Tuning

Africa

Tuning and Harmonisation of Higher Education: The African Experience

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Tuning Africa Project

Tuning and Harmonisation of Higher Education: The African Experience

Charles Awono Onana, Olusola Bandele Oyewole, Damtew Teferra, Pablo Beneitone, Julia González and Robert Wagenaar (Editors)

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P.O. box 1 - 48080 Bilbao
e-mail: publicaciones@deusto.es

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Preface

African systems of higher education are diverse, based on various historical legacies. As a result, there is limited mutual recognition of university degrees among African Universities and member states, which limits African academic integration. The Commission of the African Union (AUC) therefore developed the African Union Harmonisation Strategy for Higher Education, under the Plan of Action for the Second Decade of Education for Africa, expressing the collective desire by member states to work towards facilitating mutual recognition of academic qualifications and enhancing intra-African academic mobility. Harmonisation is therefore an instrument for enabling African higher education to contribute to and be aligned with the African vision of integration.

The implementation of the Harmonisation Strategy is supported by the Revised Arusha Convention; and it involves, among others, designing common curriculum development frameworks to enable comparability and equivalence of learning outcomes in African universities. It is in this context that the project on African Higher Education Harmonisation and Tuning was agreed upon as a worthy initiative of the Joint Africa-European Union Strategy (JAES) under the Migration, Mobility and Employment (MME) Partnership. In the pilot phase, sixty higher education institutions across the continent are involved in five subject groups: medicine, teacher education, agriculture, mechanical engineering, and civil engineering.

The project uses the "Tuning" methodology that has been previously successfully implemented in Europe, Latin America and Russia. The

Tuning process provides opportunity for peer-learning among the participating institutions as they develop curricula profiles in response to determined or expected outcomes and competences for the selected subject areas. It also helps to share experiences in the determination of credit loads, learning outcomes and quality in higher education.

The AUC and EC are grateful to the African and European experts involved in the publication of this book, which is an outcome of the project on African Higher Education Harmonisation and Tuning, within the framework of the JAES.

African Union Commission and European Commission

Acknowledgments

In carrying out the Tuning Africa project, the collaboration of numerous academics from a large number of African countries has been essential. A remarkable degree of talent, expertise, generosity, loyalty and commitment has distinguished the Tuning Africa project. We owe great gratitude to all the academics involved directly and indirectly in the elaboration process. They have shown tremendous commitment and imagination, finding new solutions and ways forward in an open and constructive dialogue. They have shown that African academics have the calibre and the vision necessary to tackle vital issues at an international level. Today's global society requires this kind of vision and commitment. We also thank the European experts cooperating with Tuning from the very start who have greatly enriched the project both with their patrimony of knowledge and insight, and new questions and ideas.

This project would never have been possible without the dedication and the wisdom of the five Subject Area Coordinators, as well as the support of the rest of the members of the Management Committee. They have been the pillars of the project, not only carrying great responsibility but also channelling discussions and debate in a constructive and stimulating manner. They have shown their ability to build consensus and reach outcomes that will prove useful for African higher education institutions in general.

Gratitude is also owed to numerous international organisations, in particular and especially to the African Union Commission and the

Association of African Universities (AAU) which have accompanied Tuning Africa along its entire path, offering valuable ideas and comments.

Our deep thanks go to the European Commission and especially to the Directorate General of Education and Culture, not only for its generous financial support but also for its moral support, interest, advice and commitment.

Project assistant María Ortíz Coronado has been indispensable in running the project. All members of Tuning highly appreciate her key role, great devotion and commitment to the Tuning Africa project.

The Editors

December 2013

Introduction

This book represents the contribution of more than 100 experts in a host of fields and disciplines—but most typically in education, engineering and medicine—who have engaged in an intense dialogue in the Tuning and Harmonisation of Higher Education in Africa. An outcome of a three-year initiative funded by the Commission of the European Union and sponsored by the African Union Commission and Commissioned by the University of Deusto, the group met in seven countries: in Accra (May 2010), Addis Ababa (July 2010), Nairobi (March 2011 and January 2013), Dakar (November 2011), Yaoundé (January 2012), Cape Town (May 2012) and Brussels (November 2012) to deliberate on the generic and specific profiles of five disciplines including agricultural sciences, civil engineering, mechanical engineering, medicine and teacher education.

Each team, responsible for its respective discipline, was led by a coordinator who also took leadership in drafting, reviewing and finalising the subject-specific chapters with extensive input from the designated contributors.

The first chapter, contributed by Damtew Teferra, Professor of Higher Education and Director of Higher Education Training and Development and the International Network for Higher Education in Africa at the University of Kwazulu Natal, South Africa, sets the scene for higher education in Africa by exploring the state of access, funding, research, gender, communication technologies, quality and regional and international organisations concerned with and interested in the development of higher education in Africa. The chapter concludes that, as the mode, magnitude, outlook and expectation of the higher education area are expanding, initiatives such as Tuning will become vital instruments in ensuring harmony, promoting quality and enhancing the credibility of the system.

In Chapter 2, Julia González, General Co-coordinator of Tuning, chronicles the emergence of the Tuning project, its background and its context, along with its aims and objectives, its actors, development and results. This chapter discusses Tuning as a network of communities of learners and as a methodology with clearly designed steps but also with a dynamic perspective permissible for adaptation to different contexts. Gonzalez further maintains that Tuning possesses some identified requisite steps but an open capacity in specific developments at regional level. Tuning, she stresses, aims at identifying and addressing the needs of the productive sector of the economy, of society as a whole, and the needs of individual learners within a particular area of study and mediated by their specific social and cultural contexts through engagement of a host of stakeholders.

In Chapter 3, Pablo Beneitone, Director of the Tuning Academy at the University of Deusto, articulates generic competences and the consultation process by defining the generic competences for Africa, the methodology for the consultation process and the analysis of the results. The chapter identifies a list of eighteen generic competences that include the unique competences related to professionalism, ethical values and commitment to Ubuntu, i.e., respect for the well-being and dignity of fellow human beings. The chapter reports the five most and least important competences according to African academics, graduates, students and employers and the correlation matrix between averages based on the level of importance, achievement and ranking among different groups.

Chapter 4 reports the findings of the Agricultural Sciences Group, led by Olusola Bandele Oyewole, Professor of Food Science and Technology and Vice Chancellor of the Federal University of Agriculture University—Abeokuta, who is also the current President of the Association of African Universities, and facilitated by Margaret Schermutzki, a Tuning higher education expert. This Subject Area Group deliberated on the context for curricula reform and modernisation in agricultural sciences and its importance to Africa with a group of sixteen experts from fourteen African countries from all five regions of the continent. Their work involved reviewing degree profiles in agriculture in a few countries, describing agricultural specialisations and their core elements and exploring job opportunities for graduates of agriculture programmes in Africa. The chapter described the ratings of stakeholders on the importance, level of achievement and difference between ratings of the perceived importance and the real achievement of the eighteen generic and sixteen subject-specific competences that the group identified for the agricultural sciences. The chapter concludes by laying out some of the outstanding challenges in effective incorporation of competences in agricultural programmes and pointing to the way forward.

The Civil Engineering Subject Area Group was coordinated by Haddis Rebbi Teklemariam, a civil engineer at Addis Ababa University and facilitated by Karola Hahn, senior advisor at GIZ and a Tuning higher education expert. In Chapter 5, the authors identify the degree profile of civil engineering programs of the ten participating institutions in terms of degrees, duration, structure, credits and employability, among others. The chapter also outlines a large host of diverse stakeholders of civil engineers in African higher education and a brief description of civil engineering education and programmes in Africa. The group identified eighteen generic and twenty subject-specific competences in civil engineering for Africa. The chapter also provided reflections on the civil engineering meta-profile in Africa compared to findings in other regions.

For Chapter 6, the Mechanical Engineering Working Group was coordinated by Charles Awono Onana, Professor of Mechanical Engineering at the Université de Yaoundé I, Cameroon, and facilitated by Beatrice Delpouve, a Tuning higher education expert. The working group was composed of experts in mechanical engineering from eleven universities. The chapter provides basic facts on the state and development of mechanical engineering education in a number of universities. The chapter documents some statistics on the number of universities offering programmes as well as professional bodies in mechanical engineering and explores some aspects of mechanical engineering in the Pan-African and sub-regional context. The chapter, which identified eighteen generic and nineteen subject-specific competences, also explores the policies related to mechanical engineering education at different levels.

The Medicine Working Group, coordinated by Mahmoud Benali Abdellah, Professor of Medicine and Vice-Rector at the Université de Algier I and facilitated by John H. Reilly and Hanneke van Bruggen, both Tuning higher education experts, was composed of medical doctors from ten countries. Chapter 7 describes fifteen generic and fourteen core subject-specific competences on the basis of survey questionnaires that were distributed to students, graduates, employers, heads of hospitals, clinical departments, primary care centres and health ministries. The chapter concludes that, while a detailed curriculum in medicine should and will vary from institution to institution, and between regions and countries, the competences that are required of a graduate in medicine at the end of the "basic education" and training are essentially universal.

For Chapter 8, the Teacher Education Working Group was coordinated by Matete Madiba, Dean of Students at the University of Pretoria, South Africa, and facilitated by Arlene Gilpin, a Tuning higher education expert. Educators from fifteen countries undertook the task of reviewing degree profiles in teacher education in a host of countries, describing the length of the various programmes, varieties/specialisation and credits. The group identified eighteen generic and seventeen key subject-specific competences that were further subdivided into four groups of thirty-one competences. The chapter recognizes the rapidly changing role of a teacher from primarily that of an information-giver to that of a facilitator, guide and co-learner to succeed in providing rich learning and teaching environments.

In Chapter 9, Charles Awono Onana, writing the conclusion of the Tuning exercise in Africa, describes it as "undoubtedly a success" in paving the way for major improvements on issues that seemed, according to him, "inextricably complex for the establishment of a higher education area in Africa". Without claiming that Tuning solves all higher education problems, he noted that it is beginning the search for solutions to problems of graduate unemployability, student mobility and disparate systems and frameworks of higher education.

We recognize that the articulation of the different groups and their rendering, as they engaged with the Tuning exercise, are rich and wide ranging. It is the very nature of Tuning's flexibility, combined with due regard for quality, that makes it an exceptional instrument in addressing multiple needs and rationales in higher education. We trust that this first book on the Tuning and Harmonisation of Higher Education in Africa provides a strong rationale and solid foundation on the scope, importance and implications of the methodology on the region's higher education system.

The Editors

December 2013

Chapter 1

The African Higher Education Landscape: Setting the Scene

Damtew TEFERRA

Introduction

As global competitiveness and the economic success of nations have increasingly relied on their capacity to generate, develop, consume and market knowledge, the importance of the knowledge citadels —higher education institutions—has been catapulted enormously upwards. It is predicted that, without the creating and consuming capacity of knowledge, no successful and durable social and economic development is guaranteed. As a consequence, while those already at the cutting edge of the knowledge domain are consolidating their positions, others are striving to catch up through a host of both strategic and ad hoc approaches.

In the last decade, higher education in Africa has witnessed a transformation influenced and catalysed both by internal intricacies and external dynamics. The external environment—fuelled by the "knowledge economy," economic liberalisation and regional integration—as well as the internal environment impacted by changing governance and political dynamics have all had considerable impact on the development of higher education in Africa.

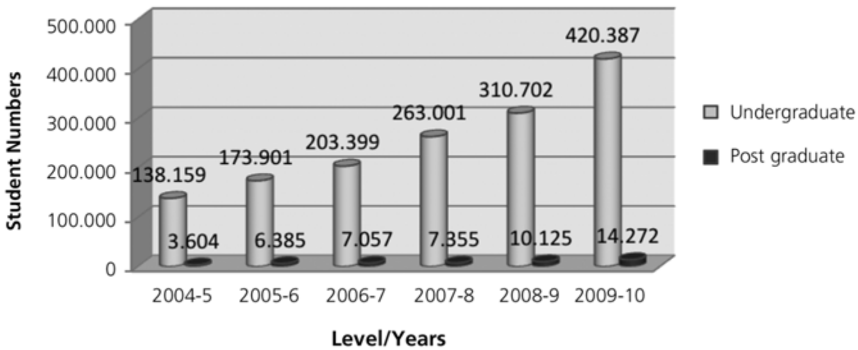
The Tuning Africa initiative, which is an outcome of the Commission of the European Union and African Union Commission, is one such continental effort that strives to harmonise the disparate higher education systems in the region. This chapter discusses the underlying higher education landscape in Africa where the Tuning and harmonisation efforts have been laid out.

Access

Africa has the lowest enrolment rates for higher education in the world. It is estimated that the average rate of enrolment for the region hovers around 6 per cent with considerable disparity by country and sub-region. According to a recent report, the tertiary gross enrolment ratio for Anglophone countries averaged 6.7 per cent, in comparison to the 2.9 per cent that characterised Francophone nations. Despite rapid enrolment growth, Africa's GER remained the lowest in the world, trailing South Asia (10 per cent), East Asia (19 per cent) and North Africa and the Middle East (23 per cent). Although Africa is making great efforts, the gap is closing only slowly, due in part to high rates of population growth (World Bank, 2009).

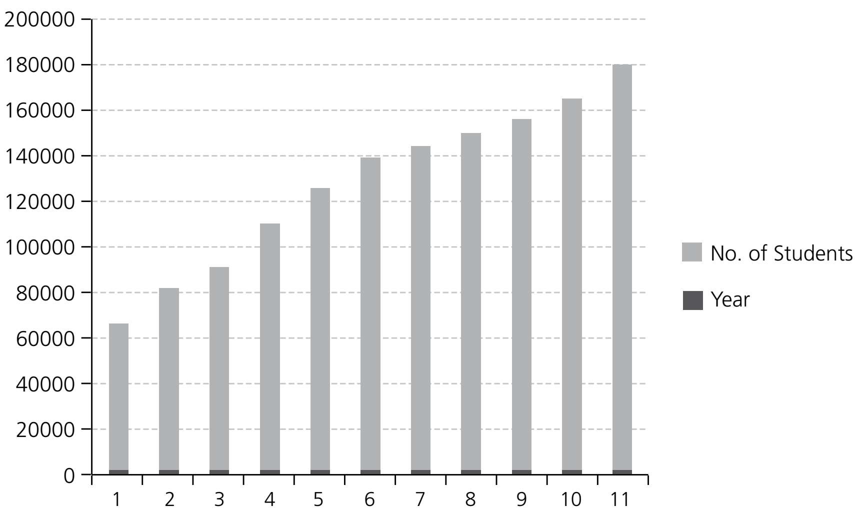
Virtually all African higher education systems have recorded massive growth in the last decade. In Uganda, where Makerere University dominated the higher education scene of the country up until 1988, now half a dozen public universities have been opened, with the result that the enrolment figures in Uganda grew from under 10,000 in the 1990s to over 100,000 in 2008 (Kasozi, 2009). In 1980, Zimbabwe just had only one state university—the University of Zimbabwe. The country, which is divided into ten provinces, today counts twelve universities—eight state-owned and four private (Nyaruwata, 2011). In Ethiopia, the growth of the higher education sector may be described as simply phenomenal. In this second most populous African country, the number of public universities has grown from two in early 1990s to more than thirty. Even in Malawi, a country with the lowest enrolment rate even by SSA standards, the figure has more than doubled in just over half a decade to reach in excess of 10,000 (Dunga, 2013).

As recently as 2000, a few small countries, such as Djibouti, Equatorial Guinea, Gambia, and Seychelles, did not have national universities. Seychelles, a country of only 86,000 people, became the latest to establish a national public university in 2010. In terms of sheer numbers, Nigeria, with about a million students, has student figures comparable with Egypt, considered to have the highest number of post-secondary students in Africa, at over 1.8 million (Levy and Savry, 2011). According to the World Bank report (2011), during the previous fifteen years, the total number of students pursuing higher education in Africa tripled, climbing from 2.7 million in 1991 to 9.3 million in 2006—an annual average rate of 16 per cent. The total number of African universities, according this author, now is estimated at 500.



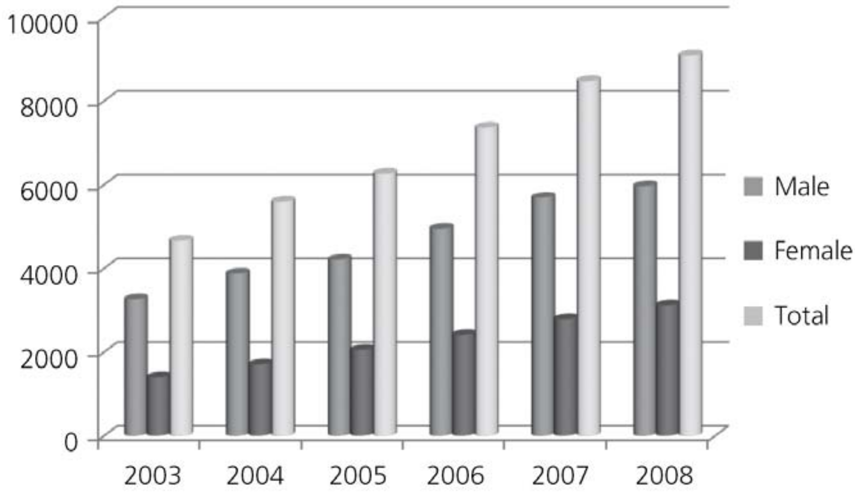
Source: MOE, 2011 in Moges (2013).

Figure 1.1
Enrolment, Ethiopia



Source: Oboko (2013).

Figure 1.2
Enrolment, Uganda



Source: Dunga (2013).

Figure 1.3
Enrolment, Malawi

Despite these massive expansions, significant access disparities in gender, geographical location, ethnicity, economic and social status, religious affiliation, and field of studies remain in the sector. In several countries, cut-off points for admission for certain groups, considered marginalised, have been lowered; and at others, special preparatory programmes have been designed. Despite considerable on-going efforts to bridge these gaps, and also some gains, access to higher education for these groups still remains low.

Finance

Higher education institutions in Africa, particularly in Sub-Saharan Africa, are the most financially challenged in the world (Teferra, in press). Academe everywhere, even in wealthy industrialised nations, faces fiscal problems, but the magnitude of these problems is far greater in Africa than anywhere else. According to Teferra and Altbach (2003a, 2003b) the causes include: (1) The pressures of expansion and "massification" that characterise most African academic institutions and systems; (2) The economic problems facing most African countries that make it difficult, if not impossible, to provide increased funding for higher education; (3) A changed fiscal climate and policy direction induced by multilateral lending agencies such as the World Bank and the International Monetary Fund; (4) The pressure of other social and health issues such as HIV-AIDS on government budgets; (5) The inability of students to afford the tuition rates needed for fiscal stability; and (6) Misallocation of available financial resources, such as the provision of free or highly subsidised accommodation and food for students.

More than any other factors that affected higher education funding in Africa, the policy pursued by major development institutions, notably the World Bank, has been the most prominent which erroneously concluded that the rate of return on higher education in Africa is lower than investment in the lower education sub-sector. Because of a belief that primary and secondary schooling is more important than tertiary education for poverty reduction, the international development community has encouraged African governments' relative neglect of higher education. For example, from 1985 to 1989, 17 per cent of the World Bank's worldwide education-sector spending was on higher education. But from 1995 to 1999, the proportion allotted to higher education declined to just 7 per cent (Bloom, Canning and Chan, 2006).

To be sure, financing higher education is an expensive enterprise—knowledge creation, knowledge dissemination and innovation do not come cheap. High-end expertise, expensive equipment and instruments, extensive infrastructure (such as labs, libraries and dormitories) and the accompanying requisite logistics (such as information technology) and a complex academic culture entail that the sector, unlike the sub-sectors of primary and secondary education, is costly—without comparison (Teferra, 2013). It is *higher* education, and it thus costs more and is expensive. In light of the preponderance of these basic facts and explicit evidence, it is curious why such an argument, for so long, has been peddled on the high unit cost of higher education (in Africa) with severe consequences to the sector in particular and national development in general.

With the major expansion of higher education and the different funding approaches, the funding trends vary across the continent. In Ethiopia, one of the countries that has made massive investments in higher education, the average higher education budget in relation to the education budget hovered around 24 per cent in the last decade (Moges, 2013). In 2007-2008 only 7.3 per cent of development expenditure in Kenya, where fluctuations are normal, went to university education compared to 81.6 per cent for primary and 1.5 per cent to secondary education (Abagi, 2010, in Oanda, 2013). In Uganda, government funding for tertiary education has been declining over the years. In 2004-2005, higher education received only about 10 per cent of the total education budget (MoES, 2005, in Oboko, 2013); this rate has remained constant since the mid-1990s despite the ten-fold increase in enrolment. In Zambia, the government could underwrite only 20 per cent of institutional budgets, and the funding level remained almost the same for three years, from 2009 to 2011, amidst major inflation and depreciation of the local currency (Masaiti, 2013).

A more complex challenge in the region will be to design and implement appropriate policies for financing secondary, vocational/ technical and higher education. As increasing numbers of children complete primary education, they will expect to enter secondary education, and graduates of secondary education will naturally wish to enter tertiary education. The policy imperatives that demand an expansion in upper levels of education are strong in terms of balancing resource requirements and availability, social demands and economic needs for a more highly skilled labour force (UNESCO, 2011).

Privatisation

One of the outcomes of the liberalisation of the global economic climate is the emergence of private higher education providers in the region. In countries where no private institutions existed, several dozen now adorn the higher education landscape. In virtually all countries in the region, private institutions now outnumber the public ones.

The private higher education landscape is itself guided by both for-profit and non-profit modalities. (See Table 1.1.) The non-profit private institutions are often dominated by religious denominations, both Christian and Muslim. For instance, in Tanzania, the distribution pattern of ownership and affiliation of 21 private universities and colleges is: Evangelical Lutheran Church of Tanzania (38.0 per cent); Roman Catholic (19.0 per cent); other Christian religious denominations (19.0 per cent); Muslim (14.3 per cent); other non-Christian and Muslim religious denomination(s) (4.8 per cent); and non-religious (4.8 per cent) (Ishengoma, 2010).

Table 1.1
Private Institutions in Select African Countries

Country	Number
Egypt	20
Ethiopia	60
Ghana	50
Senegal	40
South Africa	100
Sudan	50
Tanzania	20
Uganda	40

Source: Culled from different sources and rounded up, largely because these numbers are constantly changing. For instance, there are a number of private higher education institutions in Uganda including 37 private universities, 21 of which are licensed, according to the National Council for Higher Education (2009; cited in Ishengoma, 2010). In South Africa, since 2003, the government has dealt with about 177 private institutions which applied for registration. Eighty-six of these institutions are currently registered; 31 are provisionally registered (Sehoole, 2012).

