WHY DO AGRICULTURAL FACULTIES FAIL TO ATTRACT THE BEST STUDENTS?

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Acronyms and Abbreviations

ANAFE	African Network for Agriculture, Agroforestry, and Natural Resources Education
CAADP	Comprehensive Africa Agriculture Development Program
GDP	gross domestic product
ICT	information and communications technologies
NEPAD	New Partnership for Africa's Development
R&D	research and development
SADC	Southern African Development Community
SSA	Sub-Saharan Africa

Abstract

Agriculture is the backbone of the vast majority of Sub-Saharan African economies, accounting for up to 40 percent of the gross domestic product, 15 percent of exports, and 60–80 percent of employment. Yet Africa is the only continent where hunger and poverty are projected to worsen in the 2020s, and the number of malnourished children will increase correspondingly. Research, extension, marketing, credit, and policy institutions are not providing sufficient support to smallholder agriculture, which is central to advancing agriculture in the region. Underlying problems include inadequate emphasis on effective and relevant tertiary agricultural training and an inability to attract the best students into agriculture. As a result, agricultural graduates have not been able to "hit the ground running" upon graduation, and many lack the competence and experience to establish their own enterprises.

At the same time, agricultural graduates have faced a serious problem of unemployment because the public sector has not been able to absorb them, even though the share of agricultural graduates relative to other fields of study has been declining. There is little to convince prospective enrollees that pursuing a career in agriculture will be rewarding. African governments have not helped the situation either. Despite agriculture's importance for food security and livelihoods, support to agricultural education and training, production, value addition, marketing, and policy development has not been commensurate. In fact, the pursuit of higher education in agriculture is considered by many as evidence of students' failure to be accepted into fields perceived to be more prestigious and lucrative, such as medicine, engineering, information technology, law, and business.

Studies conducted by the African Network for Agriculture, Agroforestry, and Natural Resources Education (ANAFE) from 2009 to 2011—which include tracer studies of agricultural graduates in Botswana, Lesotho, and Zambia; contextualized learning materials development; and experiential learning in West and Central Africa—indicate the need for a shift in mind-set through the promotion of the true potential of agriculture as a rewarding and fulfilling profession. Higher education programs in agriculture and related studies need to attract and mentor high-quality, motivated students with a genuine interest in agriculture by improving the quality and relevance of training and increasing investments across the agricultural value chain.

1. INTRODUCTION

In Sub-Saharan Africa (SSA), about 75 percent of people live in rural areas, and almost all of them depend on agriculture for their livelihoods. Agriculture accounts for 40 percent of gross domestic product (GDP), 15 percent of exports, and 60–80 percent of employment. Agriculture therefore remains highly important for sustainable development and poverty reduction, as a livelihood source, as a source of economic growth, and as a provider of environmental services (World Bank 2008). Support to the agricultural sector, however, has not been commensurate with its importance. Since 1980, agricultural spending as a share of total spending in Africa ranged from 4 to 6 percent in the aggregate (Omilola et al. 2010), which has led to general stagnation.

For change to be achieved in SSA, agriculture—and smallholder farming in particular—must be made to work. Rukuni (2002) and Vandenbosch (2006) emphasize the need to improve the performance of research, extension, marketing, credit, and policy institutions. Very little focus, however, has been given to attracting the best students from high school and to offering effective and relevant higher education in agriculture. This is now the weakest link because entry qualifications for students of agriculture are less than those required in other, more prestigious fields. As a result, graduates cannot be expected to perform better. Furthermore, if smallholder farming remains the bastion of rural poverty, the image agriculture presents to students from rural households is already compromised; seeing the drudgery their parents go through to make ends meet is a sufficient disincentive to pursuing a career in agriculture.

Among high-school graduates, interest in agriculture is declining. As a career choice, agriculture is burdened with misperceptions and lack of information and awareness (Kruijssen 2009). The sector also has a negative image in that it is seen as dusty, dirty, and poorly paid (Rammolai 2009). The attractiveness and therefore popularity of a tertiary-level training program is principally driven by

1. employment and career development opportunities;
2. the salary levels associated with various careers;
3. the quality and relevance of the training program;
4. the perceived prestige of the profession, including associated opportunities (for example, to participate at the cutting edge of development); and
5. critical enabling factors across the industry value chain.

