when so many others never reached the front door? Based on this research we can categorize these characteristics of success as: family support, awareness of agricultural careers, and individual determination and confidence.

Family support

The students we spoke with in university agricultural programs all received support and encouragement from family members. Support was understood in its financial, emotional, and

practical dimensions. Students gave examples of receiving money for tuition costs from older siblings, rice from grandparents, lodging in the city from extended family, relief from household work from their mothers, help with homework from uncles, school materials from cousins, and childcare from grandmothers. The particular family member who was perceived to be the most supportive varied, with no clear patterns within or between countries.

Often putting a child through the university depends on the help of many different family members. Families may sacrifice and divert money from other activities to ensure their son or daughter can make it through their studies. As one woman student in Mozambique explained:

All the investment from our house comes to me. My parents always find a way to help me. They always say you must go to school no matter what, even if someone else in the family needs something, they find a way to get me food, money for the *chapa* (public transportation), money for photocopies, and clothes.

Parents' education attainment, also related to socio-economic status, appears to be a factor in women's higher education participation (Mangheni et al., 2010).

While different family members play different roles in supporting a woman's education, women most often talked about drawing inspiration from their mothers or older siblings. Interestingly some women drew inspiration from their mothers because their mothers were educated and had good jobs, while others were inspired by their mother's hard work (often on the farm and in the household) and the sacrifices they made to send them to school and find a better life. As a woman faculty member in South Sudan explained:

I think the number one role model I have in my life is my mom. Because I see how she has been busy in the house, being a school teacher, and handling the family. She was my first role model. And I was like I want to be like her, yeah.

In Mozambique, several women spoke about their fathers encouraging them to study so they could find good jobs and don't have to be dependent on men. As one woman at the UniZambeze said during the focus group:

My father too said you should not depend on men. He always showed me examples of other girls who didn't study and said you would be like them and be dependent on men for everything. I knew I didn't want this, this motivated me.

Older women students with families often depend on their families, especially their mothers, for childcare. One man on the faculty in Cambodia, whose wife also worked at the same university, acknowledged that without his mother living with them to watch the children and do the cooking that it would not be possible for his wife to work. Nearly all of the married women studying or working in agriculture also mentioned the support their husbands gave them to advance their own careers.

Awareness of agricultural careers

Most of the men and women we spoke with were highly motivated to pursue careers in agricultural programs. Contrary to the typical perceptions of agriculture as a dirty and traditional activity, these women saw it is dynamic, practical, full of opportunities, and a critical area for their countries' development. At UniZambeze in Mozambique a young woman explained her choice to study agriculture in the following way:

I always wanted to pursue this program because I had some uncles and friends who already worked in this field of agriculture, first I saw that it was very profitable and had a remuneration that was my first choice. Second because I know that in my country the main source of economy is agriculture, so I would like to do something to make my country rich.

Many of the agricultural students come from rural farming areas and grew up farming with their families, and as one student at the UniZambeze commented:

When I decided to embrace this career I had no negative feedback from my family. I am from Zambezia and agriculture is what we do, it is the base of our province. So being here I don't feel like a fish outside of water.

These students from rural upbringings are motivated to return home to help their families and communities improve their farming techniques, as a woman student at the University of Juba in South Sudan explains:

I joined the college of agriculture to learn about modern agriculture. In my village women used their hands to perform all agricultural tasks. By the end of the day, they just managed to cultivate small quantity, not enough to feed their hungry children. I would like to go back and help my people in the community to adopt the best methods and tools that we are learning, so I will be able to replicate, to improve the productivity. Our land is fertile, we have water why do we spend our hard currency for imported food from our neighbors. This is really shameful.

This quote like others are full of patriotism and optimism about the benefits of an agricultural education for household and national food security.

Many girls and women were encouraged to enter agriculture because they were informed of the broad range of jobs available, and understood that they did not need to rely on their physical strength. Women often received advice about which degree program to enter from their family members. As one woman student in Mozambique explains:

In 12th grade, we have to choose our courses. I talked with a lot of people, my friends, my family. I don't like medicine. I talked to my aunts and uncles, other people in my house to know my options. I heard about math and agronomy and

we started to talk most about agronomy because there won't ever be problems in employment.

Other women mentioned role models who inspired them and opened their eyes up to the possibilities in agriculture. In South Sudan, a woman faculty member commented that in her country there are a lot of educated and strong women, including the woman who serves as the agricultural minister. Seeing these women on television and on the radio growing up she knew that she could also be like them.

