

# **African Agricultural and Life Science Universities in the present and future**

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## **Abstract**

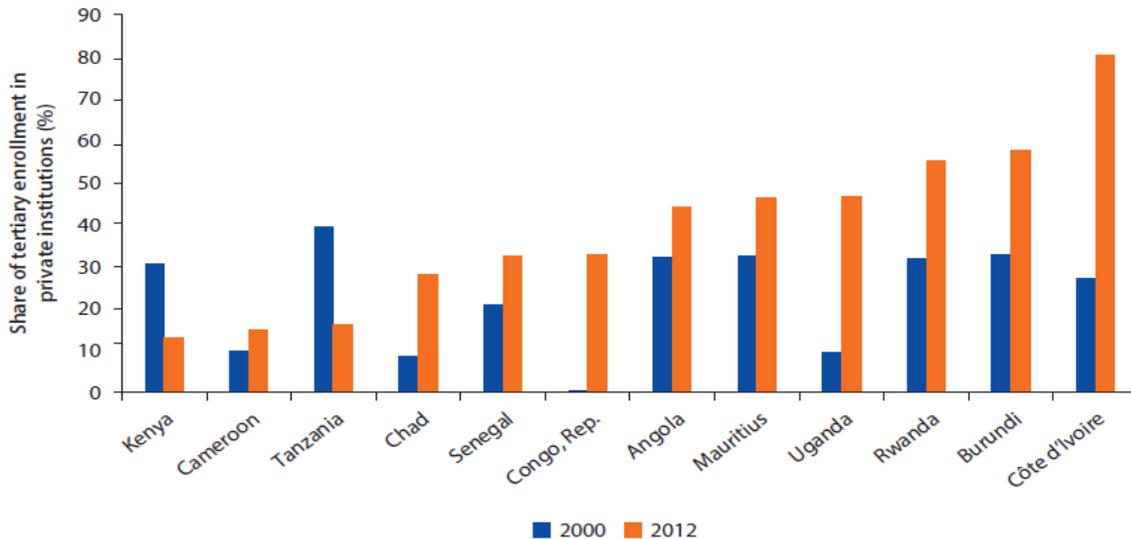
There is a recognition that higher education has a catalytic role in expanding opportunities; employment, business and entrepreneurship owing to innovation potential resident in the universities. Trends in the present bring to the fore that the future of agriculture is about science, technology and innovation and higher education institutions are better positioned to propel a knowledge driven growth. In this article we report that agricultural and life science universities like other higher education institutions in Africa have seen an increase in student enrollment. However, this enrolment was not matched with corresponding investments in the staffing, infrastructure and associated services. One of the effects of these unmatched investments is high student-faculty ratio, low capacity of the universities to deliver high quality training in particular output of doctoral level graduates which is impacting the number of PhD level trained faculty in many universities. This deficit in PhD level qualified staff in the continent is costly; it is indicated that Africa spends approximately US\$4 billion annually on salaries of western experts that help to fill the gap in the supply of professionals. However, this does not mean that everything in the continent is on a sloppy side of things, there are successes registered amidst these prevailing constraints for example the ability of the universities to innovate agricultural training programmes beyond what they inherited from colonial times. Looking ahead, a more than double the number of faculty is required to meet the interim policy objectives and at least a five times increase in the faculty number is required in the 2025 and beyond period.

**Key words:** Capacity, enrollment, PhD, quality, staffing.

## **Background**

Africa is in a demographic boom; currently the youngest continent in the world. About 40% of the population in Sub-Saharan Africa and North Africa regions is under 15 years and nearly 70% is under 30 years (Lin, 2012). Projections of the continent's population indicate that by 2050, Africa's is expected to reach over 830 million (Chatterjee and Mahama, 2017). These demographic patterns are driving the continent's education trends in particular; enrollment, education expenditure and teaching and training capacity. Gross enrollment into primary education school which is a driver for enrollment into all other levels of formal education has seen exponential rise. Between 1990 and 2012, the enrollment more than doubled from 62 million to 149 million. Despite this exponential growth in enrollment some 38 million of the 58 million children of school going age in the world were in Africa during the same period. Within

the same period, there were 49 million students in secondary school and about 5.2 million at university (AAI, 2015) and since then enrollment into tertiary education has risen to 12 million (Chipperfield, 2016). The 2017 report by the World Bank on sharing higher education’s promise beyond the few in sub-Saharan Africa further revealed that between 1970 and 2013, Africa had the fastest growth in its tertiary gross enrollment ratio at 4.3% annually, higher than the global average of 2.8 percent (Darvas et al., 2017).