This study aims to assess the underlying reasons why agricultural programs have been unable to attract the best students. Based on the work of the African Network for Agriculture, Agroforestry and Natural Resources Education (ANAFE), the paper traces these drivers as determinants of the level of attractiveness of agricultural training. The analysis includes

- tracer studies carried out between 2009 and 2011 to assess the relevance, in terms of employment opportunities, of education programs in agriculture offered in Botswana, Lesotho, and Zambia;
- a contextualized learning materials development project carried out between 2009 and 2011 in Benin, Ethiopia, Kenya, Malawi, Mali, Rwanda, Sudan, and Tanzania to identify reasons for the failure to generate relevant learning resources in agriculture and natural resources; and
- an experiential learning project that began in 2010 in Benin, Burkina Faso, Cameroon, The Gambia, Ghana, Mali, Niger, Nigeria, and Senegal to determine the level and extent of integration of experiential learning in agricultural institutions of higher learning.

Other sources of information were consulted where results from the aforementioned studies did not provide a complete picture.

2. CAREER OPPORTUNITIES FOR GRADUATES

Data from Temu, Mwanje, and Mogotsi (2003) and Vandenbosch (2006) show that, at best, agricultural graduates end up in the public sector; very few graduates are absorbed into the private sector given its small size in SSA. Even if the private sector were in a position to employ some of these graduates, they lack the entrepreneurial skills needed (as is discussed further Section 4 of this case study).

In a review of the development of agricultural training in SSA, Saint (2005) notes that agricultural training was intended to supply skilled civil-service labor. Over the years, the civil service has either been flooded with workers (Temu, Mwanje, and Mogotsi 2003) or instituted employment freezes due to funding constraints (Beintema and Stads 2011). As a result, in recent years graduates of agriculture have been forced to look elsewhere for employment, and quite a few have succeeded in becoming high school teachers. Because the curricula are not structured to enable graduates to pursue agriculture as a business enterprise, graduates are ill-equipped to create their own opportunities through self-employment. Consequently, employment and career development opportunities for graduates of agriculture are limited, and this sends a negative message to high school students, causing manyto avoidthe profession as a career option.

3. REMUNERATION ACROSS PROSPECTIVE CAREERS

Most jobs for agricultural graduates are in the civil service where remuneration is generally not competitive (UNECA 2003). Positions tend to be in government extension services and research institutions, or in teaching, where salaries are also uncompetitive. Graduates compare their salaries to those of colleagues in the fields of accounting, business, and social sciences. After a few years of employment, business graduates, and particularly those in the private sector, have often advanced to management positions with significant remuneration and benefits. By comparison with accounting, business, and social sciences, agriculture tends to be a far more restricted field. The majority of agricultural graduates remain in junior positions for extended periods of time, which is understandably frustrating.

4. THE QUALITY OF TRAINING PROGRAMS

Strong agricultural education and training systems are fundamental to the quality of human resource capacity and ultimately to the agricultural productivity gains that are necessary for economic growth and poverty reduction in developing countries (Kruijssen 2009). Results from the tracer studies carried out by ANAFE, with support from the Southern African Development Community (SADC) from 2009 to 2011, highlight shortcomings in the quality of agricultural training in the region.

The studies also solicited employers' perceptions of the performance of graduates of agriculture to identify key gaps in skills. Employers noted that graduates were deficient in certain important skills and competencies; poor communication and limited managerial capacity were lacking at all levels. At the certificate and diploma levels, for example, graduates were deemed to have limited competency in information and communications technologies (ICT) and inadequate theoretical knowledge. At the BSc, MSc, and PhD levels, graduates lacked practical skills (that is, technical laboratory and field skills), adequate financial management skills, and the ability to write proposals and reports (Table 1).