Role models are not always such high profile women, and might just be encountered by chance as three responses from the women's focus group at the UniZambeze illustrate. One young woman mentioned seeing a television program about agriculture. As she recounts:

One day there was a woman who was an agriculture engineer and had a big rice field and told people about things, she had a big field, she had freedom. I have always liked strong women who do the work of men.

Another woman recounted how she often passed a check point near her village where she saw a woman forestry officer who managed the forest and logging rights. The third woman said she learned about the possibilities in agriculture because she lived close to the Provincial Department of Agriculture, and saw what the officers did on a daily basis.

The students interviewed had different career dreams. In Cambodia, women students were quite optimistic about the wide range of economic opportunities in agriculture. They wanted to find employment in veterinary medicine, floriculture, vegetable production, plant breeding, working for an agriculture NGO, and owning a farm. The most commonly mentioned activity was owning and managing a farm. In contrast, in Bangladesh, the women students wanted to work in research or teaching and lab work. A woman student in Bangladesh explained that she was studying biotechnology so that she could do bio-pesticide research in a lab after graduation. Students in South Sudan were not as optimistic about their job prospects, although women aspired to run their own shops, start agribusinesses or do lab work. In Mozambique, many of the men mentioned agribusiness activities, while the women were less sure of what they wanted to do and felt more constrained by their family responsibilities. As one young woman explained:

I don't have a fixed dream, like a company, but I would like to do something that can improve my life...I also want to help my mother, it is my turn to help her. Anywhere that can help me do this is fine even if it is in the rural areas that is fine. Our reality is that we must study to get money and not do what is always our dream.

While nearly all the students interviewed expressed a high degree of motivation to study agriculture, this sentiment is not found among all students. Another study shows that many girls and women accidentally ended up in agriculture, through failing a course, family pressure or lack of alternative choices (Acker et al., 1998; Kayobyo et al., 2010). However even in these cases, students' perceptions changed in a positive way once they were in the degree program (Forsythe et al., 2010). "Some students mentioned that they had never known that the field of agriculture was so diverse, remunerative or high profile" (Forsythe et al., 2010).

Personal determination and confidence

The awareness women held about the range of agricultural careers was often complemented by their strong personal determination and confidence. The personal stories we heard during the interviews revealed courageous and perseverant women who were excited to work in agriculture and unwilling to let any gender-based obstacle deter them. This inner strength was a characteristic central to the success of the women students we spoke with. The choices that women make break down the gendered perceptions of agriculture and show that the hurdles can be transcended.

As a woman in Cambodia explained during the focus groups:

No, agriculture is not just for men, because now we don't use strength, we can use our brains to make a machine and girls can make a machine because girls have brains like the boys. Boys can think about something new, girls can think too.

Overall, the women interviewed were self-confident, firmly believing that they were equally as capable as men in agriculture disciplines and careers. As a young woman in Bangladesh said, "Women think they can do it even if men think they can't. Men think women won't work in the field, but women are more honest and hardworking than men."

Most of the women we spoke with were not afraid of working in rural areas or leaving home to study agriculture. In Mozambique, when women from UEM in the capital were asked if they would have any difficulties working in rural areas, they all replied that it would not matter as long as they were paid well and many were excited to "see the reality" of agriculture. One woman added, "They will think that we are scared, that we are not strong, but in reality we are not scared of anything, but they still put us behind because of these ideas they have." Even in Cambodia where safety was the greatest concern, this barrier does not keep women away:

Many people said it is not good to send a girl to the city ...I got high scores and my mom agreed but was still worried. I promised myself I will break the record in my village. No girl had ever studied in Phnom Penh...I never listen to people who say 'she cannot do it.' I only listen to me, and listen to the people who encourage me.

This woman, like others, is a trailblazer creating a path where there was not one before and clearing the way for other women to follow. The journeys of the women interviewed for this paper provide many inspiring examples of hard work, persistence, struggling against cultural perceptions, and challenging gender norms.

Policies and Practices

There is no single solution for addressing the wide range of gender issues this paper raises for higher agriculture education. Effective interventions must cover the complex and multifaceted issues of policy, economic constraints, lack of political will, restrictive cultural norms, and lack of awareness and capacity that occur at many different levels. Consideration of how to foster the characteristics of success described in the previous section is also needed. The top recommendations proposed by interview participants were: increasing the number of women in agricultural programs through scholarships and affirmative action programs, implementing gender sensitization programs, providing support services and leadership training for women, addressing safety conditions for women, and changing perceptions of agriculture.