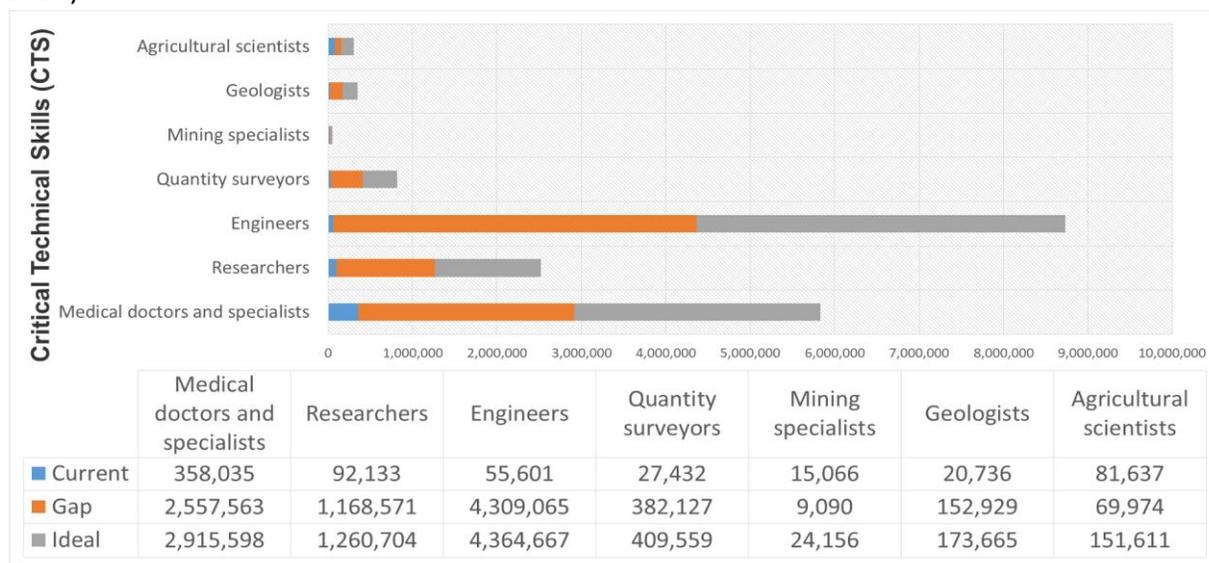


**Figure 1:** Share of Tertiary Enrollment in Private Institutions, 2000 and 2012 (Source Darvas et al., 2017; pp13)

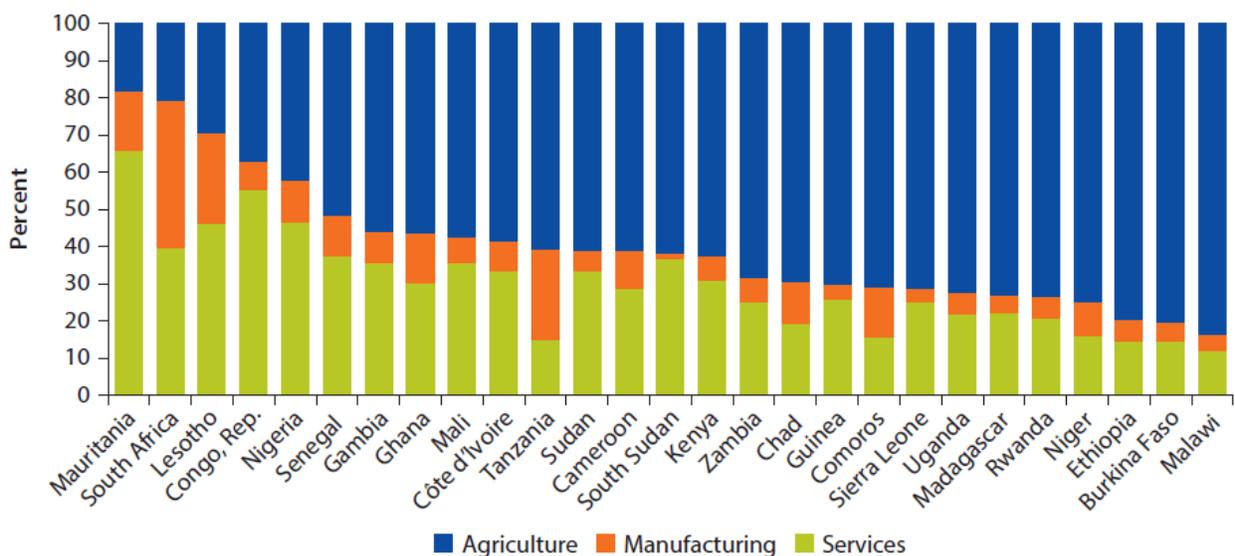
The tremendous growth in Africa’s tertiary education has therefore been realised as a strategic response to; i) absorb the increased demand for higher education as part of transitions and progression; ii) respond to policy decisions and political commitments by African leaders to provide expanded opportunities for higher education; iii) a population that believes that there are more opportunities for employment with the acquisition of a university degree. Accordingly, the growth of universities has been dramatic in the continent in the last decade. The growth of universities in the continent has been both through governments establishing new universities as well as liberalizing the higher education sector allowing private sector investments into education as a franchise. The observed rapid expansion (Figure 1) of private sector led tertiary education service provision has been attributed to: (i) the inability of the public sector to meet growing social demand for tertiary education; (ii) declining subsidies to the social sector; (iii) demand for programs and courses more appropriately aligned with the needs of the labor market; (iv) the perception that operations in the private sector are comparatively more efficient than those of the public sector; and (v) the privatization of public universities in line with broader economic policy shifts away from state planning, and toward market forces (Darvas et al., 2017).

Growth patterns in the Africa’s tertiary education has taken on at least four patterns exponential expansion, major expansion, sizeable expansion, and a stabilization (Tefera, 2016). Despite these growth patterns, the continent still lags behind in many respects, in particular with the production of the requisite man power in the science, technology, engineering and mathematics

(STEM) including agriculture (Figure 2). The deficits are real and call for significant investments into STEM including agricultural sciences which form part of the critical skills required for meeting Africa’s development aspirations espoused in Agenda 2063. In this regard, the current state of African agricultural and life science universities is that of inability to train the requisite number of agricultural scientists. While, higher agricultural education is primarily offered in universities, polytechnics and other colleges of agriculture provide agricultural training and qualifications that are essential in agricultural development processes and innovation (Davis et al., 2007). Agricultural Education Training (AET) in Africa remains critical in part because agriculture defines most of Sub-Saharan Africa’s economy (Figure 3); employs nearly half of the labour force (ranging from 83% in Malawi to 20% in Mauritania), contributes appropriately one fifth of the region’s gross domestic product (Darvas et al., 2017) and critical to the continent’s food security (ACBF, 2017).



**Figure 2:** Critical technical skills in Africa (Source: Courtesy of Prof. Emmanuel Nnadozie, African Capacity Building Foundation).



