

## CHAPTER 2.1

## Reforming Higher Education: Access, Equity, and Financing in Botswana, Ethiopia, Kenya, South Africa, and Tunisia

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In an increasingly interdependent and globalized world, countries that are able to compete and effectively participate in the global economy are those with large and rapidly expanding stocks of human capital. The importance of education, especially higher education, for Africa's economic growth has been highlighted by the recent World Bank publication *Accelerating Catch Up: Tertiary Education for Growth in Africa*.<sup>1</sup> Unfortunately, very little work has been done to study Africa's tertiary education sector—including elements such as enrollment trends, relevance, efficiency, adequacy, management, and financing.

The objective of this chapter is to analyze systems of higher education in Africa using five African countries—Botswana, Ethiopia, Kenya, South Africa, and Tunisia—as case studies. Other countries that were originally meant to be included—Mauritius, Senegal, Ghana, and Nigeria—were excluded because of inadequate coverage in the initial stages.

Specifically, the chapter analyzes current enrollment trends, accessibility and equity, governance, quality and relevance, financing, university-industry linkages (UILs), and entrepreneurship education in tertiary education curricula. The idea is to look at what works well and what does not, to consider what challenges need to be confronted, and to discuss lessons learned and the way forward for reforming tertiary education in Africa.

Although African countries have generally spent relatively large proportions of their national resources on the production of education, the stock of human capital with tertiary education in Africa continues to be very low compared with other regions of the world. While the proportion of the adult population (25 years and older) who have completed tertiary education averaged 3.94 percent in the world in 2010, the average for sub-Saharan Africa in that year was 0.78 percent. The average years of tertiary education completed by the adult population in Africa is 0.05, compared with 0.2 for the world as a whole, as shown in Table 1. This figure varies among different African countries—for example, the proportion of the adult population that has completed tertiary education and the average years of tertiary education are 0.43 and 0.02, respectively, for Ethiopia; in Tunisia, this is 6.20 and 0.11, respectively (Table 1).

**Table 1: Tertiary educational attainment, Africa and the world**

Country/Region	Adult population with tertiary education (percent)	Average years of tertiary education
Botswana	2.70	0.06
Ethiopia	0.43	0.02
Kenya	2.00	0.05
South Africa	0.60	0.08
Tunisia	6.20	0.11
Sub-Saharan Africa	0.78	0.05
World	3.94	0.20

Source: Authors' calculations, based on Barro and Lee, 2010.

Other major concerns include the relevance of the fields of study, the curricula, and the effectiveness of pedagogy for the development needs of African countries as well as the general quality of programs and graduates. While about 50 percent or more of students enrolled in tertiary educational institutions in fast-growing countries such as Korea, China, and Taiwan are enrolled in science, engineering, technology (SET) or business, only about 20 percent of tertiary education students in Africa are enrolled in these subjects. The result is that while graduates of African tertiary educational institutions go unemployed, African countries continue to face shortages of skilled labor. The perceived low quality and irrelevance of tertiary educational institutions, as well as their small size, indicate that it may be difficult for these institutions and their graduates to lead Africa's development.

There is solid theoretical and empirical evidence that education—especially tertiary education that emphasizes SET and business—has a strong positive effect on the growth rate of income in all countries.<sup>2</sup> The quality of tertiary education, as well as the subjects studied, may be more important for growth than the quantity of people who have obtained a tertiary education. For example, a high-quality SET-based and empirical inquiry-driven tertiary education may contribute more to a country's growth than a social science-based education that is not driven by relevant research based on local needs. This positive effect could come through several channels, including knowledge creation and spillovers,<sup>3</sup> as well as the ability to borrow and adapt technologies.<sup>4</sup>

In a recent study, Teal concludes that African economic growth has been powered by increased investment in physical capital rather than increased tertiary education.<sup>5</sup> However, he also finds that investment in physical capital depends on the availability of an educated workforce, suggesting that tertiary education indirectly contributes positively to income growth in Africa.

Several researchers argue that it is not only the quantity but also the quality of tertiary education that matters for income growth.<sup>6</sup> In addition, democratic access to improved tertiary education can be a pro-poor growth strategy.<sup>7</sup> When the quality of tertiary education is unequal among groups, it generates inequality in incomes.<sup>8</sup>

Africa has devoted substantial resources to higher education, especially in the last decade, during which some African countries have doubled or tripled capacity at considerable cost. Indeed, some African countries spend a larger proportion of their GDPs on tertiary education than most rich industrial nations. However, the stock of human capital with a tertiary education is low. The average quality of that education is equally low, with most African countries at the bottom of world rankings, as various analysts show. In addition, tertiary educational institutions are producing workers with

skills that are irrelevant to the needs of Africa. The unemployment rates among graduates of tertiary institutions are in the double digits in most African countries, while businesses are not able to find the skilled labor they need. This suggests a mismatch between what the tertiary institutions produce and the skills that businesses demand. This has led to massive emigration of African graduates of tertiary education to the developed world, effectively making African countries pay for the training of workers for developed countries. There are also questions of gender and of geographical and socioeconomic equity in access, as well as cost inefficiency, in tertiary educational institutions in Africa.

The low endowment and low quality of tertiary education in Africa has serious implications for the continent's development in an increasingly globalized world in which economic growth and development is critically dependent on knowledge intensities of countries. A workforce with abundant high-quality, relevant tertiary education may hold the key to Africa's future development. Although economic growth rates in African countries rose dramatically in the last decade, most of that growth was the result of commodity price booms. It is unlikely that this commodity price-led growth will be the region's recipe for long-term growth and development. African countries may have to transition very quickly from natural resource-based growth to growth that is based on knowledge.

Knowledge creation and accumulation, together with a positive work ethic, is seen as the key to long-term success in economic development.<sup>9</sup> In addition to the well-established private benefits of higher education (including better employment possibilities, higher salaries, and a greater ability to save and invest), higher education also has a major public benefit: it enhances economic development through technological catch-up.<sup>10</sup> This idea supports the proposition that expanding tertiary education may promote faster technological catch-up and improve a country's ability to maximize its economic output. Raising tertiary education attainment as well as its quality in sub-Saharan Africa will enable these countries to stimulate innovation, promote the diversification of products and services, and maximize returns from capital assets through more efficient allocation and management.<sup>11</sup> In the face of competition from South and East Asian countries, a more skill-intensive route to development could provide both resource-rich and resource-poor countries with an avenue for raising domestic value-added. These arguments underscore the importance of tertiary education for the development of African countries.

This analysis is timely, relevant, and important for Africa's development for a several reasons. First, this is the first time a comprehensive and comparative study of higher educational systems in African countries has been done. At the minimum, there is the need to ensure that African countries get suitable social and private returns

**Table 2: Tertiary enrollment statistics, 2000–07**

Country/Region	2000			2007			Change in enrollment (2000–07)
	GER (percent)	Total enrollment	Women (percent)	GER (percent)	Total enrollment	Women (percent)	
Botswana	3.0	6,332	47.0	5.0	16,950	50.0	167.7
Ethiopia	0.8	67,732	22.0	1.8	210,456	25.0	210.7
Kenya	4.8	89,016	35.0	3.4	139,524	36.0	56.7
South Africa	14.0	644,763	55.0	15.0	761,090	55.0	18.0
Tunisia	19.0	180,044	48.0	32.0	364,283	57.0	102.3
Africa*		2,342,358			4,139,797		76.7

Sources: UIS, 2009; Republic of Kenya, 2010.

\* For 2003–08.

on their tertiary education investment. Second, the internal efficiency of the educational system must improve, and these institutions must be made responsive to the needs of society. Finally, it is important that higher educational institutions provide the necessary skilled workers as well as the intellectual leadership for Africa's development.

This chapter defines *tertiary education* as post-secondary education, and *tertiary educational institutions* as those institutions (both public and private) that provide training in post-secondary education. The composition of tertiary institutions differs across countries in the sample. Although the discussion in this chapter is relevant to all tertiary institutions, most of it is directed at universities.

The rest of the chapter is organized as follows: the first section discusses recent trends in tertiary education enrollment, with particular reference to the most recent period and to access and equity issues in tertiary education in the five countries. The next section discusses issues of governance, quality, and relevance of higher education; the third section focuses on entrepreneurship education in Africa. This is followed by a discussion of financing issues involved in higher education; the subsequent section is devoted to a discussion of university–industry linkages in African universities. The final section discusses the lessons, challenges, and the way forward for Africa.

### Access to tertiary education

Several African countries, including the five case-study countries presented in this chapter, have dramatically expanded the capacities of their tertiary educational sectors. Between 2003 and 2008, enrollment in African universities increased from 2,342,358 to 4,139,797—a 76.74 percent increase compared with a 53.2 percent increase worldwide over the same period. However, Africa's gross enrollment ratio (GER) of less than 6 percent is the lowest rate in the world.<sup>12</sup> Most of the reasons for this low GER can be attributed to the continent's lack of capacity to absorb the demand, because the number of students seeking admission to tertiary institutions far outpaces the rate of capacity

expansion in these countries. For example, in Kenya less than 20 percent of candidates who qualify for admission to tertiary institutions each year actually gain admission to these institutions.<sup>13</sup>

Enrollment in tertiary institutions has more than doubled in the last decade in each of the five countries. This increased demand for tertiary education is partly a function of demographics, as most African countries are undergoing demographic transitions. The proportion of the population between the ages of 18 and 24 (the age at which most people enter tertiary educational institutions) is increasing rapidly. It is expected that the growth rate of demand for tertiary education will slow in the second half of the 21st century, when the demographics again shifts.

Most African governments have responded to the rapidly expanding demand for higher education in two ways: (1) by expanding the supply of tertiary education in the public sector, and (2) by allowing the private sector to set up and expand tertiary educational institutions and programs to complement the public-sector supply. Between 2000 and 2007, enrollment in private tertiary institutions in Africa increased by more than 80 percent. In Kenya, for instance, such enrollment increased by 230 percent, rising from 10,639 in 2005 to 35,179 in 2010.<sup>14</sup> In some cases, the increase in private enrollment was purely a private effort; in others, it was the result of joint public-private collaboration.

However, there remain serious accessibility problems, because the demand for access far exceeds the capacity to meet it. There are also serious issues relating to gender, regional, racial, and socioeconomic equities of access to tertiary education. In addition, equity issues relating to access to particular academic programs are of concern.

### Tertiary education enrollment, 2000–07

Drawing from UNESCO data, tertiary education enrollment trends in the five countries are not different from the average for Africa (Table 2). Total enrollment in Botswana increased by 167 percent over the seven-year period; in Ethiopia and Tunisia, the increase was 210 and 102 percent, respectively. Tertiary enrollment increased by 56 percent in Kenya and 18 percent in South Africa during the same period. By 2009, enrollment in South

Africa had increased to 799,490, of which 118,622 were graduate students. In spite of the rapid rise in enrollment, what remains clear is that enrollment ratios remain generally low and lag behind those in other parts of the world. In 2007, Tunisia had the highest GER among the group, at 32 percent—unusually high for African countries.

Tunisia was followed by South Africa, with a GER of 15 percent, while Ethiopia had the lowest GER, of 1.8 percent. Tunisia's GER was higher than that of China at 23 percent and the worldwide average of 23.8 percent.

UNESCO's data on enrollment suggest that about 23 percent of tertiary enrollment in African countries, and 17 percent in the sample countries, are in SET. The rest are enrolled in other fields, including about 33 percent in the social sciences and 35 percent in education. In Ethiopia, 25 percent of students are enrolled in education, 40 percent in social sciences and business programs, 8 percent in science, and 7.5 percent in engineering.

Botswana's tertiary educational system has two public universities, the University of Botswana and the new Botswana International University of Science and Technology (BIUST) that opened in March 2011, as well as Botswana Teachers College, the Botswana Institute of Management, the Botswana College of Accountancy, and specialized research institutions such as the Okavango Research Institute. In Botswana, only 12 percent of students in public universities are currently enrolled in SET, while the majority are enrolled in the social sciences and education.

By 2007, enrollment in Ethiopian tertiary educational institutions had reached 210,456 students in 21 public universities and 60 private universities, more than tripling enrollment in a space of only eight years. Ethiopia achieved this seemingly impossible feat by expanding admissions to existing public tertiary institutions, building new ones, and attracting a large number of private providers.<sup>15</sup> However, Ethiopia's GER, of less than 2 percent, was among the lowest in the world in 2007. In addition, the gender ratio in tertiary institutions in Ethiopia was very low: only 25 percent of graduate students were female, most of whom were enrolled in the social and human sciences.