Gender mainstreaming is an approach that can work to address all of these areas as part of an integrated program. It can be defined as:

The process of incorporating a gender perspective into organizational policies, strategies, and administrative functions, as well as into the institutional culture of an organization. This process at the organizational level ideally results in meaningful gender integration (IGWG, 1998).

Gender mainstreaming aims to move beyond access “to issues affecting women’s ability to fully engage and perform within these institutions” (FAWE, 2015). The mainstreaming process should encompass the entire spectrum of the university function (teaching, research, and service) and be all inclusive in regards to the various stakeholders (male and female students, faculty members, and administrators) (Kwesiga & Ssendiwala, 2006). Gender mainstreaming demands putting the right policies in place and securing commitment and leadership at the highest level (Mangheni et al., 2010). Some key features of a gender mainstreaming program include capable and motivated gender focal persons for each academic unit, gender training for teachers and administrators, gender budgeting, gender policies and clear and measurable action plans (Association for the Development of Education in Africa, 2006; Kayobyo et al., 2010).

Often the first step is to undertake a policy audit of all existing policies for gender sensitivity and identify gaps (Mangheni et al., 2010). Gender policies should focus on increasing the number of women and minority groups in the institution, promoting a safe and equitable learning environment, building gender-sensitivity into the curriculum and staff trainings, and ensuring that adequate budget support is set aside for gender and diversity activities (Mangheni et al., 2010).

Men play a key role in reducing gender disparities and changing the culture of institutions. Cultivating high level male allies in universities and the government who can advocate for policies and programs that support women in AET is a key strategy. Programs like African Women in Agricultural Research and Development (AWARD) have found that involving senior male AET professionals as mentors for women who received fellowships increased men's appreciation for the constraints that women face in AET institutions (Meinzen-Dick et al., 2011).

Transformative gender mainstreaming is missing from most higher education institutions (Association for the Development of Education in Africa, 2006). Some challenges to gender mainstreaming efforts identified by RUFORUM include: a lack of human capacity and resources, absence of clear and measurable work plans, and resistance from some senior staff. Gender initiatives are often short term projects that depend on "outside donor funding and the initiative of a few individuals within the institutions raising questions about institutional ownership and sustainability" (Mangheni et al., 2010). Furthermore, most gender interventions tend to be narrowly focused on addressing symptoms rather than the fundamental root causes of gender based disadvantage for women (Mangheni et al., 2010).

African universities are at different stages establishing institutional frameworks for undertaking gender mainstreaming (Mangheni et al., 2010). Makerere University, which began the mainstreaming process in 1991 has some of the most advanced gender integration, along with universities in South Africa (Association for the Development of Education in Africa, 2006). Makerere has established a Gender Mainstreaming Division to implement the program and has the official recognition of the University Council (the highest governing body). This program has strategically retained an independent leadership group, while actively engaging across departments (Kwesiga & Ssendiwala, 2006).

In Mozambique, Eduardo Mondlane University set up a Centro de Coordenacao dos Assuntos do Genero (Centre for Coordination of Gender Issues) and appointed a center director and deputy along with faculty gender focal persons (Mangheni et al., 2010). Other African universities such as the University of Botswana, SUA, the University of Nairobi, Egerton University have also developed gender policies (Mangheni et al., 2010).

However, even when clear gender policies exist, implementation, monitoring, and enforcement is often lacking (FAWE, 2015 ; Kayobyo et al., 2010; Mangheni et al., 2010; Van Houweling, 2014). A recommendation coming out of the RUFORUM 2014 workshop was to create mechanisms for monitoring, implementing, enforcing and evaluating existing policies (Van Houweling, 2014). One good example of this comes from SUA, where there is a structure for monitoring all activities related to gender, including gender disaggregated data on students and faculty enrollment and job placement (Kayobyo et al., 2010). Kenyatta University has also set up the Gender and Affirmative Action Implementation Centre with the mandate of implementing gender policies in the institution (FAWE, 2015).

Increase the number of women in university agricultural programs

Utilize scholarships, quotas and affirmative action

Scholarships, quotas and affirmative action policies are commonly used to increase women's enrollment in higher education institutions and were one of the most popular recommendations offered by the research participants. However, Kayobyo et al. (2010) found that some staff including women in senior positions expressed deep concern about how to apply affirmative action in admissions without compromising merit. They recommend that more awareness raising is needed to overcome this resistance.