These results imply serious gaps in training programs, together with a serious disconnect between curricula and industry needs. It seems that what is required is improved linkages between training institutions and stakeholders, regular reviews of curricula to ensure their ongoing quality and relevance, an appropriate balance between theoretical and practical course content, experiential learning, and incorporation of an entrepreneurial/business-oriented perspective in course components. It should be noted that as long as graduates' skills, knowledge, and experience fail to satisfy industry

requirements, improving the profession's reputation and hence marketing it to new students will be an ongoing challenge. Use of internship and sandwich programs[1] (at postgraduate levels), and working with farmers are likely to benefit the training program.

Table 1. Summary of skills required by employers, and graduates' strengths and weaknesses in Botswana, Lesotho, and Zambia

Certificate level	Diploma level	BSc level	MSc/PhD
Skills required by employers			
Hands-on technical skills, communication skills, and leadership skills	Hands-on technical experience, theoretical knowledge, supervisory skills, communication skills, farm-management skills, and leadership skills	Professional and technical knowledge, technical skills, managerial skills, and analytical skills	Strong theory and research skills, a good understanding of the industry, including business management skills, good communication skills, ICT skills, and leadership skills
Strengths observed by employers in graduating students			
Hands-on technical skills	Hands-on technical skills, a sound technical background, ability to plan and prioritize work, and the ability to conduct laboratory work and collect data	Adequate knowledge of theory, eagerness to learn , ability to coordinate activities, and good writing skills	Technical competence, independence in executing duties, very strong research and report writing abilities
Weaknesses observed by employers in graduating students			
Limited competence with ICT, inadequate depth of understanding issues, poor communication skills, poor work ethics, poor record management	Limited competence with ICT, poor communication skills, inadequate theory, limited skills of data analysis, low managerial skills, limited market knowledge, limited report writing skills	Lack of practical hands-on skills, limited financial management skills, poor communication skills, lack of specialization, limited analytical skills, limited market knowledge, limited farm management skills, limited leadership skills	Insufficient communication skills, insufficient managerial and financial management skills, poor skills in coordinating with other stakeholders, resistant to challenges, insufficient hands-on skills (too theoretical at times), poor reading culture.

Source: ANAFE 2011.
Note: ICT indicates information and communications technologies; hands on technical skills or experience refers to laboratory and field skills.

Selection and Enrollment of Students

In much of SSA, the prerequisites for students applying for agriculture programs are passing grades in biophysical science subjects and mathematics. Given the relative popularity of different programs, this means that the students who ultimately study agriculture are those who fail to meet the necessary criteria to be accepted into medicine, pharmacy, or engineering—the more popular programs (Vandenbosch 2006). Data on tertiary level enrollment in SSA are limited. On a positive note, many large and small-scale activities are currently underway to involve youth in agriculture. Kruijssen (2009) highlights six types of initiatives: (1) the creation of interest in or commitment to agriculture and development, (2) capacity building and skills development, (3) direct career development,

[1] A sandwich program is a postgraduate program offered by local institutions in collaboration with a (generally foreign) training institution. In such programs, students initiate their studies at the foreign institution, usually taking classes and defining a problem; in a second phase, lasting anywhere from a few months to one or more years, students conduct related research at the home institution; finally, students complete their studies back at the foreign institution where they present their thesis/dissertation.

(4) improvement of the educational system, (5) strengthening of research, and (6) stimulation of innovation.

Kruijssen (2009) further reviewed data on enrollments in agricultural programs from the United Nations Educational, Scientific, and Cultural Organization (UNESCO) for 21 SSA countries on enrolment in agriculture (Table 2). The results show that the changes in student enrollment in tertiary education as a whole differ greatly across countries, ranging from no change in Namibia to a 51-percent overall increase in Guinea. Enrollments in agriculture and related fields ranged from a negative trend in Congo (down 18 percent), to a significant increase in Sierra Leone (up 315 percent, admittedly starting from a very low base). Agriculture's share of total enrollments ranged from 0.02 to 15.4 percent, and averaged 4.9 percent. In most countries, agriculture's share of total student enrollments has been declining in recent years.