Kenya currently has 7 public and 27 private universities. However, it had a low GER of about 3.4 percent (in 2008); this ratio has been decreasing over the years. The major cause of the low enrollment ratios in Kenya seems to stem from supply constraints rather than demand for enrollment. Demand for enrollment is growing faster than the ability of the tertiary educational systems in Kenya to meet it. For example, in the 2002–03 academic year, 42,158 candidates out of a total of 194,798 qualified for admission to Kenyan universities. Out of this number, only about 25 percent, or 11,046, were admitted. This represented about 5.7 percent of the potential pool of applicants.<sup>16</sup> In 2006–07, public universities were able to admit only 3.8 percent of the 260,665 potential applicants through the Joint Admission Board (JAB),

even though 26.1 percent of the applicant pool qualified for admission to the country's universities. There were similar experiences in Botswana, Ethiopia, South Africa, and Tunisia.

An alternative way to expand enrollment in Kenya is through a scheme called *Module II admissions*. Under this plan, students are admitted with the condition that they pay not only the full cost of their education at the public universities, but pay an amount that is the equivalent of attending a private tertiary institution. In this way, the universities generate extra revenue to fund their operations. Kenya is increasingly relying on this source of funding: in 2008, about 40 percent of all admissions to tertiary institutions of learning were of this variety.

In 2008, South Africa had 23 public tertiary educational institutions—11 universities, 6 comprehensive universities, and 6 technical universities—that enrolled a total of 761,090 students. Universities of technology offer vocational education at both degree and subdegree levels, while comprehensive universities' curricula fit somewhere in between the two, offering programs for research degrees to career-oriented diplomas. The comprehensive education reforms were codified in the 1997 Education Reform Act, focusing on (1) increasing participation in tertiary education for all, (2) providing greater responsiveness (relevance) to the needs of society, and (3) boosting cooperation and partnerships. The state was to act as an enabler and supervisor of the system rather than as its controller. The technical universities were upgraded from the technikons to full universities during the 2003 reforms.

South Africa has achieved gender parity in tertiary education enrollment. In addition to gender parity, blacks make up the majority of students enrolled in tertiary institutions, although the enrollment share for blacks is far less than their share in the South African population overall. In terms of subject areas studied, however, its distribution remained unchanged between 2000 and 2007. In 2000, 32 percent of students were enrolled in business, commerce, and manpower; 41 percent were enrolled in human and social sciences; and 27 percent were enrolled in SET. In 2007, the respective ratios were 30 percent, 42.3 percent, and 27.6 percent. In spite of the relatively rapid expansion, the public sector is not able to provide enough access to a majority of people who qualify. South Africa's relatively low GER for a country at its income level suggests there is a problem with access to tertiary education.

Tunisia enrolled about 364,283 students in 13 public universities, 24 institutes of technological studies, and 20 private universities in 2007, giving it a GER of 32 percent. What is impressive about the Tunisian expansion in tertiary education is that it did not come at the expense of quality. Tunisia's tertiary education is ranked the highest in Africa and it is in the top quartile worldwide in terms of quality. In 2008, 38 percent of tertiary education enroll-

**Table 3: ICT use and policies in tertiary education in five countries**

Country	National ICT policy	National ICT education policy	Tertiary education connection through ICT	ICT in distance education
Botswana	Yes: Maitlamo and Vision 2016	Policy that ICT should be available in all junior and senior secondary schools and tertiary institutions	Yes	Yes: Botswana College of Distance and Open Learning
Ethiopia	Yes: WoredaNet Initiative	Policy to connect all schools, but only 35 percent of schools have computers	A few individual universities have computers but most universities are not connected	No: Only 15 percent of universities use ICT for distance learning
Kenya	Yes: National ICT Policy (2006)	Yes: Kenya Education Sector Support Program (KESSP) (2005)	Yes, all universities are connected via Kenya Education Network Trust (KENET), allowing for joint development and distribution of course materials	Yes
South Africa	Yes: Accelerated and Shared Growth Initiative for South Africa (ASGISA) (2005), South African State Information Technology Agency (SITA) (1999), Information Society and Development (ISAD) (2007), and Electrical Contractors Association of S. AFRICA (ECA) (2002)	Yes: ECA (2002), Universal Service and Access Agency of South Africa (USAASA) (2001), Education Network (EDuNet), and Enhanced Learning Investigation (TELI) (1995)	Yes, but not all universities are connected to a national system; several projects such as African Virtual Open Initiatives and Resources (AVOIR) are in place	Yes: Free and open-source software (FOSS), Knowledge Environment for Web-based Learning (KEWL), Next Generation(NextGen), SakaiSA, and ASGISA
Tunisia	Yes: RTES (2002–07)	Yes: Educational Act (2002)	Yes	Tunisian Virtual School, Virtual University of Tunisia

Source: *infoDev*, 2007.

ment in Tunisia was in medicine and SET, one of the higher showings in these areas in Africa. This ratio also compares favorably with the enrollment ratio of 37 percent for East Asia.<sup>17</sup> Tunisia has also achieved gender parity in tertiary education enrollment and geographical balance. Finally, the government's policy of keeping tuition low ensures access equity across all socio-economic classes. Although there are a growing number of private tertiary education providers in the last decade, these institutions enroll a very small proportion of the student body in Tunisia.

#### Responses to inadequate supplies of tertiary education in Africa

The capacity in publicly provided tertiary educational institutions cannot grow fast enough to meet anticipated demand in the continent. The high demand is partly due to the relatively high private returns to higher education in these countries,<sup>18</sup> and partly due to the fact that most parents recognize that their children's future is through tertiary education. In addition, recent trends in international emigration suggest that most Africans see tertiary education as a necessary condition for emigration to the developed world.<sup>19</sup>

In Kenya, the enrollment capacity of tertiary institutions is expected to grow at the rate of 5 percent

per annum, at best, until 2015. But capacity needs to grow at least twice as fast to meet demand.<sup>20</sup> In Ethiopia, even though enrollment in tertiary education tripled between 2000 and 2007, the country's GER still remains below 2.0 percent. And in Tunisia, demand still outstrips capacity to provide spaces for students. This may suggest that the supply of higher education in these countries could be another example of governments failing to adequately meet the demand. It is clear that if these countries are going to boost their tertiary enrollment, the private sector has to play an increasing role. To meet this demand for higher education, these countries have adopted three strategies: distance learning and ICT use; international enrollment, and private provision.

#### *Distance learning and ICT use*

All five countries considered here are using some form of distance educational programs to increase access to tertiary education. However, *infoDev* suggests that the use of ICT to deliver courses in African countries is inadequate, even though they have enacted ICT policies (Table 3). Indeed, with the exception of Tunisia and North African countries, distance education is primarily delivered through print material.

### International enrollment

Wealthy families in the five countries have been able to send their dependents abroad for tertiary education. For example, in 2004, about 14,123 Kenyan students were studying in universities based in Organisation for Economic Co-operation and Development (OECD) countries and not Kenyan universities—this is equivalent to about 13 percent of all tertiary education students in Kenya. South Africa had about 5,619 students in OECD universities, representing 0.8 percent of South African university students. Similarly, a large number of students from Botswana, Ethiopia, and Tunisia, especially at the graduate level, were studying in European universities. For most families with modest incomes, it may be impossible to afford university education outside their countries of origin short of a scholarship offer from their government or from foreign organizations. Clearly, tertiary education outside Africa or out of a student's country of residence represents a relatively small fraction of the tertiary education enrollments in these countries.

### Private provision

From a small number of institutions at the beginning of the 1990s, private tertiary institutions have increased rapidly to fill the unmet demand. These private universities are either branches of well-established universities from the developed world that provide specific programs in African countries or completely independent institutions established in Africa. They tend to be relatively small, offering a limited range of courses and programs—such as those in business administration, technology, and nursing—that are in high demand. They focus mainly on instruction, with little emphasis on research. An important characteristic of these private universities is that they charge enough in tuition and fees to, at a minimum, fully cover the cost of the education they provide. These private universities operate with the encouragement of governments, which see them as a way to relieve pressure on the public universities.<sup>21</sup>

Bjarnason et al. provide three typologies of private suppliers of tertiary education: elite, religious, and demand absorbing.<sup>22</sup> *Elite* private-sector providers refer to world-class academic leadership, which is generally limited to academic institutions in the United States. At best, private tertiary institutions in Africa are semi-elite, with an emphasis on good teaching and very little research. They are mainly in business-related fields, focusing on business administration curricula, and often have ties to foreign universities.

*Religious* providers, such as those affiliated with churches and other religious institutions, tend to be nonprofit-oriented institutions but are set up to generally spread the ideology of the religion. By far the largest and the fastest-growing portion of private providers of higher education in Africa can be characterized as *demand absorbing*. They are market driven, are entrepreneurial in their approach, provide small niche

programs, are careful to minimize cost, and do not generally have large overhead such as physical infrastructure and extensive student support services. In most cases, they charge “market-rate” tuition.

A major concern with the private provision of tertiary education in some of these countries has been one of quality control. It is believed that, because of lack of strong administrative and quality controls, fly-by-night providers are able to set up shop in African countries, provide substandard degree programs in areas that are in high demand, and charge exorbitant fees.<sup>23</sup> The solution to these perceived or real quality problems lies in the regulation and governance of private higher-education providers. In South Africa, where private tertiary institutions are required to receive certification before they offer any classes and where institutions receiving authorization are subject to review a year later, substandard private-sector tertiary education is less likely to be a problem than it is in countries that take a hands-off approach to tertiary education.

Botswana has 10 private universities that enroll about 20 percent of the country's higher-education students, and 2 public universities with 80 percent of the students. A 2008 White Paper on Higher Education envisages increasing the GER to 17 percent by 2016 and ultimately to 25 percent by 2026.<sup>24</sup> Botswana sees private universities as playing a key role in this expansion. Its private universities—such as Linkokwing University of Creative Technologies (a branch campus of an Indonesian university), NIIT, ABM University College, and Ba Isago University College—provide niche programs in emerging skill needs such as ICT and business administration, among others. These institutions are for-profit and tend to be branch campuses of foreign universities. An interesting aspect of private provision in Botswana is the joint public-private collaboration in which the government subsidizes private tertiary education. In addition, the government pays for students' tuition costs at private tertiary institutions.

Ethiopia has aggressively pursued private higher educational institutions since 1990. There are currently over 60 private tertiary educational institutions, enrolling about 17 percent of students. These institutions are either operated as foreign branches of well-established European, American, or other OECD universities or for-profit independent private institutions. Most of these institutions are small and provide programs in one or two areas of concentration—mostly in business, nursing, and ICT—where market demand is very strong and highly related to labor market needs.

Kenya currently has 34 universities, of which 7 are public and 27 private. In 2009, the private sector enrolled about 22 percent of the student population. This compares with an enrollment ratio of just over 13 percent in 2004, suggesting that enrollment in the private sector grew much faster than in the public sector. Private tertiary institutions tend to concentrate

on providing programs in specific niche areas. For example, Kiriri Women's University of Science and Technology provides science and technology programs for women, Strathmore University focuses on ICT and business management, and Aga Khan University offers advanced nursing and medicine programs.

There were about 103 private tertiary institutions in South Africa in 2008, which together enrolled less than 10 percent of the tertiary-level students in that year. These institutions are relatively small, with enrollments ranging from under 1,000 to 20,000 students, and offer a small range of programs. Unlike their counterparts elsewhere, these institutions are not established in response to excess demand in the public sector but rather were set up to offer particular programs—such as business, theology, ICT, health, beauty, and fashion—not offered by public tertiary institutions. In 2008, these institutions were very much concentrated in a few states in South Africa: 93 percent were concentrated in only three states—Gauteng (54 percent), Western Cape (21 percent), and Kwazulu-Natal (17 percent).

In 2008, there were about 20 private tertiary educational institutions in Tunisia, which enrolled less than 1 percent of the total number of students in programs of higher education. They offer training in areas such as technology, where demand exceeds supply in public institutions. Although the private sector currently plays an insignificant role in Tunisian tertiary education, the government anticipates that its role will increase in the future because it is providing incentives to private providers. Public-private collaboration in the provision of tertiary education in Tunisia takes several forms, including government subsidy for private tertiary educational institutions. The government pays the tuition of students who go to private tertiary institutions, provides land and subsidized capital construction (up to 25 percent of the cost of construction), provides subsidies for utilities, and pays some of the salaries of faculty for up to 10 years of the establishment of the institutions.