**Figure 3:** Economic Structure by Employment, Latest Household Survey (Source: Darvas et al., 2017; pp17)

### Programs and enrollment patterns in agricultural and life science universities in Africa

African agricultural and life science universities are at varied levels of growth from diversity of degree programmes on offer, number of students enrolled, student-staff ratio to gender dimensions in the student and staff populations. Surveys conducted by ASTI/IFPRI–RUFORUM across African agricultural universities reveal these varied levels. In Kenya for example; Egerton University - Faculty of Agriculture (EU-FA), Jomo Kenyatta University of Agriculture and Technology - Faculty of Agriculture (JKUAT-FA), Kenyatta University - School of Agricultural and Enterprise Development (KU-SAED), Maseno University - School of Agriculture and Food Security (MasU-SAFS), Masinde Muliro University of Science and Technology - School of Agriculture, Veterinary Sciences and Technology (MMUST-SAVET), Moi University-School of Agriculture and Natural Resources (MoiU-SAB), Pwani University - School of Agricultural Sciences and Agribusiness (PU-SASA), University of Eldoret - School of Agriculture and Biotechnology (UOELD-SAB), University of Nairobi - Faculty of Agriculture (UoN-FA), and University of Nairobi, Faculty of Veterinary Medicine (UoN-FVM) there is a relatively consistent number of BSc programmes (Table 1a) on offer ( $7.4 \pm 1.3$ ) but disparities exist at Masters ( $9.5 \pm 5.6$ ) and PhD ( $7.0 \pm 5.2$ ). In this regard, the older universities (EU, JKUAT, UoN) offered relatively more PhD and MSc programs compared to other emerging universities. This pattern was similarly observed in Uganda universities<sup>1</sup> where Makerere University; College of Agricultural and Environmental Sciences, College of Natural Sciences, and College of Veterinary Medicine, Animal Resources, and Biosecurity are the only units that hosted agricultural PhD based programs in the country (Table 1b).

**Table 1a. Number of degree programs offered during 2015–2016 (Kenya)**

University/Faculty	PhD	MSc	BSc
(EU-FA)	10	10	8
JKUAT-FA	9	8	10
MasU_SAFA	6	7	8
MMUST-SAVET	1	6	8
PU_SASA	2	3	7
UOELD-SAB	2	6	10
UoN-FA	10	17	8
UoN-FVM	16	19	na

Source: Compiled by authors from ASTI/IFPRI–RUFORUM survey returns. Note: Data for KU-SAED were unavailable.

<sup>1</sup> Busitema University, Faculty of Agriculture (BU-FA), Gulu University, Faculty of Agriculture and Environment (GUCCL-FAE), Kyambogo University, Faculty of Vocational Studies, Department of Agriculture (KYU-FVS-DA), Makerere University, College of Agricultural and Environmental Sciences (MAK-CAES), Makerere University, College of Veterinary Medicine, Animal Resources, and Biosecurity (MAK-COVAB), Makerere University, College of Natural Sciences, School of Biosciences (MAK-CONAS-SBS), Ndejje University, Faculty of Environment and Agricultural Sciences (NU-FAES), Uganda Christian University - Faculty of Science and Technology - Department of Agricultural and Biological Sciences (UCU-FOST-DABS), and Uganda Martyrs University, Faculty of Agriculture (UMU-FA).

**Table 1b. Number of degree programs offered during 2015–2016 (Uganda)**

	PhD	MSc	BSc
BU-FA	—	2	7
GUCCL-FAE	—	3	4
KYU-FVS-DA	—	—	3
MAK-CAES	10	17	14
MAK-CONAS-SBS	5	2	4
MAK-COVAB	1	11	4
NU-FEAS	—	1	5
UCU-FOST-DABS	—	4	5
UMU-FA	—	1	3

Source: Compiled by authors from ASTI/IFPRI–RUFORUM survey returns

The pattern of the number of programs offered by the respective universities seemed to influence the total overall enrollment observed in the two countries. University of Nairobi had an exceptionally higher number of students enrolled into the BSc programs (2,879) compared to all other universities in Kenya during period of analysis (Table 2a). These patterns were comparable to Uganda where Makerere University remained a dominant university in enrolment though with relatively lower completion rates (Table 2b). Thus, it is not a surprise that universities that had a higher number of PhD programs had relatively more PhD students enrolled in both countries. Interviews with some of the students indicated that the observed patterns could be attributed to several considerations; at PhD level enrollment into the agriculture programme was influenced by: i) available employment opportunities in the mushrooming universities countrywide, and ii) more competitive for job opportunities in specialized areas of research. The MSc students in agricultural sciences has also increased as a result of job opportunities and sociocultural background influences such as cattle keeping as well as scholarship opportunities. Meanwhile, at BSc level the enrollment was a result of: i) influence of parents and peers, ii) job opportunities-prospects, and iii) no choice given student placement in universities by the admissions office.

**Table 2a. Student population by degree, 2015–2016 (Kenya)**

University	Enrolled			Graduated		
	PhD	MSc	BSc	PhD	MSc	BSc
EU-FA	36	59	573	15	35	515
JKUAT-FA	72	81	259	na	na	na
MasU-SAFA	11	16	999	2	2	109
MMUST-SAVET	2	11	904	—	3	131
PU-SASA	3	3	629	na	na	na
UOELD-SAB	12	41	512	2	18	393
UoN-FA	65	216	2,879	7	29	275
UoN-FVM	59	108	na	5	16	na

Source: Compiled by authors from ASTI/IFPRI–RUFORUM survey returns. Note: Enrollment and graduation data for KU-SAED and graduation data for JKUAT-FA and PU-SASA were unavailable.