Despite their prominence on the African higher education map, the enrolment capacities of private institutions have so far generally remained modest. Yet these institutions have proven to be diverse in their programme delivery, flexible in their character, and market-responsive in their approach. These characteristics have offered private providers an opportunity to dominate higher education, not only in sheer numbers, but also in enrolment figures in some fields and countries. For instance, enrolments have reached close to 20 per cent in Egypt, 17 per cent in Ethiopia (MOE, 2010), 27 per cent in Tanzania (Ishengoma, 2010) and 45 per cent in Lesotho (Kotecha, 2008). According to the World Bank (2010), in Burundi the participation of private higher education institutions was a success story accounting for 53 per cent of the higher education enrolment in 2008 through grants of scholarship to 25 per cent of students attending private institutions.

The programmes offered in private institutions predominantly cater to market needs. Information technology, secretarial science, banking, accounting, management, healthcare, entertainment and hospitality dominate the private higher education landscape across the region. With only a few exceptions, virtually all of these home-grown providers offer undergraduate programs. The exceptions occur primarily in such countries as Ethiopia, Ghana, and Nigeria, where massive growth in the sub-sector has been registered and where quite a large number of home-grown, for-profit providers also offer postgraduate degree programmes.

Research

To be sure, research is an expensive endeavour. It is no wonder that those who pay for it are at the frontiers of creativity, innovation and development. As the knowledge society became a reality and global competitiveness depends increasingly on the capacity to innovate, develop and market knowledge and information, the importance of research has taken centre stage ever more prominently.

Africa has the lowest research, innovation and communication capacity of any world region, and its contribution to the global knowledge pool is woefully low. Numerous indicators show its contribution as less than 1 per cent and declining in relation to the increased efforts in the rest of the world's regions to raise their output. Reasons for Africa's dismal contributions abound, as discussed below.

Shortage and lack of funds

For all the impressive higher education expansion and growth that have been taking place in the region for over a decade now, we have not witnessed a commensurate commitment to research and innovation. Government funds for most African universities are essentially non-existent or insignificant.

More than 70 per cent of research money in African universities originates from external sources. In some universities, the only research money available is completely external. For instance, Liberia, Mali, Rwanda and Zambia financed more than 50 per cent of their education budgets from external sources in 2008.

Calls and pledges for raising the national research and development funds to 1 per cent of GNP have been made on numerous occasions though these remained mostly unfulfilled. A rare but hopeful development is Ghana, which introduced an education tax that increased the resources available for education and research.

Exodus of the highly skilled

The mass migration out of the region of the highly skilled and talented, a phenomenon largely known as "brain drain", has deeply frustrated the capacity for building education in the region. Many attribute the massive migration of such a group to the "push" factors of poor working and living conditions at home while simultaneous "pull" factors are increasingly attractive competitive academic markets internationally.

The literature is rich with anecdotal reports, often unsubstantiated but sometimes buttressed with plausible figures, on the extent of this intellectual migration. Some claim that more Nigerian, Ghanaian and Ethiopian doctors live and work in the developed world than in their respective countries. According to the UN's African recovery journal, in one Canadian province, Saskatchewan, 20 per cent of the medical staff came from South Africa (allafrica.com, 2003).

Moonlighting and incentives

The proliferation of private institutions in the region has provided an excellent opportunity for many academic staff in public institutions to seek second jobs in those settings. Most private institutions depend on academic staff from public institutions. While moonlighting has had some positive impact on the livelihood of the academic staff involved, and hence to some extent has curtailed brain drain, it has siphoned energy, time, loyalty and commitment away from public institutions where virtually all research undertakings in the region take place.

In many countries in Africa, salaries and benefits of academia are generally unattractive. As better paying job opportunities for the highly skilled are opening up, universities are losing their competitive edge as attractive recruiting institutions. Furthermore, even when measures have been taken to raise salaries and benefits, their significance has been largely diminished due to high inflation and devaluation.

High emphasis on teaching and learning

The unprecedented expansion has put considerable emphasis on, and given priority to, teaching and learning. The major, and probably sole activity, if not mission, of new (and also older) institutions has become teaching. For many, their activities have not reflected their underlying mission statements that espouse teaching, research and community service as equally valued activities.

One of the phenomena of the higher education expansion in the region is the changing profile of the academic community with cohorts of predominantly new and less qualified educators staffing more posts in their respective systems. The burden of heavy teaching loads is such that research has been relegated to the sidelines—in fact, is often considered a luxury that "we could live without". So whereas significant strides have been made in expansion and access, it seems that such progress has come, for many, at the expense of a vital research and publication capacity.

Distance Education

Increasingly, demand for higher education has exceeded supply, particularly in the developing countries where the rate of participation of the college-age cohort is still relatively small. This demand for higher education has been fuelled by numerous factors: (1) The number of primary and secondary students has grown considerably, creating a large pool of prospective higher education students in the system; (2) The state and reality of the globalised economy is such that lifelong learning has become a normal trend; (3) Competition for the existing positions and their growing number demanded higher levels of training and, consequently, an escalating need for higher education (Teferra, 2009a, in UNESCO, 2009).

Despite massive growth in the higher education system in the region in the last decade, the enrolment figures remain far from satisfactory; and Africa still lags far behind the rest of the world in terms of access. Furthermore, the need to upgrade one's skills constantly, the interest in lifelong learning, and the growing urge to acquire "credentials" represent mounting pressures on the system. As a result, other avenues of educational modes, such as distance and online education, are expanded and consolidated.

The potential benefits associated with an expanded use of distance education in Africa are numerous. If adequately managed, distance education could enable an expansion of tertiary enrolments at less cost per student than under the traditional residential campus system. Greater flexibility in the design and delivery of curriculum content than is normally associated with classroom teaching enables distance education courses to adapt to specific student needs or work requirements, thereby enabling greater relevance. Distance education also accommodates the growing demand for lifelong learning more easily than residential programmes. It can effectively reach those learners who have been denied access to tertiary education, such as women who are unable to attend traditional educational programmes because of household responsibilities or cultural constraints, economically marginalised groups, refugees and the incarcerated (Saint, 2003).

Numerous flagship and newly established private institutions are already involved in the delivery of distance education in their respective countries. For instance, the University of Ghana, has been offering distance education programmes since 2007 to expand access to higher education. In Ethiopia, a number of newly established colleges provide distance education. Leading universities and middle-level colleges in Kenya are increasingly using technology-enhanced learning to remove geographical and financial barriers to higher education, and Kenya's government intends to increase support for e-learning (Kyama and Mwaura, 2011). Even in countries where major public expansions and commitments have been made and where considerable private higher education developments have taken place, the need for distance education has paramount significance. The niche, constituencies and "catchment areas" of distance-learning beneficiaries are simply different.

The huge need for access to tertiary education, economies of scale for small countries, the growing trend of ephemeral knowledge and the necessity for lifelong learning, flexibility, versatility and robust outreach will continue to fuel growth in distance learning—in the process easing the pressure on the system. But weak quality assurance mechanisms, poor publicity, personnel who are inadequately trained in distance education, limited and unreliable ICT access and controversial content dimensions confront its success.

According to Barasa (2011), issues confronting distance education in Africa are numerous. These include ensuring access, guaranteeing quality, and managing cost to ensure affordability and success. Other issues that are key in promoting online and distance education include exercising political will; recognizing the diversity of the African continent and the need for relevance; developing leadership and effective management systems; ensuring sustainability of distance education institutions, projects and programmes; creating distance education readiness; and creating ICT readiness in nations, institutions and learner communities.

Gender and Geographical Equity

Gender imbalance and other inequities are common phenomena in the continent's educational institutions. These imbalances and inequities are engendered through cultural, sociological, economical, psychological, historical and political factors.

In the sphere of gender, student profiles in Africa, with the few exceptions of South Africa, Lesotho and Mauritius, exhibit considerable imbalance in favour of male students. In Tanzania, for instance, 34 per cent of students in public universities and 41 per cent in private universities are women (Ishengoma, 2010). While a number of efforts are underway to rectify these imbalances, more remains to be done across all educational sectors. Furthermore, even when the gender balance is not heavily skewed, the distribution profile shows disproportionate enrolment figures of women in "soft" sciences.

In contrast, in the Middle East and North Africa (MENA), participation of women in higher education has increased in all countries and especially in the GCC countries, where 62 per cent of enrolled students are female. This is a significant achievement, not only for the key role that women's education plays in contributing to economic growth, but also for women's contribution to social development as a whole (Jaramillo and Melonio, 2011).

Some of the approaches instrumental in increasing the participation of female students in post-secondary institutions include instituting "affirmative action" policies that, among other approaches, provide entry points for female students and/or providing intensive remedial programmes.

The proliferation of private institutions in Africa has played a considerable role in increasing the number of female students in the sector. In some countries, the heightened proportion of women in the overall student profile has been attained due to private and distance education providers.

However, encouraging as the growth of female enrolment has been, their completion rates remain the subject of considerable concern. Although institutional policies have facilitated their entrance to campuses, parallel institutional policies to help them cope with the complex demands of university life are often lacking, resulting in a high rate of attrition. Sexual discrimination, sexual harassment, lack of role models, a sense of minority status, a lack of belongingness, the burden of family responsibilities and matters of sanitary and health needs combine to raise the attrition rate.

If the number of female students on campus is small, the number of female faculty is even smaller. The under-representation of female faculty in higher ranks, qualification levels and certain fields of study is particularly severe.

The issue of equity in higher education suffers from more than gender imbalance. The urban-rural disparity is a common phenomenon in most countries in the region. Most universities, especially those of flagship status, are predominantly based in national and state capitals and major cities. Even the expansion of the private higher education landscape follows that pattern simply because the market, the human and material resources and the infrastructure are based there. These inherent disparities favour the urban more than the rural, as well, in the students' preparedness for college entrance and national examinations.

Communication Technologies

The advent of information and communication technologies (ICT) has had a tremendous impact on teaching, research and the management of institutions. This development has contributed in orders of magnitude to improving quality, delivering programmes, consolidating activities and expanding intellectual networks around the world.

Research activities entail considerable communication infrastructure, expertise and support. Major strides in ICT access have been made in African institutions since the advent of the technology, particularly in more recent years. This improvement has been instrumental in addressing the long-standing complaints that African academics are professionally isolated from the rest of the world.

While the frontiers of academic isolation have been gradually conquered and the quality of and access to teaching and research resources have improved the academic environment, Africa still remains the continent with least IT communications, poorest wired and greatest service deficiencies in the world. Many universities in Africa, including national flagships, enjoy only limited access to the Internet, in the process losing out on the tremendous opportunities and possibilities that accompany robust ICT platforms. According to Bon (2010), the formidable physical, institutional, infrastructural, logistical and technical challenges will continue to constrain institutions from effectively tapping the technology.

Labour Market

A critical challenge that promises only to intensify in countries that have recorded unprecedented enrolment growth is now finding jobs for graduates. Despite the steady growth registered in the region over the past decade, the economic base for absorbing the exploding graduate population still remains thin. Furthermore, a good number of graduates who have jobs feel that they are under-employed and under-compensated.

Some experts advise that youth unemployment can be reduced if tertiary education institutions link up with productive sectors in curriculum development and in the so-called "open space activities". The tracer studies carried out by national authorities in Ghana and Namibia show that, the greater the distance between skills imparted in the classroom and those required in the worlds of work, the higher the rate of graduate unemployment is likely to be (Mihyo, Hammond, Makhoka and Tjihenuna, 2011).

In many countries, universities are engaging numerous stakeholders in designing, implementing and evaluating curricula. Others are consolidating university-industry linkages, among others, to foster innovation and technology transfer. Others are strengthening entrepreneurship and internship opportunities, while many others frame the problem in terms of "job-creating graduates" as opposed to "job-seeking graduates". Although this approach may be fruitful, in many cases it lacks the requisite frameworks and support mechanisms to promise success.

On the other hand, the issue of graduate employment is compounded by incompetent, un(der)-qualified and unemployable graduates. Furthermore, the mismatch between labour market demands and practical knowledge and skills is rampant, further complicating the employment dynamics in the region.

In Africa, governments continue to remain one of the largest, if not *the* largest, employers of professionals (and graduates) in their respective countries. And yet government positions have lost much of their attraction, especially for those with considerable intellectual prowess and entrepreneurial skills. Thus, even with considerable and meticulous planning, for instance in curriculum development, the best graduates may not be attracted to the largest employer and the most promising job market, consequently perpetuating the issue of mismatch.

The issue of unemployment and under-employment in Africa is simply a time bomb waiting to explode with catastrophic social and political consequences for countries, the region and the world as a whole. The gravity of the challenge will certainly be exacerbated due to the region's high birth rate, burgeoning primary and secondary education, and ever-expanding sector of tertiary education.

Quality

Since the middle of 2000, a number of initiatives have been launched in Africa to develop common frameworks for comparable and compatible qualifications in order to promote and further strengthen academic mobility. The most prominent one—though not yet successful—is the Arusha Convention, otherwise known as the UNESCO Regional Convention on the Recognition of Studies, Certificates, Diplomas, Degrees and other Academic Qualifications in Higher Education in the African States (1981).

The first national quality assurance agency was established in 1962 in Nigeria. By 2012, twenty-one African countries had already established such agencies and a dozen other countries were at relatively advanced stages in moving towards this direction. Francophone Africa is lagging; only five such countries in Sub-Saharan Africa have quality assurance agencies. Quality assurance agencies were initially established to ensure the quality of programmes delivered by private institutions that engaged in face-to-face teaching modalities. This mandate has gradually been expanded to include public institutions and other modes of delivery.

At a sub-regional level, two quality assurance agencies operate: the African and Malagasy Council for Higher Education (in its French acronym CAMES) and the Inter-University Council for East Africa (IUCEA). CAMES was established in 1968 with the objective of harmonising academic programs and policies in regard to staff recruitment and promotion in its nineteen member states. Since 2005, the harmonisation of programmes under CAMES is implemented through the "Licence-Master-Doctorat" (LMD) reform that has the goal of aligning the seven higher education degrees in Francophone countries—Diplôme d'études Générales, Licence, Maîtrise, Diplôme d'études approfondies, Doctorat de troisième cycle, Doctorat unique and Doctorat d'Etat—to the three Anglophone degrees of bachelor's, master's and PhD degrees. IUCEA has the responsibility of ensuring internationally comparable standards in the five member states of the East African community: Burundi, Kenya, Rwanda, Tanzania and Uganda.

At a regional level, the Association of African Universities (AAU) and the African Union Commission are spearheading the quality regimes. The AAU oversees two initiatives: the African Quality Assurance Network (AfriQAN) and the Europe-Africa Quality Connect Pilot Project. AfriQAN implements its main mandate of promoting collaboration among quality assurance agencies through capacity building and the African Quality Assurance Peer Review Mechanism.

Currently, the African Union Commission implements three initiatives: The African Higher Education Harmonisation Strategy, Tuning Africa, and the African Quality Rating Mechanism. The African Higher Education Harmonisation Strategy was adopted in 2007 to ensure comparability of qualifications.

More than 60 per cent of quality assurance agencies have been created during the last decade and many of them still lack the capacity needed to implement their mandates effectively, necessitating capacity building in quality assurance. Since 2006, UNESCO and its partners have organised five international conferences that have helped to train more than 700 experts in several key issues including accreditation, quality assurance and Institutional audit. (Most of this section comes from Shabani, 2013).

Internationalisation

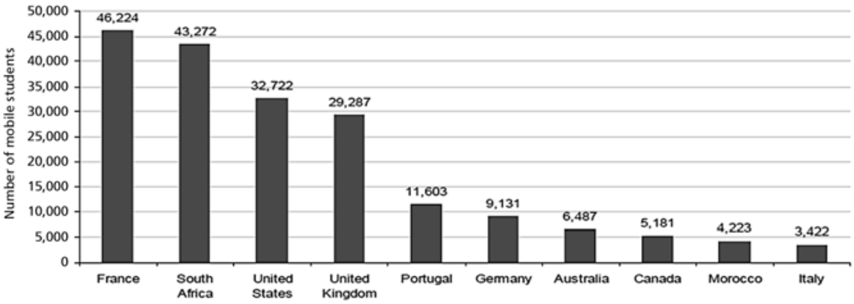
To be sure, higher education in Africa has always been an international affair owing to its history and trajectory. The internationalisation of higher education is increasing in importance and complexity. It is contributing to the quality of higher education and research, the level of regional and international interaction and connectivity, and the development of human resource capacity, especially for countries active in the knowledge society.

Growth in the international dimension of higher education includes such factors as student/scholar mobility, regional and international networks, curricular reform, research initiatives, new types of providers and commercial cross-border programme delivery. These elements bring new opportunities, challenges and risks to higher education systems and institutions in Africa and other regions of the world (Teferra and Knight, 2008). Among the numerous manifestations of internationalisation, the major one is mobility of the intelligentsia—students, faculty, researchers and professionals.

Mobility

Knowledge and information have become central elements of development and economic competitiveness in the globalised economy. This trend has significantly raised the importance of intellectual workers, prompting the global search for high-calibre knowledge workers and fostering the global and regional mobility of students and skilled labour.

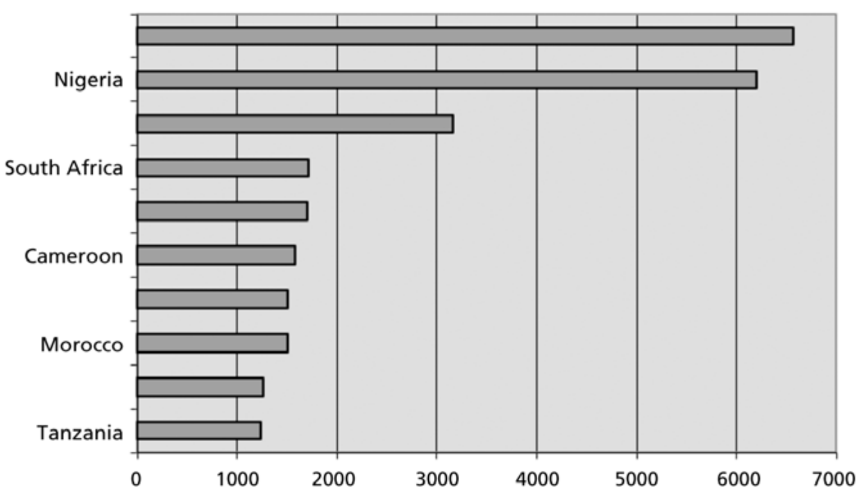
According to UNESCO-UIS (2006), with 194,000 international students, Sub-Saharan Africa accounts for 8 per cent of the global total. Sub-Saharan countries that send the most students abroad are Zimbabwe (17,000), Nigeria (15,000), Cameroon (15,000) and Kenya (14,000); 51 per cent go to Western Europe. Their second most important destination is Sub-Saharan Africa (21 per cent) followed by North America (20 per cent). Nine out of ten international students who stay



Source: UNESCO/UIS (2011).

Figure 1.4
Top destinations of mobile students from Sub-Saharan Africa, 2007

in the region go to South Africa, especially those from other countries in Southern Africa: Botswana, Malawi, Namibia, Swaziland, Zambia and Zimbabwe. In addition to South Africa, Ghana, Egypt and Uganda have also emerged as major recipients of international students, particularly from within Africa (Mulumba et al., 2008).



Source: Open Doors (2006).

Figure 1.5
Students from select African countries studying abroad

France is a much more attractive destination of choice for French-speaking African countries as exhibited by numbers of students from the following countries in 2005: Morocco (25,782), Algeria (21,552), Tunisia (9,593) and Senegal (9,019) (OBHE in Mulumba et al., 2008).

The movement of African students within the continent is limited. The only meaningful African hub of scholarship for African students still remains South Africa. Numerous reasons abound which include better equipped and staffed institutions, cheaper costs of study, more relevant curricula, preferred instructional medium and better chances of returning to one's country of origin. As a result, a number of governments in Africa—such as Ethiopia, Eritrea, and the SADC countries—have been looking at South Africa as an attractive destination for post-graduate studies.

As the higher education environment has improved, for instance, in Ghana, students from neighbouring countries such as Nigeria, find it an attractive destination for higher education. The same situation has developed in Eastern Africa where an estimated 40,000 Kenyan students were reported to be studying in Uganda in 2010 (Mwaura, 2010). The proximity of countries, related language and cultural settings, and cheaper cost of study and living play a role in attracting students from neighbouring countries. Considerable ambivalence, however, exists among local students in South Africa in regard to students coming from other countries into what is an already highly competitive educational environment (Jansen et al., 2008). Similarly, in Ethiopia, close to 500 refugees from rival Eritrea are currently studying in public institutions of higher education.

As these figures make clear, Africa needs to make greater efforts to expand the movement of students and scholars within the continent. Through the (Revised) Arusha Convention of UNESCO and the Harmonisation and Tuning initiatives of the African Union and European Commission, the formidable barrier of mobility is being addressed, albeit slowly. Still, the complex challenges of mobility include more than the recognition of diplomas, including the academic interests of students, the competence and academic standing of host institutions, affordability, safety issues, entry requirements and political stability.

The mobility phenomenon at a global scale has created considerable opportunities for those who have lacked educational training opportunities as well as those who endure poor working and living conditions in their home countries. However, the departure of a large contingent of high-calibre experts, especially those in the areas of health care, engineering, and IT, has had adverse effects on their countries' socio-economic development.

International and regional networks

The African higher education system is probably the most internationalised higher education system in the world—not by participation but by omission. As the weakest global higher education system, it relies heavily on the discourse, paradigms and parameters set by others, rendering it vulnerable to global whims and idiosyncrasies. African higher education assumes the position of the most internationalised system by being the least internationally engaged (Teferra, 2008).

As the global interest in engaging Africa has gained momentum, so have the number and complexity of international and regional development partnerships. As the "historical" partners consolidate their engagement in African higher education through new and existing schemes, new and emerging players such as Brazil, China, India and South Korea are also joining in with even more vigour than some traditional partners.

As it is, without giving due consideration to their impact, African universities are engaging in extensive partnerships with universities and research institutions around the world. In a typical "flagship" university in Africa, initiatives supported by major development partners, such as CIDA, DAAD, DFID, NORAD, SIDA, USAID, VLIR-UOS (Belgium), are commonplace. For instance, Tanzania has benefited from university partnerships supported by NORAD for over four decades amounting to 750 million NOK (Teferra, 2011). One South African university claims to have more than 500 university partnerships (Alexander and Hahn, 2005).