### Equity of access to tertiary education

Issues associated with gender inequity, regional differences in admission, and different groups enrolling in particular subjects, as well as differences in enrollment according to race and socioeconomic class, are also of concern. In 2000, of the five countries only South Africa had achieved gender parity, with women constituting 55 percent of university enrollment. By 2007, Botswana and Tunisia had also achieved gender parity in university enrollment, while, to date, Ethiopia and Kenya still remain behind although both are making progress in this area (Table 2). Gender inequities also manifest itself in fields of study: women generally tend to be under-represented in SET and mathematics, while they tend to be over-represented in liberal arts and social sciences. Kenya's educational plans envision achieving gender parity through a variety of policy approaches,

including affirmative action and quotas. In all five countries the female/male enrollment ratio is much higher in private than in public tertiary institutions. This may in part reflect the fact that private institutions tend to enroll more students in social sciences, business, technology-related fields, and the humanities than in the natural and laboratory sciences.

Another dimension of access inequity is related to geography and socioeconomic status. Often, because admission is based strictly on performance in national examinations, admission to universities tends to be skewed toward households with higher incomes and social connections that can afford to send their children to the best secondary schools. Although the reliance on national examination results usually ensures higher academic standards from incoming students, this process tends to discriminate against students from rural and poorer regions of a country where secondary schools tend to be of lower quality on account of poor resource inputs. In Kenya, for example, in 2005 only 3.2 percent of students from the Coast Province met the minimum qualification for admission to a university, compared with 21.6 percent from Central Province. In Ethiopia, similar patterns exist between rural and urban areas, especially between Addis Ababa and other parts of the country. In South Africa, there is a concentration of tertiary educational institutions in Gauteng, Eastern and Western Cape, and Kwazulu-Natal Provinces, while such institutions in other provinces are very sparse. This inequity has implications for regional differences in enrollment in tertiary institutions.

These regional inequalities in access are exacerbated by regional differences in income and wealth because wealthier regions and districts tend to have the best secondary schools. The introduction of self-sponsorship admissions (full fee-paying admissions) into public tertiary institutions increases the access inequality based on socioeconomic status because students from poorer backgrounds are less likely to be able to pay full tuition for their tertiary education in either public or private institutions.

In addition, not all races have equal access to tertiary education in Africa. This is especially the case in South Africa, where the apartheid regime systematically restricted access to tertiary education for the majority black population as well as other non-white citizens. While the education reforms of 1997 attempted to address this inequality, racial inequality in enrollment seems to persist. In 2008, blacks—who constitute 79 percent of the South African population—made up 63 percent of students enrolled in tertiary institutions; on the other hand, whites—who constituted 10 percent of the population—made up 24 percent of tertiary school enrollment. Moreover, whites comprised 34 percent of all university students while blacks made up 50 percent, but white enrollment in technical universities was as high as 77 percent.

The current structure of enrollment by field of study suggests that South African blacks tend to enroll in less prestigious tertiary institutions. There are also wide variations in the racial composition of students in different fields of study. Blacks make up 60 percent of all SET enrollment, while whites make up 26 percent; and 78 percent of enrolled students in education are black, while only 15 percent are white. This situation has implications for the future racial composition of the skilled workforce in South Africa.

#### Other accessibility issues: Entry pathways, differentiation, and articulation

Other issues of access to tertiary education in all the five countries include different pathways of entry to tertiary education, differentiation, and articulation. There appear to be no generally systematic policies in these countries to facilitate the admission of older students (those older than the prime college-attending age of 19–24 years). However, some tertiary educational systems have recognized this issue and are developing policies to ease this problem. For example, Kenya's new Higher Education Policy recognizes this need and is providing pathways for older students to access tertiary education, particularly through its Module II programs.

Other issues impinging on access are differentiation and articulation in the tertiary educational systems.

*Differentiation* refers to the emergence of distinct types of tertiary educational institutions in response to a country's need for different types of skills; *articulation* is a mechanism that allows students to move from one type of institution to another type, or to move laterally among the same type of institutions across geographical locations. In theory, different institutions at the same level are supposed to specialize in different areas in order to meet the needs of a country. After all, differentiation is supposed to allow universities to specialize and thus increase efficiency and innovation in the areas they have chosen. In most of the five countries, institutions are set up to provide differentiation; in some, such as Kenya, South African, and Tunisia, there is also evidence of course differentiation. However, as institutions begin to provide programs in "hot areas," they seem to encroach on each other's territory. The result is a gradual erosion of the element of differentiation between institutions.

#### Governance, quality, and relevance

Rapidly expanding enrollment in tertiary educational institutions in these countries has raised concerns about the governance, efficiency, quality, and relevance of tertiary education for the countries' development needs. There is a perception that these institutions are inefficient and produce relatively low-quality graduates with skills that are not very relevant for the labor market. For example, although there is a shortage of skilled labor in these countries, there is also evidence of both

open and disguised unemployment of graduates of tertiary institutions.

The quality of output/service is partly a function of the quality of inputs, including managerial inputs and the environment in which production takes place. Input quality and a better environment are necessary, but they may not be sufficient conditions to achieve a higher-quality output. The critical inputs include the physical and social infrastructures—such as classrooms, offices, laboratories, library facilities, and student expectations—along with a well-qualified and motivated faculty and support staff; high-quality, motivated students; and a competent and forward-looking visionary administration. All these should be combined with the appropriate political and financial support that sets out what outcomes are expected, what incentives will be given to achieve them, and what the consequences are for failing to achieve those objectives.

#### Governance

The productivity of the tertiary educational sector, its efficiency, and the quality of its output as well as the relevance of its curricula are intimately related to the sector's governance structure. Governance provides the institutional environment within which the educational enterprise functions. Efficiency in both system governance and institutional governance is necessary for the educational system to produce the desired results. This requires accountability and transparency, neither of which can be possible without the autonomy of higher educational institutions. Autonomy implies freedom to make management decisions, such as allocating resources among programs and determining the optimal input combination.

Good governance includes promoting quality, responsiveness, transparency, and accountability in the sector as well as providing it with appropriate standards, incentives, and information. Tertiary education governance in these countries is a tricky business. On the one hand, the need to produce skilled labor to meet development needs, the amount of public resources devoted to providing tertiary education, and the political power that students in tertiary educational institutions wield may suggest the need for the government's central control of these institutions. On the other hand, the need for academic freedom, the freedom to innovate in both teaching and research, to achieve efficiency generally, and the ability to respond to changing environments suggests that these institutions should be free from political control as much as possible if they are to succeed. The governance structure of tertiary institutions that emerges in any country is the result of a balance between these contrasting forces. While some countries set up structures that allow for the central government's direct control of structures, others set up buffers between the political administration and the governance system (Table 4).

**Table 4: Governance and quality assurance bodies in higher education in the five countries**

Country	Highest governance body	Relevant legislation	Accrediting body	Relevant legislation
Botswana	Tertiary Education Council	Tertiary Education Act (1999)	Tertiary Education Council	Tertiary Education Council (1999)
Ethiopia	Ministry of Education	Higher Education Proclamation (2003)	Higher Education Relevance and Quality Agency (HERQA) (2003)	Higher Education Proclamation (2003)
Kenya	Commission for Higher Education	Universities Act (1985)	Commission for Higher Education	Universities Act (1985)
South Africa	National Council on Higher Education	Higher Education Act (1997)	Higher Education Qualification Council (HEQC)	Higher Education Act (1997)
Tunisia	Ministry of Higher Education and Research	Higher Educational Framework (1989), Law 4 (2008)	n/a	n/a

Source: Ng'ethe et al., 2008.  
Note: n/a means not available.

**Table 5: Composition of membership on buffer governing boards**

Country	Administration	Academic representative	Students	Government	Private sector	Undefined	Total
Botswana	2	1	1	5	3	2	14
Ethiopia	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Kenya	n/a	n/a	n/a	21–25	n/a	3	24–28
South Africa	n/a	n/a	n/a	n/a	n/a	17	17
Tunisia	n/a	n/a	n/a	All	n/a	n/a	n/a

Source: Saint et al., 2009.  
Note: n/a means not available.

Table 4 shows the highest governance bodies (external) and the relevant legislation that established these bodies, and quality assurance agencies with the appropriate legislation that established them. In addition, there are internal governance bodies that are charged with the day-to-day administration of the universities—dealing with academic issues as well the hiring (and firing) of university staff, finance, different academic disciplines, and other aspects of tertiary education governance. The differences in the structures of governance across the five countries are based largely on the degree to which the political system has direct control of the decision-making process in higher education.

Table 5 shows the composition of buffer governing boards in the five countries. In general, there is a mix of internal and external members on these boards, with most countries trying to strike a balance between internal and external membership. However, in some cases—such as South Africa—it is not clear how membership on these boards is determined. Another aspect of governance authority is who appoints the chair and members of these boards. In Botswana and Kenya, the head of state (who is the chancellor of the university) and the

minister of education appoint the chair; in South Africa, the chair and membership of this governing board are appointed based on a stakeholder representation formula stipulated by law.

The appointment of internal administrators of universities also differs across countries. For example, in Kenya, the chief operating officer is appointed on a competitive basis, the university board appoints the chief officer's deputies, and the deans are elected by staff while department heads are appointed by the vice chancellor. In South Africa, on the other hand, the board appoints the chancellor and all senior management, including deans (but not department chairs).

### Quality assurance

The quality of a tertiary educational system is multi-dimensional, since tertiary institutions are multi-output producers—of teaching, research, and service, among other outputs. An institution may excel in one or two dimensions but not in others. Similarly, evaluating the quality of a tertiary educational system is very difficult because different evaluators may emphasize different aspects of quality; hence they will rank the same

**Table 6: Quality rankings of tertiary education in the five countries**

Country	African ranking	Global ranking
Botswana	6	87
Ethiopia	26	126
Kenya	5	86
South Africa	2	57
Tunisia	1	27

Source: UNESCO, 2007.

**Table 7: The Global Competitiveness Index rankings on individual education indicators\***

Country	Tertiary education enrollment rate	Quality of the educational system	Quality of math and science education	Quality of management schools	Internet access in schools	Local availability of specialized research and training services	Extent of staff training
Botswana	114	48	79	113	94	108	54
Ethiopia	129	60	94	106	127	122	122
Kenya	123	32	69	59	91	56	70
South Africa	99	130	137	21	100	49	26
Tunisia	69	20	8	22	47	27	18

Source: World Economic Forum, 2010.

\* Rank out of 139 countries.

institution or system differently. However, there is general agreement that the quality of these institutions is low by international standards for the five countries (Table 6).<sup>25</sup> Only Tunisia is ranked in the top quartile of quality rankings globally. In addition, it ranks as first regionally (Africa), followed by South Africa and Kenya.

These tertiary institutions rank very low in research productivity as measured by publications, citations, or patent awards. South Africa had the highest number of ISIC publications of the group between 2002 and 2007, with a count of 29,225, while Botswana produced 948 ISIC publications in the same period.<sup>26</sup> Given the relatively large size of the South African tertiary system, this is not very impressive by international standards. While there is definitely some subjectivity in institutions' rankings, the fact that most of them tend to be ranked low in all cases seems to suggest that the rankings are correct.

Another quality measure of tertiary educational systems is their ability to improve the competitiveness of their countries. The Global Competitiveness Index (GCI) discussed in Chapter 1.1 ranks the quality of educational systems in various areas (Table 7). Apart from Tunisia, which ranks in the top quartile in most categories of tertiary educational systems, the four African countries are ranked low in most of the categories.

A major cause of low productivity and quality has to do with lack of resources. Although these countries devote a relatively larger share of their national resources to providing tertiary education than other parts of the

world, low incomes imply that these high ratios still translate to low *absolute* amounts. For example, although Ethiopia may spend six times its per capita income on a student in a tertiary institution, this translates into about 20 percent of per student expenditure in a typical OECD country. While resources for tertiary education have grown moderately at best in most African countries, enrollment has exploded, as in the case of Ethiopia.

Both rapid enrollment growth and relatively stagnant funding has resulted in a reduction in per student resources for tertiary education as well as a reduction in the quality of such inputs. For example, the proportion of faculty without terminal degrees has increased; so have student-faculty ratios, and physical infrastructure in some institutions has deteriorated with a concomitant deterioration of teaching and learning environments. In addition, there is a lack of resources to support research and staff training. For example, between 2000 and 2007, Botswana devoted only 0.43 percent of its GDP to research and development (R&D); South Africa devoted 0.87 percent of its GDP. In Ethiopia, the per capita expenditure on research at public universities was less than US\$20.00 per year during the 2000–07 period. On the other hand, Tunisia devoted about 2 percent of its GDP to support research and training.