**Table 2b. Student population by degree, 2015–2016 (Uganda)**

University	Enrolled			Graduated		
	PhD	MSc	BSc	PhD	MSc	BSc
BU-FA	—	24	332	—	18	324
GUCCL-FAE	—	28	12	—	3	12
KYU-FVS-DA	—	—	664	—	—	636
MAK-CAES	55	256	996	9	123	461
MAK-CONAS-SBS	—	18	187	6	19	293
MAK-COVAB	19	86	204	14	34	51
NU-FEAS	—	2	53	—	2	43
UCU-FOST-DABS	—	26	144	—	—	33
UMU-FA	—	4	209	—	3	195

Source: Compiled by authors from ASTI/IPPRI–RUFORUM survey returns

### **Trends in teaching staff in agricultural and life science universities in Africa**

Africa's agricultural and life science universities have varied staffing capacity in terms of qualification (Figure 4a-Figure 4h), age and gender dimensions. Within Kenya's agricultural and life science universities, staffing levels varied from 10-15 to 124-125 at Masinde Muliro University of Science and Technology - School of Agriculture, Veterinary Sciences and Technology (MMUST-SAVET), Egerton University - Faculty of Agriculture (EU-FA) and Jomo Kenyatta University of Agriculture and Technology - Faculty of Agriculture (JKUAT-FA) respectively (Figure 4a). In terms of the staff qualified with a PhD; at least four universities had their staffing at 80% at PhD level with no BSc degree level staff. In the case of Uganda, total staffing similarly varied and so was the number of staff with PhD level qualification (Figure 4b). There were some universities with BSc. degree level staff as part of its staffing.

Across the rest of Africa, the total number of teaching staff is varied with quite pronounced number of staff with MSc. Degree level qualification and some with BSc. degree level qualification (Figure 4c, 4d, 4e, and 4g). Some exceptions have been observed in universities in Benin University of Abomey Calavi and Université Nationale d'Agriculture, Porto-Novo, and University of Port Harcourt (Figure 4h) where the entire staffing has a PhD level qualification. This is attributed to the recruitment policy of the respective universities in line with Government directives requiring university academics to have a PhD qualification. However, what is evident across most of sub-Saharan Africa is that there is a shortage of PhD level staff in agricultural and life science universities. According to Darvas et al. (2017) sub-Saharan Africa on average spends an estimated US\$4 billion annually on salaries of an estimated 100,000 western experts that help to fill the gap in the supply of professionals.

It is also important to note that the majority of the PhD level qualified staff across the continent is general in their 50s and 60s. Some universities such as Busitema University in Uganda have exceptionally high number (74%) of its staff above 50 years. These partners were similarly observed at Egerton University (65%), Jomo Kenyatta University of Agriculture and Technology (64%), University of Nairobi-Faculty of Veterinary Medicine (79%) and University of Nairobi Faculty of Agriculture (66%) and Masinde Muliro University of Science and Technology (88%).

This appears to be a common pattern across many African agricultural and life science universities.

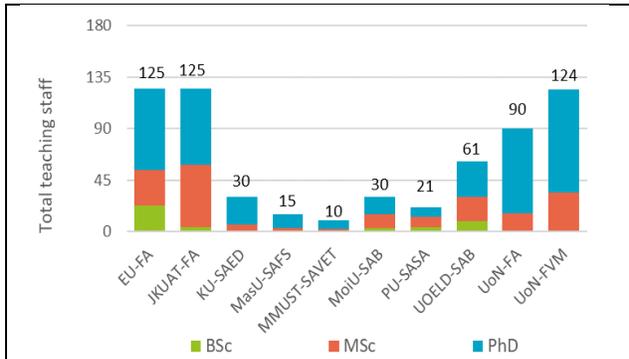


Figure 4a: Kenya Total teaching staff by degree, 2016

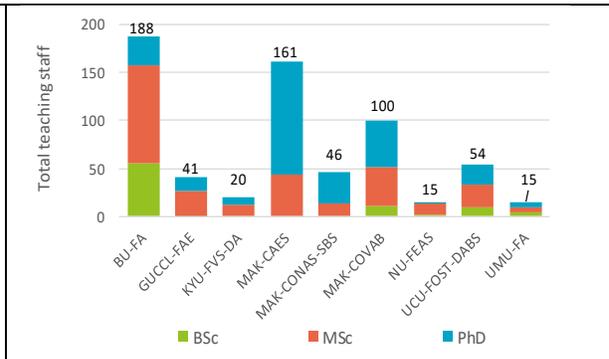
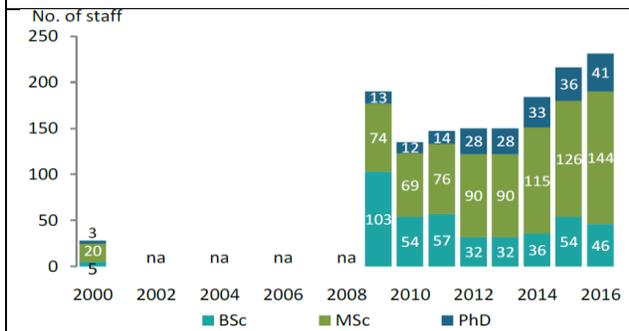
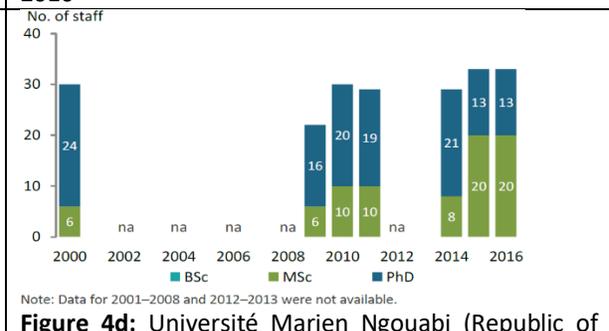


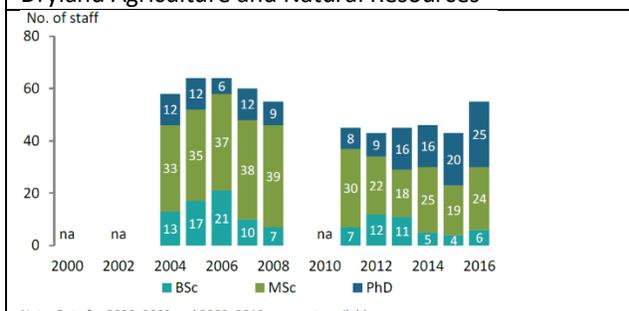
Figure 4b: Uganda Total teaching staff by degree, 2016