Table 2. Tertiary enrollment statistics in 21 selected Sub-Saharan African countries, 1999–2007

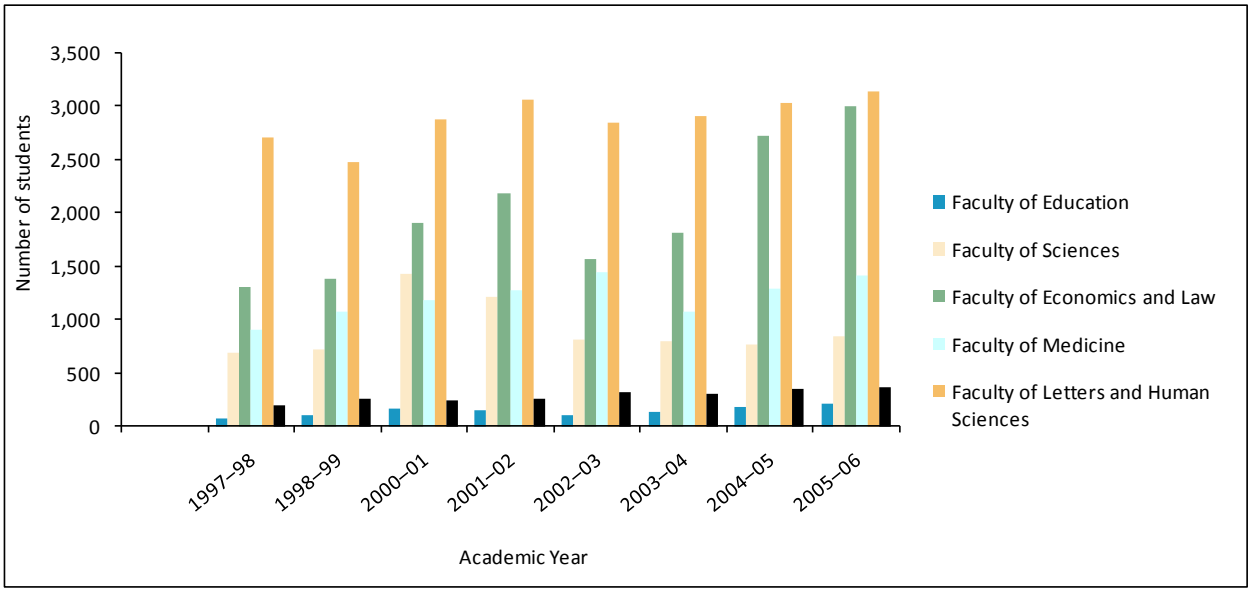
	Total enrollments in tertiary education			Total enrollments in agriculture at the tertiary level			Share of agriculture in total enrollments	
Country	Number	Yearly growth (%)	Years	Number	Yearly growth (%)	Years	%	Yearly growth (%)
Burkina Faso	33,459	30	1999–2007	321	na	2007	1.0	na
Burundi	17,061	34	1999–2006	392	na	2002	3.7	na
Cameroon	120,298	11	1999–2006	696	4	2004–06	0.6	–0.1
Congo	12,456	4	1999–2003	380	–8	2001–02	3.1	0.0
Eritrea	4,612	3	1999–2004	416	9	1999–2004	9.0	0.3
Ethiopia	210,456	38	1999–2007	17,884	33	1999–2007	8.5	–0.1
Ghana	140,017	22	2000–07	3,019	8	2000–04	4.3	0.0
Guinea	42,711	51	2003–06	4,670	204	2004–06	10.9	2.8
Kenya	102,798	4	2000–04	6,969	5	2000–01	7.4	–0.1
Lesotho	8,500	16	1999–2006	356	36	1999–2006	4.2	0.2
Madagascar	58,313	11	1999–2007	1,362	10	2005–07	2.3	–0.1
Malawi	6,458	13	1999–2007	490	na	1999	15.4	na
Mauritius	16,773	17	1999–2006	318	–1	1999–2006	1.9	–0.4
Mozambique	28,298	29	1999–2005	1,477	0	2004–05	5.2	–1.4
Namibia	13,185	0	2001–06	298	9	1999–2003	2.5	0.3[a]
Sierra Leone	9,041	17	2000–02	1,360	315	2000–01	15.3	10.4
South Africa	741,380	2	1999–2006	13,452	8	2000–06	1.8	0.1
Swaziland	5,692	2	1999–2006	345	4	1999–2006	6.1	0.1
Tanzania	51,080	28	1999–2005	2,417	15	1999–2005	4.7	–0.3
Togo	18,455	11	1999–2001	166	na	2000	1.1	na
Uganda	88,360	24	1999–2004	1,403	11	1999–2004	1.6	–0.1