Research productivity and output in these universities is low because few resources are allocated to the research enterprise (Table 8). Annual per capita research expenditures range from a low of US\$1.30 in Ethiopia to a high of US\$76.20 in South Africa. Besides, only a

**Table 8: Higher education research expenditures in the five countries, 2007**

Country	Total research expenditures (US\$ millions, PPP)	Percent of GDP	Per capita expenditure (US\$ PPP)	Percent performed by higher educational institutions
Botswana	84.91	0.38	46.30	5.80
Ethiopia	106.79	0.17	1.30	14.60
Kenya	n/a	n/a	n/a	n/a
South Africa	3,654.27	0.92	76.20	19.30
Tunisia	660.61	1.02	65.41	38.41

Source: UIS, 2009.  
Note: *n/a* means not available.

**Table 9: Science and technology enrollments**

Country	Total enrollment in science & technology	Enrollment ratio in science and technology
Botswana	2,778	17.68
Ethiopia	30,284	14.39
Kenya	n/a	n/a
South Africa	181,596	23.86
Tunisia	133,910	36.76

Source: Authors' calculations, based on UIS, 2009.  
Note: *n/a* means not available.

small proportion of the research takes place in higher educational institutions. This suggests that expenditures on research at these universities are too low by international standards to generate any meaningful research output. However, a few countries—such as Tunisia—are making a good effort to increase research resources. For example, 2.5 percent of government budget in Tunisia goes to support research in universities and research laboratories, a figure that is higher than the OECD average of 1.5 percent. In addition, research funding in Tunisia grew by 300 percent between 2000 and 2008.

### Relevance

Skilled labor shortages in these countries have an impact on their economies. These shortages are also evident in the very high private returns to tertiary education in Africa—these returns are among the highest in the world. This situation implies that graduates should have no difficulty in finding productive employment. These countries' relatively large investments in tertiary education are intended to address this skill shortage. Unfortunately, there is evidence of open unemployment, underemployment, and disguised unemployment among graduates in all five countries. Anecdotal evidence indicates that graduate unemployment in these countries is very high,<sup>27</sup> which results in a massive emigration of highly educated Africans. This suggests that there is a mismatch between what these institutions produce and the skills needed in the countries.

Unlike the fast-growing countries of East Asia, where 50 percent or more of students in tertiary educational institutions are enrolled in SET and mathematics, only a very small proportion of students are in SET or business in the five countries (Table 9). These enrollment rates also compare unfavorably with the rates in OECD countries. However, there are differences across the five countries, with enrollments in SET and mathematics higher in Tunisia (37 percent) than in the other four.

It is difficult to evaluate with any precision the degree to which tertiary institutions are meeting the skill needs of these countries because there are inadequate statistics on labor demand. Indirect methods must be used to evaluate whether these institutions are training graduates in the areas needed, and whether those trained are equipped with the skill sets necessary to meet the development needs of their countries. One method is to compare the expected number of graduates—a number derived from projections of manpower needs in particular fields—with the actual number of graduates produced in those fields.

In Botswana, it is estimated that unemployment rates among tertiary education graduates is about 15 percent, suggesting that these institutions are training students in skills that are, possibly, not very relevant for the needs of the country. A relatively large proportion of university graduates go unemployed for long periods of time in Ethiopia as well. This mismatch also manifests itself in high emigration rates among Ethiopian graduates even though the country lacks skilled workers, for which

it heavily relies on technical aid. In Kenya, too, there appears to be a mismatch between industry skill needs and those possessed by university graduates.

The number of SET and business graduates produced by the system in South Africa between 2003 and 2007 fell below what was expected by the Council on Higher Education (CHE), while the number of graduates produced in the social and human sciences exceeded the numbers expected in these fields. This may suggest that the South African system is not meeting the needs of the economy given that it is not producing an appropriate mix of skilled workers as envisaged by the CHE. Although there are no serious overall shortages of skilled labor in the country, there are serious shortages of skilled South Africans in critical areas of SET that the system is not able to fill. South Africa has had to rely on labor imports to meet demands in these critical areas.

It is estimated that unemployment rates among Tunisian tertiary education graduates is about 19 percent, even though it leads African countries in enrolling students in SET and mathematics and produces high-quality graduates. This has led to high rates of emigration of these graduates, especially to OECD countries. This situation led the government to adopt the strategy of linking education to technical innovation by establishing technology parks. However, it is important to take cognizance of the recent events in Tunisia and other North African countries that have led to revolutions in these countries (see Box 1), a situation arising mainly from high graduate unemployment and the countries' inability to create adequate jobs and shared growth in their economies.

Several reasons may account for why tertiary education in the five countries is generally of poor quality and less relevant to their needs. These include each country's particular history, slow economic growth, labor market policies, a lack of university-industry linkages (UILs), resource constraints, and the inability of these institutions to change and adapt curricula and pedagogy to the changing skill needs of the economy because of inflexible governance and management structures. Most of these countries (possibly excluding Ethiopia) inherited educational systems that were either geared toward colonial administration and therefore stressed medium-level administrative clerical skills rather than problem-solving skills, or they were geared toward ensuring racial segregation (South Africa). The educational system therefore focused on social sciences and the humanities, and a pedagogy based on what is written in books rather than a focus on SET-based, practical problem-solving pedagogy. The skill sets developed in these institutions may be less appropriate for these countries' development needs in an increasingly globalized world that depends on knowledge-intensive production. Unfortunately, most of these countries have not been

able to restructure and change their educational systems to meet their development needs.

These economies have not grown fast enough to absorb the growing supply of graduates. The rapid economic growth of some countries has been based on natural resource extraction, which tends to demand few skilled workers. For the most part, growth has not been a shared and job-creating growth. In addition, partly because of labor market policies that compensate graduates equally, regardless of the skill shortages in different fields and without regard to the marginal productivity of labor, there is no incentive for students to enroll in needed fields such as SET. Also, because of the possibility of emigration when a student graduates, students think of their degrees as "passports" for emigration to a developed country.

On the supply side, governments do not discriminate in terms of which subject areas are financed. Once students are accepted to a university, the government subsidy tends to be the same for each student without regard to the subjects studied. One of the major weaknesses of tertiary education in these countries is the inflexibility and static nature of the programs offered. Instead of expanding areas that are in demand and contracting or eliminating areas that are not, the universities continue to offer programs that may be of little relevance. Students are forced into existing program offerings and, once admitted into a program, are seldom allowed to transfer to another one. In this way dying programs are kept alive while the expansion of needed programs is thwarted. The universities have molded their teaching and research agendas on the "high standards" of OECD countries focusing on niche areas. While this may be important in bringing fame to the researcher, specialization in a very narrow niche may be of little relevance to the needs of the country.

One of the major reasons that the universities tend to educate and produce a labor force whose skill sets are not needed is that there are few linkages between universities and industry in these countries, and also the private sector is inadequately developed in most of them. Often industry has no idea what the curricula in universities are, is never asked for inputs in training programs, and faculty research is unrelated to what businesses are doing. Businesses, on the other hand, have come to see universities as isolated islands of academic "pomposity" where academics do not work with the industry and therefore are never approached to help solve real industry problems. While most of these countries pay lip service to UILs, it will take serious national efforts at nurturing this linkage: it is not likely to grow organically on its own in the current economic and social climate.

Tertiary institutions generally train people for the future, and hence the way they train students should be in anticipation of the future labor and research needs of the country. In this regard, manpower planning by

### Box 1: Recent political events and graduate unemployment in Tunisia

The recent political events have changed the political landscape of the North Africa region and have had a potential impact on the economic performance of the region. Tunisia has been the catalyst for the current Arab unrest. With a well-educated—to the tertiary level—population, it was precisely these unemployed graduates who took to the streets of Tunis, leading to the turbulence. It is interesting that the current events were sparked by a Tunisian graduate—who could not find work and took to selling fruit and vegetables from a cart that was demolished by local authorities, leading to his self-immolation. With no jobs and no prospects, the future was dismal for these graduates. The political upheavals in these countries call for governments to address issues related to the quality and relevance of education, to skills development and apprenticeship training, and to job-creating economic growth.

Tunisia has persistently high unemployment rates. For instance, in 2007, young people (aged 15–24) had the highest unemployment rates in the nation, exceeding 30 percent; these rates were gender neutral. On the other hand, unemployment rates for the age groups 25–34 and 35–44, as well as the overall unemployment rate, were higher for women.

In fact, the persistently high unemployment rates among the educated seems to be a general feature of labor markets in North African countries, suggesting that there is a persistent mismatch between the demands of the economy and skills offered by recent university graduates. The unemployment rate for those with a tertiary education (19 percent) is much higher than the average rate of 14.1 percent. The second-highest rate

(which is also higher than the country's average rate) is found among those with a secondary education. A similar picture of the unemployment rates is revealed in Algeria, Egypt, and Morocco.

Unemployment rates in Tunisia have been high for many years now, but the composition of unemployment by level of education has changed dramatically over the past two decades. For example, in 1994, the total unemployment rate was 15.8 percent, and in 2007 it was 14.1 percent. The rate of unemployment among Tunisians who have completed tertiary education increased by 500 percent; from 3.8 percent in 1994 to 19 percent in 2007. During the same period, unemployment among illiterate workers was reduced by about two-thirds (from 16.8 percent to 5.9 percent), and unemployment for workers with a primary education also declined significantly (from 19.2 percent to 13.5 percent). Finally, there was an increase in unemployment rates for workers with a secondary education (from 13 percent in 1994 to 15.45 in 2007).

Tunisia and most of the African countries need to address some important constraints and macroeconomic weaknesses, particularly the persistently high youth unemployment rates, especially among university graduates. They also need to continue strengthening the institutional and input prerequisites for a strong and competitive private sector-led development, and to continue implementing policies and interventions that open up opportunities for productive entrepreneurship and employment for all members of society.

**Sources:** AfDB, 2011; European Commission, 2010.

these countries may be a necessary input into the curriculum development planning of universities if they are to succeed in producing graduates who have the required skill sets for national development.

#### Entrepreneurship in higher-education curricula

Entrepreneurship is central to the growth and development of a country because it is the most important factor in bringing about innovation and new ideas that move an economy along.<sup>28</sup> The role of entrepreneurship in least-developed countries may be more critical to economic development than it is in high-income, developed countries. There is a consensus by governments and development agencies that the development of small- and medium-sized enterprises (SMEs) based

on entrepreneurial knowledge and spirit is critical for economic development. The role of entrepreneurship in development is not limited to economic/business activities; indeed, social entrepreneurs, political entrepreneurs, and other types of entrepreneurs are all equally important in moving the society forward.<sup>29</sup> African countries now see entrepreneurship as a way of reducing high rates of unemployment, especially among youth, and reducing poverty. In this regard, entrepreneurship in higher-education curricula should be prioritized.

The objective of entrepreneurship education is to assist young people to become innovators and active participants in the labor market.<sup>30</sup> Urban makes a distinction between traditional management education and entrepreneurship education:<sup>31</sup> while the former is functional and does not care about the stage of the

**Table 10: Entrepreneurship programs in the five countries**

Country	Doctorate	Master's degree	Undergraduate degree	Undergraduate module	Entrepreneurial activities	Outreach
Botswana		■	■		■	
Ethiopia						
Kenya	■	■	■		■	■
South Africa		■	■	■	■	■
Tunisia			■	■	■	

Source: Compiled by author from World Economic Forum, 2009.

enterprise, the latter is mainly concerned with the discovery and building phases of business. Entrepreneurship education is more concerned with developing skills, knowledge, and attitudes necessary to *build* a business, while traditional management programs are concerned with how to *manage* a business.

Entrepreneurship education is generally accepted as a separate field of study in higher educational institutions and is probably one of the fastest growing.<sup>32</sup> The fast growth of entrepreneurship education is mainly caused by demand from both students and businesses for entrepreneurial skills. Despite the importance of entrepreneurship, entrepreneurship education—at least at the university level—did not take off until the 1970s, when the first course in the field was offered at Harvard University. Currently, several universities in both developed and developing countries offer a variety of courses on entrepreneurship. For example, Stanford University in the United States offers a PhD program in entrepreneurship, and Kenyatta University in Kenya offers a master of science degree and a doctorate in entrepreneurship.

There is a wide variation in entrepreneurship education across the five African countries. Kabongo finds that while about half of all African universities he surveyed offer some courses or programs in entrepreneurship, few offer degree programs or specialization in that discipline.<sup>33</sup> While some countries offer entrepreneurship programs in which students can earn certificates up to doctoral degrees, others offer only courses; still others offer concentrations and/or extension services. In addition, curricula and pedagogical approaches to entrepreneurship education differ across countries and even across institutions within the same country. While some institutions stress coursework, others may stress practical training and experiential learning.

