An assessment of the gender gap in African agricultural research capacities

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Abstract

Female researchers offer different insights from their male counterparts, and their input provides an important perspective in addressing the unique and pressing challenges of female farmers. Consequently, it is important that agricultural research agencies employ a balance of male and female researchers. Statistics on sex-disaggregated capacity trends are needed to enable decision-makers to set priorities and benchmarks and to monitor progress. New evidence collected through Agricultural Science and Technology Indicators (ASTI) shows that the gender gap in African agricultural research, although still substantial, continued to decline. In some countries, however, the participation of women in agricultural research continues to be extremely low. Furthermore, female researchers are often young and less qualified than their male colleagues. Although the ASTI evidence provides some useful insights, this article argues that more detailed information is needed to ensure that gender issues are better and more effectively taken into consideration in policy formulation for and implementation of agricultural research issues.

Keywords: Agricultural research, gender, indicators, female researchers

Introduction

Women play an important role in agricultural and food production and provision but are often lacking access to resources in developing countries. Gender relations differ across regions and cultures. Meinzen-Dick *et al*. (2011) argue that because gender and cultural issues are strongly interrelated, it is important to have a more gender-balanced agricultural research, development, and extension system. These systems should involve both women and men in agricultural research issues to address existing gender roles and how these can be improved upon through enhanced education and capacity strengthening. Consequently, it is important that agricultural research agencies employ a balance of male and female researchers. Various studies have argued that higher rates of female participation in science and technology (S&T) can improve the quality and competitiveness of research and innovation (Huyer and Westholm, 2007; European Commission, 2008). Greater participation will increase the diversity of skills, experiences, and perspectives in the working force. Furthermore, attracting more women into the sciences can address the serious S&T capacity shortages that many countries are facing (IAC, 2004).

Anecdotal evidence, however, shows that female participation drops with career progression in S&T systems, which is called "the leaking pipeline." UNESCO's latest data analysis (UNESCO, 2015) shows that globally more women than men are following BSc and MSc-degree level training; women accounted for 53 percent of the total enrollments in 2013. But their share drops

 DOI: 10.19268/JGAFS.212017.1

at the PhD-degree level where 43 percent of the students are women. The gap increases at the researcher level, where women only account for 28 percent of the total number of researchers worldwide. Although data on women shares in high-level research and management positions are scarce, it is well known that women are even less represented in high-level research and management positions and as a result have less influence in policy- and decision-making processes (Huyer and Westholm, 2007; European Commission, 2008; Shen, 2013). The leaking pipeline of women dropping out of science careers is attributable to many workplace, societal, and cultural challenges facing women. These challenges include unequal access to basic education in developing countries, traditional beliefs on the role of females in society, balancing work and family, potential gender discrimination, and often relatively lower salaries than their male colleagues in similar positions (Andres, 2011; Shen, 2013; Beintema, 2014).

But overall, the participation of women in research has increased over the past years in many countries in the world (UNESCO 2015). Evidence collected through Agricultural Science and Technology Indicators (ASTI)[i] shows that this has also been the case in agricultural research in developing countries. ASTI data, however, also shows that the increases in female researcher shares have occurred at the lower level of research systems and that women continue to be under-represented in management positions in many countries (Beintema and Di Marcantonio, 2010; Beintema, 2014).

This article will begin with setting the context of why measuring female participation in agricultural research is relevant and what role ASTI plays in gathering such evidence. The next section highlights various demographic details of the agricultural research capacity in Sub-Saharan Africa (SSA), disaggregated by gender building on updated and expanded datasets collected through a series of country survey rounds on agricultural research investment and human resources in 40 SSA countries. This will be followed by a section that assesses where SSA's gender parity stands in relation to other regions in the world. The article concludes that for improved policy-making on gender issues in agricultural research, more quantitative and qualitative information is needed than what is currently being collected through ASTI.

Setting the context: Relevance of measuring female participation in agricultural research and ASTI's role

Sex-disaggregated data on the role of women in agricultural research, both over time and across regions and countries, are extremely important for decision-makers, including research and human resource managers, at national, regional, and international levels. They need data and indicators for setting policy priorities and benchmarks, measuring progress towards these benchmarks, and identifying gaps. Decision-makers will need better understanding of the specifics of gender inequities and how they are exhibited. This will result in better policies addressing gender issues in agricultural research. Furthermore, agricultural research systems in most developing countries suffer from a shortage in human resource capacity, which is essential for economic growth and securing food security. Stimulating women to pursue a research career will result in attracting additional and much-needed human resource capacity for agricultural research (IAC, 2004; Beintema and Di Marcantonio, 2010). Strengthening the agricultural researcher capacity in SSA requires not only increasing the number of female researchers, but also enhancing the number of women in decision-making roles. The latter results in women

issues being understated in critical policy debates and decision-making processes dominated by men (Meinzen-Dick *et a*l., 2011).