Source: Modified from Kruijssen (2009).
Notes: na indicates that data were not available; "years" indicates the earliest and most-recent year for which data were available; yearly growth rates are for the same years as agricultural enrollments.
a. Data are for 2001–03.

Vandenbosch (2006) also showed similar trends in a review of enrollment trends of six African countries. Enrollment in agriculture lagged behind the other options. Gyimah-Brempong and Ondiege (2011) carried out detailed tertiary level enrollment studies for Botswana, Ethiopia, Kenya, South Africa, and Tunisia, showing that overall tertiary students'enrollment in agriculture has lagged behind. Dramé-Yayé (2010) also highlights the case of the Abdou Moumouni University in Niger (Figure 1). Despite the importance of agriculture in the country (contributing 39.65 percent of GDP), enrollment in the Faculty of Agriculture has remained significantly depressed. The majority of the students are enrolling in

humanities and social sciences. Admittedly, other factors might also be at play in Niger, for example, very attractive student support fees might encourage students to enroll in easier programs.

Figure 1. Percentage of students enrolled in the various faculties of the Abdou Moumouni University, Niger, 1997–2006



Source: Dramé-Yayé 2010.

Curriculum Content

The curricula followed at agricultural training institutions have largely been designed based on those devised before countries gained their independence. Subsequent reviews have been highly limited, which calls the relevance of these programs into question. In addition, there is limited contextualization of the learning process.

From 2009 to 2011, ANAFE carried out a study to assess the bottlenecks in human and institutional capacity to contextualize learning resources in tertiary agriculture and natural resource management institutions in eight SSA countries: Benin, Ethiopia, Kenya, Malawi, Mali, Rwanda, and Tanzania. It was found that the extent to which lecturers were developing and using contextualized learning materials was limited (Table 3). Teaching materials were obtained by downloading information from the Internet, coupled with very limited locally generated materials. The common methods used in course delivery were lecturing and project assignments, and there were no incentives for developing contextualized learning materials. Obviously, this lack of relevance is a major shortcoming.

Table 3. Relative use of teaching materials by lecturers

Source of learning material	Country								Average	Ranking
	Ethiopia	Benin	Malawi	Mali	Rwanda	Sudan	Tanzania	Kenya		
Self-prepared materials	3.7	4.4	3.9	3.8	2.8	4.1	3.5	3.0	3.7	1
Downloads from the Internet	3.4	4.7	3.8	2.7	2.8	2.9	3.7	3.4	3.4	2
Personal library	3.0	5.0	3.8	4.0	2.3	3.0	3.3	2.0	3.3	3
University library	3.2	3.9	3.6	2.7	2.0	3.3	3.2	4.0	3.2	4
National research organizations	5.0	2.5	2.0	3.0	1.7	2.7	2.3	5.0	3.0	5
Farmers' local knowledge	2.5	4.0	2.5	3.3	2.1	2.7	2.3	3.0	2.8	6
Material from own research	2.6	3.8	2.9	1.0	2.9	3.0	2.6	3.2	2.8	6

Source: Chakeredza et al. (2009).
Note: Ratings in responses were given a score ranging from 1 (strongly disagree) to 5 (strongly agree).

Entrepreneurship courses have not been integrated into the curricula at higher levels of training. As a result, graduating students are not able to set up enterprises of their own. Over and above agribusiness programs alone, Gyimah-Brempong and Ondiege (2011) looked at entrepreneurship courses in general in five countries: Botswana, Ethiopia, Kenya, South Africa, and Tunisia (Table 4).