As stated elsewhere, one important development of inter-tertiary education collaboration has been the formation of National Educational and Research Networks (NERNs). In Sub-Saharan Africa several such initiatives, including the UbuntuNet Alliance have been established. UbuntuNet, an alliance of more than forty universities, was launched in 2006 to collaborate in forming NERNs in many countries including

Ghana, Kenya, Malawi, Mozambique, Tanzania and Uganda (Bon, 2010).

Global higher education developments such as the Bologna Process have also affected the national higher education systems, especially those in West Africa—a result of continuing links with historical European partners. For instance, the LMD system (Licence-Maîtrise-Doctorat) has been actively promoted across French-speaking Africa by CAMES. Anglophone countries in Africa already had a bachelor-master-PhD model following the British system. In Portuguese-speaking African countries such as Cape Verde, degrees have been revised within the Bologna framework. This movement is facilitated through the Association of Portuguese Speaking Universities (AULP) that promotes higher education in that geographical area (Oyewole, 2011).

Regional and international actors

Regional and international actors involved in the development of academic and research cooperation programmes in Africa abound. These include multinational agencies, such as the African Union Commission; the European Union Commission; multilateral agencies such as the World Bank, UNESCO and the African Development Bank (ADB); regional associations such as the Association for the Development of Education in Africa (ADEA), Association of African Universities (AAU); and sub-regional associations such as the Southern African Universities Association (SARUA), Inter University Council for Eastern Africa (IUCEA), CAMES, the ECOWAS Education Sector, and CEMAC Space for Higher Education, Research and Professional Training.

Cooperation between Africa and Europe has become increasingly visible with different new initiatives emerging in the recent years including the exploration of new cooperation modalities. Among the new ones are included EU-Africa Cooperation in Higher Education through Mobility, Access to Success, Tuning and Harmonisation, Network for the Coordination and Advancement of Sub-Saharan Africa-EU Science & Technology Cooperation (CAAST-Net), and the most recent one called ERAfrica, a new international ERA-NET which aims at improving research cooperation and coordination between Europe and Africa.

The role of cooperation agencies in the development of higher education in the region has been vital. Their contributions are especially significant in the area of research, amounting to 70 per cent of the region's resources for such activities. For instance, in Burkina Faso, more than 90 per cent of the research undertaken by the University of Ouagadougou in 2003 was funded from external sources (Traore, 2004).

Major U.S.-based foundations have played an important role in higher education development in Africa, especially following independence and also from the mid-1990s to mid-2000. For instance, in ten years, the Partnership Foundations (consisting of Carnegie Corporation of New York and the Ford, Hewlett, Kresge, MacArthur, Mellon and Rockefeller Foundations) had collectively invested $440 million in nine countries as well as in regional networks aimed at strengthening higher education in Africa. These countries include Egypt, Ghana, Kenya, Madagascar, Nigeria, South Africa, Tanzania and Uganda (Partnership for Higher Education in Africa, 2010).

Donor-recipient dynamics are also changing, albeit slowly. Donors—as complex and diverse as they are—have, over the years, manifested different responses to the multitude of criticisms and concerns, some with considerable sensitivity and others with few adjustments, largely because the primary driver of their giving is not simply altruistic motives alone (Teferra, 2009). The Paris Declaration and the Accra Accord for Action on aid effectiveness have become increasingly standard procedures of international development cooperation, directly and indirectly affecting the higher education landscape.

Conclusion

Higher education in Africa faces considerable challenges, risks and threats while it also concurrently enjoys remarkable opportunities and potentials. While expansion has been the hallmark of the sector in the last decade, it has also witnessed a hiatus of quality and relevance issues.

Numerous national, regional and international initiatives to foster quality and harmonization in higher education in Africa abound. As the mode, magnitude, outlook and expectations of the higher education area are expanding, initiatives such as Tuning will become vital instruments in ensuring harmony, promoting quality and enhancing credibility of the system.

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Chapter 2

Tuning Definitions

Julia GONZÁLEZ

In March 2011 the feasibility study for Tuning in Africa and harmonisation presented four possible scenarios from which one was selected to launch the pilot phase, which is now being finalised with important results. This book will spell out the results, but it is worth giving a perspective of the African context on the one hand and of the Tuning in Africa Project on the other. The African context was presented in Chapter 1. The meaning of "Tuning" and the ways it was implemented by the African representatives will be explained in this chapter.

Three definitions encompass most of the reality of Tuning: (1) Tuning is a project for the universities and by the universities; (2) Tuning is a community of learning communities of academics; and (3) Tuning is a methodology for designing and delivering degrees.

2.1. The Tuning Project

Tuning is a project and as such has a background and a context, was born out of certain needs, and can identify its aims and objectives, its actors, its development and its results.

Its initial context emerged in 1999 in Europe when students had started to move in large numbers within the region. These movements created a sense of newness, of sharing something extremely important for a university—the students. The need for the full recognition of students' spending significant periods abroad could not be postponed. But simultaneously, the need to move freely once a first degree had been completed was also becoming urgent. It further meant that many of the students who had been abroad through the Erasmus programme wanted to pursue their second degree in another country. Once the richness of the experience was confirmed and once the capacity for carrying it through was tested, there was no going back in the process of internationalisation for university students. The number who decided to take their second degree in a new country or countries increased significantly.

But a parallel need for employment came from the perspective of the students, their families and, in this case, the European labour force. Accompanying the development of mobility of goods was Europe's need for real capacity for mobility in the sphere of employment, coupled with a need to develop the identity of the region. At the political level, Europe was being built. A critical element in that factor was the necessity for a multicultural workforce and serious efforts to develop in university students a sense of belonging, something that mobility in the region helped to develop.

The mobility of students brought with it a sense of closeness between academics, the development of common projects and the fascination of joint ventures. Europe was to be understood as a region built on diversity and centres of excellence that, radiating from the central level, should be built on shared intercultural perspectives. The region's history confirmed the strength of this approach; and in the field of education, countries joining together could count on greater strengths at the level of ideas and of human resources. Such an approach was important at a time when the concept of centers of excellence and internationalisation are leveraging quality, both among universities and also among firms, since the ability to function competently at the international level became an ever-more vital criterion of quality.

A third widely recognised need was that of academic bodies to join forces and stand poised between the needs of individual students and the international needs of institutions. It was their opportunity to participate, to cooperate, to be active in the field and, above all, to use the moment to create higher levels of quality in university programmes. The role that higher education thus played immediately became an important driver permeating the commitment and focus of academics who participated in the Tuning in Africa Project.

The actors were, therefore, clear. They were: (1) The academic staff who were responsible for creating degrees and degree programmes, and (2) Those who were classroom teachers, who programmed and implemented projects. This was their task and their contribution, and they felt the responsibility of taking part and responding, making themselves available for the task and generously investing their time, their ideas and their energy.

Their success, in large part, depended on the clarity of the aims and the objectives. They were tasked with the development of degrees, internationally compatible and comparable, built using a common language and, therefore, readable across the whole region. Transparency so the mutuality of this goal could be easily recognised was a high priority. However, this aim was enriched by two more: (1) The first was the issue of relevance at the degree level, the need to have an education that was close to the needs of society ranging from the local to the international level depending on the degree's aims. This goal required relevance to social needs, present and future, which in turn required building degrees in consultation with stakeholders. (2) The first aim was buttressed by the second: to use the opportunity to increase quality at the degree level. Both the search for quality at that moment and the energy created by academics coming together with a common goal resulted in enhancing quality at the programme/degree level as one of the more powerful driving forces of the project.

The result became very visible. It was the development of an intercultural system for developing outcome-based, student-centred and competence-based learning. It was a bottom-up system built at the subject level, founded on mutual trust and confidence, and manifesting deep respect for the autonomy of participants at the institutional, country and regional level. This system, from its earliest articulation has been based on listening, sharing and learning, is organised according to regional needs and choices, and is evaluated against objectives for which it can be held accountable at every step.

Although Tuning and Harmonisation of Higher Education was developed to meet the concrete needs of a region and was never intended to be broader in scopes, Latin American soon discovered its capabilities. Later, other regions saw value in adopting it and adapting it to their contexts and needs. Its nature as a project requires that the actors be those of the region, the needs and background on which to base it adapted to the context; if Tuning is authentic to its purpose and its mission, the aims and objectives will be those of the region itself. It has developed further into a powerful instrument of understanding and cooperation between regions across the world, a way of reaching global consensus but beginning from the institution, the country and the region. In this context, the different regions of the world feel drawn to become part of the project or to launch parallel processes of searching for recognition, identifying relevance and building quality in higher education, starting from the needs and choices of their students, academic staff, employers, social organisations and diverse relevant groups. As these constituencies become involved and active in the process of thinking about the requirements of the graduate, the need to develop the region socially and economically and to advance a more fair and forward-looking society with the highest levels of civic involvement and responsibility comes into focus.

The African continent is proving to be a fascinating new challenge for Tuning. Whether Africa be considered as a consolidation of five regions or as a territory in itself, the decision to carry out the project at the continental level was wise indeed. The capacity of the entire continent in working towards a common language in developing higher education as a common space and the potential impact of strong bodies of academics with instruments for developing, in African terms, scenarios, contexts and tools for recognition, relevance and quality in degree design and delivery has become one of the most exciting developments, not clearly envisioned when the project began. The Tuning African experts who have observed this maturation continue to see its unfolding possibilities and, hence, have committed to the task with their impressive professional skills and with remarkable personal generosity.

2.2. Tuning Is a Network of Communities of Learners

A useful way of understanding Tuning is as a network of interconnected communities of practitioners and learners who reflect, debate and elaborate instruments and share the results. They are academic experts, gathered around a discipline or theme in the conscious context of building mutual trust and confidence. They work in international, intercultural groups, communicating deep respect for the autonomy of co-participants at the institutional, country and regional level and generously sharing knowledge and experiences. They work in an organised system according to regional needs, remaining focused on accountability and goal-centeredness by articulating and evaluating clear aims, objectives and outcomes at every step of the process.

In addition to working with a common language to understand and compare issues in higher education, they also take part in refining a set of useful tools that have been developed by other academics. They are able to participate in a platform of reflection and action about higher education, a platform in which, at present, communities of more than one hundred different countries participate. Thus, these participants become parties to the development of reference points for the disciplines, the degrees they represent, and levels of quality that continue to involve many who continue to share and refine the process Participants have the possibilities of networking with professionals in their own subject areas from many world regions and feel very responsible for this task. They enter a community of learners in which they experience the capacity to build and engage in a search for quality in higher education.

In turn, these communities seek engagement and commitment from both their respective institutions and from individual persons. The setting assumes their participation in meetings at which they work to advance the mutually defined and mutually shared tasks with a schedule that maintains the momentum of timely progress toward goals but also arranges the time so that all participants are able to contribute. They are also required to have the capacity to listen and to share, of being prepared to take part in a joint building project. The group selects some to be their coordinators, becoming, in essence, members of the management committee of the given region.

Tuning is built on every person who takes a part in it and shares ideas, initiatives and doubts. It invites contributions from each hands-on academic and every professional who cares about education and future trends in his/her field. It rests on people from different regions of the world who share the project's goals and have the creativity and flexibility to adapt it to their needs. It is global because it must relate to global standards; but, at the same time, it is local and regional because of the conviction about a shared mission and the focused efforts to build together to fulfill that mission. In this context, the project tries to follow the needs and demands of the region. The only limit is quality.

The recent publication *Communities of Learning: Networks and the Shaping of Intellectual Identity in Europe, 1100-1500* (Crossley and

Mews, 2011) asserts as a fundamental insight that all new ideas are developed in the context of a community, whether that community's basis is academic, religious, or simply a network of friends. The Tuning communities have the challenge of making an impact on the higher education development of their regions.

2.3. The Tuning Methodology

Tuning is a methodology with clearly designed steps but with a dynamic perspective that allows for adaptation to different contexts. It has some identified requisite steps, but its capacity in specific developments at regional level remains remarkably open.

The methodology has a clear objective: to build compatible and comparable degrees that are relevant to society and that are intensively focused on maintaining and improving quality. These degrees need to be accepted by all the countries involved. This methodology explicitly calls for the process to value and preserve the valuable diversity coming from the traditions of each country.

These requirements demand a collaborative methodology, based on a consensus being developed by experts from as varied a background as possible to be representative of the context in which higher education engages seriously and consistently with its real-world context. These experts are expected to have the capacity to understand the geographical negotiable and non-negotiable realities as much as they must understand essential elements of the discipline and the degrees themselves.

2.3.1. *Organisationally*

The different steps take place in a succession of group meetings where the work is planned, debated and jointly understood. The results are shared and discussed, preceded and followed by periods of work, consultation and online and web communication that enriches the encounters and the joint actions taken.

The academic discipline is the backbone of the debates that occur in these group meetings. Except for some transversal cases or requirement highlighted by the group providing political backing, all the groups are discipline-based although the discipline can be understood in broad terms such as gender equality or humanitarian action. Every group is led by a coordinator(s), who is selected by the group and who, as a consequence, becomes part of the management committee. Every meeting is carefully prepared for by the general coordinators.

The programme and documents showing the state of the debate are circulated electronically before the meeting so that all participants arrive fully briefed and prepared to engage in the on-going debate. These documents are also collected in booklets that mark the steps of the process and document it.

2.3.2. *Thematically*

The methodology has a clear aim: to develop degrees of quality and social relevance. These degrees must meet the criteria of being comparable and recognisable as region/institution specific but must also preserve the rich diversity within the regions.

The methodology follows a number of questions/problems which mark its different steps:

Question 1. How can participants build mutually compatible and comparable degrees, that are capable of being recognised by all participants?

The search for an answer brought the Tuning approach to conclude that a critical area of agreement should be the final outcome of the learning process. Meeting this criterion would allow the final end to be comparable within the participating group, recognised by members of that group and respectful of the diversity represented among the participants. Thus, each successful degree required clear articulation of goals but also a highly sophisticated negotiation process. Working towards achieving these three criteria—which on their face seem to be in conflict—pointed to one focal point: the importance of the degree profiles.

This realisation next led to the exploration of how these profiles could be best described and developed. The consensus centred around the competences and the learning outcomes as objective accomplishments that could be reality-based, rather than relying on rhetorical compatibility.

Question 2. How to create socially relevant degrees?

In order to make degrees socially relevant, the degrees needed to be comprehensible to many actors at many levels of experience; they needed to contain criteria by which they could be evaluated and held accountable. They needed to be transparent, readable, and able to be consulted by participants from a variety of backgrounds and experience levels. To meet the demand for an understandable language led to the agreement that this language must be the language of competences.

Question 3. Could this process allow students to go beyond the content to attain degrees that produced highly relevant learning, thus marking in this moment of change the opportunity to reach the highest levels of quality in higher education?

Again the direction led participants to set, as a requirement for these degrees, their ability to be expressed in terms of competences. "Competence" itself was defined broadly, including knowledge and understanding, skill and capacity for autonomy and responsibility.

This is how the Tuning project began its work on a consistent system of developing degrees. The degrees would be competence-based and have student outcomes as the central focus. In other words, the critical focus of these degrees would be learners' development of competences that could be clearly evaluated by a number of different participant-groups. This methodology was developed around three axes that organised clusters of processes: (1) The degree profile, (2) The degree programme and (3) The path of the learner.

2.3.2.1. Approaches for the development of degree profiles

Introduction. The degree profile holds a central position in Tuning methodology. Its satisfactory development is determined in relation to its manifest social relevance, to the quality of the entire degree and to recognition by other participant groups. The profiles guide the rest of the processes. They lead the entire degree and heavily influence all other aspects of the degree.

The definition of degree profiles has advanced significantly as reflection and discussion have focused on various facets during the latest period of the Tuning project. Degree profiles were always clearly identified with the block of competences that must be developed to receive the degree. It was also the guiding element in the entire process of designing degrees. It is not surprising that, when the European Qualification Framework for Higher Education (EQF) was elaborated in 2005, the programme introduced degree profiles by referring to Tuning as the leading force behind the development of degrees.

The definition has remained simple and straightforward from the start. In fact, reshaping slightly the definition given in *A Tuning Guide to Formulating Degree Programme Profiles* (Lokhoff et al., 2010, p. 52), it is clear that a degree profile describes the specific characteristics of a qualification in terms of learning outcomes and competences. A degree profile describes in clear, understandable language what a learner should be expected to know, understand and do at the end of his/her learning experience.

After a long process of reflection and debate to clarify Tuning projects in Russia, Latin America, and Africa, this definition of the degree profile has emerged as a combination of forces around four poles:

- The needs of the region (from the local to the more international context).
- The meta-profile of the subject area, the structured points of reference.
- The consideration of future trends in the profession and in society.
- The specific mission of the institution.

2.3.2.1.1. *Analysis of social needs and professional demands*

The issue of social relevance is paramount for designing degree profiles. Without a doubt, the analysis of the relationship between university and society is at the core of the theme of relevance in higher education. Social relevance in a degree profile, however, can take different forms such as being readable and understandable so that both students and employers can comprehend the essence of the training offered. It can also mean accountability and transparency. In addition, it can mean taking society into account and listening to the values and requirement of the different stakeholders. Built into it is the capacity to develop processes of consultation that can be a part of the designing of degree profiles.

Given the multiplicity of stakeholders and the different expectations that they have of higher education, striking a balance between employability, citizenship, and personal growth becomes a challenge. In an attempt to address such a challenge, Tuning has developed a specific methodology that has proved successful in building new design programmes (including reshaping existing programmes) that respond to these multiple aspirations. The Tuning consultation process also tries to identify the right mix of skills and their translation to curricula so that higher education graduates may be able to face current—and prospective—needs, to satisfy "global" demands, and to contribute to the betterment of their societies and immediate environments.

In addition to these broad social aspirations, other academic and labour imperatives must be met, perhaps most significantly, the needs of the knowledge society. The OECD (2008), for example, stresses the role of tertiary education in fostering research, innovation and development, and suggests the development of educational policies in articulating clearly the nation's expectations of the tertiary education system and aligning priorities of individual institutions with the nation's economic and social goals.

Tuning aims at identifying and addressing the needs of the productive sector, of the economy, of society as a whole and of individual learners within a particular area of study as mediated by their specific social and cultural contexts. To strike a balance between these varied needs, goals and aspirations, Tuning has undertaken consultations with leading persons, key local thinkers and experts from industry, academia, and civil society, and working groups that include all stakeholders. These practises are explained below.

The search for relevance is one of the driving forces behind Tuning exercises that are destined to:

- Understand, discuss and enrich the definition of generic and subject specific competences.

- Reflect critically on the needs and the strengths of their own region and the thematic and professional fields related to their own field.

- Know how other regions of the world position themselves in this respect.

- Provide for a frame of reference for later individual degree profiling.

- Be aware of shortages and gaps present in the area.

- Reflect on the characteristics of the citizens who can best contribute to the culture of the region and to a world culture of democracy, sustainability and human rights.

- Consult with other discussion groups selected in each of the academic communities.

To accomplish this first collective task of defining generic competences for the specific region, each Subject Area Group prepares a list of the generic/ transversal competences considered to be relevant to its perspective region. Its members first reflect on and discuss their own understanding of the socio-economic needs of the area. They then analyse lists found in the current literature and those selected by previous Tuning groups. This task is finalised when the group has understood, broadly discussed and reached consensus on a selection of competences thought to be most appropriate for the region. They approach this task from a rich intercultural perspective since the participants come from different countries and cultural backgrounds. The final stage occurs at the general group level where understanding, debate and agreement must be reached for all of the Subject Area Groups involved. It is a process of enrichment and responsibility-raising awareness that focuses on relevance and is expressed in the common language at group level. This task is also conducted with the subject-specific competences.

It is necessary to undertake this major check on relevance in the context of the entire list of socio-economic needs which has been identified and agreed upon. The analysis seeks to measure the degree to which the broader society sees these competences, as selected by academics, as leading to basic required levels of employability and active citizenship. This search for relevance has recently been redefined as “preparing for sustainable employment; preparation for life as active citizens in democratic societies; personal development; [and] development and maintenance, through research, teaching, and learning, of a broad, advanced knowledge base” (from the Committee of Ministers to member states on the public responsibility for higher education and research quoted in Samardži´c-Markovi´c, 2013, p. 7). It is this personal, professional, institutional and social responsibility, which may be referred to in different ways and which may respond to the necessity of placing knowledge and capacity at the service of social development and innovation.

The next task relates to the process of consultation. This requires (1) Understanding the reasons behind the consultation as well as the value attached to this practise; (2) Selecting the mode of consultation which participants agree is most appropriate; (3) Understanding the technical requirements; (4) Acknowledging the existing traditions and literature; and (5) Identifying, discussing and agreeing on the most relevant groups to be consulted (other academics, employers, students, graduates, professional bodies, government bodies, associations of citizens, platforms, think-tanks, etc.).

Once the mode of consultation has been agreed upon and the process has been completed, the final stage in this practical exercise of searching for social relevance refers to the analysis of the findings. This exploration is carried out jointly by the group, which takes special care not to lose any of the contributions emerging from different cultural perceptions. These perceptions should enlighten the understanding of the concrete reality, define the most urgent needs, pinpoint recognised strengths, weaknesses, opportunities and threats, and plan for them in terms of educational measures, taking into account the characteristics of the specialists and the citizens whose combined perspectives are most valuable in offering an answer.

The specific process followed by the region of Africa in this project is explained in detail below.

2.3.2.1.2. *The development of meta-profiles for the area*

It is in the tradition of Tuning to build reference points for each of the fields and to offer an understanding of the specific academic area. Communities of Learning from different parts of the world have identified the core elements in terms of competences that would make a degree identifiable and hence recognisable. It is the knowledge of and the joint debate about each specific academic area that most tellingly identifies the work of Tuning. The process of using the five topics below leads the experts to the reference points:

- From their particular background, they analyse how the academics in each group would define their specific area.
- Which competences are the core contributions of each area to the development and advancement of society?
- Which are the core elements in a particular subject area or field of knowledge and how may they be determined?
- Which competences can be considered core for those attaining a qualification in this particular field and at each of the levels?
- Which competences, although not core, are most needed in the region?

The intercultural debates end with the final selection of competences that can define the specific cohorts of learners who achieve a degree in a given field.

The need to build degrees capable of being recognised in the European Higher Education Area was one of the earliest aspirations of the Tuning experience. Debates on the core elements of every area constitute an essential process in Tuning. Such debates seek to define and highlight the collective understanding of a particular field and to achieve agreement on what constitutes core (as opposed to diverse or specialised) competences. It is critical to differentiate between the core elements and the specialised aspects introduced for different reasons into the different subject areas. The goal of this work is to build and discuss lists of competences in the different regions, giving participants ownership over the comprehension of each of the fields as well as ownership of the results. This finding has been significant and useful in different parts of the world.