Gender policies are often not high on the agenda of many decision-makers and there continues to be a lack of awareness of addressing the gender gap in S&T. Although there has been an increasing emphasis on the need for sex disaggregated capacity data for S&T at the international level, progress of collecting such data at the country levels remained limited, and often collected and funded by international external sources. SSA is particularly lacking in the provision of gender data (Huyer and Hafkin, 2007). An exception is ASTI, which has been collecting sex disaggregated human capacity data as part of its overall data collection and analytical activities on agricultural research investments, capacities, and outputs. As such, ASTI provides the most comprehensive datasets on the participation levels of women in agricultural research in the developing world.

ASTI compiles, analyzes, and publishes investment and human capacity data on agricultural research in low- and middle-income countries. The program functions through collaborative alliances with national research agencies, regional coordinating bodies, and international institutions. ASTI datasets are collected and processed using internationally accepted definitions and statistical procedures for compiling research statistics (see OECD, 2015). Realizing the importance of sex disaggregated human capacity data as outlined above. ASTI began collecting such data in the 1990s. However, the data collection then was limited only on the number of total researchers by gender. During its 2000-2001 data collection efforts, ASTI expanded the coverage by collecting researcher and research support data by degree and gender. Since then, ASTI further expanded its sex disaggregated indicators with researcher data by age and by position. See ASTI's website for more information on its methodology and data collection procedures and access to the various datasets (www.asti.cgiar.org).

Although ASTI tracks women's participation in agricultural research including some demographic dimensions (by degree, age, and position), ASTI provides only a small part of the quantitative and qualitative information needed to fully capture women's participation in agricultural research, which is key information for decision-makers. For example, trends of female student enrollment and graduation in agricultural sciences at higher education level remain limited. Another data gap is information on the working conditions of female researchers including recruitment, salaries, mobility, research outputs, career paths, and institutional gender policies (Huyer and Hafkin, 2007).

Detailed demographics of women's participation in African agricultural research

Overall share of female researchers across time and countries

The total number of agricultural researchers (excluding the private for-profit sector) increased substantially from less than 9,000 in 2000 to more than 15,000 in 2014, in full-time equivalents (FTEs) (Beintema and Stads, 2017). This meant a large influx of female (and male) researchers in absolute terms over this period. In 2014, an average of 24 percent of the total number of FTE agricultural researchers employed in a sample of 40 SSA countries were female (Figure 1). This regional average, however, masks a wide variation of female researcher shares across countries, but in general countries in Southern Africa have relative higher female shares than those in West

and Central Africa. With female shares of 40 percent or higher in 2014, Lesotho, Mauritius, and Namibia are close in reaching gender parity in agricultural research. Other countries have a very long way to go. Of the total agricultural researchers in Chad, The Democratic Republic of Congo (DRC), Eritrea, Ethiopia, The Gambia, Guinea, and Togo, between six and 10 percent were women. None of the nine total researchers in Guinea Bissau were female in 2011 (the latest year for which data were available).

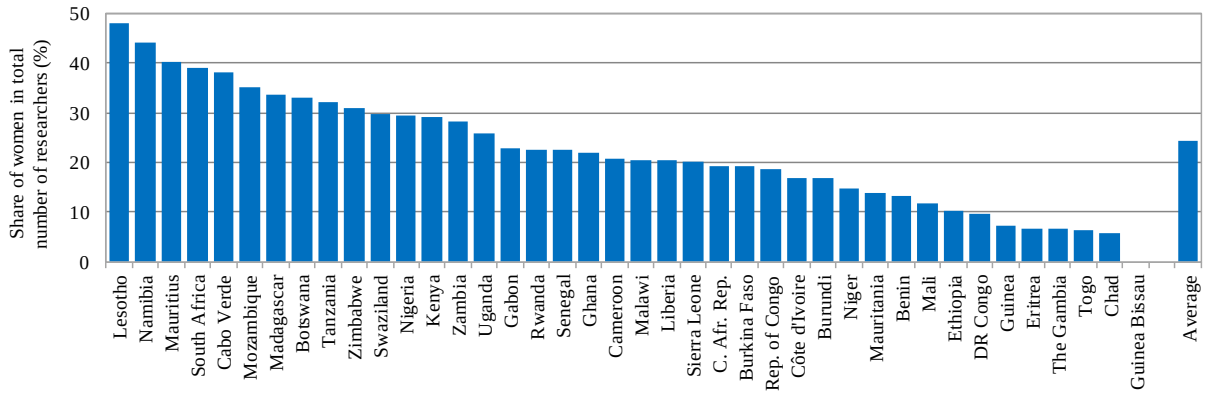

Figure 1: Share of women in the total number of researchers at country levels, 2014

Source: Calculated by author from ASTI datasets.
Notes: Female shares for Central African Republic, Eritrea, Guinea Bissau, and Liberia are for 2011. The total number of researchers excludes the private for profit sector and for Malawi, Nigeria, Senegal, and Sierra Leone also excludes the higher education sector. The female share for South Africa includes the Agricultural Research Council and the higher education sector.