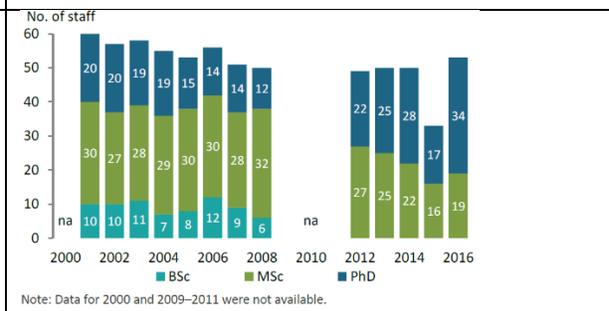
Note: Data for 2001–2008 were not available.  
Figure 4c: Mekelle University (Ethiopia), College of Dryland Agriculture and Natural Resources



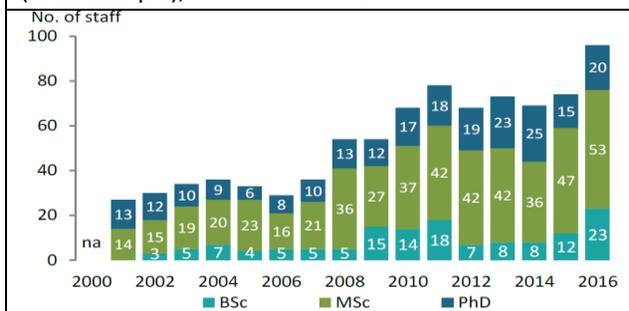
Note: Data for 2001–2008 and 2012–2013 were not available.  
Figure 4d: Université Marien Nguabi (Republic of Congo), Ecole Nationale Supérieure d'Agronomie et de Foresterie



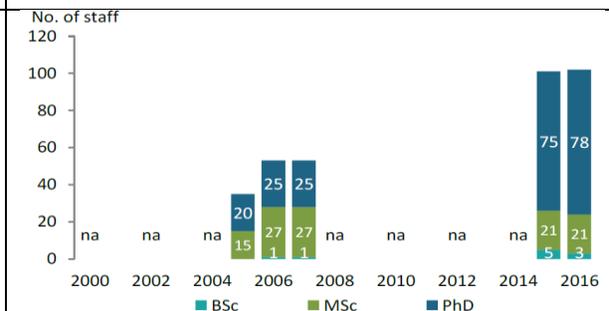
Note: Data for 2000–2003 and 2009–2010 were not available.  
Figure 4e: Universidade Eduardo Mondlane (Mozambique), Faculdade de Veterinária



Note: Data for 2000 and 2009–2011 were not available.  
Figure 4f: University of Zimbabwe (Zimbabwe), Faculty of Agriculture



Note: Data for 2000 were not available.  
Figure 4g: University of Namibia (Namibia), Faculty of Agriculture and Natural Resources



Note: Data for 2000–2004 and 2008–2014 were not available.  
Figure 4h: University of Port Harcourt, Faculty of Agriculture

Source: Compiled by authors from ASTI/IPRI–RUFORUM survey returns

### Share of staff by positions in agricultural and life science universities in Africa

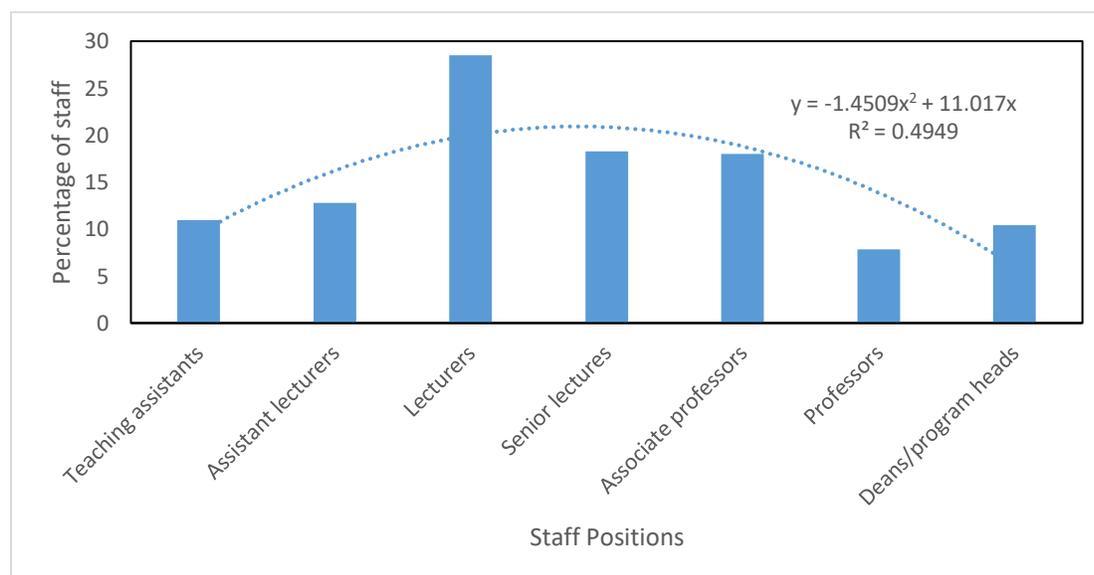
Staff in agricultural and life sciences within Africa are distributed in various staffing positions including; Teaching Assistants (the lowest in rank), Assistant Lecturers, Lecturers, Senior Lecturers, Associate Professors, Professors, and Deans/Principals/program heads (Table 3). In some of the universities; the lower rank such as that of a teaching assistant is non-existent owing to human resource policy directives such is the case University of South Africa, University of Mauritius, and University of Zimbabwe as illustrative examples. In terms of proportion; Mekelle University, Faculty of Veterinary Medicine had 61% of its staff at the rank of Associate Professor, this was sort of an outlier from the norm in which the number of staff decreases as one they progress through the rank with a significant number of staff being at the rank of Lecturer (Figure 5).