Scholarship programs, such as AWARD specifically target agricultural programs. Scholarships have also been provided by various foundations, including Winrock International, African Women Leaders in Agriculture and Environment (AWLAE), the Rockefeller Foundation, and the Carnegie Corporation. RUFORUM consistently advertises scholarship opportunities for African students in its newsletter. In addition, many universities have their own programs to increase the number of female students. For example, the Makerere University Gender Mainstreaming Division has been implementing a Female Scholarship Initiative (FSI) project since 2001 that offers females from disadvantaged backgrounds access to undergraduate studies. Funded by Carnegie Corporation, the project had supported 691 beneficiaries as of 2010 (Kayobyo et al., 2010).

Recruit students from rural areas

Some universities also work to actively recruit students from rural areas. For example, in Mozambique at the UniZambeze, faculty members travel to surrounding communities and speak with parents, provide information about their programs, and also use women faculty as role models (Van Houweling, 2014). As Mangheni et al. (2010) recommends, scholarship opportunities should be widely advertised and efforts should be made to use various forms of communication to reach girls from more remote areas.

Provide support for Ph.D. students

Support for Ph.D. students was identified as a critical need by participants. Most of the current university scholarship and affirmative action policies are restricted to the undergraduate level, with little if any internal interventions directly targeted at improving women's enrollment at postgraduate levels (Kayobyo et al., 2010). Without high-level degrees, women faculty are not able to advance into higher levels of university administration or decision-making positions. As one woman administrator from the Royal University of Agriculture in Cambodia said:

If we want to build women's capacity, we need to focus on long-term training, on getting degrees. NGOs are working a lot on women, but in short trainings. [We] cannot use these for getting higher positions and cannot do decision-making. Always when we have to decide something and need to have opposition, you need a degree. You can join 30-40 trainings and increase your livelihood but for higher positions you need a Ph.D.

Provide support for families and language training

Scholarships for women should also provide additional support for their families to accompany the recipient abroad if they choose. Many women are forced to turn down overseas scholarships because there is no funding for their children and spouse to travel with them. In the Mozambique RUFORUM workshop participants debated the pros and cons of having their families travel with them during their studies. They concluded that women should be able to make this choice for themselves and must have the opportunity to consider including their families. Another critical aspect identified by the group was the need for language training to enable women from non-English speaking countries to compete for overseas scholarships and be successful in their programs.

Besides scholarships, a diverse range of affirmative action and quota policies have also been used to increase the number of women students. In Mozambique, female students, and poor and rural students all receive extra points on their admission applications. Other sub-Saharan African countries, including Ethiopia, Tanzania, Zimbabwe, Malawi and Uganda, have lowered the grade point average or awarded additional points required for admission for female candidates (Teferra & Altbachl, 2004). In Kenya, women are given two extra points in admissions, and students from disadvantaged areas are given one extra point (Kayobyo et al., 2010). The Kenya Professional Association of Women in Agriculture and Environment provides need-based scholarships and mentorships for gifted women (Kayobyo et al., 2010).

The positive correlation between affirmative action initiatives and the improvement in female enrollment rates highly suggests that affirmative action is improving women's access to higher education (FAWE, 2015). In the College of Agricultural Studies at Sudan University of Science and Technology women's enrollment increased from 10% in the 1980s to 72% in 2007 (Gebre-

Ab, 1988; Idris, 2007; World Bank, 2008), due in part to a policy that women students compose a minimum of 30% of the students and established new housing for women. Makerere University implemented affirmative action in favor of female applicants through accreditation of 1.5 points from 1990-2008. This effort increased enrollment of female students in science programs from 17% in 1989/1990 to 33% in 2008/2009 (Kayobyo et al., 2010).

Implement supplementary, bridging, or precollege courses

Supplementary, bridging, or precollege courses in science and other subjects can target women and improve their success at the university (World Bank, 2008). SUA has developed a pre-entry science program specifically for woman students (Kayobyo et al., 2010). In Malawi, a life skills course at LUANAR was created to help the women transition from high school to college, and a monthly women's meeting was created to help woman students discuss and report on issues that they face.

Introduce gender sensitization at all levels

Gender sensitization is needed at all levels, from the household to the university to the greater society. The responses from the research participants focused primarily on addressing the cultural traditions, gender norms and attitudes that discourage girls' and women's education. Some of the issues specifically identified included early marriage, dowry payments, the high domestic workload of girls and women, and the tendency to give preference to boys' education. If these norms and practices don't change then women will have little chance in gaining equal access to education opportunities.

Some suggestions offered by participants to combat these challenges include campaigns to address women's rights issues, working with families to encourage them to send their girls to school, and increasing awareness about gender issues at all levels of the community. As a man who serves as a faculty member in Cambodia suggested: "Media, internet, TV, and magazine should be used to spread information related to gender. Most people in rural areas don't read the newspapers but they listen to radio."