Overall, the average share of women in the total number of agricultural researchers at the government sector was like that of the corresponding share at the higher education sector: 21 and 22 percent, respectively. However, for many countries that discrepancy between female shares at government versus higher education sectors was moderate to substantial. In some countries, such as Botswana, Burundi, Gabon, Liberia, Namibia, and Zambia, the share of women in agricultural research was 10 percentage points or higher in the government sector compared to the higher education sector. In contrast, for the higher education sector in the Central African Republic and Mauritius, the higher education sector employed relatively more female agricultural research than the government sector (a difference of 33 and 16 percent points, respectively). Note that some of these countries have very small overall agricultural researcher capacities and a limited number of government and higher education agencies involved in agricultural research. This can have a larger effect on share differences compared to countries with medium to large agricultural research systems. Due to confidentiality issues, the data presented in this article exclude the private for-profit sector, but does include the private non-profit sector.

For only 24 of the 40 countries, ASTI's 2008 researcher data could be broken down by gender. The average share of women in agricultural research in 2014 measured 30 percent for this 24-country sample. This is higher than the aforementioned 24 percent share for the sample of 40 countries, because relatively more countries with low female shares were missing. Most of the 24

countries experienced an increase in the share of women in its agricultural researcher capacity from 2008 to 2014. Specifically, the female share increased 10 percent points or more in Senegal and Tanzania during this period.

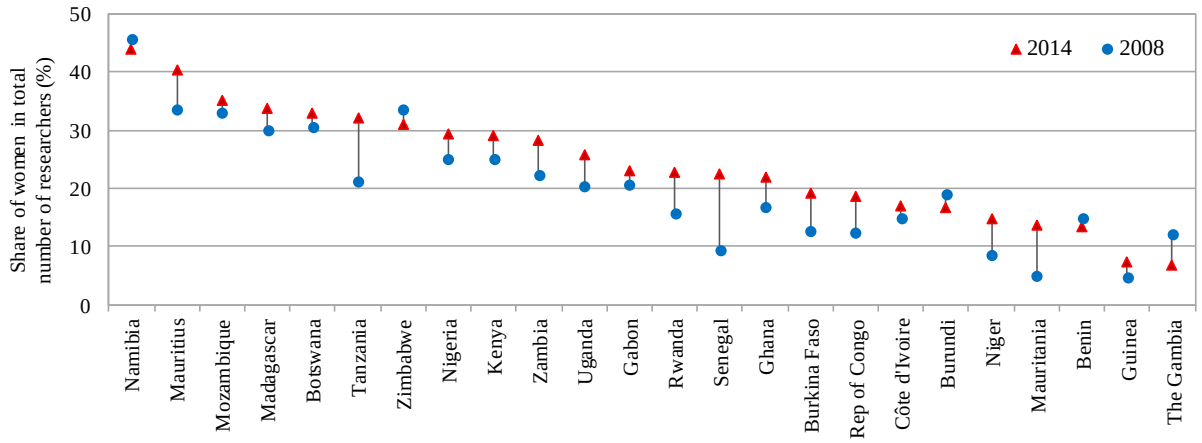

Figure 2: Growth in the share of women researchers, 2008 to 2014

Source: Calculated by author from ASTI datasets.
Note: See Figure 1. 2008–2014 data were only available for 24 countries.

Qualification levels of female researchers

A minimum number of PhD-qualified scientists is generally considered fundamental to the conception, execution, and management of high-quality research; to effective communication with policymakers, donors, and other stakeholders, both locally and through regional and international forums; and for increasing an institute's chances in securing competitive funding. Of the 36 countries for which a complete set of degree-level data was available, four countries recorded shares of PhD researchers (female and male) of more than 50 percent (Burkina Faso, Côte d'Ivoire, Mali, and Senegal) whereas 16 countries reported shares of PhD researchers of 20 percent or lower. Ethiopia, with only seven percent of the researchers qualified to the PhD level, recorded the lowest share in the 36-country sample (Beintema and Stads, 2017).

The overall share of women in the number of PhD-qualified researchers was, on average 21 percent, slightly lower than the share of women in the total number of researchers (24 percent). This lower share occurred in most SSA countries. Burundi, Liberia, Malawi, Namibia, Nigeria, Sierra Leone, South Africa, and Zambia showed differences from 10 percentage points or more. In contrast, Cabo Verde, Central African Republic, Lesotho, and Mauritius employed relatively more female researchers with PhD degrees compared to the overall total, which is explained by the low number of researchers qualified to PhD-degrees in the researcher pools in these countries.