**Table 3:** Share of teaching staff by position (2016) in agricultural and life science universities in Africa

University	College/School/Faculty	Percent position occupancy						
		Teaching assistants	Assistant lecturers	Lecturers	Senior lectures	Associate professors	Professors	Deans/program heads
Makerere University	College of Agricultural and Environmental Sciences	23	27	22	10	7	7	4
Makerere University	College of Veterinary Medicine, Animal Resources, and Biosecurity	8	41	16	7	16	9	3
Masinde Muliro University of Science and Technology	School of Agriculture, Veterinary Sciences and Technology	na	10	20	10	10	20	30
Mekelle University	College of Dryland Agriculture and Natural Resources	16	4	49	0	27	1	3
Mekelle University	College of Veterinary Medicine	9	0	11	0	61	4	15
National University of Lesotho	Faculty of Agriculture	16	0	48	13	3	3	16
University of Cape Coast	School of Agriculture	2	8	10	37	22	8	12
Universidade Eduardo Mondlane	Faculdade de Veterinária	7	0	0	31	31	2	29
Uganda Martyrs University	Faculty of Agriculture	20	13	7	27	13	13	7
University of Namibia	Faculty of Agriculture and Natural Resources	2	4	44	29	6	2	13
University of Eswatini	Faculty of Agriculture	na	na	56	10	19	13	2
University of Port Harcourt	Faculty of Agriculture	3	14	32	22	13	15	2
University of South Africa	College of Agriculture and Environmental Sciences, School of Agriculture and Life	na	na	32	36	20	4	8

	Sciences, Department of Agriculture and Animal Health							
University of Eldoret	School of Agriculture and Biotechnology	11	8	38	13	11	8	11
University of Mauritius	Faculty of Agriculture	na	na	30	25	20	10	15
University of Nairobi	Faculty of Veterinary Medicine	13	4	22	15	24	17	6
University of Rwanda	College of Agriculture, Animal Sciences, and Veterinary Medicine	10	46	22	8	4	3	7
University of Zimbabwe	Faculty of Agriculture	na	na	34	38	25	2	2
University of Zimbabwe	Faculty of Veterinary Science	13	na	48	16	10	na	13

Source: IFPRI/ASTI-RUFORUM Factsheets on Capacities in Agricultural Higher Education in Africa 2018.



**Figure 5:** Average staff positions by rank in 2016 in African agricultural and life science universities

### **Agricultural and life science universities in the post 2020 period**

Like other sectors in Africa that are bound to be disrupted by the continent's population growth, the education sector is not escaping from the effects of a growing population. The massification of education in Africa especially in sub-Saharan Africa is in part a result of the population bloom in the continent and significant efforts that were put into both primary and secondary education resulting into a larger cohort of students seeking access to higher education. Further, higher education has been recognised as a critical component for economic development. Growth in student numbers in Africa will continue; for example University of South Africa (UNISA) has the largest student population estimated at over 300,000 students; this is far higher than the total student population enrolled in higher education in some countries such as Uganda, Burundi, Rwanda and perhaps Tanzania. What is critical to note is that the countries with lower student

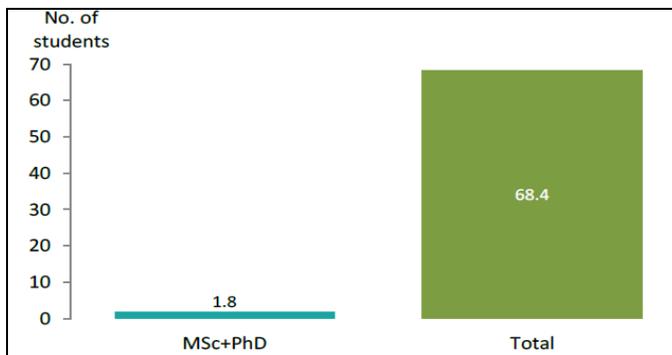
enrollment in sub-Saharan Africa are countries with some of the fastest growing population thus, growth in student enrollment is a critical imperative that is bound to occur in the post 2020 period.

Massification in universities in Africa has occurred without comparable increase in resources-financial, physical and human - which has had a direct impact on the physical infrastructure, the quality of teaching and learning, research, and quality of life of the students (Mohamedbhai, 2008). In this, the future of agricultural and life science universities will be based on how they circumvent the current conditions brought by higher education whilst striving for a radically new generation of universities that have significant transformational ability in society. Calls for radically transformative agricultural universities were echoed in the famous 2003 Jinja consensus that called for the creation of a new African agricultural university to build a new cadre of agricultural graduates who will go on to become entrepreneurs and wealth creators rather than cogs in the wheels of existing agricultural education, research, and extension organisations. In this case, the university would rely on student-centered learning styles in which instructors would facilitate rather than direct the learning process. These graduates would be armed not only with market-oriented skills, but also with a new standard of morals, ethics, and awareness (Idabacha, 2003; Davis et al., 2007).

Agricultural and life science universities will also be focused on achieving and delivering quality education. One of those aspects that the universities ought to focus on how to increase the pool of its teaching staff to match the student enrollment. The current staff-student ratios in some of the agricultural and life science universities are not favorable (Figure 6a-6c) but this does not mean that there are universities in the continent that have strived for a good staff-student ratio such as University of South Africa despite its considerable enrolment record in the continent (Figure 6d). The teacher-student ratio is an important indicator of quality in education delivery. In order to realise this, there is need to ramp-up staff capacity development, recruitment and strengthen retention in African agricultural and life science universities. In a 2019 study undertaken by Association of African Universities, Education Sub-Saharan Africa and Population Reference Bureau (AAU-ESSA-PRB) on the demographics of African faculty with Ghana as the case study, they opine that in order to meet the current policy goals of increasing the number of students in science including agriculture there is need to double the number of faculty (Figure 7). However, the current output of PhDs is far removed from meeting the required demand and yet it is important to produce PhDs that are quality and whose graduation and completion is not questioned at various levels. Doing so is not only important for keeping public trust in the universities but also for maintaining the value that is attached to award of a doctorate.