The pedagogical approach makes a difference in the quality and effectiveness of the entrepreneurship education students receive. For example, Styrdom and Adams report that when students were required to start and run a business as part of their entrepreneurship education at the University of Pretoria, after graduation they were more successful in forming businesses and engaged more in entrepreneurial activities than their counterparts who were not.<sup>34</sup> The result may suggest that practical training

may be extremely important in entrepreneurship education.

The types of entrepreneurship education offered in the five countries range from full-blown doctoral programs in Kenya through master's and MBA programs in South Africa to almost nonexistent programs in Ethiopia (Table 10). Most of the degree programs are either in business and management schools or in colleges of education; only a few science and engineering and other students get the opportunity to take courses in entrepreneurship. Generally, students from colleges other than business (and, in rare cases, engineering) get to take specializations or courses in entrepreneurship (where available) because of the exclusionary, discipline-focused nature of tertiary education in these countries.

Entrepreneurship education in Botswana has been embedded in the educational curriculum at all levels since the 1990s. The government's objective is for graduates from entrepreneurial programs to establish and grow SMEs as a way to reduce unemployment and spur economic growth. At the university level, entrepreneurship education is embedded in the business curriculum at the University of Botswana. There are no degree programs or specializations in entrepreneurship, but business students take courses in the field as part of their business education. Students also undertake experiential learning by being attached to businesses through the University of Botswana Business Clinic (UBBC), which is considered the ultimate experience in the student's entrepreneurship education. Since 2008, the UBBC has offered short-term training programs for entrepreneurs as well as occasional educational programs, such as Start and Improve Your Business (SIYB). Business students of the University of Botswana also have access to further business education through international business education organizations such as the Association Internationale des Étudiants en Sciences Économiques et Commerciales (AIESEC) and Students in Free Enterprise (SIFE).

Mafala's evaluation of the UBBC suggests that students who participated in the clinic gained some valuable experience although the clinic has not continued on a consistent basis for lack of funding and graduates' inability to get jobs.<sup>35</sup> Moreover, the review suggests that participants in the program are no more likely to start

or develop a business than their counterparts who did not participate. In addition, Moremong-Nganunu and others' evaluation of the SIYB program suggests that the program has no significant effect on entrepreneurial activities in Botswana, implying that entrepreneurship education in Botswana has not been effective.<sup>36</sup>

Ethiopia sees entrepreneurship as a way out of high unemployment rates and abject poverty. There are no degree programs or specific set of courses systematically devoted to entrepreneurship education at the country's universities. However, there appears to be a number of programs at vocational and technical training schools designed to develop skills. Several private universities that focus on providing business courses have been established in recent years, but no Ethiopian university has a program with strong industry linkages.

Entrepreneurship education has long been a part of the Kenyan educational philosophy and landscape. The publication of the *Kamunge Report* in 1988 put entrepreneurship education at the center of Kenyan tertiary education.<sup>37</sup> Kenya views entrepreneurship as a vehicle for self-employment, hence as a way to reduce unemployment, increase income, and reduce poverty. Entrepreneurship education is part and parcel of the curriculum of technical and vocational schools in Kenya. Its success is reflected in the fact that Kenyatta University offers both PhD and master's degree programs in entrepreneurship development, Moi University and the University of Nairobi offer undergraduate courses in entrepreneurship, and Higher Diploma degree programs are offered at Kenya Technical Teachers College. Training in these programs includes coursework, research, and attachment to industry. In addition, the government has established the Regional Center of Entrepreneurship Development at Kenyatta University for outreach activities in entrepreneurship. Besides research and teaching entrepreneurship as a genuine field of academic study, Kenyan universities are also engaged in training teachers of entrepreneurship for secondary and vocational training schools.

Although there has not been any formal evaluation of the effectiveness of entrepreneurship education in Kenya, it appears that this training has been successful. Kenya is one of the most dynamic countries in Africa when it comes to the development of SMEs, especially in the ICT sector. While a large proportion of SMEs established may fail or may not grow, the fact that they continue to be established in both the formal and informal sectors suggests that entrepreneurship education in Kenya has succeeded in developing the entrepreneurial spirit that gives confidence to would-be entrepreneurs to start new businesses.

Entrepreneurship education in South Africa is institutionalized by the Higher Education Act of 1997, which reformed the higher educational system. In addition, the National Small Business Act of 1996 mandated entrepreneurship education. The government of South

Africa established the Small Enterprise Development Agency that is linked to its Outcomes Based Education Strategy. The objective of education reforms in South Africa is the development of skills—especially technical and entrepreneurial skills of the majority of citizens—to increase economic growth as a way to reduce unemployment. Several South African universities and academic departments provide entrepreneurship education.

As in most countries, the degree to which entrepreneurship education is embraced in a university's education agenda differs across universities in South Africa. While some universities offer entrepreneurship as a full degree program at both graduate and undergraduate levels, others offer it as a concentration within a degree program (such as an MBA); still others offer a course or two in entrepreneurship studies within another degree program. Entrepreneurship education is more likely to be offered by the universities of technologies that focus on training people in technical skills than by those universities that focus on training students for intellectual endeavors. Most South African universities that offer these programs do so through their colleges of business or commerce; some universities, however, provide an entrepreneurship module within engineering degree programs. Most of the universities that offer entrepreneurship degree programs also engage in outreach activities, in part because these activities generate incomes for the institutions. Pedagogy involves both coursework and practical training; however, the relative weight given to coursework and experiential learning differ across universities and programs.

An important aspect of entrepreneurship education is the pedagogy used in training these students. There is evidence that, at least in South Africa, entrepreneurship education is more effective when there is an element of experiential learning involved. Whether entrepreneurship education is succeeding in creating a class of entrepreneurs in South Africa or not is not yet known, since there has not been a systematic evaluation of these programs. However, the *GEM 2006 South Africa Country Report* suggests that: (1) entrepreneurship education does not encourage entrepreneurship as a career, (2) a paradigm of entrepreneurship does not exist in South Africa, and (3) entrepreneurship skills are lacking in South Africa.<sup>38</sup> The report's conclusions suggest that entrepreneurship education may not be achieving its objectives.

In Tunisia, entrepreneurship education is embodied in law as enshrined in the 2002 Educational Reform Act.<sup>39</sup> Entrepreneurial skills are to be developed through individual and group activities in all courses within the educational system. Thus not only does the law require that entrepreneurship education be implemented in every course in the entire educational system, it also suggests the pedagogical approach to be used to achieve this objective. To provide for entrepreneurship activities, Tunisia established several technology parks to spur business incubation, especially in the field of ICT. These

**Table 11: Higher education expenditure in five countries and the world**

Country/Region	Per capita expenditure (US dollars)	Education expenditure/GDP (percent)	Education expenditure/government expenditure (percent)	Tertiary expenditure/education expenditure ratio (percent)	Per student expenditure/GDP per capita
Botswana	4,600	8.1	21.3 (2008)	12.5	313.4
Ethiopia	863	5.5	23.0	20.0	683.4
Kenya	1,600	7.0	17.9	16.0	235.4
South Africa	1,934	5.1	16.2	13.0	98.2
Tunisia	4,634	7.1	23.4	28.0	64.1
Africa	2,000	7.2	22.4	22.0	292.7
World	4,600	5.3	15.5	22.0	124.4
			<b>12.0 (OECD)</b>		<b>28.0 (OECD)</b>

Sources: SARUA, [www.sarua.org](http://www.sarua.org); UIS, 2008; World Bank, 2010b.

parks are to collaborate with higher educational institutions, including students and research organizations to develop new businesses.

### Financing higher education

Financing higher education in most African countries has generally been a challenge, and—at a time when the continent can least afford not to expand in this arena—the challenge has become more difficult. Indeed, per student spending on tertiary education has been declining in recent decades. The World Bank estimates that between 1990 and 2004, per student expenditure in African tertiary educational institutions *decreased* by 4 percent a year.<sup>40</sup> Compared with other parts of the world, tertiary education financing on the continent remains inadequate.

Resources available to finance tertiary education in the five countries are far lower than elsewhere (Table 11). For example, the average per student expenditure in tertiary education in Africa is about US\$2,000, while the world average is US\$4,600. Rapid increases in enrollment combined with slow growth in funding suggest that there will be large expenditure gaps in the five countries.

The relative lack of adequate resources to finance tertiary education in some of these countries may be due to low incomes. However, they devote a larger share of their GDP to fund tertiary education than the rest of the world (Table 11). Similarly, they devote even larger proportions of government expenditure to education than the rest of the world, and the share of national education expenditures that goes to tertiary education is larger than the average for the rest of the world. The ratio of per student expenditure to per capita GDP is much higher in Africa than in the rest of the world. For example, in 2007, the per student expenditure on tertiary educational institutions in Africa as a ratio of per capita GDP averaged about 2.93 compared with the world average of 1.24 and 0.28 for OECD countries.

There is, however, a wide variation in tertiary education per student expenditure/GDP per capita

ratios across the five countries. For example, while this was 6.83 in Ethiopia, it was 0.64 in Tunisia. These figures suggest that, on average, these countries may be making greater efforts to finance education than other parts of the world.

Tunisia, the country that devotes most resources to tertiary education of the five, exemplifies the high education-funding effort that still leads to low absolute expenditures on education. In 2008, Tunisia spent 7.4 percent of its GDP on education (2.04 percent on tertiary education) compared with 5.3 percent in OECD countries; 23.4 percent of its government expenditure was for education, while the OECD average was 13.4 percent. However, in the same year, Tunisia's per student spending on tertiary education was US\$4,634, compared with the OECD average of US\$9,984 in PPP. The difference in absolute per capita spending stems from differences in per capita GDP; the lower per capita GDP in Tunisia translates into lower absolute per student spending, given the expenditure/GDP ratio. However, per student expenditure on tertiary education in Tunisia exceeds those of countries in its income level.

Although the financing of tertiary education in Tunisia is below OECD standards, it is comparable with that of middle-income countries. Funding in other countries, such as Ethiopia, is woefully inadequate for any level of income. Ethiopia's per capita student spending of US\$863.00 in 2007 is far less than adequate for quality tertiary education. Regardless of the amount of resources devoted to tertiary education, the mechanisms for allocating it among universities in a system vary across countries.

An important aspect of tertiary education expenditure is its efficiency. There are two aspects of efficiency—internal and external. *Internal efficiency* refers to whether the allocation of expenditure leads to an optimal mix of inputs to produce tertiary education effectively. Internal efficiency is measured, among other things, by the ratio of capital expenditure to total expenditure, and the proportion of recurrent expenditure devoted to instructional staff. *External efficiency* refers to the ability to allocate funding to effectively produce what society expects

the universities to produce. External efficiency is measured by such outcomes as returns to different levels of education, producing the appropriate skill mix for the economy, and employment rates among university graduates.

The efficiency of spending varies among the five countries. In Tunisia, for example, the ratio of capital to total expenditure, the share of current expenditure on instructional staff, and the student/teacher ratios are 25 percent, 64 percent, and 19 percent, respectively. These are similar to OECD averages of 34 percent, 66 percent, and 15 percent, respectively. At the extreme end, the averages for Ethiopia are 9 percent, 50 percent, and 41 percent, respectively. Figures for the other three countries lie between the two extremes. Regarding external efficiency, it is clear that returns to tertiary education in all the five countries are high, suggesting the possibility of external efficiency. However, returns to education are a function of labor market policies as well as the growth of demand for skills.

Employment measures of external efficiency, on the other hand, suggest the existence of external inefficiency in the five countries. The fact that there is a high rate of unemployment among these graduates suggests that external efficiency has not been achieved. Even in Tunisia, unemployment among university graduates was estimated to be 19 percent in 2008, and it is not uncommon for Tunisian university graduates to take up to 60 months to get a job.

Financing for tertiary education in the five countries comes from several sources: government, student fees, private-sector gifts, international development agencies, and other donors (Table 12). While the government is the source of practically all financing of tertiary education in Tunisia, Botswana, and Ethiopia (75–85 percent), it provides about 40 percent of the funding in South Africa. The distribution of the funding is allocated differently among specific institutions in tertiary educational systems in the five countries. For example, in South Africa, the universities of technology rely more on government funding than general universities do.

In South Africa, government funding of higher education is based on the principles of shared cost, equity and redress, and development. Because both student and society benefit from education (except in the cases of public goods, such as nursing, in which the public is the major beneficiary), the principle of shared cost suggests that both the student and government should contribute to the provision of education. The principle of equity and redress implies that nobody should be denied an education on the basis of race, gender, or socioeconomic status, hence these factors should be considered in funding tertiary education. The principle of development links higher education funding to the production of highly qualified skills to meet national development needs.