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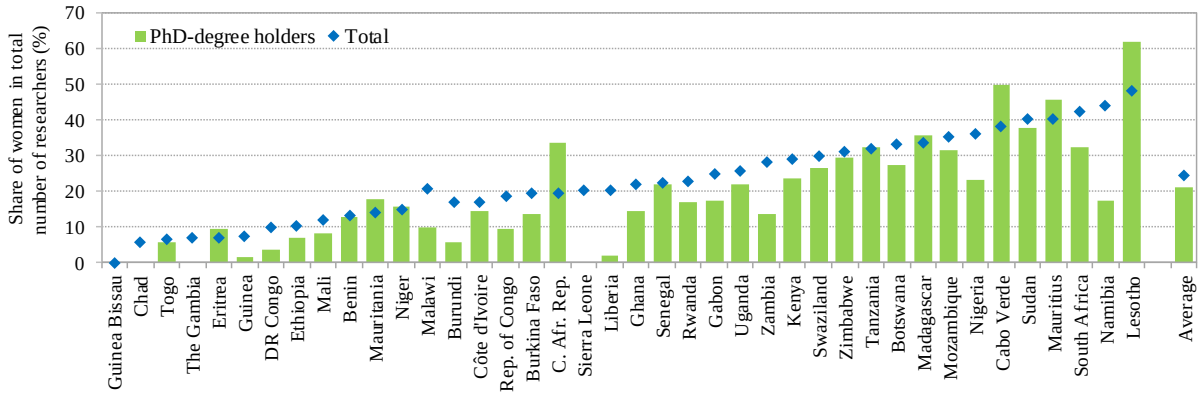

Figure 3: Shares of women in the total number of researchers by degree, 2014

Source: Calculated by author from ASTI datasets.
Notes: See Figure 1.

Unsurprisingly, the share of women in the total number of researchers qualified to the BSc level is more at par with the overall shares. Furthermore, a large number of countries had a relatively higher share of women qualified to the BSc degree level compared to those with PhD and MSc degrees.

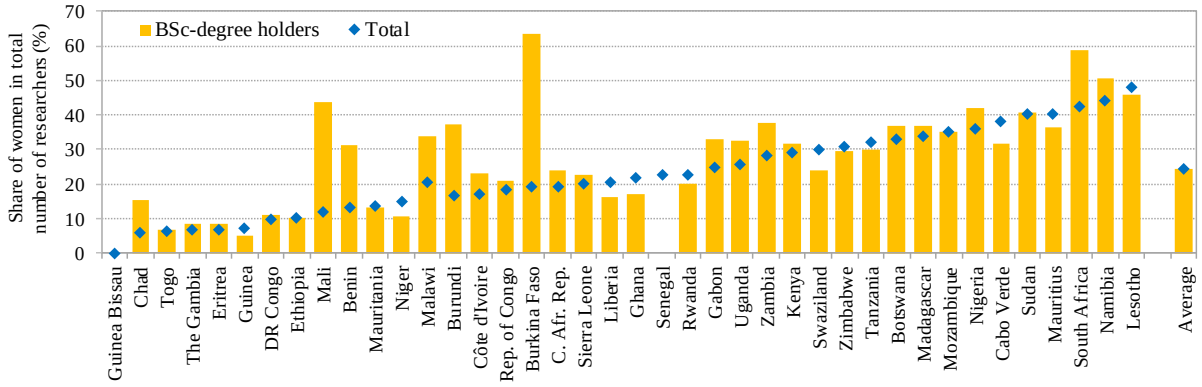

Figure 4: Shares of women in the total number of BSc-qualified researchers, 2014

Source: Calculated by author from ASTI datasets.
Notes: See Figure 1.

The female shares in the total number of researchers increased for all three levels. For the sample of 24 countries for which 2008 and 2014 data were available, the share of women in total researchers qualified to the PhD degree increased, on average, from 19 percent in 2008 to 24 percent in 2014. Only six of the sample countries experienced a decline in these female shares during this period; most of these were small countries with low numbers of PhD-qualified researchers.

Aging of female researchers

One key challenge African research systems are facing is the rapidly aging pool of researchers, especially those trained to the PhD level, many of who will approach retirement age within the next decade. In 2014, about one half of the PhD-qualified agricultural researchers in SSA were in their fifties or sixties. For one third of a sample of 36 countries, these shares increased by five percent points or more during 2011 to 2014 (Beintema and Stads, 2017). Sex disaggregated data of researchers by age and degree was unavailable, but it is expected that the aging problem is similar for female and male researchers.

As seen for the other demographic indicators, there is a wide variation in female shares across countries. In general, however, women are relatively more represented in the younger age group, and underrepresented in the older age group. Only in Cabo Verde, the Gambia, Guinea, Mozambique, and Zimbabwe, was the share of female researchers older than 50 years in the total number of female researchers higher than the similar share for male researchers. Noteworthy are the large differences between female and male shares for some countries. For example, in Benin and the Republic of Congo, 65 percent of male researchers were in their fifties and sixties compared to only 34 and 28 percent, respectively, of the female researchers.