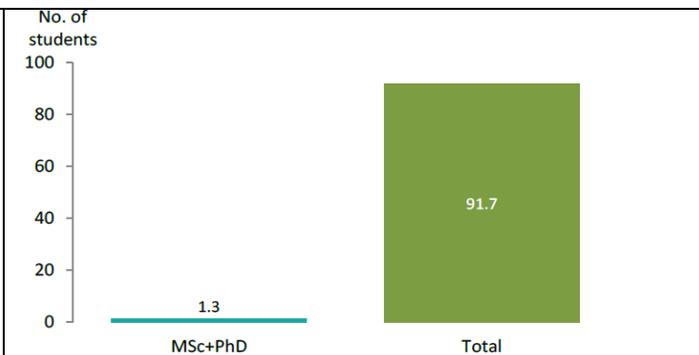
In 2019, Jomo Kenyatta University of Agriculture and Technology (JKUAT) graduated 118 PhDs, this raised a public concern that the Commission for University Education (regulatory authority) had to undertake an audit into the process leading to the award. The findings were startling in many respects for example in the College of Human Resource and Development (CoHRED) three academic supervisors from CoHRED each graduated: 41; 30; 33 PhD students, respectively. In addition, each of the three supervisors graduated 45, 106 and 72 Master's students (Commission for University Education, 2019). While, the College of Agricultural and Natural Resources

(COANRE) graduated 14 PhDs in the same period; which is within the normal in the university, the inquiry to all the PhDs and the public outcry casts doubt on the quality of PhDs that are passed by the entire university including those from the agricultural disciplines. It thus becomes imperative for the universities to take into consideration best practices into PhD training to match the international standards at all levels. The AAU-ESSA-PRB 2019 study indicates that for Ghana (in many respects the larger sub-Saharan Africa) to meet the 2025 policy goals assuming a modest enrolment progress, a five times increase in faculty staff is required (Figure 8) and it further requires that additional investments in supporting services and facilities will need to be undertaken.



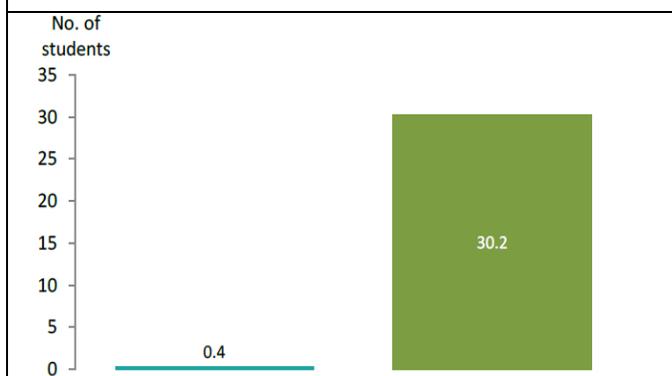
Note: Data indicate the ratio of MSc and PhD students to MSc- and PhD-qualified teaching staff, and total students to total teaching staff.

Figure 6a: Maseno University, Kenya



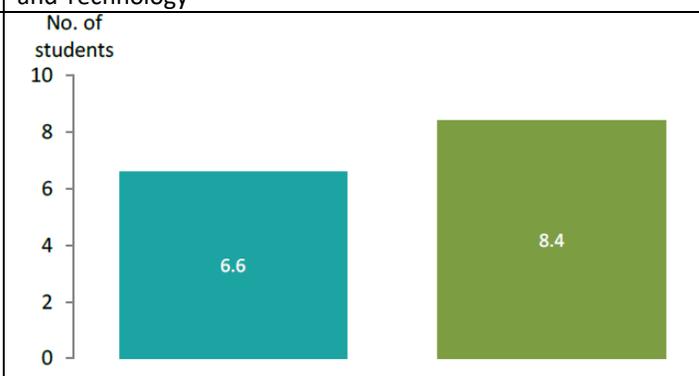
Note: Data indicate the ratio of MSc and PhD students to MSc- and PhD-qualified teaching staff, and total students to total teaching staff.

Figure 6b: Masinde Muliro University of Science and Technology, Kenya. School of Agriculture, Veterinary Sciences and Technology



Note: Data indicate the ratio of MSc and PhD students to MSc- and PhD-qualified teaching staff, and total students to total teaching staff.

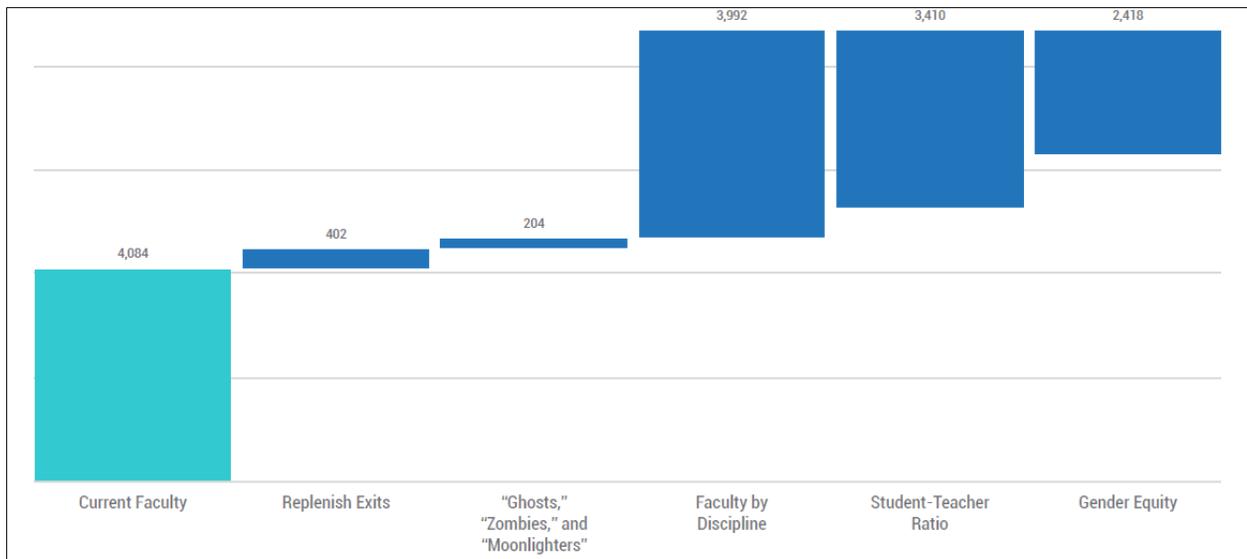
Figure 6c: Pwani University, Kenya. School of Agricultural Sciences and Agribusiness.