**Table 12: Sources of financing for higher education in five countries, 2008 (percent)**

Country	Government	Student fees	Own revenue sources
Botswana	78.0	22.0	0.0
Ethiopia	75.0	15.0	6.0
Kenya (2007)	60.0	39.6	4.0
South Africa	40.0	28.0	33.0
Tunisia	85.0	16.6	1.5

Sources: Authors' calculations, based on UIS, 2009 and government sources.

The government allocates subsidies to tertiary educational institutions through the South African Post-Secondary Education Foundation based on a formula that is driven by enrollment. Besides the formula-driven subsidies, tertiary institutions receive extra funding earmarked for capital projects, municipal assessment, financial aid schemes, and funding for redress. A system of rewarding institutions for research productivity has been implemented. Since 2004, funding has been based on plans drawn up by institutions to achieve the government's national policy goals.

The next-largest source of revenue for universities in these countries is fees paid by students. The proportion of students' contribution to financing tertiary education varies among the five countries (28 percent in South Africa and 39 percent in Kenya, for example). A large part of government funding in public universities goes to support student welfare, such as food and housing, rather than tuition. It is only in a few cases, such as South Africa and Kenya, that students are required to make modest contributions to tuition payment.

A second group of students, not supported by the government (e.g., the Module II students in Kenya), pays the full cost of their education in public universities as if they were in private universities. In Kenya, 39 percent of all students admitted to public universities were in this category. In Botswana, Ethiopia, South Africa, and Tunisia, there are efforts to increase cost recovery in tertiary education. On the other hand, Botswana's government directly pays for students to attend private tertiary institutions.

Governments have devised several mechanisms to make it possible for students to pay their share of the cost of their tertiary education: grants; loans guaranteed by the government; and graduate taxes, as in the case in Ethiopia. The essence of the graduate tax is that payment for the cost of education is deferred until after graduation. While loan schemes have been implemented in all the five countries, evidence suggests that loan repayment remains a challenge.

A third source of revenue for university financing is internally generated funds. These are mainly from tuition fees for part-time studies, certificate courses, ICT courses, distance education, and other market-driven courses. For example, in Ethiopia, while full-time students in public tertiary educational institutions pay no tuition fees, all part-time students in these institutions pay modest tuition fees. In addition to these fees, universities also generate modest revenues from contract research and other services that they provide to private businesses and the community as a whole. The amounts of income generated from this source differ not only across countries but also across institutions in the same country. For example, while this source of revenue is almost absent in Botswana and Tunisia, it is sizable in South Africa.

There is very little external support for tertiary education, including international resources. However, there is indirect support through graduate scholarships, research collaboration, and student and faculty exchanges. In general, there is not much financial support of tertiary education from the private business sector in these countries.

The cost of tertiary education and the funding mechanisms in each country depend on the objectives of the government and the political economy of education in that country. For example, in Tunisia, the government pays about 85 percent of tuition and provides scholarship, grants, and loans that are means tested. In addition, tuition is deliberately kept low to ensure equitable access for all socioeconomic classes. Admission to tertiary institutions, however, depends on performance in entrance examinations, secondary school grades, coursework, and enrollment quotas placed on specific programs. Private institutions are allowed to charge higher tuition fees than public ones. Affordability is ensured through a system of grants and loans that makes it possible for students from low-income households to participate. However, there is evidence of socioeconomic inequality since a disproportionately larger share of university students come from middle- or high-income backgrounds. On the other hand, students pay a larger share of the cost of tertiary education in Kenya and South Africa than in the other three countries.

The current systems of funding tertiary education in the five countries face challenges on issues of equity: students from well-to-do families tend to benefit at the expense of students from low-income ones. Students from high-income households are more likely to gain admission to universities and benefit under the current systems than students from low-income backgrounds. In the same way, the existing funding systems are likely to benefit urban areas at the expense of rural areas and those without good secondary schools. If there is gender inequity in university admission, as is the case with Ethiopia and Kenya, the current funding approaches will perpetuate the gender inequity in tertiary education.

The discussion above shows that governments have been the major source of funding for tertiary education in the five countries. With the possible exception of Tunisia, this funding has not kept up with the rapid growth in enrollment, resulting in decreases in per student funding. Given the relatively low growth of some of these economies and the fact that most African countries have just started demographic transitions, it is unlikely that government revenues can grow fast enough to keep pace with enrollment growth in the foreseeable future. Thus there is a need to find new and innovative ways of financing tertiary education in African countries.

### University-industry linkages

Universities and other tertiary educational institutions have and continue to play leading roles in the development of societies, training skilled labor for the economy and creating processes and knowledge that lead to new products and technologies. The quality of human capital and tertiary institutions determines which countries move to the technology frontier in the world and which countries do not.<sup>41</sup> If skilled labor trained by these tertiary institutions is to be useful to the economy, it must meet the needs of the economy. Hence the tertiary institutions must take into account the skill needs of the society. If knowledge created in these institutions is to be useful to society, it has to be transferred to industry rather than kept in the labs of the institutions. This knowledge transfer can be achieved through constant communication and collaboration between universities and industry in R&D as well as other innovative activities. UILs therefore become critical if the universities are to play meaningful roles in the development of nations. UILs focus on how universities interact with industry as a whole for their mutual benefit and to support the development of countries. In addition, countries with a developed private sector that enables entrepreneurship to flourish are likely to tap into UILs by creating a domestic market for university-produced technologies.

In an era of open innovation, R&D efforts in industry alone are not sufficient to drive innovation in a country;<sup>42</sup> innovation requires strong UILs. UILs have been instrumental in the development of industrialized countries. In the United States, for example, research from land grant universities fueled the development of modern agriculture and agro-industries; current innovation revolves around universities creating growth poles such as California's Silicon Valley and Boston's Route 128. In the developing world, there are strong UILs in countries such as China, Korea, and Brazil, among others. UILs provide incentives for universities to conduct research with practical applications through the funding they receive from industry; in turn, industry is able to influence the type of research conducted by universities.

**Table 13: University-industry linkages and competitiveness in Africa: GCI 2010–11 rankings**

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.

In parts of the world—such as Silicon Valley and Route 128, where universities have been catalysts for economic and social development—the universities have not only transformed themselves as entrepreneurial institutions that commercialize the technologies they have invented, but they have also worked closely with businesses to develop innovative ideas. Entrepreneurial universities are those that seek and recognize opportunities, take risks, and work with businesses or other organizations to exploit these opportunities.

The ability of universities to forge linkages of course depends on the political environment as well as the governance structure within which they operate. UILs are likely to emerge in environments where governments promote these linkages and where universities have autonomy to pursue opportunities when they arise. Unfortunately for many African countries, there are few university systems that take UILs seriously, with the possible exception of South Africa and Tunisia. Although there seems to be some evidence of UIL policy borrowing by some African countries, it appears that these efforts do not involve local industries. For example, Kruss and Peterson report that, while there is evidence of some UIL in the pharmaceutical industry in South Africa, none of the collaboration involves local pharmaceutical companies as a university's partner; the universities seem to work exclusively with foreign companies.<sup>43</sup> African tertiary institutions have not, and are not, leading the way in innovation, leaving the continent less competitive internationally.

The rankings of these countries in innovation competitiveness show that two of the countries—Botswana and Ethiopia—do not fare well in this regard. Tunisia, South Africa, and Kenya, however, rank relatively highly in this area (Table 13). In the area of university-industry collaboration in R&D, only South Africa is ranked in the top quartile of countries out of the 139 surveyed in the GCR 2010–2011. There are wide differences among the five countries, with the rankings ranging from South Africa's 24th to Ethiopia's 101st position.

There are several reasons why UILs are weak in Ethiopia and in most of the African countries. It is pos-

sible that there is a dearth of experienced research talent able to identify problems facing local industry and formulate a research agenda to solve them; there is also a lack of large pools of researchers in these countries that could collaborate to solve industry problems. Second, given the small sizes of enterprises in African countries and their less-developed private sector, it is most likely that their industries lack the ability to absorb new technologies. The result is that, even when universities do develop new technologies, there may be no innovators to bring the technology to the market either through the development of new products or through the development of new processes.

A related obstacle to the development of robust UILs is the low level of R&D expenditure by African industry. In none of the countries studied does R&D expenditure exceed 1 percent of GDP, and most of this is spent by the government. The presence of UILs is predicated on industry funding basic or applied research in universities. With low research funding, university faculty are forced to use all their time teaching and the only role business plays in tertiary education is to suggest curricular changes. Besides, with little to no research funding from industry, university faculty have no incentives to work with industry.

Botswana does not seem to have any well-documented and articulated national UIL policy, although there is the general expectation that university and business will collaborate to solve the country's development problems. However, some faculty members at the University of Botswana (UB) collaborate with industry to conduct joint research. For example, faculties in engineering, geology, and hydrology at the UB have collaborated with the water sector. Similarly, the Department of Agriculture at the UB conducts research on animal husbandry and the beef-exporting sector in Botswana. In addition to the UB, special research institutions such as the Okavango Delta Basin research project also have a major impact on water and land management in Botswana.

In Ethiopia, the National Science and Technology Policy (NSTP) of 1993 mandated tertiary educational institutions to help build, generate, select, upgrade, and

disseminate appropriate technology for the development of Ethiopia. The NSTP was not mandated to encourage or facilitate UILs, and, as a result, it has not been successful in UILs. However, some individual faculty members and groups have made attempts at forging university-industry relationships. For example, the technology faculty of Addis Ababa University formed the Technology Faculty Industry Linkage (TFIL) in 2000 to foster collaboration between the engineering faculty and industry. This effort failed for lack of funding. There were attempts to replace TFIL with the Higher Education Industry Resources Integration Center (HEIRIC), funded by industry and the Chamber of Commerce. HEIRIC also failed for lack of funding and general support. Overall, UILs in Ethiopia have not succeeded partly because of the over-concentration of UIL activities in Addis Ababa, with no linkages to different regions and enterprises, and partly because of a lack of interest from researchers, a lack of skills, and a lack of funding.

However, there are examples of successful linkages between foreign universities and industry in Ethiopia. One example is the highly successful small-scale agricultural extension program of Haramaya University, a largely experiential BSc program in agriculture that forces the faculty to bring the classroom to the field. The program provides constant extension services to small-scale farmers and also helps the academic staff to revise their curricula to reflect local conditions.

Although Kenya does not have a national policy on UILs and does not vigorously promote such linkages, there do exist some linkages between individual academic departments in a few universities and some industries at the student and faculty levels. Most degree programs in business, engineering, law, and ICT in Kenyan universities require internship and industrial attachment for graduation. Two private universities in Kenya—Strathmore University and the United States International University—require industrial attachment for *all* degree programs. In addition, a few university departments have signed collaborative agreements and conduct joint research with industry. For example, in 2006, Safaricom Kenya Limited signed an agreement with Moi University to set up and support a modern telecommunications laboratory on the latter's campus. The agreement also included faculty internship at Safaricom so the former could improve their skills at the university's laboratories.

Kenya established the National Council for Science and Technology in 1977 to advise the government on technology and UILs. In addition, the government provides research grants to faculty through the Commission for Higher Education. The report of the Taskforce for the Development of National Strategy for University Education in Kenya of 2008 suggests that there exist formal channels for university-industry relationships, but that these channels are not fully used by either side.<sup>44</sup> The report also suggests increasing R&D expenditure

to 1 percent of GDP and establishing a venture capital fund to finance technology transfer from university to industry. The report suggests several strategies to make these linkages effective. One is to establish a national policy on university-industry collaborative research; another is to develop policies on university-industry innovation clusters and/or technology parks, and yet another is to promote joint research between universities and industry and other research organizations.

In addition to local universities, Kenya hosts a large number of local and foreign research institutes, some of which are affiliated with foreign universities that interact with local industry, government, and other research institutions. For example, the International Livestock Research Institute has been instrumental for the development of the Kenyan livestock industry, while ICRISAT Nairobi has been instrumental in the development of semi-arid agriculture in Kenya and the rest of East Africa. These institutions employ a large number of Kenyan science graduates who then go on to work with either industry or other academic institutions, thus transferring research skills to industry.

South Africa spent about 0.98 percent of its GDP on R&D in 2007, a ratio that is lower than those of OECD and East Asian countries, but comparable to those countries that are in similar stages of development, such as Brazil. Of the 0.98 percent of GDP spent on R&D, 58 percent—more than half—comes from industry, suggesting a strong potential for meaningful UILs. The Higher Education Act of 1997 gave South African universities three missions: social and industry outreach (mainly market-driven, entrepreneurial activities based on spinoffs of research results), research parks, and university-business joint research. The well-endowed universities emphasize research, while some of the less-well-endowed—such as the universities of technology—focus more on teaching and skilled development missions.