However, during the last two years, a new step has been developed: Tuning participants have undertaken a further exercise beyond providing the reference point: that of analysing the classification, structure and desired weight attached to each point of reference. Discussion of questions concerning how such points of reference could be grouped, their linkages and their comparative importance have led to the creation of meta-profiles. Tuning Subject Area Groups (SAGs) are prepared to carry out this task at the regional level because they are genuine Communities of Practise, formed of highly experienced academics in their respective areas (Eckert, 2006). Furthermore, the Tuning Communities are continually open to communication with parallel groups from other regions and other academic fields/areas of practise and can, therefore, be truly considered Communities or Networks of Learning (explained below).

Thus, Subject Area Groups not only agree on the lists of components that identify the core and the level of diversification but also take the next necessary step of classifying the findings and creating a structure that communicates how they understand the relationship of the components to each other. These are called meta-profiles.

Thus, a meta-profile represents the structure and combination of competences that give identity to a subject area. A meta-profile is a mental construct that categorises competences into major recognised components and illustrates their interrelationship.

The meta-profiles have become effective tools for achieving understanding of a field of study at the level of the individual region. One advantage is their capacity to create collective understanding of and to raise the level of the debate about essential versus secondary elements in, for example, medicine, history, agriculture or architecture. This collective understanding is important in reaching a common comprehension of degrees since it focuses on the centrality of the reference points and their respective weights in an educational programme. Once this collective understanding is reached, it offers the possibility of reflecting on and discussing further the combination of elements. Such reflection and debate normally lead to greater depth and accuracy in understanding and to higher quality.

The second contribution relates to recognition, or the validation of a learning experience. Among its meanings is the validity of an academic qualification acquired in one country when its holder enters another country, either to participate in the labour market or to enrol in a postgraduate programme in that country. Tuning maintains that recognition depends on having proof of having achieved the desired set of outcomes. This approach allows for a broad variety of routes, approaches and processes to achieve the goals. Historians, for example, can study past developments in different geographical settings. They can do so by reference to a very wide range of methodologies. They can also explain contexts citing different traditions, variations of cultural institutions and events that belong to different settings. However, the outcomes should be comparable in terms of the graduates' capacity to analyse societies in their evolution across time and transparent in the methodologies and rigour used in their research or in the language in which their findings are presented while allowing for academic debate to continue and deepen.

The conscious decision to focus on outcomes leads directly to the relevance of meta-profiles for recognition. Meta-profiles present an understanding not only of the core elements and their description but also of their identification and explanation in a readily understood and shared language. They offer the location, importance and weight of the different factors that make up the whole image. The meta-profiles give the contours within which degrees can be identified and recognised because the key elements are clearly portrayed and lucidly described.

The third advantage of developing meta-profiles is the possibilities they offer in the development of joint degrees. Through the consideration of the meta-profile, a degree profile's main elements may be identified and responsibilities for its construction be shared, based on a common understanding of the whole area. In this age of transnational degrees, tools that foster common understandings are particularly helpful.

Finally, meta-profiles provide a new and different path to regionalisation (Knight, 2012) and ultimately to globalisation. The Tuning process builds meta-profiles are jointly built, owned and later validated at the regional level (e.g., Europe, Latin America, Africa). A logical next step is the further level of comparison with other world regions with the ultimate goal of eventually achieving harmonisation at the global level. These further steps, like the entire Tuning process, occur through a bottom-up approach, that is, from the regions upwards. At these final two stages, each region owns its own processes and may agree to compare or share with another only if, when and to the extent it chooses to do so. In this way, the Tuning methodology respects the core validity of the local elements that are at the heart of the process. The significance of this difference in developing global indicators cannot be overestimated. Using a bottom-up, rather than a top-down process, creates a new and improved path to reach global indicators.

Thus, in Africa, as it will be seen by the different results in each of the Subject Area Groups, the development of meta-profiles creates the possibility of at least six uses.

- This process required a great deal of genuine intercultural dialogue to achieve understanding of how to locate the different competences in each degree. The experts, with their different countries of origin, linguistic backgrounds, cultural traditions and professional careers, arrived at an understanding of the main elements to be considered.

- They were able to discuss how the different elements interrelated and the level of centrality they occupied.

- In working on the problem of degree recognition, these experts found it extremely useful to weigh the significance of the core competences against those located more in the periphery.

- Each Subject Area Group contrasted the meta-profile with a number of universities in the different countries to determine which elements were either missing or over-represented and how to improve the degrees in the various contexts.

- Very much to the point, this meta-profile serves as an on-going reference for developing degree profiles in terms of the specific region’s needs.

- Finally, meta-profiles will be used to compare and contrast the regional perspective with meta-profiles developed by other geographical areas in a bottom-up way of reaching a global perspective.

2.3.2.1.3. *Consideration of future trends*

The present concern for the relevance of higher education means a preoccupation with today's social needs. Higher education can help meet those needs, but it also provides a process by which to evaluate the influence of degrees in shaping future societies and in anticipating social, economic, cultural and political changes. Designing degree profiles is basically an exercise in looking into the future. In the present context, it takes time to plan, develop and approve degrees. Students need years to earn their degrees and mature in their learning. They are called to prepare themselves to act, serve, innovate and transform future societies and to meet future challenges. Profiles should look as much—perhaps even more—to the future as to the present. Taking into account future trends in the specific field or fields where the degree is located is a requirement of quality.

The Tuning project in Latin America took up this aspect of the task and initiated a methodology for introducing the analysis of future trends in the designing of profiles. In preparing to undertake this study, participants reviewed key contributions in the field of future and foresight studies, revealing how well developed and sophisticated this field has become. Thus, methodology was adapted to the task-specific context, emphasizing some steps and opening the way for further analysis.

The aim of this group was to identify and draw conclusions jointly on the changes and drivers for change present in society and the predictable challenges that would occur in the next twenty years. Participants, using these projected challenges, developed a number of possible scenarios and considered the implications for each of the specific scientific and professional areas. A further step was reflecting on the implications for each scenario that new professions or professional approaches or tendencies would call forth. A very relevant aspect in the analysis was the focus on the new competences required by the general trends or by the specific context, scenarios and professions emerging in the future and how these factors can shape the future of the education in general and of degree profiles in particular.

In the case of the African region, this exercise has yet to be taken beyond the pilot project but will surely bring new elements of reflection and quality into the development of degree profiles.

2.3.2.1.4. *The mark of the university where the degree is anchored*

Finally, another consideration in degree profiling is the university where the degree is anchored. An important achievement in the post-Bologna phase is that degrees have become an institutional venture, a fruit of collegiate activity in both design and delivery. At present, virtually every institution of higher education has articulated a mission, a vision and a set of values that it proclaims to follow. This characteristic was rare in many parts of the world before the 1990s.

Consideration of the context added by the individual university requires reflecting on the processes of differentiation manifest in the world of higher education institutions. Thus, Van Vught (2010) considers that the educational literature is clear about the desirability of diversity as one of the major factors associated with the positive performance of such higher education systems. Based on previous literature, he summarises the arguments in favour of an increase in diversity as: (1) An important strategy to meet student needs, offering access and opportunities to people from different backgrounds who require an educational environment more suited to their needs; (2) A way to favour social mobility by providing multiple forms and points of entry, transfer and exit, which thus allows a system for correcting errors caused by poor choice and encouraging further opportunities for success; (3) A means to meet more adequately the diverse needs of employability; (4) A way to serve the political needs of interest groups in society to achieve their own identity and legitimisation; (5) A strategy to permit the important combination of elite and mass in higher education; (6) A means of attaining high effectiveness due to the concentration of skills and the participants' dedication to performing specific tasks; (7) A context to experiment with innovation without having to implement innovation at all institutions and allowing for low risk in this experimentation.

This diversity can certainly be fostered in the definition of these institutions' degree profiles. In this context, diversity will predictably have an international impact if the institution has an international orientation rather than a regional commitment, for example, and, as another example, a number of research profiles in its degrees if the institution prides itself on being research-driven rather than focusing on applied science.

The identification and even the strategy of working towards a specific real or desired profile of a higher education institution can be equated to a strategy of striving for quality, attempting to build on institutional strengths as well as being a way to foster the realisation of the university mission. Once the university mission is declared, it will influence the degrees offered by that same university as a sign of quality, service and mission consistency.

This type of analysis will be developed at later stages in this project of Tuning and Harmonisation in Africa. Also to be explored in greater detail are the other two major axes: the degree programme and the learner's path.

2.3.3. *The degree programme*

The degree programme deals with the length, level and definition of the programme in terms of competences and learning outcomes; it also analyses the methodologies for developing the appropriate strategy of teaching, learning and assessing those competences as well as setting up the internal systems for assuring programme quality.

2.3.4. *The learner's path*

The individual learner's path is the point of departure. It includes his/her style of learning, personal objectives, his/her motivations, difficulties and above all strengths.

Identifying the learner's path is the task for future developments of Tuning in the African region. The commitment of the experts and their proven capacity can make an impact, first with the development of degree profiles of high quality but later with providing excellent ways of implementing them to take a significant step into the development of high-quality performance in the region.

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Chapter 3

Generic Competences and the Consultation Process

Pablo BENEITONE

3.1. Definition of Generic Competences for Africa

The Tuning Africa Project began at the end of 2011. One of its first tasks was to define generic competences for Africa. Each Subject Area Group (agricultural sciences, civil engineering, mechanical engineering, medicine and teacher education) was asked to submit a list of the generic competences considered to be relevant to their perspective. As a starting point for preparing this list, they were given the thirty-one generic competences identified in Europe (http://tuning.unideusto.org/tuningeu/), the twenty-seven generic competences identified in Latin America (http://www.tuningal.org), the thirty generic competences identified in Russia (http://www.tuningrussia.org) and a range of contributions from different participants in the project.

At the first General Project Meeting, held in Yaoundé, Cameroon, in January 2012, the five Subject Area Groups (SAGs) working at that time discussed a proposal for the generic competences. The five groups presented a compilation of the generic competences in draft form, and the five coordinators agreed on a final list. On the last day of the meeting, the participants decided in a plenary session to present a definitive list of eighteen generic competences and define the specifications for further consultation: (1) Who should be consulted, (2) How many agents should be consulted, and (3) The way in which the process should be carried out. They further agreed that the sixty participating universities should consult on the generic competences through the areas of the project on which they were working. An agreed-upon questionnaire included a final "other" option, to allow those consulted to add generic competences that had not been included in the original list.

3.1.1. *List of generic competences agreed upon for Africa*

1. Ability for conceptual thinking, analysis and synthesis.
2. Professionalism, ethical values and commitment to Ubuntu (respect for the well-being and dignity of fellow human beings).
3. Capacity for critical evaluation and self-awareness.
4. Ability to translate knowledge into practise.
5. Objective decision-making and practical cost-effective problem solving.
6. Capacity to use innovative and appropriate technologies.
7. Ability to communicate effectively in both the official/national and the local languages.
8. Ability to learn how to learn and capacity for lifelong learning.
9. Flexibility, adaptability and ability to anticipate and respond to new situations.
10. Ability for creative and innovative thinking.
11. Leadership, management and teamwork skills.
12. Communication and interpersonal skills.
13. Environmental and economic consciousness.
14. Ability to work in an intra- and intercultural and/or international context.
15. Ability to work independently.

16. Ability to evaluate, review and enhance quality.

17. Self-confidence, entrepreneurial spirit and skills.

18. Commitment to preserve African identity and cultural heritage.

A comparison of the lists drawn up in the European project, the Latin American project and the African project shows a high degree of similarity among the main generic competences. The three projects also identify many convergent competences, which are easily comparable. Many other competences from the European and Latin America list were regrouped and redefined as one competence by the African project. Finally, the African project incorporates a particular competence that is unique to its list: "Professionalism, ethical values and commitment to Ubuntu (respect for the well-being and dignity of fellow human beings)".

3.2. Methodology for the Consultation Process

As in other Tuning projects, the SAG participants decided to use a system of cluster sampling, given that the people surveyed are grouped in the universities themselves. This decision acknowledges that survey respondents are not strictly independent of each other, with the result that such sampling could not, in all probability, be considered random. At the same time, the universities have a certain clustering effect at the level of each country.

Cluster designs are widely used in research and do not represent a source of partiality (Bryk and Raudenbusch, 1992; Draper, 1995; Goldstein, 1992, 1995; Goldstein and Spielgelhalter, 1996). Cluster sampling can affect the error rate of sampling of the study of any calculation generated. The sampling error increases depending on the differences in the questions measured between conglomerates.

The design effect due to cluster sampling has to be calculated using an intra-class correlation. A high intra-class correlation indicates that differences among the conglomerates are high and, therefore, increases the sampling error in the research. It should be noted that a low inter-class correlation in any question, i.e, close to zero, indicates that a simple random sample would have given similar results.

All the calculations and conclusions take into account the nature of data clusters, at both university and country level, using multi-level models. This model was considered to be the most suitable, because it takes into account the structure of data clustering. That is, it does not assume that the observations are independent as they are in a random sample. These models have been extensively used in educational research since the segmented structure is nearly always present.

At the same time, multi-level models allow for the simultaneous appreciation of individual differences and conglomerates, giving suitable calculations of typical errors and making appropriate any deduction at an individual and conglomerate level (i.e., countries/universities).

In this context, the conglomerates are not seen as a fixed number of categories of an explanatory variable (e.g., the list of the universities selected as a fixed number of categories), but rather the selected conglomerate is considered as belonging to a totality of conglomerates. At the same time, it provides better calculations at an individual level for groups with a small number of observations.

3.2.1. *Variables*

The participants decided to consult subjects according to two variables:

- The degree of importance, meaning the relevance of the competence, in their opinion, for work in their profession
- The level of achievement, meaning the achievement of this competence as a result of having taken this university degree.

To evaluate these two variables, the interviewer used a four-point scale: 1 = “none”; 2 = “weak”; 3 = “moderate”; 4 = “strong”.

Based on the categorisation of the five most important competences according to academics, graduates, students and employers, a new variable was created for each competence. The competence that was ranked highest in the survey was allocated five points, four for the second and so on, with one point for the last in the selection. If the competence was not chosen in the survey, it scored zero points.

3.2.2. *The consultation process*

Once the variables had been defined, agreements were reached on which and how many people to consult:

- Academics: University lecturers teaching in any of the theme areas of the project. Each university was asked to gather information from at least 30 academics in the area in which the university was participating.

- Graduates: People who had successfully completed a full study programme/university degree, in any of the areas of the project and had received the corresponding degree. Each participating university was asked to survey at least 30 graduates from the area in which it was participating. The graduates selected had to have received their degree three to five years before the date of the survey. This criterion depended on the number of graduates who had received their degree during this period. If the number of graduates was few (number specified), the sample had to include graduates from the five previous years. If graduates exceeded a specified number, the sample was limited to those from the three previous years.

- Students: People who are either engaged in the last two years of a first degree in any of the project areas in the participating universities or still awaiting graduation despite having completed their studies. Each university was asked to sample a minimum of 30 students from the subject area in which it was participating in the project.

- Employers: People and/or organisations who have employed graduates from the university, or people and/or organisations which, although there is no evidence that they have hired graduates from the university, appear to have jobs of interest for graduates. Each university was asked to obtain information from at least 30 employers of graduates in the subject area represented by the university in the project.

Various alternatives were proposed for carrying out the survey. Each university could use the form or forms it considered most suitable, depending on its institutional characteristics and the survey groups in question. The systems proposed were (1) an online survey and/or (2) an explanatory face-to-face meeting followed by administration of the survey:

- Online survey: the simplest of all the variants. The technical staff of the project provided the universities with an electronic form for completing the questionnaire. The questionnaire was made available on the project website. Access to the survey required a user code. Each institution choosing to work with this form had to inform the technical project staff, who then assigned a user code for each group with which the institution was going to use the online survey. This alternative simplified the work of the participating university, in that it had only to send an e-mail to possible interviewees, giving them the URL of the website with the questionnaire and an access code, together with a covering letter and an explanation of the reasons for the survey. The electronic questionnaires were available in English and French.

- Face-to-face meeting followed by administration of the survey: In this variant, the group of interest was invited to a talk on the Tuning Africa Project that explained its importance for the education system. Once the aims and the characteristics of the survey had been described, those present received a printed questionnaire. This procedure facilitated information gathering, given that both the explanatory talk and the information-gathering could be completed in a short time. The institution then incorporated the answers into an Excel spread sheet, which was sent to the technical core. That staff began the process of consolidating the information and the subsequent statistical analysis.

The survey was conducted in March and April 2012, predominantly through the online system, resulting in a very significant number of completed surveys. From the thirty-three African countries participating, more than 4,300 questionnaires were returned. The information was analysed by Jon Paul Laka, a statistician at the University of Deusto, who prepared the tables, graphs and analyses of the information the groups worked with, some of which are shown below.

3.3. Analysis of the Results

The data and results gleaned from the questionnaire allowed for three levels of analysis: (1) The general analysis gives the results from the academics, graduates, students and employers throughout Africa. (2) The analysis by subject area shows the opinions of these four groups, in relation to each discipline. (3) The results of the questionnaires by institution were sent to each institution for its consideration and use. Because the information gathered might be highly sensitive for participating universities, this chapter observes conditions of confidentiality by focusing exclusively on the general analysis and the analysis by subject area. The analysis by subject area will be developed at greater length in the following chapters.

To introduce the general analysis of the results of the questionnaire, Table 3.1 presents the totals gathered in Africa, divided according to the four groups of respondents:

Table 3.1
Totals of Surveys Administered in Africa

Academics	1,130
Graduates	1,051
Students	1,304
Employers	838
Total number of questionnaires received	4,323

Note: This report is the summary only. For the working documents containing tables and graphs, see http://www.tuningafrica.org/.

The general analysis below is presented (1) by group and (2) by variable.

3.3.1. *Analysis by group*

The group analysis presents the results for the four respondent groups (academics, graduates, students and employers), showing in each case which factors were considered most and least important and the respondents' attitude toward the achievement of competences. This analysis includes the differences between the degree of importance and the degree of achievement, in order to highlight any findings that invite re-thought. At the same time, where relevant, the analysis includes a comparison between the African project and those in Europe and Latin America, identifying which competences each group in the three regions considered to be the most and the least important factors.

At the second level, the axis of analysis consists of the three variables (importance, achievement and ranking), which identifies how each of the four groups rated the variable in question. This analysis highlights the degree of correlation between them.

3.3.1.1. Academics' responses

Table 3.2
Importance and Achievement of Generic Competences for Academics from Africa (by decreasing order of importance)

	Description	Importance	Achievement
4	Ability to translate knowledge into practise.	3.76	2.80
1	Ability for conceptual thinking, analysis and synthesis.	3.74	2.79
2	Professionalism, ethical values and commitment to Ubuntu.	3.64	2.63
15	Ability to work independently.	3.60	2.74
10	Ability for creative and innovative thinking.	3.60	2.60
17	Self-confidence, entrepreneurial spirit and skills.	3.58	2.55
3	Capacity for critical evaluation and self-awareness.	3.58	2.61
16	Ability to evaluate, review and enhance quality.	3.57	2.57
6	Capacity to use innovative and appropriate technologies.	3.57	2.54
5	Objective decision-making and practical cost-effective problem solving.	3.56	2.59
11	Leadership, management and teamwork skills.	3.56	2.65
12	Communication and interpersonal skills.	3.56	2.68

	Description	Importance	Achievement
9	Flexibility, adaptability and ability to anticipate and respond to new situations.	3.55	2.55
7	Ability to communicate effectively in both the official/national and local language.	3.54	2.77
8	Ability to learn how to learn and capacity for lifelong learning.	3.48	2.70
14	Ability to work in an intra- and intercultural and/or international context.	3.43	2.45
13	Environmental and economic consciousness.	3.37	2.45
18	Commitment to preserve and add value to African identity and cultural heritage.	3.25	2.27

Academics: Of the eighteen competences, fourteen scored over 3.5. However, all competences scored below 2.8 in terms of how well they were achieved. The three competences considered by academics to be least important are also those that score lowest on achievement ("Ability to work in an intra- and intercultural and/or international context," "Environmental and economic consciousness" and "Commitment to preserve and to add value to African identity and cultural heritage").

Table 3.3
The Five Most and Least Important Competences,
according to African Academics

Most Important Competences	Least Important Competences
Ability to translate knowledge into practise.	Ability to work in an intra-and intercultural and/or international context.
Ability for conceptual thinking, analysis and synthesis.	Environmental and economic consciousness.
Professionalism, ethical values and commitment to Ubuntu (respect for the well-being and dignity of fellow human beings).	Commitment to preserve African identity and cultural heritage.
Objective decision-making and practical cost-effective problem solving.	Ability to evaluate, review and enhance quality.
Ability for creative and innovative thinking.	Ability to communicate effectively in both the official/national and local languages.

In the Tuning project Europe (2008), the academics considered the five most important competences to be: (1) Ability for abstract thinking, analysis and synthesis, (2) Ability to apply knowledge in practical situations, (3) Knowledge and understanding of the subject area and understanding of the profession, (4) Ability to identify, pose and resolve problems and (5) Capacity to learn and stay up-to-date with learning.

The least important competences were considered to be: (1) Ability to communicate with non-experts in one's field, (2) Commitment to the conservation of the environment, (3) Spirit of enterprise, ability to take initiative, (4) Commitment to safety and (5) Ability to show awareness of equal opportunities and gender issues. (See working documents, tables and graphs on http://www.unideusto.org/tuningeu/.)

In the Tuning Latin America project (2007), the academics considered the five most important competences to be: (1) Capacity for abstraction, analysis, and synthesis, (2) Ability to apply knowledge in practise, (3) Knowledge regarding the area of study and related professions, (4) Capacity for investigation and (5) Ability to identify, pose, and solve problems.

The least important competences were considered to be: (1) Ability to motivate and work towards common goals, (2) Interpersonal skills, (3) Ability to work autonomously, (4) Commitment to look after the environment and (5) Ability to work in international contexts. (See working documents, tables and graphs on http://www.tuningal.org.)

Comparing the three regions (Africa, Europe and Latin America) shows an overlap in three of the competences considered to be most important in the two projects: (1) Ability to translate knowledge into practise, (2) Ability for conceptual thinking, analysis and synthesis and (3) Objective decision-making and practical cost-effective problem solving. As the introduction to the methodology mentions, all generic competences in Africa were reformulated and are defined using expressions that are different from, though in most cases equivalent to, those presented in the Tuning Europe and Tuning Latin America projects.