Recognize parents as critical gatekeepers

Parents and teachers need to actively work to overcome the social barriers, norms, and practices that explicitly or implicitly discourage women and girls in the agricultural sciences (World Bank, 2008). Parents are critical gatekeepers in deciding whether to send their daughters to school, and many of the research participants emphasized the need to explain the benefits of agricultural courses to parents and to create more linkages between parents and the schools.

Increase gender sensitization at universities and ensure adequate resources

Raising awareness of gender issues in AET is important at all levels to overcome assumptions that women already have equal opportunities in AET. At the university, gender sensitization needs to be increased for faculty members, staff and decision makers. Seminars or workshops on gender and diversity should be a required element of orientation programs or continuing education (World Bank, 2008). These should aim to disseminate information on the gender policy and activities, and increase the awareness of staff and students on gender and diversity issues within the institution and in the curriculum (Mangheni et al., 2010). It might also be necessary to provide the gender focal points and the training they need to be successful (Mangheni et al., 2010). Budgets should be structured to ensure adequate resources for training students, staff and the gender focal points as needed (World Bank, 2008).

One bright example of gender training comes from Makerere University in Uganda. Makerere has trained hundreds of men and women in gender awareness and analysis and students have formed a Gender Students Association with gender peer trainers. The program seems to be well accepted based on the rising interest from many units for assistance from the Gender Mainstreaming Division, and a rising consciousness about good gender practices in formal meetings, informal communication and decision making (Kwesiga & Ssendiwala, 2006). However, this initiative, like others, is not specific to agriculture and addresses general gender issues in higher education institutions.

Mainstream gender into the curriculum

Mainstreaming gender into the curriculum can help better prepare all students to attend to the needs of men and women farmers and be sensitive to gender issues in the workplace, community, and family life (World Bank 2008). AET programs should develop a gender awareness course that is required for all students in their first year to help change “mindsets” about the importance of gender. The course should include modules on the importance of women’s roles and contributions to agriculture, working with rural women, understanding gendered agricultural constraints, and conducting gender analysis, etc. Graduates should be capable of identifying and addressing gender issues in their work (Mangheni et al., 2010).

While few participants suggested a gender course without any prompting, most agreed that such a course was important and currently absent from the AET curriculum. As a man who serves as a faculty member in the South Sudan expressed: “Gender studies in the agriculture college should be integrated as part of courses. Gender studies is vital because it promotes equality between men and women in the community.”

In addition to developing a course of gender and AET, it is also necessary to ensure that the rest of the courses are gender sensitive and attend to the needs of both men and women farmers

and students (Karl, 1998). This means eliminating gender bias from text books and creating new courses that better align with women's interests and meet marketplace demands. For example, courses on post-harvest processing and the nutritional value of food processing techniques provide key examples of women's often overlooked role in agriculture as it relates to provisioning of nutrition for the household (Jones & Christie, 2014).

Makerere University has undertaken a process to engender the entire university curriculum in 16 disciplines and a Gender and Development course is one of the elective courses students can take along with another discipline (Kayobyo et al., 2010; Kwesiga & Ssendiwala, 2006). The University of Pretoria requires every college to integrate gender and community work into at least one course and students are also required to do community service every semester.

Address safety issues for women students

Maintain gender appropriate infrastructure

Safety is one of the primary constraints for women in AET. Gender appropriate infrastructure, including housing, latrines, child care services, transportation services, and adequate lighting is necessary for women to feel safe and comfortable at the university (World Bank, 2008). The study participants identified affordable and safe on campus housing as a top priority. Latrines, which are an often overlooked aspect of infrastructure, also should be designed with women's needs in mind. Adequate lighting on campus along with security guards and safe and accessible transportation services can improve the safety on campus and in the travels to and from school. Safety can also be an issue for fieldwork. As a woman faculty member suggested in Cambodia, women should work in teams during fieldwork and should have transportation provided by car, rather than motorbike. Appropriate housing for women at field sites is also necessary when overnight stays are required.

Work with parents to assuage their fears

Many participants also suggested working with parents to assuage their fears of their daughters going to the university. As a woman faculty member in Cambodia recommended: "Tell families not to worry about their daughter. Reassure them, and encourage them to give her opportunity to work far from home and encourage her. Let her go by herself." The RUFORUM workshop participants recommended that universities host a family day twice a year on campus to help parents feel comfortable with the school environment and assure them that the facilities are suitable for their daughters.