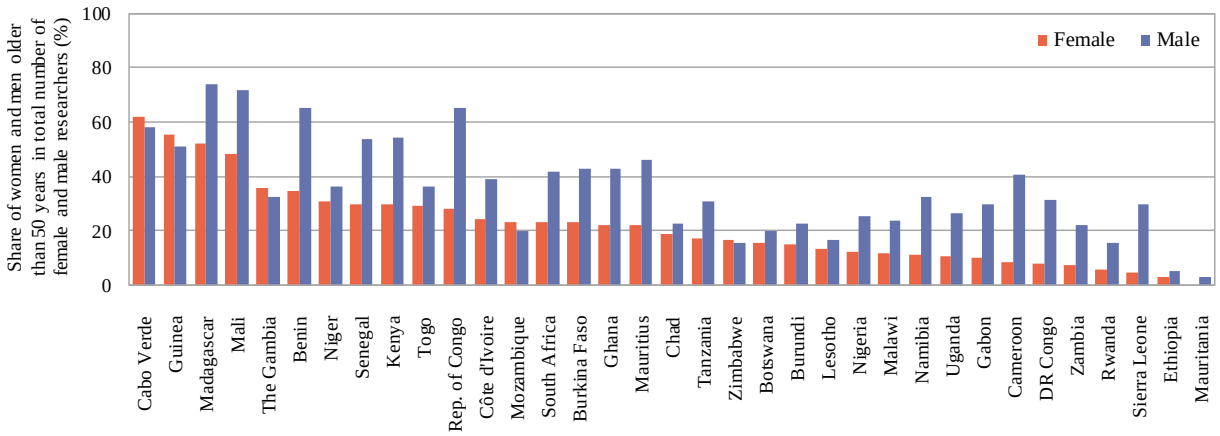

Figure 5: Shares in the total number of researchers older than 50 years, 2014

Source: Calculated by author from ASTI datasets.
Notes: See Figure 1.

When looking at the share of female and male researchers under 41 years, only the Gambia, Lesotho, Mali, Mauritania, Togo, and Zimbabwe had a younger pool of male researchers relative to female researchers. But for most countries the proportion of researchers 41 years or younger was substantially higher for female researchers than their male colleagues. Ethiopia has the youngest agricultural researcher pool in the region. In 2014, more than 80 percent of the country's agricultural research staff, female and male, were in their twenties or thirties, of which close to 60 percent were trained to the BSc level only. More than 60 percent of the female researchers in Chad, DRC, Ethiopia, Namibia, Nigeria, Sierra Leone, and Zambia, were younger than 41 years.

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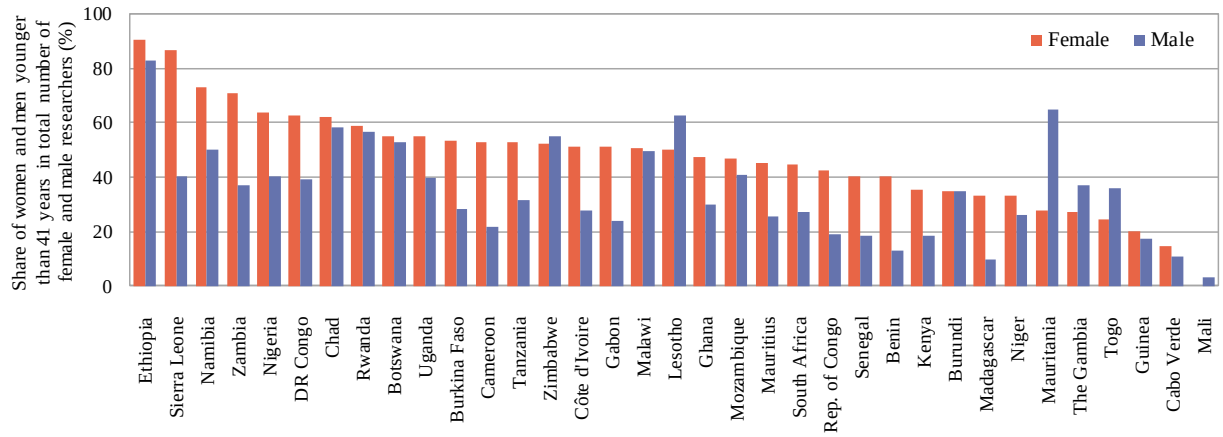

Figure 6: Shares in the total number of researchers younger than 31 years, 2014

Source: Calculated by author from ASTI datasets.
Notes: See Figure 1.

Position levels of female researchers

To provide quantitative evidence that female participation decreases at senior researcher and management levels, the latest ASTI survey round in East and Southern Africa included the collection of sex-disaggregated researcher staff data at different professional levels. In 2014, 11 of a sample of 19 countries showed that the share of women in management positions was between five and 30 percent lower than the country's share of women in the total number of agricultural researchers. Nigeria, South Africa, and Tanzania were lagging behind relatively more.