Analysing the similarities and differences between the competences that the African, European and Latin American academics consider to be least important, one competence appears in all three "bottom five” lists: “Environmental and economic consciousness.” African and Latin American respondents also rated another common competence in the bottom five: “Ability to work in an intra- and intercultural and/or international context.”

It is important to note that “ethical values” is considered one of the most important competences by both African and Latin American academics but as one of the least important by European academics.

Finally, returning to the work of the Tuning Africa Project, it is interesting to analyse the differences between the academics’ relative scores for importance and achievement, or, in other words, to identify the gap in each of the eighteen competences between importance and achievement.

The competences with the least difference in the relative score for importance and achievement are: (1) Ability to communicate effectively in the official/national and local languages and (2) Ability to learn how to learn and capacity for lifelong learning. These two competences, which show no significant gap between importance and achievement, were considered to be among the least important, suggesting that, despite not being considered important, they are perceived as being properly carried out.

At the other extreme are the two competences with the greatest difference between what was considered important and the rating given to its achievement: (1) Capacity to use innovative and appropriate technologies and (2) Self-confidence, entrepreneurial spirit and skills.

A significant difference emerges between the average scores for importance and for achievement, documenting significant gaps between the competences considered to be the most important and success in achieving them. They are: (1) Ability to translate knowledge into practise, (2) Ability for conceptual thinking, analysis and synthesis and (3) Professionalism, ethical values and commitment to Ubuntu (respect for the well-being and dignity of fellow human beings). These gaps merit special attention in reflecting on where the academic respondents see challenges to the education process.

3.3.1.2. Graduates' Responses

Table 3.4
Importance and Achievement of Generic Competences for Graduates from Africa (Measures in decreasing order of importance)

	Description	Importance	Achievement
4	Ability to translate knowledge into practise.	3.68	2.81
1	Ability for conceptual thinking, analysis and synthesis.	3.65	2.89
11	Leadership, management and teamwork skills.	3.58	2.76
17	Self-confidence, entrepreneurial spirit and skills.	3.58	2.63
5	Objective decision-making and practical cost-effective problem solving.	3.56	2.72
2	Professionalism, ethical values and commitment to Ubuntu.	3.56	2.68
10	Ability for creative and innovative thinking.	3.56	2.66
15	Ability to work independently.	3.55	2.85
16	Ability to evaluate, review and enhance quality.	3.55	2.71
6	Capacity to use innovative and appropriate technologies.	3.53	2.58
12	Communication and interpersonal skills.	3.52	2.78
3	Capacity for critical evaluation and self-awareness.	3.51	2.70
9	Flexibility, adaptability and ability to anticipate and respond to new situations.	3.50	2.66
7	Ability to communicate effectively in the official/national and local languages.	3.47	2.80
8	Ability to learn how to learn and capacity for lifelong learning.	3.47	2.79
14	Ability to work in an intra- and intercultural and/or international context.	3.38	2.56
13	Environmental and economic consciousness.	3.35	2.54
18	Commitment to preserve and to add value to African identity and cultural heritage.	3.24	2.39

In the case of graduates, thirteen generic competences scored higher than 3.5 on importance but, on level of achievement, all competences scored below 2.8.

Table 3.5
The Five Most and Least Important Competences, according to African Graduates

Most Important Competences	Least Important Competences
Ability to translate knowledge into practise.	Ability to work in an intra- and intercultural and/or international context.
Ability for conceptual thinking, analysis and synthesis.	Environmental and economic consciousness.
Objective decision-making and practical cost-effective problem solving.	Ability to evaluate, review and enhance quality.
Professionalism, ethical values and commitment to Ubuntu (respect for the well-being and dignity of fellow human beings).	Commitment to preserve African identity and cultural heritage.
Leadership, management and teamwork skills.	Ability to communicate effectively in the official/national and local languages.

In the Tuning Europe project, the graduates considered the most important competences to be: (1) Ability for abstract thinking, analysis and synthesis, (2) Ability to apply knowledge in practical situations, (3) Knowledge and understanding of the subject area and understanding of the profession, (4) Ability to identify, pose and resolve problems and (5) Capacity to learn and stay up-to-date with learning.

The least important competences were considered to be: (1) Commitment to the conservation of the environment, (2) Commitment to safety, (3) Ability to show awareness of equal opportunities and gender issues, (4) Appreciation of and respect for diversity and multiculturality and (5) Ability to act with social responsibility and civic awareness.

In Latin America, the graduates considered the five most important competences to be: (1) Ability to apply knowledge in practise,

(2) Capacity for abstraction, analysis, and synthesis, (3) Ability to identify, pose, and solve problems, (4) Knowledge regarding the area of study and related professions and (5) Ability to learn and update learning. The least important competences were considered to be: (1) Ability to work in international contexts, (2) Ability to work autonomously, (3) Commitment to socio-cultural environment, (4) Value and respect for diversity and multiculturality and (5) Commitment to look after the environment.

A comparison of the scores given by African, European and Latin American graduates shows agreement on three of the most important competences ("Ability to translate knowledge into practise," "Ability for conceptual thinking, analysis and synthesis" and "Objective decision-making and practical cost-effective problem solving"). Analysing the similarities and differences between the competences that the African, European and Latin American graduates consider to be least important shows results parallel to those of the academic respondents. One competence appears in the "bottom five" lists in the three regions: "Environmental and economic consciousness." Also like the academic respondents, African and Latin American graduates ranked another common competence in the bottom five: "Ability to work in an intra- and intercultural and/or international context."

An analysis of the results from Africa that focuses on the gap between "importance" and "achievement" assigned by the graduate respondents for each of the generic competences highlights two aspects of interest.

- The competences with the least difference in the relative scores between importance and achievement are: (1) Ability to communicate effectively in the official/national and local languages and (2) Ability to learn how to learn and capacity for lifelong learning. However, these two competences, in which graduates perceive no significant gap between importance and achievement were also considered to be among the least important, suggesting that, although they are not considered important, the respondents perceive them as being achieved.

- The competences that display the greatest difference between the scores for importance and achievement are: (1) Self-confidence, entrepreneurial spirit and skills and (2) Capacity to use innovative and appropriate technologies. The first one, with significant gaps between importance and achievement, is among the five generic competences that graduate respondents considered to be most important.

3.3.1.3. Students' Responses

Table 3.6
Importance and Achievement of Generic Competences
for Students from Africa
(Measured in decreasing order of importance)

	Description	Importance	Achievement
4	Ability to translate knowledge into practise.	3.63	2.79
1	Ability for conceptual thinking, analysis and synthesis.	3.57	2.83
17	Self-confidence, entrepreneurial spirit and skills.	3.56	2.71
11	Leadership, management and teamwork skills.	3.55	2.86
10	Ability for creative and innovative thinking.	3.52	2.72
12	Communication and interpersonal skills.	3.52	2.84
6	Capacity to use innovative and appropriate technologies.	3.50	2.56
2	Professionalism, ethical values and commitment to Ubuntu.	3.50	2.74
5	Objective decision-making and practical cost-effective problem solving.	3.49	2.78
9	Flexibility, adaptability and ability to anticipate and respond to new situations.	3.48	2.76
16	Ability to evaluate, review and enhance quality.	3.48	2.79
15	Ability to work independently.	3.47	2.87
7	Ability to communicate effectively in the official/national and local languages.	3.47	2.87

	Description	Importance	Achievement
8	Ability to learn how to learn and capacity for lifelong learning.	3.45	2.84
3	Capacity for critical evaluation and self-awareness.	3.44	2.74
13	Environmental and economic consciousness.	3.41	2.68
14	Ability to work in an intra- and intercultural and/or international context.	3.35	2.53
18	Commitment to preserve and to add value to African identity and cultural heritage.	3.28	2.50

Students rated only eight competences higher than 3.5 for importance. In terms of achievement, they scored all competences below 2.8.

The two competences seen as being least important ("Ability to work in an intra- and intercultural and/or international context" and "Commitment to preserve African identity and cultural heritage") are, in turn, considered to have the lowest level of achievement.

Table 3.7
The Five Most and Least Important Competences,
according to African Students

Most Important Competences	Least Important Competences
Ability to translate knowledge into practise.	Ability to work in an intra- and intercultural and/or international context.
Ability for conceptual thinking, analysis and synthesis.	Ability to evaluate, review and enhance quality.
Professionalism, ethical values and commitment to Ubuntu (respect for the well-being and dignity of fellow human beings).	Environmental and economic consciousness.
Ability for creative and innovative thinking.	Commitment to preserve African identity and cultural heritage.
Self-confidence, entrepreneurial spirit and skills.	Ability to communicate effectively in the official/national and local languages.

European students consider the following competences to be the most important: (1) Ability to apply knowledge in practical situations, (2) Ability for abstract thinking, analysis and synthesis, (3) Ability to identify, pose and resolve problems, (4) Knowledge and understanding of the subject area and understanding of the profession and (5) Ability to work in a team.

They rated the least important competences as: (1) Ability to act with social responsibility and civic awareness, (2) Commitment to the conservation of the environment, (3) Ability to communicate with non-experts in one's field, (4) Commitment to safety and (5) Ability to show awareness of equal opportunities and gender issues.

In Latin America, the students considered the five most important competences to be: (1) Ability to apply knowledge in practise, (2) Capacity for abstraction, analysis, and synthesis, (3) Knowledge regarding the area of study and related professions, (4) Ability to identify, pose, and solve problems and (5) Ability to learn and update learning.

The least important competences were considered to be: (1) Ability to work in international contexts, (2) Commitment to socio-cultural environment, (3) Interpersonal skills, (4) Ability to work autonomously and (5) Commitment to look after the environment.

A comparison of the scores given by African, European and Latin American students shows that they agree on two of the most important competences ("Ability to translate knowledge into practise" and "Ability for conceptual thinking, analysis and synthesis"). Only one common competence appears on all three of the African, European and Latin American students' "bottom five" lists: "Environmental and economic consciousness". As in the case of academics and graduates, African and Latin American students ranked another common competence in the bottom five: "Ability to work in an intra- and intercultural and/or international context."

Analysing the gap between the scores given by African students to the importance and achievement of each of the generic competences displays the following results:

- The competences with the least difference in the relative score for importance and achievement are: (1) Ability to work independently,

(2) Ability to communicate effectively in the official/national and local languages, (3) Ability to learn how to learn and capacity for lifelong learning, (4) Communication and interpersonal skills and (5) Leadership, management and teamwork skills. These five competences, which show no significant gap between importance and achievement, include one that students considered to be among the least important ("Ability to learn how to learn and capacity for lifelong learning"). This finding suggests that, even though the competence is not considered important, it appears to have been achieved.

- At the other extreme are the competences with the greatest difference between what was considered important and the rating given to its achievement: (1) Ability to translate knowledge into practise and (2) Ability for creative and innovative thinking. The student respondents considered these two competences among the most important yet among the lowest in level of achievement.

3.3.1.4. Employers' responses

Table 3.8

Importance and Achievement of Generic Competences for Employers from Africa (Measures in decreasing order of importance)

	Description	Importance	Achievement
4	Ability to translate knowledge into practise.	3.69	2.73
1	Ability for conceptual thinking, analysis and synthesis.	3.67	2.83
2	Professionalism, ethical values and commitment to Ubuntu.	3.64	2.72
10	Ability for creative and innovative thinking.	3.61	2.63
17	Self-confidence, entrepreneurial spirit and skills.	3.58	2.64
5	Objective decision-making and practical cost-effective problem solving.	3.58	2.62
16	Ability to evaluate, review and enhance quality.	3.58	2.68

	Description	Importance	Achievement
9	Flexibility, adaptability and ability to anticipate and respond to new situations.	3.58	2.66
11	Leadership, management and teamwork skills.	3.57	2.68
6	Capacity to use innovative and appropriate technologies.	3.57	2.60
15	Ability to work independently.	3.55	2.77
3	Capacity for critical evaluation and self-awareness.	3.53	2.66
12	Communication and interpersonal skills.	3.52	2.67
7	Ability to communicate effectively in the official/national and local languages.	3.50	2.74
8	Ability to learn how to learn and capacity for lifelong learning.	3.50	2.68
13	Environmental and economic consciousness.	3.39	2.47
14	Ability to work in an intra- and intercultural and/or international context.	3.39	2.56
18	Commitment to preserve and to add value to African identity and cultural heritage.	3.24	2.43

Employers scored fifteen competences over 3.5 in terms of their importance. In terms of achievement, all competences scored below 2.8.

One competence that employers considered to be most important ("Ability for conceptual thinking, analysis and synthesis") also scored first in level of achievement.

For employers, the three competences rated as being least important are also those that employer respondents considered to be least achieved ("Environmental and economic consciousness," "Ability to work in an intra- and intercultural and/or international context" and "Commitment to preserve African identity and cultural heritage").

Table 3.9
Five Most and Least Important Competences,
according to African Employers

Most Important Competences	Least Important Competences
Ability to translate knowledge into practise.	Ability to work in an intra- and intercultural and/or international context.
Ability for conceptual thinking, analysis and synthesis.	Environmental and economic consciousness.
Professionalism, ethical values and commitment to Ubuntu (respect for the well-being and dignity of fellow human beings).	Commitment to preserve African identity and cultural heritage.
Objective decision-making and practical cost-effective problem solving.	Ability to evaluate, review and enhance quality.
Leadership, management and teamwork skills.	Ability to communicate effectively in the official/national and local languages.

European employers consider the following competences to be the most important: (1) Ability to apply knowledge in practical situations, (2) Ability for abstract thinking, analysis and synthesis, (3) Ability to identify, pose and resolve problems, (4) Knowledge and understanding of the subject area and understanding of the profession and (5) Ability to work in a team.

The least important competences were considered to be: (1) Ability to act with social responsibility and civic awareness, (2) Ability to work in an international context, (3) Ability to show awareness of equal opportunities and gender issues, (4) Commitment to the conservation of the environment and (5) Appreciation of and respect for diversity and multiculturality.

In Latin America, the graduates considered the five most important competences to be: (1) Ability to apply knowledge in practise, (2) Capacity for abstraction, analysis and synthesis, (3) Knowledge regarding the area of study and related professions, (4) Ethical commitment and (5) Ability to identify, pose, and solve problems.

The least important competences were considered to be: (1) Ability to work in international contexts, (2) Ability to work autonomously,

(3) Commitment to socio-cultural environment, (4) Value and respect for diversity and multiculturality and (5) Commitment to look after the environment.

A high level of correspondence can be seen in three of the five competences considered to be most important by employers who responded in the African, European and Latin American survey: ("Ability to translate knowledge into practise," "Ability for conceptual thinking, analysis and synthesis" and "Objective decision-making and practical cost-effective problem solving"). African and Latin American employers ranked another common competence in the top five: "ethical values."

A similar level of overlap occurred twice in employers' least valued competences in all three projects. These two competences thus identified were "Ability to work in an intra- and intercultural and/or international context" and "Environmental and economic consciousness."

The differences between the ratings given to the importance and achievement of each competence show the following pattern:

- The competences with the least differences between the importance and achievement ratings are: (1) Ability to communicate effectively in the official/national and local languages, (2) Commitment to preserve African identity and cultural heritage, (3) Ability to learn how to learn and capacity for lifelong learning and (4) Ability to work in an intra- and intercultural and/or international context. Employers in the survey considered these competences among the least important, suggesting that, although they are not considered important, the employers perceived them as having been achieved.

- At the other extreme are the competences with the greatest difference between those that employers considered most important but furtherest from successfully being achieved: (1) Ability for creative and innovative thinking, (2) Ability to translate knowledge into practise and (3) Self-confidence, entrepreneurial spirit and skills. In short, employers consider these competences to be the most important yet the achievement of which they rate as least successful.

3.3.2. *Analysis by Variable*

3.3.2.1. Importance

In the area of "importance", it is significant that all eighteen competences were rated above 3, on a scale in which 3 is equivalent to "moderate" and 4 to "strong". This means that the eighteen competences defined by the Tuning participants received backing and/or confirmation from the four groups who responded to the survey. In other words, the four constituent groups consider that these eighteen competences should be serious considerations in defining the usefulness, skill sets, and portability of a degree from an African university. The survey, as mentioned, included an open-ended question inviting respondents to identify other possible competences. The analysis of items included on that list concluded that none was sufficiently significant to be incorporated into the list of eighteen; indeed, they consisted of rephrasings and reformulations of the eighteen quantitatively surveyed competences.

The four groups surveyed agreed that two competences qualified as "most important": (1) Ability for conceptual thinking, analysis and synthesis and (2) Ability to translate knowledge into practise.

The graduates agreed with the students that "Leadership, management and teamwork skills" were among the five most important competences while the academic respondents rated this competence much lower. However, employers and academics agreed on giving the highest scores to "Professionalism, ethical values and commitment to Ubuntu (respect for the well-being and dignity of fellow human beings)", a competence that students rated much lower. For their part, the academics included amongst the five most important competences: "Ability to work independently", a quality that employers and students rated much lower.

At the other end of the scale, the four groups converged in agreement on the three least important competences: (1) Environmental and economic consciousness, (2) Ability to work in an intra- and intercultural and/or international context and (3) Commitment to preserve the African identity and cultural heritage.

With regard to the correlation matrix, the values of the correlation coefficient (*r*) were very high—over 0.89 in all cases. This means that there was a high degree of compatibility among the four groups in assigning the level of importance to the eighteen competences listed in the survey. Although there was slightly less compatibility between academics and students, the correlation between academics and graduates was particularly high.

Table 3.10

Correlation Matrix between Averages, Based on the Level of Importance Assigned by the Four Respondent Groups

	Academics	Employers	Students	Graduates
Academics	1			
Employers	0.95526043	1		
Students	0.89415416	0.91828745	1	
Graduates	0.96412153	0.7074393	0.9450594	1

As Table 3.10 demonstrates, there is a high degree of correlation among the four groups surveyed.

3.3.2.2. Achievement

It is worthy of mention that, when survey respondents evaluated the level of achievement, they rated all eighteen competences between 2 and 3. In the four-point scale used in the survey, 2 is equivalent to "Weak" and 3 to "Moderate".

With regard to the competences considered highly achieved by each of the four groups consulted, there was agreement on two competences: (1) Ability to communicate effectively in the official/national and local languages, and (2) Ability to work independently.

The graduates scored "Objective decision-making and practical cost-effective problem solving" higher than employers did. Academics included "Ability to translate knowledge into practise" amongst the five most successfully achieved competences but students rated it much lower.

At the other end of the scale, the four groups agreed in rating two competences as least achieved: (1) Ability to work in an intra- and intercultural and/or international context and (2) Commitment to preserve African identity and cultural heritage.

In general, the four groups gave more divergent ratings to achievement of competences than their more general agreement among the groups with regard to the importance of the competences. This means that there was a high degree of compatibility among the four groups in regard to the level of achievement they assigned to the eighteen competences, with slightly less compatibility between employers and students, and a particularly high correlation between academics and graduates.

Table 3.11
Correlation Matrix between the Averages, Based on the Level of Achievement between the Different Groups

	Academics	**Employers**	**Students**	**Graduates**
Academics	1			
Employers	0.91790369	1		
Students	0.84406054	0.78050010	1	
Graduates	0.96305124	0.92333482	0.90614636	1

It is interesting to note that, paralleling findings in the European and Latin American surveys, African respondents in all four groups rated the level of achievement lower than the level of importance. One of the greatest gaps between achievement and importance appears with two correspondences: (1) Ability for creative and innovative thinking and (2) Self-confidence, entrepreneurial spirit and skills.

In all three regional surveys, these two competences were rated as very important, but all four of the respondent groups scored them as the lowest achieved.

3.3.2.3. Ranking

The use of a third variable in analysing the information has made it possible to verify the consistency of the information gathered and, therefore, the consistency of the conclusions described above in "Importance" and "Achievement". Table 3.12 compares the four groups, showing the ranking of the competences derived from analysis of this variable.

Table 3.12
Ranking of Competences Analysing Consistency of Survey Results

		Academics	Employers	Students	Graduates
4	Ability to translate knowledge into practise	1	1	1	1
1	Ability for conceptual thinking, analysis and synthesis.	2	2	2	2
2	Professionalism, ethical values and commitment to Ubuntu.	3	3	3	4
5	Objective decision-making and practical cost-effective problem solving.	4	4	6	3
10	Ability for creative and innovative thinking.	5	6	4	6
6	Capacity to use innovative and appropriate technologies.	6	8	8	8
11	Leadership, management and teamwork skills.	7	5	7	5
9	Flexibility, adaptability and ability to anticipate and respond to new situations.	8	7	9	9
17	Self-confidence, entrepreneurial spirit and skills.	9	9	5	7
3	Capacity for critical evaluation and self-awareness.	10	11	11	10
15	Ability to work independently.	11	12	10	11

		Academics	Employers	Students	Graduates
8	Ability to learn how to learn and capacity for lifelong learning.	12	10	12	12
12	Communication and interpersonal skills.	13	13	13	13
7	Ability to communicate effectively in the official/national and local languages.	14	14	14	14
16	Ability to evaluate, review and enhance quality	15	15	17	16
18	Commitment to preserve and to add value to African identity and cultural heritage.	16	16	15	15
13	Environmental and economic consciousness.	17	17	16	17
14	Ability to work in an intra- and intercultural and/or international context.	18	18	18	18

An examination of Table 3.13 shows a high level of coincidence among the four respondent groups, both in terms of the competences they considered to be very important and those they saw as least important.

Table 3.13
Correlation Matrix between the Averages,
Based on the Ranking between the Different Groups

	Academics	Employers	Students	Graduates
Academics	1			
Employers	0.96357870	1		
Students	0.96096625	0.94127019	1	
Graduates	0.97069420	0.97050014	0.98192419	1

It is interesting to note that the results of the Latin American and European Tuning survey show less correlation among the four survey groups than that seen in the African study.

3.4. Concluding Reflections on the Results of the Survey of Generic Competences in Africa

The methodology determined by the working group, including the selection of the eighteen competences and the determination of who should be consulted, how many respondents should be selected for the survey, and the administration of the survey itself met with wide acceptance in Africa. More than 4,300 questionnaires focused on generic competences and 3,800 related to subject-specific competences. This response rate shows a great interest that was generated among the many participants in the region.

We saw evidence of high rates of correlation among the four groups consulted (academics, graduates, students and employers) with regard to the eighteen competences, both in terms of importance, and the level of achievement. All four survey groups considered the eighteen competences to be important, awarding them ratings of over 3, on a scale in which 3 is equivalent to "moderate" and 4 to "strong".