Create and enact policies to prevent discrimination, sexual harassment and violence

Policies are critical to prevent discrimination, sexual harassment and acts of violence on the basis of gender, ethnicity, or other types of diversity (World Bank, 2008). While sexual harassment policies are becoming more common in universities, they often lack mechanisms for reporting abuse confidentially and clear guidelines on how to treat the perpetrators and the

victims (Kayobyo et al., 2010; World Bank, 2008). To solve some of these problems, Kenyatta University created a confidential mobile phone line which victims can use to report sexual violence. The Forum of African Women Educationists (FAWE, 2015) found that while this led to an increase in reported cases, interviews with students at the university indicated that most cases still go unreported due to fear of victimization (FAWE, 2015). Haramaya University in Ethiopia has an anti-harassment policy that is published in the student manual and covered in the student orientation for both men and women. It is well known by all and has clear and effective procedures for reporting an incident.

Create a supportive environment for women students

Improve the work life balance

University policies and services can be designed to create a comfortable and supportive living and learning environment that accounts for different needs and time constraints of women (Meinzen-Dick et al., 2011; Crowder, 1997). Policies can be implemented to improve the work life balance for students and faculty members with families. Government-sponsored maternity leave is a critical part of a gender sensitive policy. Flexible modes of education delivery such as distance learning, extended timetables for graduation, and evening classes can also enable women to stay in school while working or caring for their families (Mangheni et al., 2010). In many African universities, graduate courses are in the evenings and weekends to accommodate working students.

Offer childcare and support services

Childcare and support services for pregnant students and mothers can enable women to stay in school to finish their studies (Acker et al., 1998; Forsythe et al., 2010; Kayobyo et al., 2010; Mangheni et al., 2010). As a woman faculty member in Bangladesh commented:

If I get opportunity to say something I want the facilities for women faculty member to include day care centers. If we start all those then women can work more and better and independently and freely.

None of the schools included in this study had daycare centers on campus. At other universities, such as Egerton University in Kenya, student mother's clubs and nursery school are essential resources for supporting women staff and students (Mangheni et al., 2010). Two Higher Education for Development (HED) USAID programs, in Rwanda and Paraguay, set up child care facilities so working women could bring their children after work so the women could go to classes and study. To keep girls in school, participants at the RUFORUM workshop also recommended sexual education in secondary school, along with information about HIV and family planning.

Hire more women lecturers

The classroom environment could be improved for women and girls by hiring more women lecturers, a suggestion made by participants in Mozambique and South Sudan. Recruiting more women faculty can inspire more girls to enter agricultural fields and help them to feel more comfortable in the classroom (World Bank, 2008). This was the strategy described by a man serving as an administrator in Mozambique:

One of the things we are trying to do is to recruit more female faculty members to show the girls that there are women who can do the courses they are doing and they can do the work of men, to encourage them.

Utilize alternative pedagogical practices

Pedagogical practices that move away from the dominant question and answer methods of teaching also show promise for increasing women's participation. For example, group work might help women feel more comfortable participating (FAWE, 2015). Science fairs and the production of the Scientific Journal in Mozambique offer other ways to encourage and inspire women in the sciences (Van Houweling, 2014).

Provide mentoring, networking and information exchange

Mentoring and networking groups can also help provide women with support during their studies and opportunities when they graduate. There are some excellent formal networking and mentoring organizations. For example, Women Organizing for Change in Agriculture and Natural Resource Management (WOCAN) has a networking program known as Women's Leadership circles, which provide spaces for WOCAN members to share knowledge and information and develop relationships with other members at a national level. AWARD fellowships provide one-on-one mentoring and networking opportunities. Increasing access to mentoring programs for secondary school students and university students was a top recommendation coming out of the RUFORUM workshop. They also suggested providing training and coaching for women and men to be good mentors and emphasized the importance of formal guidelines for mentoring programs to be effective.

Women at the RUFORUM workshop were also hungry for more opportunities for networking and sharing information. They recommended expanding beyond RUFORUM to reach out to other countries and organizations, hosting regional meetings to share information, and creating a database of women (and male allies) involved in agricultural programs and careers.

Establish support groups for women

Support groups for women can take the form of professional organizations, student clubs, agricultural associations, or women's centers. Women's centers can provide support, confidential advice and information to female students about facilities, healthcare (particularly for mothers), reproductive health and university policies on violence, harassment and discrimination (Mangheni et al., 2010). The National University of Burundi has a Women's

Association that includes both students and staff. The organization hosts annual social events and income-generating activities for its members. As the RUFORUM report suggests, this association could be supported to broaden its focus to include mentoring, counseling, staff and student support and childcare arrangements. Rwanda and Kenya have support networks or women's clubs that offer some limited support, but they are challenged financially and unable to provide sufficient training and gain the support of management (Forsythe et al., 2010; Mangheni et al., 2010).