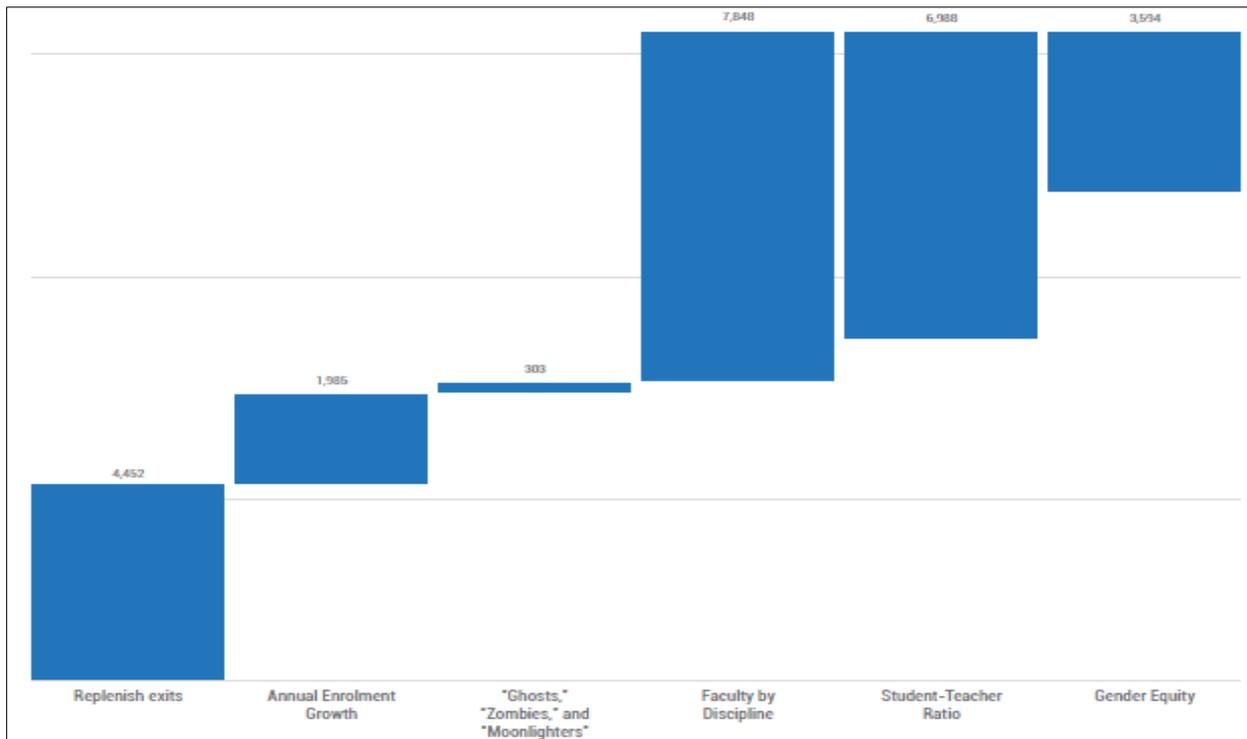
Note: Data indicate the ratio of MSc and PhD students to MSc- and PhD-qualified teaching staff, and total students to total teaching staff.

Figure 6d: University of South Africa. College of Agriculture and Environmental Sciences, School of Agriculture and Life Sciences, Department of Agriculture and Animal Health

Source: IFPRI/ASTI-RUFORUM Factsheets on Capacities in Agricultural Higher Education in Africa 2018



**Figure 7:** Faculty needed to meet policy goals in 2016/2017 (Source: AAU-ESSA-PRB, 2019; pp5)



**Figure 8:** Additional faculty needed to meet policy goals in 2025 (Source: AAU-ESSA-PRB, 2019; pp6)

## Conclusion

In this article we set out to share the evidence of the status of agricultural and life science universities in Africa in the present and future. We observe that amidst improvements in primary and secondary education across the continent in particular sub-Saharan Africa have fueled the increase in enrollment in higher education. The increased enrolment has been both in public and private universities and this increase was not matched with comparable investments in human

resources in terms of staffing capacity, infrastructure and associated facilities, and other relevant investments. This has affected the quality of education provision but this does not mean there are no success stories on the continent. Amidst constraints, agricultural and life science universities have continued to render services to the public, graduating a number of student across the continent in a number of degree programmes that have been designed and are on offer. In particular, well-established universities have continued to maintain a stronger staffing capacity, host more students-enrollment and have remained centres of doctoral training owing to their resident capacity. Student-teacher ratio remains a concern in the present and into the future and some of the staff that are currently at with a doctoral training at above 50 years of age. In some universities, this situation is acute with more than two thirds of the staff being above 50 years indicating that in the next 5-8 years, they will be retired. Looking ahead, a more than double the number of faculty is required to meet the interim policy objectives and at least a five times increase in the faculty number is required in the 2025 and beyond period. Thus, a call to action is now to rump-up investment in agricultural and life science universities in Africa so that they can effectively play the functions for which they were established.

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