South Africa adopted a comprehensive science and technology (S&T) policy in 2002 to bring structural transformation to the economy based on developed-country models of encouraging collaboration among tertiary institutions, industry, other research institutions and government.<sup>45</sup> While UILs are not widespread in South Africa, a few industries have forged linkages with universities based on the abilities of universities to help solve specific industry problems. Large mining companies that need the specific research skills of universities to complement the work of in-house research have forged research alliances with universities; so has the wine industry. In the ICT sector, Telkom South Africa has established centers of excellence in selected engineering departments to conduct joint research.

South African universities are not making much effort to commercialize their research results. For example, the HIV/AIDS vaccine project at the University of Cape Town has very little UIL with local industry. Where South African universities collaborate with

industry, they do so with foreign companies rather than local ones, as in the case of the biotechnology industry. However, the wine industry collaborates with South African universities in R&D. In a survey of a large number of firms, Kruss and others found that only large, technology- and export-oriented firms engaged in collaborative research with universities.<sup>46</sup> Large mining companies with large internal research departments collaborate with universities, while a large number of SMEs do not.

Between 1998 and 2006, enrollment in computer science in tertiary institutions in Tunisia increased from 4,000 to 40,000. In addition to the rapid expansion of science education, the government has also established six technology parks distributed across the country and has financed technology transfers and adoption through the Société d'Investissement en Capital à Risque (SICAR). Tunisia spends about 2 percent of its GDP on R&D, a proportion comparable to the low end of that of OECD countries and far higher than lower-middle-income countries. The government provides 80 percent of research funding, and university research absorbs 67 percent of R&D expenditures in Tunisia.

UILs, which are coordinated by the Higher Council for Scientific Research and Technology, are crucial if the government is to achieve its objective of rapid technical transformation and get a return on its investment. Innovation policies that encourage UILs have been implemented through a series of programs, including the 1992 Research Results Valorization, which funds projects involving partnerships among industry, universities, research organizations, and professional groups. Less than 100 projects have benefitted from this project so far. The 1994 Decree 94-536, Premium Innovation Research and Development, supports original research leading to the development of new products or process. The government pays up to 50 percent of the cost of the project; to date about 43 projects have been submitted by 40 companies for consideration.

In 2003, the Federative Research Program was created with the intention of setting industry, research institutions, and universities to tackle problems in nationally defined priority areas, such as ICT, biotechnology, and water. The National Program of Research and Innovation was set up in 2003 to respond to Tunisian industry needs for innovation and improvement in competitiveness. Projects on innovation were to be collaborative efforts between universities, industry, and other research institutions. UIL efforts in Tunisia seem to be top-heavy and mandated, organized, and financed by the government, with no organic development of the relationship between universities and industry. It is not clear to what extent these relationships have been successful.

### Lessons, challenges, and the way forward

The five African countries considered in this chapter have shown both similarities and differences in their approaches to increasing the efficiency and efficacy of their tertiary educational systems. Some have been more successful in various ways than others—for example, some have achieved gender parity in enrollment, but some have not. The next section considers the lessons that can be learned, the challenges that lie ahead, and the way forward for African countries to make higher education a key player in its development efforts.

### Summary and lessons

Enrollments in tertiary educational institutions in the five African countries over the last two decades have increased rapidly—by an average of more than 200 percent—with Ethiopia recording a much faster rate of expansion than the others. This was faster than the enrollment growth rate in any other region of the world. Progress has been made toward gender parity in tertiary education enrollment in all five countries, and three have achieved full gender parity to date. In spite of the rapid growth in enrollment, the GERs continue to rank among the lowest in the world: Ethiopia's GER comes in at less than 2 percent. Tunisia, however, has seen an increase in enrollment ratios up to international standards. Socioeconomic and regional inequity, as well as gender inequity, have occurred in some cases.

The majority of students are enrolled in the social sciences and the humanities; there is relatively low enrollment in the SET and mathematics fields. However, most of these five countries have not been able to transform their tertiary educational systems to meet the needs of their increasingly technology-driven economies. The result is that a large proportion of graduates have acquired skills that are less in demand, while skill shortages abound. The mismatch between skill needs and skills produced by these institutions is manifested in increased unemployment among graduates in the midst of skill shortages. Another consequence is the emigration of some of the graduates.

Funding has not kept pace with increasing enrollments, with the result that per student funding has decreased by an average of 4 percent annually over the period 1994–2004. This has happened in spite of the fact that these countries spend a larger proportion of their resources on tertiary education than do other parts of the world. Low per student funding has resulted in a deterioration of physical infrastructure; inadequate library and laboratory space; increased student/faculty ratios; and, in some cases, inadequately qualified senior professors to guide the academic enterprise. The net result is that the quality of tertiary education has decreased by international standards, along with the rapid expansion of enrollment. A major reason for the decrease in quality is the inability of government to finance the rapid growth in tertiary education.

The inability of the public-sector institutions to absorb the increasing number of students seeking admission has led to the rapid expansion of private tertiary education in these countries. Often, these private institutions provide programs that are in high demand at reasonable cost, and although they charge the full cost of providing this education, in some cases they even make a profit. The rapid growth of private tertiary institutions and their ability to compete with publicly funded institutions suggests two things: (1) some tertiary education students are capable of paying for their own education and the government need not support them, and (2) the cost of providing a tertiary education in the public sector may be too high, and efficiency may need to improve in publicly funded tertiary institutions. These two factors suggest that governments should be judicious in financing students at the tertiary education level, financing only those who are unable to pay for their education and ensure an efficient allocation of funding in these institutions.

Entrepreneurship education has not been systematically incorporated into the curricula of tertiary institutions in many of these countries. In most of them it is not offered at all as part of the university curriculum; in cases where it is taught, it is not offered as a major or integrated into the whole curriculum, leaving it as a series of disjointed courses. The only exception is Kenya, where some universities offer master's and doctoral degrees in entrepreneurship. Similarly, in spite of the need for university-industry collaboration to spur development, these countries do not have well-articulated and established UILs, suggesting that tertiary institutions may not be contributing to the development of industry in the countries.

Countries have different structures of tertiary education governance. These may manifest themselves in differences in efficiency and in their ability to adjust to new circumstances in order to take advantage of new opportunities to train students in innovative directions. Despite written policies that purport to provide tertiary institutions with operational autonomy, some governments still exert political control over their day-to-day administration. Internal governance of tertiary institutions has not been efficient by international standards, as a relatively larger share of tertiary education expenditure goes to current expenditure than is optimal, and a lower percentage than optimal is spent on instruction. Given that graduates frequently remain unemployed in the face of skill shortages, one can argue that these tertiary institutions are not externally efficient either.

Tertiary education efforts and outcomes in Tunisia seem to be the exception among the five countries. Tunisia's experience suggests that it is possible to simultaneously and rapidly expand tertiary education enrollment, ensure gender equity, improve quality, and redirect education toward fields that are deemed national priorities. At the same time, Tunisia transformed its

tertiary education curricula to one emphasizing S&T without compromising quality. Indeed, Tunisia's tertiary educational system was consistently ranked in the top quartile worldwide.

The experiences described in these case studies—in particular, the Tunisian experience—offer lessons for African countries on how to expand tertiary education. The first lesson is that tertiary education in Africa can be dramatically expanded, transformed, and improved at the same time. Second, such improvements and expansion require an increased infusion of resources because expansion and quality improvement cannot be had “on the cheap”—Tunisia spends a relatively large proportion of its national resources on tertiary education. The third lesson is that education policy and efforts should be intrinsically linked to national development policy and that tertiary education reforms should be part and parcel of education reforms generally. The Tunisian reforms were linked to national priorities; tertiary education policy was linked to economic development, research, and industrial policies. Tertiary education reforms are likely to fail if pre-tertiary education is also not reformed. In Tunisia, education reforms involved transforming the pre-tertiary education curricula to emphasize science, mathematics, and information technologies, thus making it possible for the reforms at the tertiary levels to be successful. The fourth lesson is that tertiary education requires a continuous and full commitment from the government. In Tunisia, education reform was a central priority of the government, which often initiated and pushed the reforms from the top. Finally, education reform is a continuous process—policy reforms may need continuous monitoring and revisions.

### Challenges

There are several challenges facing these five countries as they provide tertiary education for their growing populations. The inability to meet the rapidly expanding demand for tertiary education that is partly caused by the burgeoning demographic transition is a major concern. Among the challenges are the need to overcome capacity constraints; to prevent or reverse declines in quality; to ensure the relevance of tertiary education to the countries' needs and also its contribution to industrial development; and to provide for its cost, financing, and governance. These challenges are likely to persist in the coming years and need to be addressed.

The tertiary educational systems in these countries face the major problem of their inability to generate enough resources to finance the expansion needed to meet increasing demand. While demand has been growing at exponential rates, the resources to finance that expansion have, at best, grown at arithmetic rates, thus setting up a Malthusian catastrophe in tertiary education. The typical response has been to expand capacity without resources to support the expansion, resulting in decreased quality, increased student-faculty ratios, a

deterioration of the physical infrastructure, and the use of often inexperienced or adjunct faculty to staff courses. The faculty has very little time for research, thus decreasing knowledge creation. Another aspect of the preoccupation with teaching is the inability to reform the curriculum to reflect the needs of the country, thus making tertiary education less relevant. Most of the countries are therefore producing graduates who are not employable in the midst of skill shortages. The lack of research efforts and productivity on the part of faculty means that tertiary institutions cannot collaborate with local industry to solve countries' development problems.

Exacerbating the inability to finance expansion of tertiary education is the fact that, in most of these countries, governments bear an overwhelming financial burden. For example, in Tunisia, Botswana, and Ethiopia, about 80 percent of the cost of tertiary education is borne by the government regardless of the student's ability to pay. Worse, students are funded whether or not they study subjects in fields that countries regard as national priorities. In addition, the systems of funding create social inequities. Often the systems of rationing university admissions also create socioeconomic and regional inequalities. If there are gender inequalities in admissions, a gender bias is added to these inequalities in funding. Such a system of funding perpetuates and indeed expands social inequalities in society.

The lack of adequate funding means that tertiary institutions are not able to attract the best faculty in their specific fields, which leads to quality decline; nor are they able to retain those they have on staff. In an increasingly globalized world, these tertiary institutions face a global market for academic talent and should be prepared to offer competitive wages and working conditions to attract and retain staff.

An essential aspect of any quality academic environment is one of shared governance and academic freedom. Unfortunately, in some countries, academic departments have very little input in terms of course and curriculum design and faculty evaluation. Promotion and tenure decisions tend to be politicized, making it difficult to recruit and retain good faculty. At the systems level, the leadership of institutions and the highest policy-making bodies are usually appointed by either the head of state or government, or the minister of education.

These tertiary institutions also face a cost structure that is too high, in both absolute and relative terms. Some countries are spending three to four times per capita GDP on a tertiary education student, compared with 40 percent in OECD countries. Part of the higher cost of producing tertiary education is a result of the low quality of inputs. The high cost of producing tertiary education in African countries may also be due to the relatively small sizes of individual institutions, especially as individual institutions in a system compete to

provide similar programs. Finally, tertiary institutions in these countries are extremely costly because they tend to provide services to students—such as food, housing, and healthcare—that are not part of education itself at no cost to the students. These services are provided by governments because they are politically popular. The challenge is for governments to find the political courage to eliminate these expenditures.

### The way forward

The major challenges facing tertiary education in African countries are how to expand access and at the same time improve quality and relevance, how to make it more equitable, and how to provide adequate financial resources. Overcoming these challenges will involve a massive expansion and restructuring of tertiary educational systems in particular, and education generally. Based on the evidence from the five countries, this should be based on three pillars: quantity and equity, quality and relevance, and financing.

#### *Quantity and equity: Expanding access*

One of the major challenges facing African countries is providing enough resources to expand access to tertiary education. Part of the problem can be traced to governments' willingness to finance everyone who gains admission to a tertiary institution. One way to expand access is to make students contribute to their own education. This is already occurring in some African nations, such as Kenya, through cost recovery and Module II programs, but the scope needs to be increased. Given that private returns to tertiary education are high in African countries, cost recovery should be increased and, where possible, governments should aim for full cost recovery. The popularity of private, for-profit providers of tertiary education in Africa suggests that a large number of students can afford to pay fully for their tertiary education.

Second, to ensure that the right sets of skills are acquired by students, government support for tertiary education should be geared to high-priority fields for the nation's development. It should not cover student welfare expenditures, since these are not related to education. This approach to funding would allow government to support more students who are truly needy, and would also introduce some form of equity into the financing of tertiary education in African countries.