The comparatively lower scores these respondents assigned to the level of achievement indicated a serious level of criticism and demand for better quality among those surveyed. It is important to stress that the academics are the most critical group in this regard while the students are the most optimistic.

Significant gaps are apparent when the competences considered to be "very important" by the four groups are compared to the perceived level of achievement. It will be crucial in the future to review these "gap" areas and deal energetically with the perceived lack of satisfactory achievement in areas that participants have shown to be relevant for education, especially in improving the quality of degrees from African universities. Competences that scored least in terms of importance showed less difference when compared to achievement.

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Chapter 4

Agricultural Sciences

Olusola Bandele OYEWOLE, Yemi AKEGBEJO-SAMSONS, Guillaume Lucien AMADJI, Taky Hortense ATTA EPSE DIALLO, Kamleshwar BOODHOO, Ahmed ELAMRANI, Alexander Kigunzu KAHI, Samuel Kwame OFFEI, Jean NDIMUBANDI, Olubunmi Abayomi OMOTESHO, Randrianary Jean Baptiste RAMAROSON, Jean Roger Emile RASOARAHONA, Mariama SENE, Puffy SOUNDY, Margret SCHERMUTZKI and Christopher Mubeteneh TANKOU

4.1. Introduction

The Stakeholders Conference held in March 2011 in Nairobi, Kenya, identified agriculture as one of the major preoccupations of Africans and therefore selected it as one of the five areas of focus for the Tuning Africa Pilot project. A workshop in Dakar, Senegal, in November 2011 selected the twelve countries for the pilot project of representing Tuning Higher Education in Africa for agriculture. See Figure 4.1.

Figure 4.1
Geographical distribution of countries participating
in the Agricultural Sciences component of Tuning Africa

4.1.1. *Participants*

The composition of the agricultural sciences group covered the five regions of Africa, with West Africa as the hub. The participating members and universities comprise:

1. *Benin Republic:* Guillaume Lucien AMADJI, Professor of Soil Science and Vice-Dean, Faculty of Agricultural Science at the University of Abomey-Calavi, Benin.

2. *Burundi:* Jean NDIMUBANDI, Professor of Agricultural Economics and Dean, Faculty of Agricultural Science at the University of Burundi.

3. *Cameroon:* Christopher Mubeteneh TANKOU, Lecturer in Crop Science at Faculty of Agronomy and Agricultural Sciences, University of Dschang, Dschang, Cameroon.

4. Côte d'Ivoire*:* Taky Hortense ATTA EPSE DIALLO, Professor of Plant Pathology at the Université Nangui Abrogoua (formerly Université d'Abobo-Adjame), Abidjan, Côte d'Ivoire.

5. *Ghana:* Samuel Kwame OFFEI, Professor of Biotechnology, and Provost of the College of Agriculture and Consumer Sciences, University of Ghana, Accra, Ghana.

6. *Kenya:* Alexander Kigunzu KAHI, Professor of Animal Breeding and Genomics, and Dean, Faculty of Agriculture, Egerton University, Egerton, Kenya.

7. *Madagascar:* (a) Jean Roger Emile RASOARAHONA, Professor of Food Science and Dean Higher School of Agronomic Science, and (b) Randrianary Jean Baptiste RAMAROSON, Professor of Food Science and Technology and Vice Dean, School of the Higher School of Agronomic Science, Université d'Antananarivo, Antananarivo, Madagascar.

8. *Mauritius:* Kamleshwar, BOODHOO, Professor of Tropical Animal Production and Head of Agricultural Production and Systems, Faculty of Agriculture, University of Mauritius, Reduit, Mauritius.

9. *Morocco:* Ahmed ELAMRANI, Professor of Biochemistry and Plant Physiology, and Coordinator, Master of Food Science and Food Safety, Mohammed I University, Science Faculty, Department of Biology, Oujda, Morocco.

10. *Nigeria:* Yemi AKEGBEJO-SAMSONS, Professor of Fisheries and Coastal Resources Management, University of Agriculture, Abeokuta, Nigeria.

11. *Nigeria:* Olubunmi Abayomi OMOTESHO, Professor of Agricultural Economics; former Dean, Faculty of Agriculture, University of Ilorin, Ilorin, Nigeria.

13. *Senegal:* Mariama SENE, Gaston Berger University, Senegal. Her PhD is in parasitology.

14. *South Africa:* Puffy SOUNDY, Tshwane University of Technology, South Africa. He is a Professor and a horticulturalist.

4.1.2. *Group facilitators and management*

Olusola Bandele OYEWOLE, Professor of Food Science and Technology, and Vice-Chancellor, University of Agriculture, Abeokuta, Nigeria.

Margarete SCHERMUTZKI, Higher Education Expert, Tuning, Germany.

4.2. Context for Curricula Reform and Modernisation

4.2.1. *Preamble*

Agriculture is one of the earliest human activities, dating from primitive states of social development. It can be defined as the set of activities that transforms the environment for the production of animals and plants designed for human use. Agricultural sciences encompasses broad multidisciplinary fields that cover not only the study of plants, animals, and soil, but also the economic and social sciences that are applied to the practise and understanding of food production, processing and preservation. This field covers the study of plants and animals used for food and fibre, from production to final consumption, including their transformation into other useful products.

4.2.2. *Importance of agricultural sciences to Africa*

Agriculture plays an important role in Africa's development. In Africa, the study of agricultural sciences helps in developing human capacity for the rational creation and exploitation of nutrition sources for the population and plays an equally important role in the development of economic systems. A high percentage of the people of Africa depend on agriculture as a source of livelihood. This sector contributes the highest percentage of the gross domestic product (GDP) of most developing countries. Indeed, agriculture provides about 70 per cent of employment and 30 per cent of Sub-Saharan gross domestic product.

For many African countries, agricultural sciences engage the workforce for food and fibre production. Agriculture is an important foreign exchange earner in the continent. It provides the raw materials for many industrial processes. Agriculture, therefore, plays a critical role in the economic development of most African countries.

An educational system for high-functioning agriculture is necessary to provide the requisite human capacity for sustaining the enterprise and requires the skilled management of resources for sustainable development. Therefore, agricultural education should produce graduates who understand the vital role that agriculture plays in the rural and economic development of Africa.

4.2.3. *Agricultural curriculum reform and modernisation*

Agricultural production in Africa has not been able to keep pace with modern developments. At present, farmers in Africa are still working with rudimentary tools and employing age-old technologies. They have little exposure to modern technological developments and education that will enable a more skilled exploitation and preservation of their natural resources.

In Africa, the Faculties or Colleges of Agriculture in many conventional universities provide most of the higher education in agriculture that is available, although a few specialized universities are exclusively dedicated to agriculture. Outside of universities, agricultural education is also offered at polytechnics and other higher colleges of agriculture where ordinary and higher diplomas are offered on completion of the programmes.

Higher education courses in agriculture are offered on first, second and third cycles in these institutions, usually leading to the award of a diploma, bachelor/licence, or master's degree (MSc/MPhil) and PhD in agriculture and its related fields. The duration of the first-cycle programmes varies from three to five years, the duration of the second-cycle programmes varies between one and two years, while completing the PhD may vary from three to five years depending on the specific country and university. A typical programme offers broad-based general training for the first two or three years with specialisation in a particular area of agriculture occurring in the final stages of the bachelor's degree programme.

Among the challenges facing Africa today is the failure of many African agricultural graduates and professionals to work effectively with rural farmers, bringing to bear on agricultural practises the industry, skills and competences that they are expected to have acquired in their various institutions. This is the context in which the Tuning Africa Agriculture Working Group is addressing the challenges. It is with the belief that the challenge of food insecurity can be solved if agricultural graduates acquire the necessary skills and competences that can help them to revolutionise age-old, traditional agriculture by focusing modern skills, competences and technology to improve agricultural production and processing across the continent. The project was therefore committed to drawing out the series of generic and specific competences that have, as their primary goal, the advancement of agricultural education towards modern reforms.

4.3. Methodology

The Tuning approach makes it possible for academics in the same profession to deliberate on academic issues of common concern. For the agriculture component of Tuning Africa, academics with specialties in agriculture from twelve countries came together in four different meetings over a twelve-month period to deliberate and share ideas on the subject of addressing the competences required to meet the challenge of skill deficiencies of agricultural graduates in the continent. Various discussions and consultations were held in which participants shared experiences from their home institutions. The preliminary discussions of the group centred on five major degree profiles.

4.3.1. *Degree profiles at participating institutions*

Participants presented briefs on the degree profiles in agriculture as they currently exist in their various institutions. Table 4.1 identifies the five major categories thus identified.

Table 4.1
Degree Profiles in Agriculture in Some African Universities

		Group 1	Group 2	Group 3	Group 4	Group 5
a	Structure of the study program	Faculty of Agriculture/ Agronomy/ Faculty of Natural Sciences	Faculty of Science/ Technology/	Faculty of Agriculture / Agronomy	Faculty / College of Agriculture	High School / of Agricultural Science
b	Terms/semester, credits/	Semester/credit	Credit /modular/ semester	Semester/ yearly / credit/ modules	Semester/ credit/	Yearly
c	Typical first degrees offered (duration of courses)	BSc (Agric)/ Licence (option)	BSc /BTech (option)/ Licence	BSc Agric, (Option)	BAgric BTech/BSc (Option)	—
	Duration of bachelor's programme bachelor/ licence	3 years	3 years/4 years	3 or 4 years	5 years	none
	Duration of master's programme	2 years	2 years	1 or 2 years	2 years	5 years professional master/ingénieur d'agronomie
	Duration of PhD	3-5 years	3-5 years	3-5 years	3-5 years	Diploma of 1 year. Advanced Studies + 3-5 years

4.3.2. *Typical occupations/fields of work/labour market segments of agricultural graduates in Africa*

Institutions in Africa offer opportunities for students to study agriculture at the diploma, bachelor's, master's and doctoral levels. See Table 4.2 for the job options available to graduates of each of these levels.

Table 4.2
Typical Job Opportunities for Agricultural Graduates in Africa

Diploma	Bachelor/Licence	Master's	Doctorate
• Farm technologists • Farm supervisors • Business • laboratory technicians • Sales Rep. /Marketer • Civil service	• Agriculturists • Farm managers • Food processors • Extensionists • Researchers • Teachers/lecturers • Banking • Consultancy • Civil service • Lab. technicians • Immigration (quarantine officers) •Environmentalists • Managers in game, wildlife, forestry, fisheries • Farm technologists • Engineers • Business	• Agriculturists • Farm managers • Food processors • Extensionists • Researchers • Consultancy • Business • Civil service • Marketers • Civil service (national/ international) • Managers of game, wildlife, forestry, fisheries	• Researchers • Lecturers • Consultants • Business • Civil service (national/international)

4.3.3. *Core elements of agricultural studies*

Table 4.3 presents the core elements and academic scope covered in the training of agriculturalists in Africa as reported by participants in the agriculture component of Tuning Africa.

Table 4.3
Agricultural Specialisations and Their Core Elements

	Specialisation within the Subject Area	Core Elements	Sub-Groups within the Core Elements	Support Elements
1	Animal sciences	Animal biology, zoology, physiology, nutrition, animal health, pasture genetics, breeding, reproduction, management	Subject matter sciences, economics, management sciences, extension	Mathematics, physics, biology, chemistry, language, ICT, statistics, geology, cartography
2	Plant sciences/ crop sciences/ horticulture	Farming systems genetics, physiology, plant nutrition, seed science, breeding, crop protection, botany, biotechnology management	Subject matter sciences, economics, management sciences, extension	
3	Soil sciences	Soil biology, soil chemistry, soil physics, soil ecology, soil microbiology, soil mechanics, soil classification	Subject matter sciences, economics, management sciences, extension	
4	Agricultural extension	Communication, rural sociology, general agriculture, information management, ICT, anthropology	Subject matter sciences, economics, management sciences	
5	Food science and technology	Biochemistry, food chemistry, microbiology, processing, food engineering, food safety and quality, food machinery, nutrition and toxicology, food laws and standards	Subject matter sciences, economics, management sciences, nutrition education/ extension	
6	Fisheries and aquaculture	Zoology, fish biology hydrobiology, limnology fish nutrition, aquaculture fish pathology and health, fish quality and fisheries management, preservation	Subject matter sciences, economics, management sciences, extension	Mathematics, physics, biology, chemistry, language, ICT, statistics geology cartography
7	Forestry and wildlife / conservationists	Botany, zoology, wood engineering, wood science, wildlife management, ethnoforestry, agro-forestry, sylviculture	Subject matter sciences, economics, management sciences, extension	
8	Agricultural economics / agro-business management	Farm management, marketing, agri-business, agric. dev. & policy, micro- and macro- economics, econometrics, biometrics	Subject matter sciences, economics, management sciences, extension	
9	Agricultural engineering/ irrigation engineering	Irrigation, drainage, farm machinery, farm structures, post-harvest technology, GIS	Subject matter sciences, economics, management sciences, extension	

	Specialisation within the Subject Area	Core Elements	Sub-Groups within the Core Elements	Support Elements
10	Agricultural biotechnology	Molecular biology, bio-informatics, genomics bio-ethics, microbiology, diagnostics	Subject matter sciences, economics, management sciences, extension	
11	Water resources and agrometereology	Hydrology, climatology,	Subject matter sciences, economics, management sciences	

4.3.4. *Consultation and development process*

The Tuning competence-based approach makes it possible to consult stakeholders. The concept of competences includes learning outcomes. Tuning distinguishes between generic (relevant to any study programme) and subject competences.

In the Agriculture Sciences Working Group, experts from different regions of Africa have been able to work together constructively to design a questionnaire on generic and subject competences to consult graduates, employers, academics and students. The requisite abilities to learn and practise agriculture were elaborated in the various competences. The group developed questionnaires on the professional role the graduates are expected to carry out and the academic standards they are expected to achieve in the subject area.

Eighteen generic competences were identified for all study programmes. In addition, sixteen specific competences that are, for the most part, innate and natural endowments in the learners, were identified, discussed and jointly agreed on.

Questionnaires on generic and subject-specific competences were sent to academics, students, employers and graduates. Respondents were asked to rank the importance of the eighteen generic and sixteen subject competences and the extent to which they thought these competences are currently being achieved. Respondents were also asked to rank each of these two dimensions along a four-point scale in which 1 = "none", 2 = "weak", 3 = "considerable" and 4 = "strong".

4.4. Generic Competences: A Thematic Perspective

For our purposes, "competences" are the cognitive and meta-cognitive skills, knowledge and understanding, interpersonal, intellectual and practical skills and values (ethical, cultural, attitudinal, experiential and creative) that a learner must acquire to achieve the degree, certificate or diploma that certifies his/her training in the field of study.

"Generic competences" are transferable skills or general academic skills. They are general to any degree programme and can be transferred from one context to another. They are common to all degrees. Anybody who has completed the prescribed period and course of study can be expected to possess these competences. But they have wider implications for continuing development, both personal and also in the world of work. Generic competences are therefore considered important to success in any career for a university graduate in Africa.

One major feature of the Tuning program is its focus on these "generic competences" which graduates should acquire irrespective of their area of specialisation. The program recognizes the possibility of differences in the generic competences of graduates in the different continents of the world.

Following extensive deliberations in Yaoundé, Cameroon, during the Tuning Africa meeting held 23-25 January 2012, the representatives of all subject-specific disciplines agreed on the eighteen competences listed in Table 4.4 as generic competences, common to bachelor degree holders in all subject-specific disciplines.

Table 4.4
Generic Competences for African Higher Education Graduates

	List of Generic Competences
1	Ability for conceptual thinking, analysis and synthesis.
2	Professionalism, ethical values and commitment to Ubuntu (respect for the well-being and dignity of fellow human beings) .
3	Capacity for critical evaluation and self-awareness.
4	Ability to translate knowledge into practise.

List of Generic Competences	
5	Objective decision-making and practical cost-effective problem solving.
6	Capacity to use innovative and appropriate technologies.
7	Ability to communicate effectively in official/national and local languages.
8	Ability to learn how to learn and capacity for lifelong learning.
9	Flexibility, adaptability and ability to anticipate and respond to new situations.
10	Ability for creative and innovative thinking.
11	Leadership, management and teamwork skills.
12	Communication and interpersonal skills.
13	Environmental and economic consciousness.
14	Ability to work in an intra- and intercultural and/or international context.
15	Ability to work independently.
16	Ability to evaluate, review and enhance quality.
17	Self-confidence, entrepreneurial spirit and skills.
18	Commitment to preserve and add value to African identity and cultural heritage.

At the second Tuning Africa meeting, participants decided to survey four groups of stakeholders (academics, employers, students, and graduates), asking them to rate the "importance" and the current level of "achievement" of each of the eighteen competences discussed above on a four-point scale follows: 4 = "strong", 3 = "moderate", 2 = "weak", 1 = "none".

A total of 4,323 respondents provided answers to the questionnaire on generic competences (Table 4.5). Agriculture responses represented about 27.8% of all the responses to the questionnaire.

Table 4.5
Respondents to Questionnaire on Generic Competences

Subject Areas	Number of Respondents to Questionnaire on Generic Competences				
	Academics	Employers	Students	Graduates	Total
Agriculture	312	204	381	306	1,203
Teacher education	335	318	310	307	1,270
Medicine	164	88	203	150	605
Mechanical engineering	152	89	214	124	579
Civil engineering	167	139	196	164	666
Totals	1,130	838	1,304	1,051	4,323

4.4.1. *Rankings assigned to the generic competences: High*

The ratings that the four groups of stakeholders assigned to the eighteen generic competences are presented in Table 4.6.

All the stakeholder groups gave the highest ranking to "Ability to translate knowledge into practise (No. 4). The "Ability for conceptual thinking, analysis and synthesis" (No. 1) was ranked second by the academics, graduates, and employers; students ranked it as fourth. "Professionalism, ethical values and commitment to Ubuntu (respect for the well-being and dignity of fellow human beings)" (No. 2) was ranked third by the academics, fifth by employers and sixth by students and graduates. "Objective decision-making and practical cost-effective problem solving" (No. 5) was ranked seventh by academics and students and third by employers, but fourth by graduates. The "Capacity to use innovative and appropriate technologies" (No. 5) was not ranked among the first seven competences by employers, while "Leadership, management and teamwork skills" (No. 11) was not ranked among the first seven competences by students. "Ability for creative and innovative thinking" was not among the first seven competences ranked by graduates, while neither academics nor employers ranked "Self-confidence, entrepreneurial spirit and skills" (No. 17) among the first seven competences.

Table 4.6
Ratings Assigned to Importance and Achievement
of the General Competences by the Four Surveyed Groups

	General Competences	Academics			Employers			Students			Graduates		
		Import	achiev	gap	import	achiev	gap	Import	achiev	gap	Import	achiev	gap
1	Ability for conceptual thinking, analysis and synthesis	3.67	2.74	0.93	3.74	2.71	1.03	3.50	2.72	0.78	3.59	2.84	0.75
2	Professionalism, ethical values and commitment to Ubuntu	3.57	2.57	1.00	3.68	2.56	1.12	3.49	2.73	0.76	3.47	2.65	0.82
3	Critical evaluation and self-awareness	3.61	2.56	1.05	3.59	2.54	1.05	3.40	2.7	0.70	3.44	2.66	0.78
4	Ability to translate knowledge into practise	3.73	2.74	0.99	3.73	2.63	1.10	3.59	2.68	0.91	3.62	2.73	0.89
5	Objective decision-making, and practical cost-effective problem solving	3.55	2.46	1.09	3.68	2.56	1.12	3.38	2.66	0.72	3.53	2.67	0.86
6	Capacity to use innovative and appropriate technologies	3.60	2.48	1.12	3.64	2.58	1.06	3.44	2.46	0.98	3.54	2.59	0.95
7	Ability to communicate effectively in official/national and local languages	3.56	2.81	0.75	3.57	2.76	0.81	3.46	2.88	0.58	3.44	2.82	0.62
8	Ability to learn and to re-learn, and capacity for life-long learning	3.47	2.64	0.83	3.53	2.65	0.88	3.32	2.76	0.56	3.48	2.86	0.62
9	Flexibility, adaptability and ability to anticipate and respond to new situations	3.57	2.49	1.08	3.59	2.53	1.06	3.42	2.65	0.77	3.59	2.67	0.92
10	Ability for creative and innovative thinking	3.58	2.45	1.13	3.67	2.51	1.16	3.49	2.67	0.82	3.54	2.62	0.92

	General Competences	Academics			Employers			Students			Graduates		
		Import	achiev	gap	import	achiev	gap	Import	achiev	gap	Import	achiev	gap
11	Leadership, management and teamwork skills	3.57	2.61	0.96	3.65	2.71	0.94	3.52	2.84	0.68	3.64	2.79	0.85
12	Communication, interpersonal skills	3.59	2.65	0.94	3.55	2.66	0.89	3.45	2.80	0.65	3.56	2.91	0.65
13	Environmental and economic consciousness	3.35	2.55	0.80	3.48	2.60	0.88	3.46	2.79	0.67	3.34	2.76	0.58
14	Ability to work in an intra- and intercultural and or international context	3.51	2.56	0.95	3.39	2.45	0.94	3.35	2.50	0.85	3.37	2.69	0.68
15	Ability to work independently	3.61	2.74	0.87	3.65	2.72	0.93	3.41	2.86	0.55	3.60	2.97	0.63
16	Ability to evaluate, review and enhance quality	3.57	2.49	1.08	3.62	2.57	1.05	3.35	2.84	0.51	3.52	2.80	0.72
17	Self-confidence, entrepreneurial spirit and skills	3.57	2.46	1.11	3.69	2.58	1.11	3.56	2.83	0.73	3.60	2.71	0.89
18	Commitment to preserve and to add value to African identity and cultural heritage	3.14	2.23	0.91	3.01	2.13	0.88	3.21	2.50	0.71	3.06	2.42	0.64

4.4.2. *Rankings assigned to the generic competences: Low*

As for competences that the four groups ranked lowest (13-18), the clustering showed closer agreement. "Commitment to preserve and to add value to African identity and cultural heritage" (No. 18) was ranked eighteenth by employers and academics, seventeenth by graduates and fifteenth by students. "The ability to work in an intra- and intercultural and/or international context" (No. 14) was ranked eighteenth by graduates and students, seventeenth by employers and sixteenth by academics. "The ability to evaluate, review and enhance

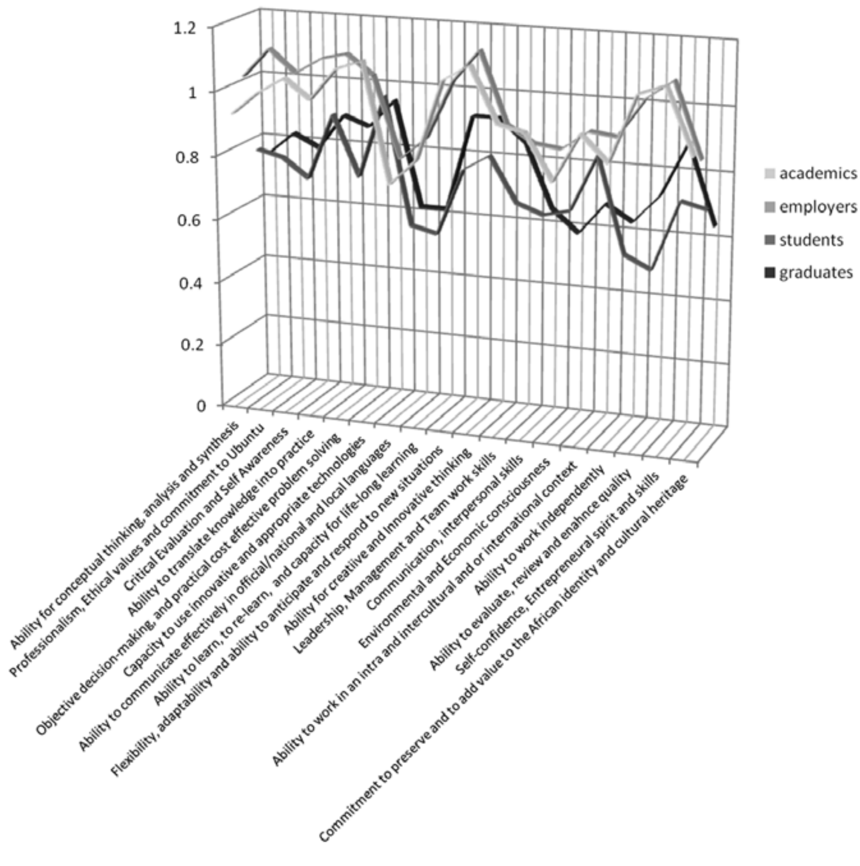

Figure 4.2
Rating differences between perceived importance
and perceived achievement for the eighteen generic competences

quality" (No. 16) was ranked fifteenth by academics, thirteenth by employers and graduates and seventeenth by students. "The ability to communicate effectively in official/national and local language" (No. 7) was ranked thirteenth by academics, fifteenth by employers and sixteenth by graduates and students. "Environmental and economic consciousness" (No. 13) was ranked low by all groups (eighteenth by students and graduates, seventeenth by employers and sixteenth by academics).