Table 4. Entrepreneurship programs in five countries

Country	Doctorate	MSc degree	Undergraduate degree	Undergraduate module	Entrepreneurial activities	Outreach
Botswana		✓	✓		✓	
Ethiopia						
Kenya	✓	✓	✓		✓	✓
South Africa		✓	✓	✓	✓	✓
Tunisia			✓	✓	✓	

Source: Gyimah-Brempong and Ondiege (2011).

Across these countries, training in entrepreneurship is rare. Degree programs focusing on entrepreneurship are either in schools of business or management or in colleges of education. Students from programs other than business generally cannot take courses in entrepreneurship because of the exclusionary, discipline-focused nature of tertiary education in these countries.

Curriculum Delivery

The emphasis in curriculum delivery is on rote learning with few practicums and limited integration of experiential learning into curricula. Most institutions contend that the cost of the experiential learning is prohibitive. As a result, students who graduate are ill-prepared to work with communities and do not understand the dynamics of rural development.

In 2010, ANAFE began carrying out surveys on the extent of integration of experiential learning in West and Central Africa.Table 5 shows the percentage of various categories of stakeholders in tertiary agricultural institutions in different countries who are well versed in the theory and practice of experiential learning and the existence of coordination offices. In general, the teachers or trainers and students have a very good knowledge of experiential learning across the countries surveyed. Agricultural colleges have an office that coordinates experiential learning in most countries, whereas universities do

not. This indicates that hands-on experience is taken a lot more seriously in the agricultural colleges, compared with the universities.

Table 5. Knowledge of experiential learning and coordination of activities in various countries

	Knowledge of experiential learning (%)			Existence of an experiential learning coordination office	
Country	Administration	Teachers or trainers	Students	Agricultural college	University
Benin		60	No information	Yes	**No**
Cameroon	57.1	81.3	89.2	Yes	**No**
Gambia	–	90	No information	Yes (67% or 4 of 6 institutions)	
Ghana	83.3	85.7	79.3	Yes (17% of the respondents)	

Source: Fonteh (2011).

University–industry linkages are another aspect of the issue. In a survey of Botswana, Ethiopia, Kenya, South Africa, and Tunisia, such linkages were found to be very weak (Table 6).

Table 6. Global Competitiveness Index ranking for selected Sub-Saharan African countries, 2010–11

Country	Local availability of specialized research and training services	Firm level technology absorption	Capacity for innovation	Quality of scientific research institutions	Company spending on R&D	University–industry collaboration in R&D
Botswana	108	81	103	82	70	69
Ethiopia	122	124	106	102	123	101
Kenya	56	67	52	54	34	55
South Africa	49	35	47	29	40	24
Tunisia	27	33	36	38	35	41

Source: World Economic Forum 2010, cited in Gyimah-Brempong and Ondiege 2011.
Note: Data are based on a sample of 139 private firms.

The competitiveness index show that Kenya, South Africa, and Tunisia rank relatively well, but Botswana and Ethiopia do not. Gyimah-Brempong and Ondiege (2011) posit several hypotheses as to why university–industry linkages are weak in most African countries:

- a dearth of experienced and talented researchers able to identify problems facing local industry and formulate a research agenda to solve them;
- a lack of large pools of researchers who could collaborate to solve industry problems;
- lack of ability of industry to absorb new technologies, given the small size of enterprises in African countries and the low degree of development of their private sectors.

Another obstacle to the development of strong university–industry linkages is the low level of R&D investment by African industry. With little to no research funding from industry, university faculty have no incentive to work with industry. Except for eight countries—Ethiopia, Ghana, Kenya, Nigeria, South Africa, Sudan, and Tanzania—which accounted for 70 percent of regional public agricultural R&D spending, the total R&D expenditure throughout SSA has been considerably depressed (Beintema and Stads 2011). Investment in most countries in agricultural R&D is still too low to improve rural development and reduce poverty.

Institutional Management

The critical inputs to tertiary education training include infrastructure, such as classrooms, offices, laboratories, and library facilities; well-qualified and motivated faculty and support staff; high-quality motivated students; and a competent administration. The supply of these inputs has been limited for tertiary agricultural training. Resources need to be available to properly equip laboratories, enable sufficient practicums to be carried out, and to facilitate experiential learning.