Expanding access also would entail providing different pathways to higher education. The current system of admissions is focused almost exclusively on secondary-school graduates and full-time students; there should be a mechanism to admit nontraditional students who may not attend a tertiary institution on a full-time basis or who may attend through Module II.

One possible way of expanding access to tertiary education is through the use of ICT for distance learning. Most providers use either a residential model or an

on-campus delivery system. This is one of the reasons why the per course cost of higher education in Africa is so high. A possible way around this is to use ICT to deliver tertiary educational instruction through distance learning. Another possible way to reduce the unit cost is through increased specialization by institutions. Although most African tertiary institutions were set up to cater to certain specialties, recently most have started to offer the same sets of courses and programs. The result is that they do not excel in any area. More importantly, because tertiary institutions try to provide a small portion of every discipline, the unit cost of providing any specific program is high because institutions are not able to take advantage of economies of scale. To take advantage of economies of scale, differentiation among tertiary educational institutions needs to be encouraged.

Given that the public sector is unable to meet the demand for tertiary education in the foreseeable future, private provision of tertiary education is increasingly critical. Governments should provide the appropriate regulatory framework and the right incentives for the private sector to expand their provision of tertiary education. These incentives may include student loans, tax holidays, subsidies for the construction of infrastructure, subsidies to hire faculty, the ability to bid for government research grants, and the ability of students to use government scholarships to attend private tertiary institutions. To ensure quality, all private tertiary education providers in a country should be brought under same quality assurance mechanisms as the public universities and should be continuously monitored. There could be public-private partnerships in the provision of tertiary education in which the private sector may be contracted to provide some services (e.g., housing) directly to students.

### *Quality and relevance*

The quality of education is more important than the quantity for development outcomes. This implies that, for African countries to benefit from improved tertiary education, they should focus with laser-like precision on improving quality and relevance even as they struggle to increase quantity. This can be achieved only through a radical restructuring of existing tertiary educational systems by carrying out curricular reforms, instituting appropriate funding mechanisms, and providing incentives.

The central focus of any reform should be high-quality improvements and upgrades. The quality of any output or service partly depends on the quality of its inputs—physical infrastructure, faculty, staff, and, above all, management. Maintaining infrastructure and retaining faculty and staff should be the top priority. While workers are trained in these countries with the appropriate skills to become high-quality faculty members, they have often emigrated because of poor working conditions in their home countries. Tertiary institutions could attract appropriate talent by providing appropriate

working conditions, including academic freedom, shared governance, and research support. Improving quality would also involve setting quality standards and strengthening the oversight of quality assurance bodies.

No systematic quality control mechanism exists either through accreditation boards or internal self-study, or through periodic program evaluations. The result is that programs continue to be offered long after they have outlived their usefulness or when their quality is not up to the desired standards. Quality assurance bodies could set minimum standards expected of graduates and researchers from such programs, and tertiary institutions should be held accountable for reaching these standards. Programs that consistently fail to meet these minimum standards should then lose their accreditation. Another way to ensure high quality is to link the funding of universities to quality outcomes; institutions that consistently meet or exceed these standards would have their funding increased, while those that consistently fail to meet these standards would have their funding decreased.

A focus on quality without relevance to the needs of Africa is an inappropriate and inefficient way of providing tertiary education for Africa. To make it relevant, curricula must be completely restructured. The emphasis should be on moving from an emphasis on social sciences and the humanities to one focusing on science, engineering, mathematics, and entrepreneurship with particular application to African problems. The curricular redesign should involve inputs from industry and non-tertiary academic institutions, as well as other stakeholders. If the curricula are to focus on the solution of African problems, then the pedagogical approach should be one of experiential learning. Experiential learning can also be conducive and supportive of strong UIIs in Africa, which would also encourage the private sector to support tertiary institutions.

A radical restructuring and redirection of tertiary education toward S&T is not likely to be successful unless primary and secondary education is also redesigned to emphasize S&T to prepare students for the new curriculum at the tertiary level. Finally, it may be necessary for tertiary educational systems to move away from the disciplinary silos approach and allow students to take courses from many disciplines before declaring a major. Allowing students to pursue a program of general education before specializing in a particular field will not only broaden the outlook of the students but also allow them to combine several areas, thus getting a more rounded education. Successful entrepreneurs, for example, are generally those who combine skills from different fields to solve a problem. Constraining students to a particular field, as the current system does, limits the problem-solving potential of these graduates.

Achieving high quality and relevance in tertiary educational programs may be impossible without quality governance and leadership. Thus the quality of gover-

nance in tertiary educational systems in African countries needs to improve. In practically all five countries, the heavy hand of government in the governance of tertiary education is everywhere, both at the systems level and the institutional level. Although most countries have buffer bodies that make policy and set general rules and standards for the system, most members of these bodies are chosen by the government and are directly responsible to the minister of education or the head of state. More often, governments have used their appointing powers to staff these bodies with political supporters. These factors have led to decisions based on political considerations rather than on what is in the long-term interest of tertiary education. Making these boards truly independent of political control—through mechanisms such as staggered terms that are far longer than any presidential term, and the ability to remain in office once appointed and confirmed, regardless of changes in the political environment—would be a step toward effective leadership.

Internally, the current system of hiring the chief executives and the appointment of university councils involves a great deal of political influence. Thus the current process may not yield the best candidate to lead the institution but rather one whose political views may be similar to those of the incumbent government. A way to overcome this is for the chief executive to be chosen through a competitive, transparent hiring process conducted by an independent search committee formed by the university community at large with the participation of other stakeholders. In addition to hiring, the chief executive should be responsible to an independent board of trustees dedicated to the long term-interests of the institution. The board would then set the standards of performance for the chief executive and provide the incentives (both positive and negative) to achieve these objectives.

### *Financing*

The current system of financing tertiary education in the five countries, and in Africa generally, is not sustainable. These countries need to explore several possible additional sources of funding. The establishment of endowment funds to finance tertiary education is a well-established practice in North American and European universities, yet this is not a funding source that has been explored by African universities. Administrations of tertiary educational institutions could approach their alumni, businesses, foundations, individuals, and families to contribute to endowment funds. In this connection, the universities could forge strong links with their alumni in the diaspora. Businesses could be encouraged—through tax breaks and other incentives—to contribute to endowed research and teaching professorships in their fields of interest.

Another possible source of funding is the entrepreneurial activities of the universities themselves. Although

some tertiary educational institutions offer short courses at more than their cost, there are far too few of these courses. Given the pent-up demand for such courses, tertiary institutions should expand these programs. These institutions can also raise additional funding through consulting and other contract research with business and other government entities. This requires close cooperation with businesses—hence the importance of establishing strong and extended UILs. The use of this source of funding is also likely to increase the relevance of tertiary education for African economies, since the research and teaching efforts of the institutions are likely to focus on African problems if they rely in part on industry collaboration for funding. This source of funding and the associated UILs will be successful only if university faculty and students are given appropriate incentives to work with industry.

Another possible source of funding of tertiary education is emigration “fees.” A disproportionately large share of the students of African tertiary institutions emigrate to work in developed countries and the oil-exporting Gulf countries after graduation. While the destination countries benefit from the skills of these emigrants, they do not contribute to the cost of their training. Since African countries are training graduates for the use of destination countries, they could negotiate with the destination countries to pay a training fee for their services. This could be a fixed amount for each graduate employed by the destination country. The income so generated could then be used to fund expansion and quality improvements in African tertiary institutions to finance more training.

### *The role of development partners*

Multilateral and bilateral development partners can complement the efforts of African countries to improve tertiary education. Given that one of the major constraints on expanding, improving, and transforming tertiary education in Africa is a lack of funding, development partners can help African countries by providing additional funding and educational resources. Currently, development partners provide very little direct support, if any, for tertiary education, although they do provide support for education generally. One of the reasons for this lack of support for tertiary education stems from the perceived belief that it does not contribute to social development as much as earlier education. However, with the publication of the World Bank’s 2008 report on the subject, this perception is now changing.<sup>47</sup>

Modest external financial support directed specifically at the tertiary educational sector in African countries could achieve major improvements to the sector. The funding should be strictly targeted for specific purposes and should be in addition to, rather than in place of, countries’ own contributions. The contribution of development partners could be conditional on extra contributions by African countries. To ensure that these

funds are effectively utilized to expand, improve, and transform tertiary education, they could be given on a cash-on-provision basis—that is, countries actually receive the funding only if they deliver the desired outcome. In addition to financing, institutions of higher learning in development partner countries can help improve tertiary education in African countries by providing and sharing reading and other library resources, especially electronic materials. Finally, these institutions could provide free educational materials—such as those provided by MIT’s OpenCourseWare—to African universities.<sup>48</sup>

In addition, development partners—such as the African Development Bank and the World Bank—could support the training of senior tertiary education staff in education management techniques and curricula development. One of the major weaknesses in African tertiary education is weakness in its governance and administration, especially as they relate to curricular development, enrollment management, optimal resource combination, and cost reduction. This training could involve collaborative arrangements whereby senior managers from institutions in a development partner country are seconded to institutions in an African country to help in developing institutional management and staff. This training should be done in African countries so that any management training not only focuses on what is of importance to the African countries but also takes into consideration African institutions and environment.

Clearly, African tertiary educational institutions have a lot of work in front of them. There are many challenges to transforming them into effective, relevant, and accessible institutions that work for African countries. But it is possible to make use of the lessons that have been learned in some of the five countries considered here, and the potential rewards are great.

## Notes

- 1 World Bank 2008a.
- 2 Barro and Lee 2010; Gyimah-Brempong et al. 2006; Krueger and Lundhal 2001; Mankiw et al. 1992; Self and Grabowski 2003; World Bank 2008a; World Economic Forum 2009; among others.
- 3 Caselli and Coleman 2006.
- 4 Commission on Growth and Development 2008. The report reflects the views of a Commission consisting of 19 well-known and experienced policy, government, and business leaders, mostly from the developing world, and two renowned economists. It was written over two years during which the Commission interacted, consulted with, and learned from leading academics, business leaders, policymakers, and NGOs. The report reflects the learning over this period and is informed by the Commission members’ own experience.
- 5 Teal 2010.
- 6 Altinok and Murseli 2006; Hanushek and Kimko 2000; Hanushek and Wobmann 2007.
- 7 Morley et al. 2009.
- 8 Hanushek and Kimko 2000.
- 9 Landes 1998.

- 10 Bloom et al. 2006.
- 11 World Bank 2008a.
- 12 UNESCO 2007. According to UNESCO, the gross enrollment ratio, tertiary level, is the sum of all tertiary-level students enrolled at the start of the school year, expressed as a percentage of the mid-year population in the 5-year age group after the official secondary school-leaving age.
- 13 Republic of Kenya 2008a.
- 14 Republic of Kenya 2010.
- 15 Teshome and Kebede 2009.
- 16 See Republic of Kenya, 2008a.
- 17 See World Bank 2008b.
- 18 Psacharopoulos and Patronis 2004.
- 19 Nyarko 2010.
- 20 See Republic of Kenya 2008a.
- 21 See Altbach et al. 2009.
- 22 Bjarnason et al. 2009.
- 23 See Alemu 2010; Levy 2007; Materu 2007; Oketch 2004.
- 24 Government of Botswana 2008.
- 25 This assessment is based on UNESCO 2007.
- 26 *ISIC* refers to International Standard Industrial Classification of all economic activities. The ISIC Code 2212 refers to the publishing of newspapers, journals, and periodicals. This is the code description and numeric code of an international classification system.
- 27 Gyimah-Brempong, forthcoming.
- 28 Schumpeter 2003.
- 29 Tracey and Phillips 2007.
- 30 UNESCO 2007.
- 31 Urban 2010.
- 32 Urban 2010.
- 33 Kabongo 2009.
- 34 Styrdom and Adams 2009.
- 35 Mafala 2009.
- 36 Moremong-Nganunu et al. 2008.
- 37 Republic of Kenya 1988.
- 38 Bosma and Harding 2007.
- 39 Act 2002-80, Tunisia’s 2002 Educational Reform Act.
- 40 World Bank 2010.
- 41 Caselli and Coleman 2006.
- 42 Chesbrough 2007.
- 43 Kruss and Peterson 2009.
- 44 Republic of Kenya 2008b.
- 45 Government of the Republic of South Africa 2002.
- 46 Kruss et al. 2009.
- 47 World Bank 2008a.
- 48 The Massachusetts Institute of Technology provides free, online lecture notes, exams, and videos through its OpenCourseWare program. See <http://ocw.mit.edu/index.htm> for more information.

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