Figure 4.2 displays the differences between the rating of the perceived importance and the perceived achievement of the eighteen generic competences by the four groups surveyed (academics, employers, students and graduates).

4.5. Identification of Specific Competences

"Subject-specific competences" are the knowledge, skills, abilities and values that individuals who have completed a course of certified study in a particular subject should possess. A degree programme in agricultural sciences is designed to develop the knowledge and skills required to manage agricultural enterprises, agricultural research, advisory work and other fields relevant to agriculture. Graduates from agricultural degrees will have a thorough understanding of crop and animal production methods and their underlying scientific, economic and business principles. The group of agriculture sciences experts, after deliberating on the competences that they expect their first-degree graduates to possess after completing their programme in agriculture, agreed that a graduate from an African university in agriculture should be expected to possess the following sixteen subject-specific competences.

1. Knowledge and understanding of agricultural production and basic sciences.

2. Ability to identify problems and apply knowledge to solving day-to-day agricultural challenges.

3. Ability to evaluate and manage agricultural projects, as well as carry out financial appraisals.

4. Possession of entrepreneurial and creative skills.

5. Ability to design, plan and implement agricultural research.
6. Ability to do business in any part of the world.
7. Ability to understand and adapt to new and emerging technologies in agriculture, including ICT.
8. Ability to implement sustainable practises and technologies for the management of natural resources.
9. Ability to think independently and ability to work with minimal supervision in the area of agriculture.
10. Ability to adapt and transfer technology, and ability to create new technologies.
11. Ability to know, advise on and implement agricultural policies and regulations.
12. Ability to make sustainable use of water and other natural resources for agricultural use.
13. Ability to understand and work within the organisation, business and community management of the rural sector.
14. Ability to identify pests, pathogens, and weeds associated with crops, animals and their products.
15. Ability to improve quality and safety along the agricultural value chains.
16. Ability to select and manage machinery, implements and equipment for agricultural use in different farming systems.

4.5.1. *Survey results for subject-related competences*

As for the generic competences, four groups of stakeholders (academics, employers, students, and graduates*)* responded to a survey asking them to rate two factors on the above list of sixteen agriculture subject-specific competences: (1) the importance of the variable, and (2) the current level of achievement. They used a four-point scale in which 4 = "strong", 3 = "moderate", 2 = "weak", 1 = "none". The views of the surveyed groups are presented in Table 4.7

Table 4.7
Stakeholders' Perceptions of the Subject-Specific Competences for Agricultural Graduates

		Academics			Employers			Students			Graduates		
		import	achiev	gap	import	achiev	gap	import	achiev	gap	import	achiev	gap
1	Knowledge and understanding of agricultural production and basic sciences.	3.80	3.37	0.43	3.82	3.14	0.68	3.67	3.27	0.40	3.72	3.27	0.45
2	Ability to identify problems and apply knowledge to solving day-to-day agricultural challenges.	3.75	2.84	0.91	3.73	2.75	0.98	3.60	2.94	0.66	3.71	2.87	0.84
3	Ability to evaluate and manage agricultural projects, as well as carry out financial appraisals.	3.65	2.64	1.01	3.63	2.67	0.96	3.49	2.78	0.71	3.61	2.68	0.93
4	Possession of entrepreneurial and creative skills.	3.61	2.58	1.03	3.59	2.36	1.23	3.48	2.75	0.73	3.53	2.60	0.93
5	Ability to design, plan and implement agricultural research.	3.71	2.84	0.87	3.67	2.66	1.01	3.52	2.80	0.72	3.68	3.00	0.68
6	Ability to do business in any part of the world.	3.27	2.31	0.96	3.17	2.21	0.96	3.40	2.58	0.82	3.37	2.48	0.89
7	Ability to understand and adapt to new and emerging technologies in agriculture, including ICT.	3.73	2.60	1.13	3.62	2.66	0.96	3.48	2.59	0.89	3.68	2.53	1.15
8	Ability to implement sustainable practises and technologies for the management of natural resources.	3.69	2.69	1.00	3.65	2.57	1.08	3.39	2.68	0.71	3.56	2.73	0.83

		Academics			Employers			Students			Graduates		
		import	achiev	gap	import	achiev	gap	import	achiev	gap	import	achiev	gap
9	Ability for independent thinking and ability to work with minimal supervision in the area of agriculture.	3.61	2.68	0.93	3.65	2.65	1.00	3.38	2.78	0.6	3.50	2.83	0.67
10	Ability to adapt and transfer technology, and ability to create new technologies.	3.55	2.63	0.92	3.51	2.36	1.15	3.27	2.33	0.94	3.47	2.54	0.93
11	Ability to know, advise on and implement agricultural policies and regulations.	3.47	2.74	0.73	3.53	2.46	1.07	3.36	2.61	0.75	3.49	2.54	0.95
12	Ability to make sustainable use of water and other natural resources for agricultural use.	3.58	2.90	0.68	3.58	2.62	0.96	3.56	2.87	0.69	3.57	2.66	0.91
13	Ability to understand and work within the organisation, business and community management of the rural sector.	3.50	2.74	0.76	3.42	2.71	0.71	3.43	2.73	0.7	3.51	2.75	0.76
14	Ability to identify pests, pathogens, and weeds associated with crops, animals and their products.	3.51	2.35	1.16	3.58	2.79	0.79	3.48	3.03	0.45	3.49	2.95	0.54
15	Ability to improve quality and safety along the agricultural value chains.	3.65	2.45	1.20	3.55	2.45	1.10	3.47	2.89	0.58	3.57	2.77	0.80
16	Ability to select and manage machinery, implements and equipment for agricultural use in different farming systems.	3.43	2.21	1.22	3.36	2.36	1.00	3.40	2.56	0.84	3.41	2.46	0.95

Figure 4.3 displays the differences between the respondents' perception of the sixteen competences' importance and their perception of its achievement.

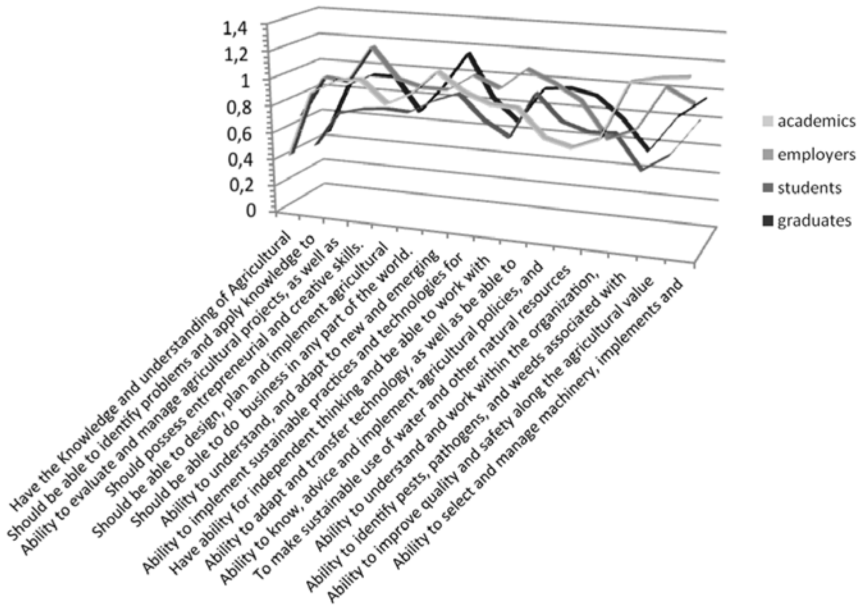

Figure 4.3
Rating differences between perceived importance
and perceived achievement for the sixteen specific competences

Table 4.8 presents the preference ranking of the sixteen agricultural subject-specific competences.

Table 4.8
Stakeholders' Ranking of Agricultural Subject-Specific Competences
(1 = most prefered; 16 = least prefered)

	Subject-Specific Competences	Preference Ranking Positions by Stakeholders			
		Academics	Employers	Students	Graduates
1	Knowledge and understanding of agricultural production, and basic sciences.	1	1	1	2
2	Ability to identify problems and apply knowledge to solving day-to-day agricultural challenges.	2	2	2	1
3	Ability to evaluate and manage agricultural projects, as well as carry out financial appraisals.	5	5	4	5
4	Possession of entrepreneurial and creative skills.	4	3	5	3
5	Ability to design, plan and implement agricultural research.	3	4	3	4
6	Ability to do business in any part of the world.	7	8	7	7
7	Ability to understand and adapt to new and emerging technologies in agriculture, including ICT.	8	7	12	9
8	Ability to implement sustainable practises and technologies for the management of natural resources.	9	10	8	11
9	Ability for independent thinking and ability to work with minimal supervision in the area of agriculture.	12	14	15	15
10	Ability to adapt and transfer technology, and ability to create new technologies.	10	9	6	14

	Subject-Specific Competences	Preference Ranking Positions by Stakeholders			
		Academics	Employers	Students	Graduates
11	Ability to know, advise on and implement agricultural policies, and regulations.	15	15	9	10
12	Ability to make sustainable use of water and other natural resources for agricultural use.	11	11	14	8
13	Ability to understand and work within the organisation, business and community management of the rural sector.	14	12	10	12
14	Ability to identify pests, pathogens, and weeds associated with crops, animals and their products.	16	6	11	13
15	Ability to improve quality and safety along the agricultural value chains.	13	13	16	16
16	Ability to select and manage machinery, implements and equipment for agricultural use in different farming systems.	6	16	13	6

4.5.2. *Rankings assigned to the subject-specific competences: High*

There is considerable agreement about the top five rankings. Three of the four stakeholder groups (academics, students and employers) considered «Knowledge and understanding of agricultural production, and basic sciences” as the most important competence for agriculture graduates to possess. Ranked first by graduates was “Ability to identify problems and apply knowledge to solving day-to-day agricultural challenges”.

All four groups were in close agreement that agricultural graduates should possess the “Ability to design, plan and implement agricultural research”, ranking it either third or fourth.

“Possession of entrepreneurial and creative skills” (No. 4) was ranked third by employers and graduates, fourth by academics and fifth by students. “Ability to evaluate and manage agricultural projects, as well as carry out financial appraisals” (No. 3) was ranked fifth by academics, employers and fourth by students

4.5.3. *Rankings assigned to the subject-specific competences: Low*

The four groups of survey respondents also manifested a level of agreement concerning competences that they rated as least important with all four groups rating three competences among the last six in the table: “Ability to understand and work within the organisation, business and community management of the rural sector” (No. 13), “Ability to select and manage machinery, implements and equipment for agriculture use in different farming systems” (No. 16) and “Ability to design, plan and implement agricultural research” (No. 5).

Further analysis of the data showed a strong correlation between the assessment of academics and employers of the importance of generic competences (0.898), their achievement (0.852) and their ranking (0.889), as displayed in Table 4.9.

Analysis of the subject-specific competences showed a stronger correlation coefficient with regard to importance (0.928), achievement (0.917) and their ranking (0.939).

In contrast, the correlation between the assessments of students and academics/employers of the generic competences was lower than that of the academics and employers, namely: importance (0.710), achievement (0.531) and ranking (0.751).

However, for the subject-specific competences, the correlation for importance was on the low side (0.578) while correlations for achievement and ranking were 0.793 and 0.881 respectively. The difference between importance and achievement, in short, is very large. The agreement between the rating and the ranking of the groups is very high.

Table 4.9
Correlation Coefficients for Generic Competences

		Academics	Employers	Students	Graduates
Importance	Academics	1			
	Employers	0.89824490	1		
	Students	0.71026404	0.77808954	1	
	Graduates	0.89361795	0.92399307	0.7386277	1
Achievement	Academics	1			
	Employers	0.85299060	1		
	Students	0.53145745	0.68507961	1	
	Graduates	0.80006793	0.83211950	0.73690882	1
Ranking	Academics	1			
	Employers	0.88976372	1		
	Students	0.86624967	0.75119360	1	
	Graduates	0.93941775	0.91714947	0.9081643	1

4.6. Consultation and Reflections

The agriculture group considered that the overall results are in line with the expectations. The high correlation between academics and employers in all aspects signals the very close cooperation and interaction between these two groups in agriculture. Certainly, one reason is that students seeking degrees in agriculture work on placements and write final theses with agricultural employers. The reasons for the differences in the rankings assigned by students and by graduates could be due to the fact that students are still in school and therefore would not have a full knowledge of the competences they will need once they are employed and dealing with a range of responsibilities.

The reason for the large differences between the views of the graduates and employers presumably lies in the different work settings. It is not uncommon for graduates in agriculture science to find jobs, not in agriculture, but in banks, schools or government offices. In contrast, the employers who responded to the survey questionnaire were all engaged in agriculture.

4.7. Creating the Agriculture Meta-Profile

A meta-profile is a representation of how the generic and subject-specific competences are categorized into their core and supportive elements in structural formats that show the combination of competences which gives identity to a subject area. This categorisation illustrates the interrelationship of the competences according to their major recognized components.

In developing the meta-profile for agriculture, the Tuning team deliberated on the competences that should constitute the core and supportive elements of an agricultural study program. Core elements are indispensable competences that all agricultural graduates should acquire. Supporting elements are other competences that are related to the core.

The team considered the rankings reported by the stakeholder respondents before categorizing the identified competences into their core and supportive profiles—in other words, their meta-profile. Competences in each group have some essential common characteristics.

The Agricultural Sciences Tuning Africa Working Group identified five core elements for agriculture. The "S" preceding the number designates a subject-specific competence.

- S1 Knowledge and understanding of agricultural production, and basic sciences.
- S2 Ability to identify problems and apply knowledge to solving day-to-day agricultural challenges.
- S3 Ability to evaluate and manage agricultural projects, as well as carry out financial appraisals.
- S4 Possession of entrepreneurial and creative skills.
- S5 Ability to design, plan and implement agricultural research.

The Tuning group for agriculture also identified supporting elements, which they classified into five groups: (1) learning process, (2) social values, (3) organisation and communication skills, (4) innovation and (5) technical/technological capacity.

The Tuning group then distributed the following competences under each identified supporting element. "G" before the number designates a generic competence:

4.7.1. *Learning process*

- G1 Ability for conceptual thinking, analysis and synthesis.
- G3 Capacity for critical evaluation and self-awareness.
- G4 Ability to translate knowledge into practise.
- G5 Objective decision-making and practical cost-effective problem solving.
- G8 Ability to learn how to learn and capacity for lifelong learning.
- S1 Knowledge and understanding of agricultural production, and basic sciences.
- S5 Ability to design, plan and implement agricultural research.
- S7 Ability to understand and adapt to new and emerging technologies in agriculture, including ICT.
- S10 Ability to adapt and transfer technology, and ability to create new technologies.
- S11 Ability to know, advise on and implement agricultural policies and regulations.
- S14 Ability to identify pests, pathogens and weeds associated with crops, animals and their products.
- S15 Ability to improve quality and safety along the agricultural value chains.

- S16 Ability to select and manage machinery, implements and equipment for agricultural use in different farming systems.

4.7.2. *Social values*

- G2 Professionalism, ethical values and commitment to Ubuntu (respect for the well-being and dignity of fellow human beings).
- G7 Ability to communicate effectively in official/national and local languages.
- G9 Flexibility, adaptability and ability to anticipate and respond to new situations.
- G11 Leadership, management and teamwork skills.
- G12 Communication and interpersonal skills.
- G13 Environmental and economic consciousness.
- G14 Ability to work in an intra- and intercultural and/or international context.
- G18 Commitment to preserve and to add value to African identity and cultural heritage.
- S2 Ability to identify problems and apply knowledge to solving day-to-day agricultural challenges.
- S12 Ability to make sustainable use of water and other natural resources for agricultural use.
- S13 Ability to understand and work within the organisation, business and community management of the rural sector.

4.7.3. *Innovation*

- G1 Ability for conceptual thinking, analysis and synthesis.
- G4 Ability to translate knowledge into practise.

- G6 Capacity to use innovative and appropriate technologies.

- G10 Ability for creative and innovative thinking.

- S5 Ability to design, plan and implement agricultural research.

- S10 Ability to adapt and transfer technology, and ability to create new technologies.

4.7.4. Organisation and communication skills

- G7 Ability to communicate effectively in official/national and local languages.

- G9 Flexibility, adaptability and ability to anticipate and respond to new situations.

- G11 Leadership, management and teamwork skills.

- G12 Communication and interpersonal skills.

- G14 Ability to work in an intra- and intercultural context and/or international context.

- G15 Ability to work independently.

- G17 Self-confidence, entrepreneurial spirit and skills.

- S3 Ability to evaluate and manage agricultural projects, as well as carry out financial appraisals.

- S4 Possession of entrepreneurial and creative skills.

- S5 Ability to design, plan and implement agricultural research.

- S6 Ability to do business in any part of the world.

- S7 Ability to understand and adapt to new and emerging technologies in agriculture, including ICT.

- S9 Ability for independent thinking and be able to work with minimal supervision in the area of agriculture.

- S11 Ability to know, advise on and implement policies and regulations.

- S13 Ability to understand and work within the organisation, business and community management of the rural sector.

4.7.5. *Technical/technological capacity*

- G4 Ability to translate knowledge into practise.
- G6 Capacity to use innovative and appropriate technologies.
- G9 Flexibility, adaptability and ability to anticipate and respond to new situations.
- G10 Ability for creative and innovative thinking.
- G16 Ability to evaluate, review and enhance quality.
- S1 Knowledge and understanding of agricultural production, and basic sciences.
- S5 Ability to design, plan and implement agricultural research.
- S7 Ability to understand and adapt to new and emerging technologies in agriculture, including ICT.
- S8 Ability to implement sustainable practises and technologies for the management of natural resources.
- S10 Ability to adapt and transfer technology, and ability to create new technologies.
- S12 Ability to make sustainable use of water and other natural resources for agricultural use.
- S14 Ability to identify pest, pathogens and weeds associated with crops, animals and their products.
- S15 Ability to improve quality and safety along the agricultural value chains.
- S16 Ability to select and manage machinery implements and equipment for agricultural use in different farming systems.

Figure 4.4 displays the inter-relationships between the core and supportive elements in the agricultural competences.

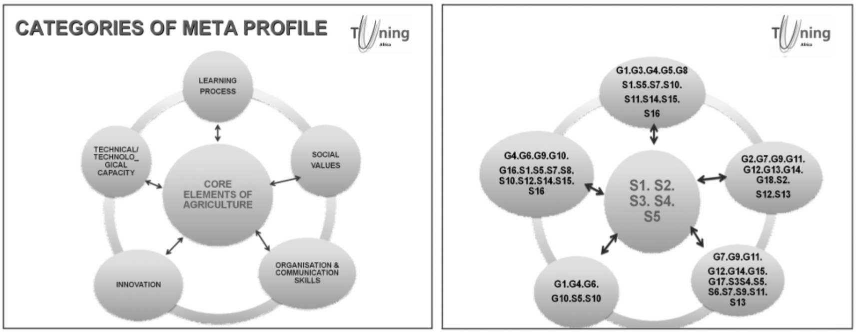

Figure 4.4
Meta-profile for agricultural core and supportive profiles

Figure 4.5 shows a Venn diagram that displays the relationships among the components of core and supportive groups.

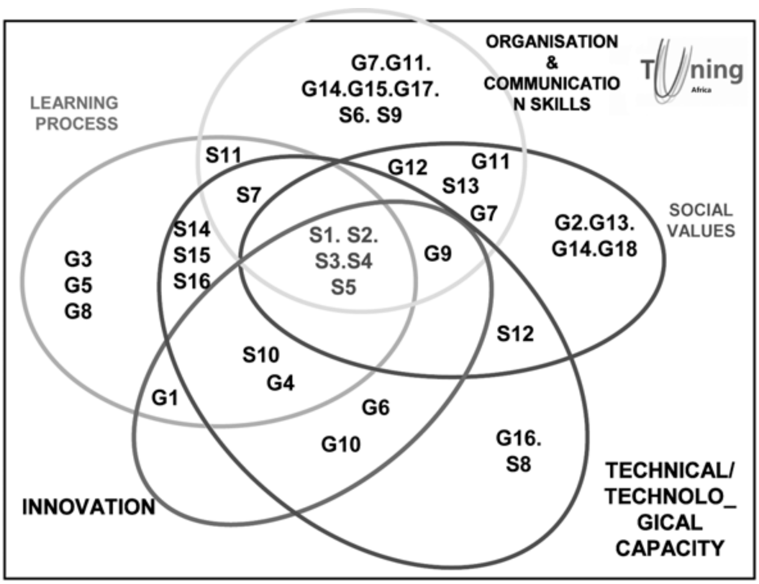

Figure 4.5
Venn diagram of core and supportive competences in the agricultural science meta-profiles

4.8. Contrast of Meta-Profiles at African Institutional and Regional Levels

The meta-profile agreed upon by participants in the Tuning in Africa meeting in Cape Town was contrasted with the current degree profile of each participating institution. This process allowed the academics to reflect on the coincidences and differences with the meta-profile. Their general observations follow:

- All the generic competences were considered relevant and important in the agricultural programmes of the universities but were not always covered.