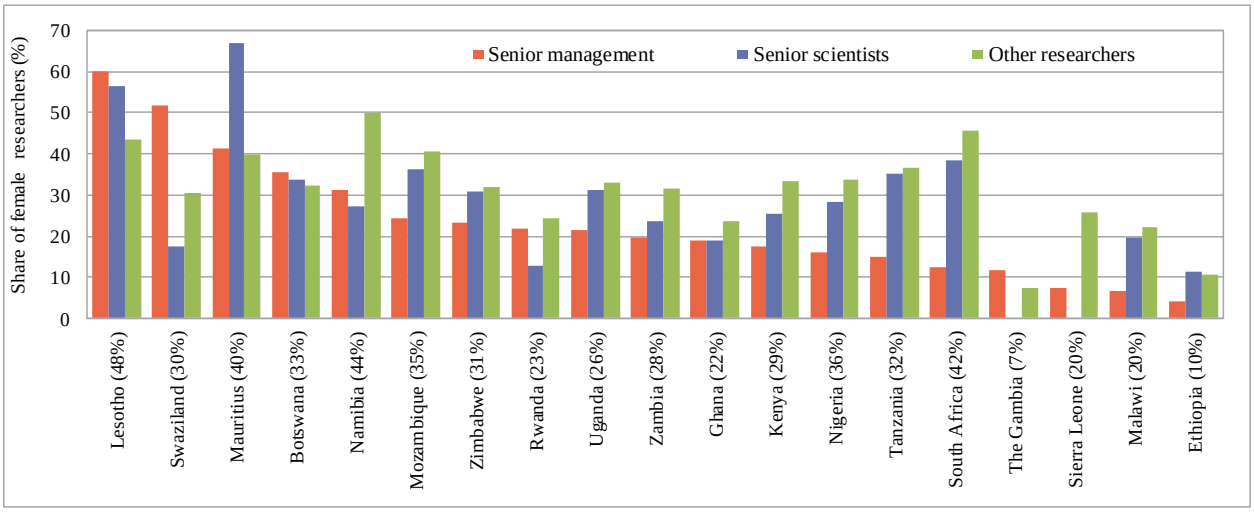

Figure 7: Total agricultural researchers by seniority level, 2014

Source: Calculated by author from ASTI datasets.
Notes: See Figure 1. Percentages within brackets are the average share of women in the country's total agricultural researchers. Management and deans include department heads. Nigeria, Sierra Leone, and Uganda exclude the government sector

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In contrast, Lesotho, Swaziland, and Botswana had higher shares of women holding management positions than the overall share. This can in part be explained by the small number of the total number of researchers in these countries. Ethiopia experienced the lowest share of women in management positions; however, the country has one of the lowest shares of female researchers in SSA. In Malawi and Sierra Leone, only seven percent of the management positions were held by women compared to a researcher pool where 20 percent were female.

ASTI conducted a detailed gender-disaggregated capacity indicators survey covering 15 African countries for the years 2007/08 in close collaboration with the African Women for Agricultural Research and Development (AWARD) program. Unfortunately, the information collected on seniority levels of female and male scientists was slightly different as well as the coverage of agencies and countries. Only for a few agencies, comparisons of the female shares in management positions over time could be made.

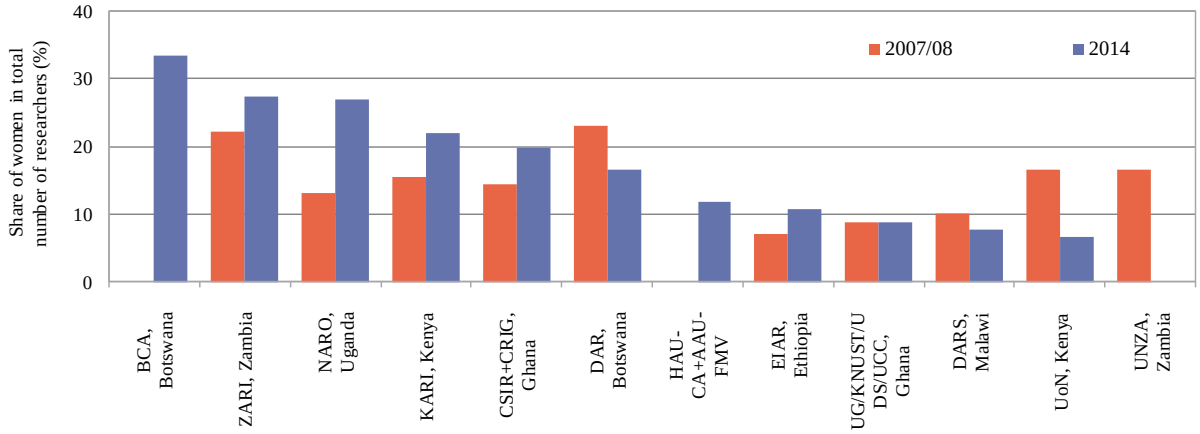

Figure 8: Total agricultural researchers by seniority level for selected institutes and universities, 2007/08 and 2014

Sources: Calculated by author from ASTI datasets and ASTI-AWARD 2007/08.