The World Bank (2008) lists additional problems of tertiary agricultural training management, including the following:

- educational institutions are isolated and fragmented;
- tertiary-level curricula are outdated, inflexible, and irrelevant;
- the aging pool of qualified staff in agricultural education is causing staff shortages; and
- teaching methods and facilities are often inadequate.

If training programs in tertiary agricultural educational institutions are to be improved, these management issues need to be addressed.

5. PERCEIVED PRESTIGE OF THE PROFESSION

Prestige reflects the professional, social, and material rewards associated with certain occupations. Most people view this as a weighted average of income, education, and work environment. Since smallholder agriculture dominates in SSA, the field is associated with high levels of physical labor, high unpredictability, low profitability, and a generally unattractive working environment. Exacerbating the situation, role models in agriculture are limited. Furthermore, career prestige largely depends on public opinion. A more broad-based understanding of what agriculture offers would enhance this general attitude and elevate the profession. Interestingly, most parents contend that they send their children to school so that they can escape the field agriculture; hence, it is not surprising that agriculture has difficulty attracting the best students. Career opportunities and remuneration undeniably play into this, however.

6. CRITICAL ENABLERS ACROSS THE INDUSTRY VALUE CHAIN

It is well documented that certain enabling factors need to be in place across the agricultural value chain to stimulate growth. Rukuni (2002), for example, stipulates six “prime movers”:

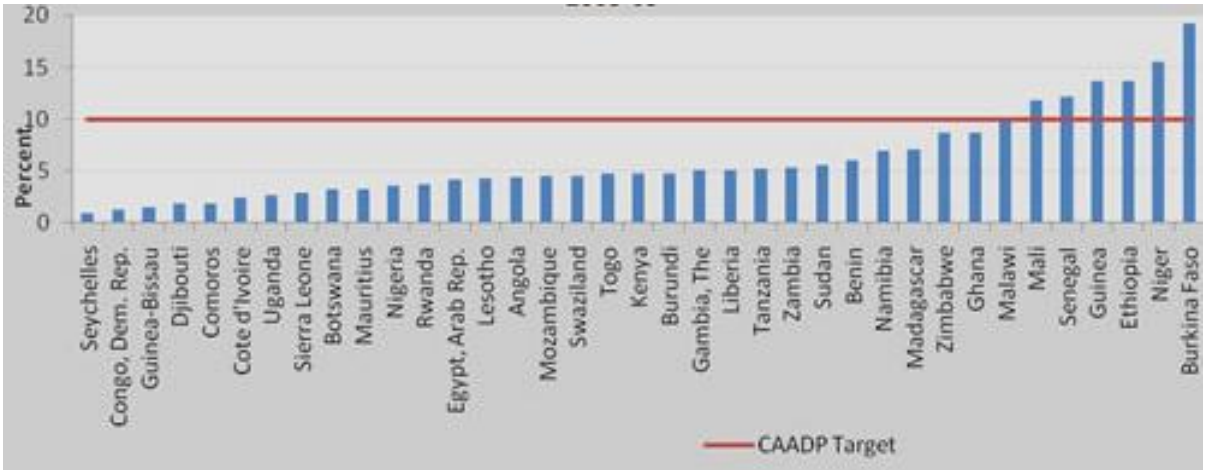
1. land tenure systems that ensure equity and resources to develop land productively;
2. new technology induced through public and private investment in agricultural research;
3. human capital in the form of professional, managerial, and technical skills;
4. sustained growth of biological capital and physical capital investments;
5. improvements in institutional performance, including marketing, credit, research, and extension; and
6. a favorable economic policy environment.

Tertiary agricultural education contributes directly to point 3 and indirectly to points 2 and 5. No single factor, such as new technology or higher prices, can sustainably increase agricultural production; a synergy of factors backed by significant political will is needed over sustained periods of time.