Increase the confidence of women

Women often have the knowledge and training to be successful, but are held back by their lack of confidence. As a Mozambican AWARD fellow explained increasing the confidence of women is a key issue:

Still now, the men still treat women in a different way and they think, 'Oh they're not good enough for this or they're not good enough for that.' And they feel a bit in the shadows still, many of them. And that's in general as well, not just agriculture. I don't know how that can be improved. Maybe some leadership courses or something like that, because I remember the ones that I did, just a few days of a good course with AWARD with really good facilitators, they were really high quality. And another thing I always remember is, they [AWARD leadership facilitators] said was, 'Feel the fear, but do it anyway.' That one I am always remembering and I tell my girls about that... The women are perhaps used to being the shadow and people are not as aggressive in a good sense. So sometimes they need a bit of a push....

Nearly all of the students we spoke with in agricultural programs all displayed a tremendous sense of self-confidence and determination. While some of these traits are a product of a supportive and egalitarian home environment they can also be deliberately cultivated. There are several programs that aim to develop the confidence and leadership of women.

WOCAN's Leadership Development Program for Gender Equality offers courses to men and women on women's leadership, organizational change, and gender analysis in the areas of agriculture and natural resource management (WOCAN, 2015a, 2015b). AWARD fellowships offer top women agricultural scientists in sub-Saharan Africa trainings and opportunities to strengthen their research and leadership skills (AWARD, 2015).

Another program, Institute of International Education's Higher Education Readiness (IIE HER) in Ethiopia provides scholarships and leadership and skill trainings to help girls finish school and prepare them for college (Institute of International Education, 2015). The Rwanda Women's Leadership Project aims to strengthen the capacity of the University of Rwanda to advance women's leadership in agricultural fields. The training and degree programs prepare women for

leadership and entrepreneurial roles as well as promote engagement with local underserved communities (Michigan State University, 2015).

Improve perceptions and visibility of agricultural education and careers

Negative and highly gendered perceptions of agriculture discourage students, and especially girls from pursuing agriculture studies. A broader awareness of the wide ranging careers possible within agriculture will help attract more women to agricultural disciplines. Young people need to be aware of professions in agriculture and rural development, such as extension, teaching services, input suppliers, agribusinesses, private sector occupations, or policy making (World Bank, 2008). As a woman student in Mozambique explained:

One of the reasons there are few girls is they don't have correct information. If we found a way to sensitize people to tell them what the courses are really about, I think they would be more interested.

As Forsythe et al., (2010) found, once students enroll in agricultural courses, both men and women discover a wide range of interesting agricultural careers. The lack of awareness of these areas of work in agriculture may reveal that women have limited exposure because of gender stereotypes that classify these areas for men (Forsythe et al., 2010).

Raise awareness of the diverse professions in agriculture

Raising awareness of the diverse professions in agriculture could take place through media efforts, career counseling, internships, and outreach by universities. Universities and other training and scholarship programs should make deliberate efforts to market their courses to students with clear messages encouraging women to apply (Kayobyo et al., 2010). This can be done by highlighting the career opportunities in agriculture and showcasing women role models working in agriculture (Kayobyo et al., 2010). Sokoine University of Agriculture in Tanzania, Makerere, University in Uganda, UniZambeze in Mozambique, and Egerton University in Kenya have taken steps to market agriculture in secondary schools by introducing students to the potential careers in agriculture and other science fields (Mangheni et al., 2010).

Offer career counseling in secondary schools

Other opportunities for raising awareness are agricultural education and training information days or weeks in schools, AET road shows in communities, media talks and advertisements in both print and electronic media (South African Agriculture Forestry and Fisheries Department, 2008). Career counseling in secondary schools was a suggestion put forth by participants and different organizations (Karl, 1998). Career counseling could include providing administrative information on entry requirements, scholarship opportunities (particularly for women), application procedures and the types of support provided by universities (Mangheni et al., 2010).

One of the goals of USAID's Excellence in Higher Education of Liberian Development (EHELD) program is to increase access for young women in engineering and agriculture university disciplines. One strategy they took to accomplish this was to organize summer "fast track" programs to expose senior high school students to engineering and agricultural training and careers and provide educational career counseling (AllAfrica Global Media, 2013).