Although the overall share of women in total agricultural research remained low in Ethiopia, the share of women in management functions at the Ethiopian Institute of Agricultural Research (EIAR) and at Haramaya University (HU) increased from 2007/08 to 2014. This was also the case at larger national agricultural research institutes (NARIs) such as the Council for Scientific and Industrial Research (CSIR) in Ghana, the Kenya Agricultural Research Institute (KARI), the National Agricultural Research organization (NARO) in Uganda, as well as the Zambian Agricultural Research Institute (ZARI). The share of women in management declined in some instances, which is often a result of the small number of management positions. At the University of Nairobi (UoN) in Kenya, two of the 12 deans and department heads were women in 2007/08 compared to one of 15 such positions in 2014.

Currently ASTI does not collect sex-disaggregated researcher data by discipline (only by degree), but this type of information was collected through a more detailed sex-disaggregated capacity indicators survey covering 15 African countries for the year 2007/08. The survey results showed that female participation levels are higher in areas such as biology and other life and

social sciences ("soft science") and much lower in areas such as physics and engineering ("hard science"). It is difficult to make a clear distinction between "soft" and "hard" fields of science within agricultural R&D, although some fields are clearly related to engineering and others are clearly related to life or social sciences (Beintema and Di Marcantonio, 2010).

Female shares in African research compared globally

During 2013–2016, ASTI also conducted similar survey rounds in Latin America and the Caribbean (LAC), South Asia, and West Asia and North Africa (WANA). In addition, the European Commission and Eurostat published gender-disaggregated researcher data by field of science, including agriculture (Figure 9).

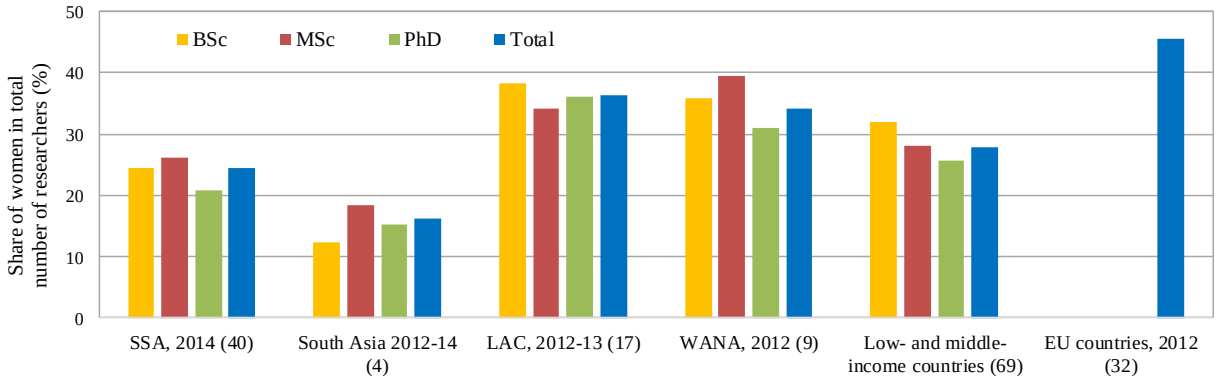

Figure 9: Female shares compared globally, 2012–2014

Source: Calculated by author from ASTI datasets and European Commission (2016).
Notes: The number of countries included in the regional totals is shown in parentheses. SSA indicates Sub-Saharan Africa; APC, the Asia-Pacific region (here excluding China); MENA, the Middle East and North Africa; LA, Latin America; and EU, EU member countries and associated non-EU countries. For countries included in the regional samples, see Stads et al. (2016) for LAC, Stads (2015) for WANA; and European Commission (2016) for EU; South Asia includes Bangladesh, India, Nepal, and Pakistan. Data are presented in full-time equivalent (FTE) researchers.

On average, 28 percent of the agricultural researchers in a sample of 69 low and middle income countries were women. At 16 percent, the share of female researchers is particularly low in South Asia. On average, more women are involved in agricultural research in LAC and WANA at 36 and 34 percent, respectively compared to SSA. Unsurprisingly, the female share was lower for those researchers qualified at the PhD level than those holding BSc and MSc degrees. An average of 26 percent of researchers with PhD degrees were female, compared with 32 and 28 percent with BSc and MSc degrees, respectively. By way of comparison, on average, women accounted for close to half of the total number of agricultural researchers employed at the government and higher education sectors in 32 EU countries in 2012 (European Commission, 2016).