In 2003 in Maputo, African leaders resolved to revitalize the agricultural sector, vowing to “adopt sound policies for agricultural and rural development and commit . . . to allocating at least 10

percent of national budgetary resources for their implementation within five years" (NEPAD 2003, 1). Notably, the Comprehensive Africa Agriculture Development Program (CAADP) of the New Partnership for Africa's Development (NEPAD) calls for 6 percent growth in agricultural production, which is supported by all governments in SSA.The Regional Strategic Analysis and Knowledge Support System (ReSAKSS), facilitated by the International Food Policy Research Institute (IFPRI), compiles data on how SSA is doing regarding the CAADP targets. Only six SSA countries are meeting their commitment of 10 percent support to agriculture (Figure 2). This reflects lack of political support, which impedes the positive feedback loop needed to develop and promote agriculture as an attractive career path and build vital agricultural research capacity to spur innovation and ultimately agricultural growth.

Figure 2. Average yearly agriculture expenditure share in total expenditures, 2003–09



Source: Omilola et al. (2010).

7. LESSONS LEARNED AND WAY FORWARD

Compared with recent trends in the overall number of tertiary students, agricultural enrollments have lagged behind, which does not bode well for the future of agricultural production in SSA. The labor market for agricultural graduates is not improving; in fact, most graduates are being absorbed into the civil service where remuneration and career advancement opportunities are limited. The quality of training has generally not improved, and in some instances increased enrollment without commensurate increases in infrastructure has compromised training such that graduating students lack the requisite skills industry demands. Although, to a large extent, African governments promote agriculture as the backbone of their economies, in practice, resource allocation does not reflect this; political support for agriculture has not been forthcoming. Across the production, value addition, marketing, and policy continuum, a number of bottlenecks negatively affect agricultural productivity and profitability. All these factors contribute to the poor perceptions of agriculture as a profession, as previously discussed.

Moving forward, a number of measures are needed to change perceptions of agriculture as a profession:

1. *Improve the quality and relevance of agricultural education.* A positive feedback loop to promoting agriculture can only be set in motion when universities begin to produce agricultural graduates with the knowledge and fundamental skills that industry needs and wants; collaboration between universities and industries needs to be developed.

2. *Develop anenabling environment across the agricultural value chain.* It is important that bottlenecks and barriers to the production, value addition, marketing, and policy continuum are minimized.
3. *Stimulate interest in agriculture on the part of prospective students.* It is only by showcasing success stories and providing career guidance that young people can be attracted into the field of agriculture.
4. *Promote university–industry linkages.* Tertiary education reforms need to be linked to economic development, research, and industrial policies.

8. CONCLUSION

Tertiary-level training in agriculture and related fields will continue to falter unless universities succeed in attracting the best students possible by improving the quality and relevance of their programs and promoting the true benefits of agriculture as a fulfilling career path. A three-pronged strategy is needed. *At the training level*, issues of the quality and relevance of higher education in agriculture, including linkages to industry, urgently need to be addressed. *At the governance level*, critical enabling factors need to be established across the industry value chain to increase successes and initiate a positive feedback loop that will improve the reality and perceptions of agriculture as a field of endeavor. *At the society level*, negative perceptions of agriculture need to be overcome through improvements in education programs and working conditions, and by overcoming misperceptions of what a career in agriculture actually entails.

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The Agricultural Science and Technology Indicators (ASTI) initiative compiles, analyzes, and publishes data on levels and trends in agricultural R&D investments, capacities, and institutional arrangements in developing countries. ASTI is managed by the International Food Policy Research Institute (IFPRI) and involves collaborative alliances with many national and regional R&D agencies.

Jointly convened by ASTI/IFPRI and the Forum for Agricultural Research in Africa (FARA), the conference, "Agricultural R&D—Investing in Africa's Future: Analyzing Trends, Challenges, and Opportunities," brought together experts and stakeholders from the region to contribute their expertise for the purpose of distilling new insights and creating synergies to expand the current knowledge base. The themes under focus were (1) Why African governments under invest in agricultural R&D; (2) How human resource capacity in agricultural R&D can be developed and sustained; (3) How institutional structures can be aligned and rationalized to support agricultural R&D; and (4) How the effectiveness of agricultural R&D systems can be measured and improved.

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