Establish a mentoring and role modeling program

Campaigns in secondary schools can promote agriculture as a career for women and encourage girls in the sciences (World Bank, 2008). One part of the AWARD program includes the fellows visiting their secondary schools to tell their stories and inspire other girls to follow their footsteps. As one AWARD fellow explained with enthusiasm, when she came back to her village there was a big celebration and everyone came to listen to her speak, even the teachers and parents. She felt very good about this event and hoped that it could become a larger part of the AWARD program. One of the strong suggestions emerging from the RUFORUM workshop was to establish a mentoring and role modeling program in secondary schools that builds on the AWARD model, but includes a longer-term strategy (Van Houweling, 2014). As one woman commented, women need to be the "face of success" for the younger generation and share their stories in rural areas and secondary schools.

Introduce agriculture in secondary or primary school

Agriculture could also be introduced as a subject in secondary or even primary school. Schools could support gardening and small animal projects and agriculture clubs to encourage interest in agriculture. Introducing agriculture sciences into the general education curriculum, along with practical examples of agricultural projects could help increase interest in agriculture and better prepare students for these subjects at the university (Forsythe et al., 2010). As a woman faculty member suggested in Cambodia, by introducing agriculture as a concept in high school, students will have a greater interest in pursuing it at the university.

Develop relationships with private sector employers

Part of improving the profile of agricultural programs is ensuring that students have jobs after they graduate. Women may face discrimination in the job market even if they graduate with high marks (World Bank, 2008). The lack of jobs and need to make agricultural jobs more attractive, was mentioned as a challenge by several interview participants. Internships during the course of the program can help provide practical training and a special effort could be made to connect women that are interested in further developing their careers with internships. Universities could develop relationships with private sector employers and research institutes to target women for internships and jobs. Other initiatives already mentioned, such as developing networking, mentoring opportunities for women as well as offering women's leadership courses, are all useful strategies for increasing women's employment opportunities.

Develop training, research and entrepreneurship capacity

The RUFORUM workshop participants recommended raising the visibility of individuals and organizations engaged in agriculture research, agribusiness and all sectors involved along the agriculture value chain and increasing awareness of the range of jobs and profitability of agriculture. They also spoke of the possibility for creating more innovations in agricultural programs that would encourage women. In some countries, women may be more interested in courses such as food processing, preservation and preparation, and nutrition, and these should be offered to the extent that they align with workforce demands (World Bank, 2008).

There are some positive initiatives in this area. For example, the Rwanda Women's Leadership Project aims to address gaps in the current curriculum to develop agribusiness training and research capacity, with a goal of training highly employable women agribusiness professionals in strong analytical and business development skills. At the University of Battambang in Cambodia, there is a special course for agricultural entrepreneurship for women. These strategies should be part of a broader effort to professionalize and modernize agricultural occupations to make them more attractive (World Bank, 2008).

Conclusions

In many countries, women are underrepresented at all levels of education. This gap only becomes wider at the higher levels, particularly in science subjects, including agriculture. This study has documented some of the reasons for this gap with a particular emphasis on higher education agricultural programs. These issues include negative and narrow perceptions of agriculture, restrictive socio-cultural norms, economic constraints, gender-insensitive learning environments, safety concerns, and pipeline access issues.

On the positive side, the number of women at all levels is increasing, and the proportion of women studying agricultural sciences is larger than the share of women professional staff employed in agriculture. Most of the women we spoke with were strongly motivated to pursue agricultural careers and unwilling to let any gender-based obstacles stop them. Some of the characteristics of their success included supportive families, visibility of role models in agriculture, awareness of diverse agricultural careers and personal determination and motivation.

If appropriate incentives can be provided to encourage women students to pursue careers in agricultural research and enter Ph.D. programs, there will be a larger pool of qualified women to compete with men for higher level academic and administrative positions (Beintema & Di Marcantonio, 2010, p. 40). This optimism was echoed by the only full woman professor in

Bangladesh, who commented: “I think in our future women will be leading national agricultural systems, research and education institutions.”

The recommendations and good practices shared in this report offer guidance for addressing gender issues in agriculture programs. These ideas are likely to be of interest to university administrators, policy makers and development programs with a mandate to increase the participation of women in agriculture.

Gender initiatives cannot be limited to external donor funding and a few committed individuals within institutions. Mainstreaming gender in higher education needs leadership at the highest level, commitments of resources, long-term awareness-raising, and the right policies in place. This cannot be accomplished by working only at the university level. Increasing women’s participation in AET entails addressing broader gender equality policies at the national level related to women’s land rights and access to extension services and inputs, as well as working with communities and parents to change socio-cultural norms that limit women’s access to education. This transformation is not only necessary to meet the goals of gender equity, but also to address the agricultural challenges facing the world.

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