Similarly, as for SSA, large variations existed across countries within the other regions with the exception of the four South Asian countries; female shares ranged between 12 and 18 percent in

2012–2014 (Figure 10). Differences across countries in the nine WANA countries were also pronounced—from seven percent in Yemen to 48 percent in Lebanon. In LAC, women were the least represented in Honduras (14 percent) and had the highest share in Venezuela's total agricultural researcher capacity (48 percent). The share of female researchers in agricultural research within Europe varied as well, ranging from 24 percent in Cyprus to more than 46 percent in Iceland.

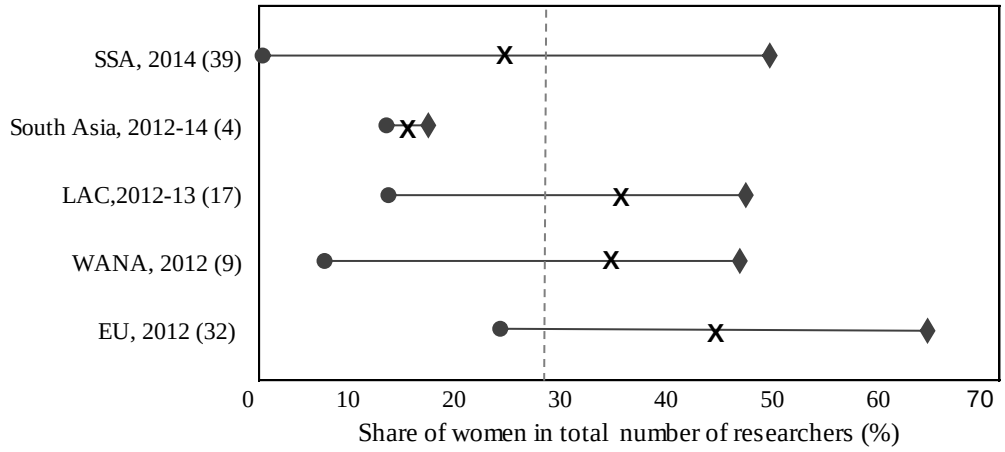

Figure 10: Variation in female shares across countries within regions, 2012–2014

Source: Calculated by author from ASTI datasets and European Commission (2016).

Conclusion

Promoting and encouraging women's participation in agricultural research has many social and economic benefits. Furthermore, they provide an underutilized resource of capacity for many countries facing shortages in their agricultural research systems. Although the share of women in the total number of agricultural researchers varies widely across countries, most SSA countries experienced a growth in its female researcher shares during 2008 to 2014. This growth occurred at all three qualification levels. It is expected that the number of women, in absolute and relative terms, will continue to grow as an increasing number of women have been enrolling in higher education, including in agricultural sciences. Despite the growth in numbers, female researchers often remain less qualified and younger than their male colleagues. Furthermore, the proportion of women in management positions continues to be low. As a result, women have less influence in policy- and decision-making processes, which can further result in biased decision-making and priority setting.

While many countries have initiated various institutional reforms and policies that promote gender equality, so far progress has been limited. In addition, agricultural research systems in SSA are facing a number of serious human resources challenges. One such challenge is the rapidly aging pool of agricultural researchers. Many of the more senior researchers (trained to PhD level) are in their fifties and sixties. This trend combined with the recent influx of more recently recruited junior staff with a lack of experience has left many national research systems vulnerable. Most countries have no adequate training and succession strategies in place and

significant knowledge gaps are already emerging. In addition to the age problem, many research agencies in SSA have difficulties in retaining researchers because of poor benefits and retirement packages; limited promotional opportunities and work flexibility; lack of infrastructure, services, and equipment; and poor management structures. In addition to these overall human resource challenges, women face additional workplace and societal challenges when entering into science.

Although the ASTI evidence provides some insights into the demographic dimensions of women participation in agricultural research, much more quantitative and qualitative information is needed about women's rates of participation in agricultural research. This includes a further analysis of the obstacles hindering women to have access to research positions and advance in their research careers (Huyer and Hafkin, 2007).

Acknowledgements

The author thanks Sandra Perez for the preparation of the underlying data files used for the figures in this article. This article provides an update of Beintema and Di Marcantonio (2010) and Beintema (2015). The data results have been updated using new datasets from a ASTI's 2015–2016 primary survey rounds on agricultural research investment and human resources in SSA countries as well as similar survey rounds in Latin America and the Caribbean, South Asia, and West Asia and North Africa during 2013-2016.

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Notes

[i] ASTI bases its calculations of human resource and financial data on full-time equivalents (FTEs), which take into account the proportion of time that researchers spend on research activities. University staff members, for example, spend the bulk of their time on non-research related activities, such as teaching, administration, and student supervision, which need to be excluded from research-related resource calculations. As a result, four faculty members estimated to spend 25 percent of their time on research would individually represent 0.25 FTEs and collectively be counted as 1 FTE.