- The core elements were covered in all of the agricultural programmes. There was a good fit between the competences identified and the subject-specific competences in the programmes.

- A few subject-specific competences identified by the group were not currently in the programmes of some of the institutions, but members commented that their institutions desired to incorporate them in their courses.

- Members of the team were concerned about teaching and learning methods of some of the competences like "S4: Possesses entrepreneurial and creative skills". Also "G8: "Ability to communicate effectively in official/national and local languages" became a point of lengthy discussion. Participants agreed that this particular competence may not be easy to achieve because of the diversity of languages in our countries.

- Participants also pointed out that it was not clear how institutions will be able to instil "G10: "Self-confidence, entrepreneurial spirit and skills" in students, particularly in courses with large classes.

- Most of the group members indicated that their programmes are designed to ensure that, in addition to coursework at the university, students will undertake further practical training on attachment communities for periods ranging from three to twelve months. During these periods, the students will live and work within the communities. Such detached duty, however, has implications for the length of the bachelor's degree programme, which, as described, covers a range of three to five years.

The participants also called attention to other good practises that have been or could be adopted to ensure the quality training of agricultural students:

- Bringing trainees in direct contact with farmers.
- Ensuring practise-centred content in agricultural programmes.
- Requiring final-year students to undertake research and write a dissertation.
- Providing pedagogical training for newly recruited lecturers before they begin teaching.

4.8.1. *Matrix for self-assessment*

A special matrix was developed to capture the current ability of institutions in Africa to achieve the objectives of the meta-profiles (Table 4.10). The purpose of the matrix is to allow universities in Africa to self-assess their level of achievement in meeting the generic and subject-specific competences in their various programmes of studies in agriculture.

Table 4.10
Institutions' Self-Assessment of Meta-Profiles Competences in Agriculture

Competences		Courses meeting the competence in your university programs [codes and credit units; e.g., AGR 403 (3)	Number of units in your degree program delivering this competence (i.e., extent or degree of coverage in program	Action that needs to be taken by your university in respect to this competence
1.0 CORE ELEMENTS				
S1	Knowledge and understanding of agricultural production, and basic sciences.			
S2	Ability to identify problems and apply knowledge to solving day-to-day agricultural challenges.			
S3	Ability to evaluate and manage agricultural projects, as well as carry out financial appraisals.			
S4	Possession of entrepreneurial and creative skills.			
S5	Ability to design, plan and implement agricultural research.			
2.0 LEARNING PROCESS				
G1	Ability for conceptual thinking, analysis and synthesis.			
G3	Capacity for critical evaluation and self-awareness.			
G4	Ability to translate knowledge into practise.			
G5	Objective decision-making and practical cost-effective problem solving.			
G8	Ability to learn how to learn and capacity for lifelong learning.			

Competences		Courses meeting the competence in your university programs [codes and credit units; e.g., AGR 403 (3)	Number of units in your degree program delivering this competence (i.e., extent or degree of coverage in program	Action that needs to be taken by your university in respect to this competence
S1	Knowledge and understanding of agricultural production, and basic sciences.			
S5	Ability to design, plan and implement agricultural research.			
S7	Ability to understand and adapt to new and emerging technologies in agriculture, including ICT.			
S10	Ability to adapt and transfer technology; ability to create new technologies.			
S11	Ability to know, advise on and implement agricultural policies and regulations.			
S14	Ability to identify pests, pathogens and weeds associated with crops, animals and their products.			
S15	Ability to improve quality and safety along the agricultural value chains.			
S16	Ability to select and manage machinery, implements and equipment for agricultural use in different farming systems.			
3.0 SOCIAL VALUES				
G2	Professionalism, ethical values and commitment to Ubuntu (respect for the well-being and dignity of fellow human beings)			

Competences		Courses meeting the competence in your university programs [codes and credit units; e.g., AGR 403 (3)	Number of units in your degree program delivering this competence (i.e., extent or degree of coverage in program	Action that needs to be taken by your university in respect to this competence
G7	Ability to communicate effectively in both official/national and local languages.			
G9	Flexibility, adaptability and ability to anticipate and respond to new situations.			
G11	Leadership, management and teamwork skills.			
G12	Communication and interpersonal skills.			
G13	Environmental and economic consciousness.			
G14	Ability to work in an intra- and intercultural and/or international context.			
G18	Commitment to preserve and to add value to African identity and cultural heritage.			
S2	Ability to identify problems and apply knowledge to solving day-to-day agricultural challenges.			
S12	Ability to make sustainable use of water and other natural resources for agricultural use.			
S13	Ability to understand and work within the organisation, business and community management of the rural sector.			
4.0 INNOVATION				
G1	Ability for conceptual thinking, analysis and synthesis.			

Competences		Courses meeting the competence in your university programs [codes and credit units; e.g., AGR 403 (3)	Number of units in your degree program delivering this competence (i.e., extent or degree of coverage in program	Action that needs to be taken by your university in respect to this competence
G4	Ability to translate knowledge into practise.			
G6	Capacity to use innovative and appropriate technologies.			
G10	Ability for creative and innovative thinking.			
S5	Ability to design, plan and implement agricultural research.			
S10	Ability to adapt and transfer technology, and ability to create new technologies.			
5.0 ORGANISATION AND COMMUNICATION SKILLS				
G7	Ability to communicate effectively in the official/national and local languages.			
G9	Flexibility, adaptability and ability to anticipate and respond to new situations.			
G11	Leadership, management and teamwork skills.			
G12	Communication and interpersonal skills.			
G14	Ability to work in an intra- and intercultural and/or international context.			
G15	Ability to work independently.			
G17	Self-confidence, entrepreneurial spirit and skills.			

Competences		Courses meeting the competence in your university programs [codes and credit units; e.g., AGR 403 (3)	Number of units in your degree program delivering this competence (i.e., extent or degree of coverage in program	Action that needs to be taken by your university in respect to this competence
S3	Ability to evaluate and manage agricultural projects, as well as carry out financial appraisals.			
S4	Possession of entrepreneurial and creative skills.			
S5	Ability to design, plan and implement agricultural research.			
S6	Ability to do business in any part of the world.			
S7	Ability to understand and adapt to new and emerging technologies in agriculture, including ICT.			
S9	Ability for independent thinking and ability to work with minimal supervision in the area of agriculture.			
S11	Ability to know, advise on and implement agricultural policies, and regulations.			
S13	Ability to understand and work within the organisation, business and community management of the rural sector.			
6.0 TECHNICAL/TECHNOLOGICAL CAPACITY				
G4	Ability to translate knowledge into practise.			
G6	Capacity to use innovative and appropriate technologies.			
G9	Flexibility, adaptability and ability to anticipate and respond to new situations.			

Competences		Courses meeting the competence in your university programs [codes and credit units; e.g., AGR 403 (3)	Number of units in your degree program delivering this competence (i.e., extent or degree of coverage in program	Action that needs to be taken by your university in respect to this competence
G10	Ability for creative and innovative thinking.			
G16	Ability to evaluate, review and enhance quality.			
S1	Knowledge and understanding of agricultural production, and basic sciences.			
S5	Ability to design, plan and implement agricultural research.			
S7	Ability to understand, and adapt to new and emerging technologies in agriculture, including ICT.			
S8	Ability to implement sustainable practises and technologies for the management of natural resources.			
S10	Ability to adapt and transfer technology, and ability to create new technologies.			
S12	Ability to make sustainable use of water and other natural resources for agricultural use.			
S14	Ability to identify pests, pathogens, and weeds associated with crops, animals and their products.			
S15	Ability to improve quality and safety along the agricultural value chains.			
S16	Ability to select and manage machinery, implements and equipment for agricultural use in different farming systems.			

4.9. Challenges in Effectively Incorporating Competences in Agricultural Programmes

The Tuning in Africa group dealing with agriculture identified and discussed a number of challenges that could affect the effective adoption of the competences and incorporating them into the programmes. They include:

- Funding. Members observed that, to effectively adopt the generic and subject-specific competences, a substantial investment to create a good learning environment must be made. Specific changes must be made, among others, to improve infrastructure; provide laboratories, equipment, teaching aids and a well-equipped library.

- Students' attitude and response. Members of the Agricultural Sciences Tuning in Africa Working Group expressed concern about the willingness of students to respond positively to innovations and changes in the programmes' content. It was the general impression that such student response could be negative, creating a disincentive to adopt these changes.

- Quality of teachers and teaching methods. The quality of teachers in participants' institutions was considered to be a major factor in successfully adopting the competence approach and in ensuring that the generic and specific competences would become integral to the courses. Members expressed concern that some pedagogues had classroom lessons that consisted entirely of dictating notes. Still other teachers lack competence in modern technologies. Most participants expressed a general need for teachers to re-tool/re-train to be more effective in their lectures. Furthermore, they expressed strong feelings that traditional styles of lecturer-centred instruction should be replaced with student-centred methods.

- Large student numbers. Some participants pointed out that their class sizes are usually so large that having effective interaction with students becomes very difficult; and, as a result, inculcating quality skills in them poses significant challenges.

4.10. Conclusions and Recommendations

This Tuning Africa project has afforded agricultural academics from twelve countries representing the five regions of Africa to meet and deliberate on the skills and competences that graduates who earn degrees in agriculture from African universities may be expected to possess. The acquisition of these competences is directly tied to their ability to contribute to African development.

As part of its task, the Agricultural Services team identified eighteen generic and sixteen subject-specific competences. Its analysis of the current status of participating universities, noted the necessity of improving the curricula to ensure that graduates are better equipped with the desired competences.

A meta-profile for agricultural science was developed in the course of this project as well as a matrix that any university in Africa could use to evaluate its agricultural programmes. Participants have been (and will be) able to bench-mark their institution's curricula against the developed meta-profiles.

The working group strongly recommends that agricultural institutions should regularly evaluate their curricula to ensure that it is delivering the expected competences.

4.11. The Way Forward

The report of this pilot project should be shared with the relevant stakeholders and departments in the participating universities. The report should also be made publicly available by being placed on the websites of the participating universities. Efforts should be made to promote the Tuning Africa approach at national levels in the various countries.

Validation	
Objectives	**Activities**
1.0 To subject the outcomes of this pilot project to external review. 2.0 To increase internal awareness and validation of Tuning Africa in the participating institutions and documenting the process and outcomes.	1. Presentation of the outcomes for discussion in different fora (seminars, scientific associations, Q&A sessions that are part of other meetings). 2. National discussions and validation of the Tuning process via: (a) Domestication (adaptation) of Tuning Africa in individual countries; (b) Orientation of tertiary educational authorities on Tuning and competence; (c) Encouraging teachers and institutional leaders to take ownership of the Tuning approach in their institutions.
Dissemination	
Objectives	**Activities**
1. To further promote awareness of the Tuning process in participating universities. 2. To create awareness and encourage the adoption of the Tuning approach to curriculum development and competence promotion. 3. To achieve stakeholder "buy-in" in Tuning Africa. 4. To promote Tuning methodology in curriculum development.	1. Developing a database of Tuning "champions" in Africa to serve as models and resources for consultation. 2. Creating Tuning Africa as a platform for interactions among Tuning "champions." 3. Developing a Tuning Africa website. 4. Creating awareness of Tuning Africa among key stakeholders, including government agencies, policy-makers, university communities and partners, regional organisations/networks (e.g., Ruforum, ANAFE, FARA) and development partners (e.g., UNESCO, World Bank, DAAD).

4.12. Future Focus: New Profile Design

The following issues will need to be addressed for Turning Africa's successful future design and continuation:

1. Credit awards and students' work-loads.
2. Learning outcomes.
3. Teaching and assessment methods.

4. Distance learning.
5. Training on curriculum development and program design.
6. Applying Tuning Africa to master's and doctoral studies.
7. Further elaborations on competences and meta-profiles.
8. Development of the African Credit Transfer System.
9. Joint programmes.
10. Linkages with employers to provide work-placement experiences.
11. Mobility of staff and students.

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Members of the Agricultural Sciences Subject Area Group (SAG) for this pilot project are:

Subject Area Coordinator: **Olusola Bandele OYEWOLE** University of Agriculture (Nigeria) oyewoleb@yahoo.com	**Higher Education Tuning Expert:** **Tuning Margret SCHERMUTZKI** Germany mschermutzki@yahoo.com
Benin **Guillaume Lucien AMADJI** University of Abomey-Calavi gamadji@yahoo.fr	**Burundi** **Jean NDIMUBANDI** Université du Burundi jean.ndimubandi@gmail.com

Cameroon **Christopher Mubeteneh TANKOU** Université de Dschang cmtankou@yahoo.com	**Mauritius** **Kamleshwar BOODHOO** University of Mauritius k.boodhoo@uom.ac.mu
Ghana **Samuel Kwame OFFEI** University of Ghana offei@ug.edu.gh	**Morocco** **Ahmed ELAMRANI** Université Mohammed Premier ahmed.elamrani@gmail.com ahmadelamrani@yahoo.fr
Ivory Coast (Cote d'Ivoire) **Taky Hortense ATTA EPSE DIALLO** Université d'Abobo-Adjamé attakyhortense@yahoo.com	**Nigeria** **Yemi AKEGBEJO-SAMSONS** University of Agriculture samsons56@yahoo.co.uk
Kenya **Alexander Kigunzu KAHI** Egerton University a.kahi@incip.org	**Nigeria** **Olubunmi Abayomi OMOTESHO** University of Ilorin yomiomotesho@gmail.com
Madagascar **Jean Roger Emile RASOARAHONA and Randrianary Jean Baptiste RAMAROSON** Université d'Antananarivo jeanras@moov.mg jean.rasoarahona@yahoo.fr rabaddy@gmail.com	**Senegal** **Mariama SENE** Université Gaston Berger mariama-sene.wade@ugb.edu.sn
South Africa **Puffy SOUNDY** Tshwane University of Technology SoundyP@tut.ac.za	

Chapter 5

Civil Engineering

*Haddis Rebbi TEKLEMARIAM, Karola HAHN, Kabiru BALA,
Mohand HAMIZI, Karin JANSEN VAN RENSBURG,
Oagile KANYETO, Lutimba Hubert MAKENGO, Robert NZENGWA,
Ignas Aloys RUBARATUKA, Stanley Muse SHITOTE
and James Janthana Bango TUKARI*

5.1. Introduction

The Civil Engineering Pilot Project of Tuning Higher Education in Africa was launched at the first meeting held in Nairobi in March 2011. With the help of the delegates and experts from African higher education (mainly academics and policy-makers), five subject areas were proposed: (1) mechanical engineering, (2) construction engineering, (3) agriculture, (4) medicine, and (5) education.

The consensus was that the success of Africa in the future would largely depend on the above-mentioned fields and on strides forward in those fields that Africans will make.

A major goal of the Tuning Africa process is to reform the curricula, to enhance the quality of higher education and to increase the mobility of students in Africa in light of the overarching objective of regional integration and sustainable development. Based on this objective, the decision was made to allot one of five relevant subject-areas for Africa's development to one of the five political regions of the continent. Universities in Africa were informed about the pilot project of Tuning and Harmonisation in Africa and were invited to apply to be part of the project. As the success of the project strongly relied on the buy-in of institutions, participation required a rector's statement on institutional commitment to the project.

At a workshop in Dakar in November 2011, the countries for the Construction Engineering Subject Area Group, as it was then called, were selected from a number of applicants to represent Tuning Higher Education in Africa as in the Construction Engineering Subject pilot project, to be started in January 2012. At that point, support to the group was provided by Inge Pieterse, University of Pretoria (Quantity Surveying).

The Eastern Africa region was assigned to "host" the Construction Engineering Group; hence, four of the participating universities were from Eastern Africa. According to the project design, which had the goal of covering the entire continent, universities from the other four regions were included to validate the project throughout Africa. Altogether ten countries were selected to participate in this subject-area of the pilot project:

1. Algeria: Université Mouloud Mammeri de Tizi Ouzou
2. Botswana: University of Botswana
3. Cameroon: Université de Douala
4. Democratic Republic of Congo: Université de Kinshasa
5. Ethiopia: Addis Ababa University
6. Kenya: Moi University
7. Nigeria: Ahmadu Bello University
8. Tanzania: University of Dar Es Salaam
9. South Africa: University of Pretoria
10. South Sudan: University of Juba

The Construction Engineering Group was formed and initiated a dialogue on the potential of the Tuning methodology for curriculum reform and quality enhancement. The working group held four major all-participant meetings, complemented by separate meetings within the participating countries or institutions, online dialogues and other electronic exchanges. The four major working meetings were held on 23-25 January 2012 at Yaoundé, Cameroon; on 15-18 May 2012, at Cape Town, South Africa; on 18-22 November 2012, at Brussels, Belgium; and on 21-24 January 2013, at Nairobi, Kenya.

The group's work was supported by two advisors: Pablo Beneitone, International Relations, University of Deusto, Tuning Higher Education Expert and Steering Committee Board Member (Spain and Argentina) and Dr. Damtew Teferra, Advisor, Steering Committee Tuning Africa, founder of the International Network for Higher Education in Africa (INHEA), Professor of Higher Education and leader of the Higher Education Training and Development at the University of Kwazulu-Natal, Durban. At a later stage, two observers assisted the group: Merle Hodges, International Education Association South Africa (IEASA), IEASA Management Council, University of Western Cape (Cape Town Meeting) and Ron Hendrix, EU Delegation to the African Union, Addis Ababa (Brussels meeting).

When the proffered programme mapping was completed for all the participating universities at the Yaoundé meeting, it had become evident that using "Construction Engineering" as the Tuning and Harmonisation focus seemed not an appropriate approach. Consensus was lacking on the definition of the scope of this subject area. Thus the group agreed to change its name to "Civil Engineering Group" at the Yaoundé meeting to allow the programme to refocus on civil engineering at the baccalaureate level. This focus better reflected the broad spectrum of disciplines and the teaching reality in African higher education.

5.2. Context for Curriculum Reform and Modernisation

5.2.1. *The importance and applications of civil engineering*

The profession of civil engineering is becoming increasingly important in the context of Africa's rapid urbanisation, demographic growth and regional integration. The construction sector is one of the fastest growing economic sectors in Africa. The *African Statistical Yearbook (*2009) highlights twenty-two African countries with an annual growth rate of above 10 per cent in the construction sector. In some countries, the growth rate is substantially higher.

Civil engineers are responsible for developing, designing and building good-quality infrastructures, buildings and facilities and improving and maintaining them. Civil engineers supply energy and clean water, including the networks of pipes to handle municipal water supplies, sanitation services, wells, sewage and desalination plants and industrial waste treatment systems. They are also responsible for creating, maintaining and upgrading transportation and traffic systems like highways, bridges, tunnels, underground systems, airports, railway lines and seaports. A civil engineer is concerned with planning, determining the right design for these structures and managing the construction process to assure the longevity and sustainability of these structures after completion. These structures should satisfy the public's expanding need for comfortable services and operations. In general, the work of the civil engineer focuses on the improvement of the quality of life.

One recent and increasingly important facet of civil engineering is environmental engineering. In this sub-speciality, civil engineers are concerned with applications of various methods of environmental protection, such as the purification of contaminated air, water and soil. The objective is to remediate polluted systems and sites and to prevent new pollution as well as re-pollution.

5.2.2. *The scope of civil engineering*

Civil engineering is the second oldest engineering science after military engineering. It has substantially developed and broadened its scope over the decades. Today, civil engineering has diversified into many branches of study. Its major branches include: (1) structural engineering, (2) construction engineering, (3) geotechnical engineering, (4) transportation engineering, (5) hydraulic engineering, (6) water resources engineering, (7) materials engineering, (8) quantity surveying, (9) offshore engineering, (10) coastal engineering, (11) environmental engineering, (12) urban engineering, (13) control engineering and (14) earthquake engineering, to mention only the most prominent specialisations.

Civil engineers are employed by a wide range of companies, from small start-up enterprises focused on innovation to large-scale companies that work on major contracts. Because many civil engineering projects involve the creation and maintenance of national (and increasingly regional) infrastructure, a major employer in many African countries is the public sector.

5.2.3. *Trends in civil engineering*

Some current trends in civil engineering are in the application of new materials, composite materials and in particular local materials. Rapid urbanisation throughout the continent has highlighted the importance of low-cost building. Another contemporary focus is improving the capabilities of standard materials. Increased attention is given to controlling the effects of natural disasters such as floods and earthquakes and to conducting environmental impact studies of new constructions. A major objective is to prevent cycles of disasters and to control the impacts of climate change in Africa.

A relatively recent specialisation of civil engineering in Africa is environmental engineering. This specialisation covers solid waste management, environmental impact assessment and mitigation, water supply and treatment, waste-water treatment and air pollution management amongst other specialisations.

Another recent emphasis is the application of specialised software programmes in the civil engineering industry as part of preparing civil engineers for the tasks emerging in the twenty-first century.

5.2.4. *Career pathways in civil engineering*

The career prospects for qualified civil engineers in Africa are generally good. However, there is no typical career path for civil engineers. Most young graduates with civil engineering degrees find entry-level positions in the public sector that require limited responsibility. As the young engineers prove their competence, they are entrusted with higher levels of responsibility.

Within every branch of civil engineering, career path options vary. In some fields and enterprises, a primary task of entry-level engineers is monitoring construction on-site, serving as the "eyes and ears" of senior design engineers. In other areas, entry-level engineers perform the more routine aspects of analysis, design and implementation. Experienced engineers perform increasingly complex analyses, do more challenging planning and design work, manage complex design projects, lead engineering teams or engage in specialised consulting.

The civil engineering sector is mainly divided into (1) consultants, (2) contractors and (3) project managers. Typically, the options for a new civil engineering graduate are consulting or contracting. Usually a high level of professional experience is required to become a project manager.

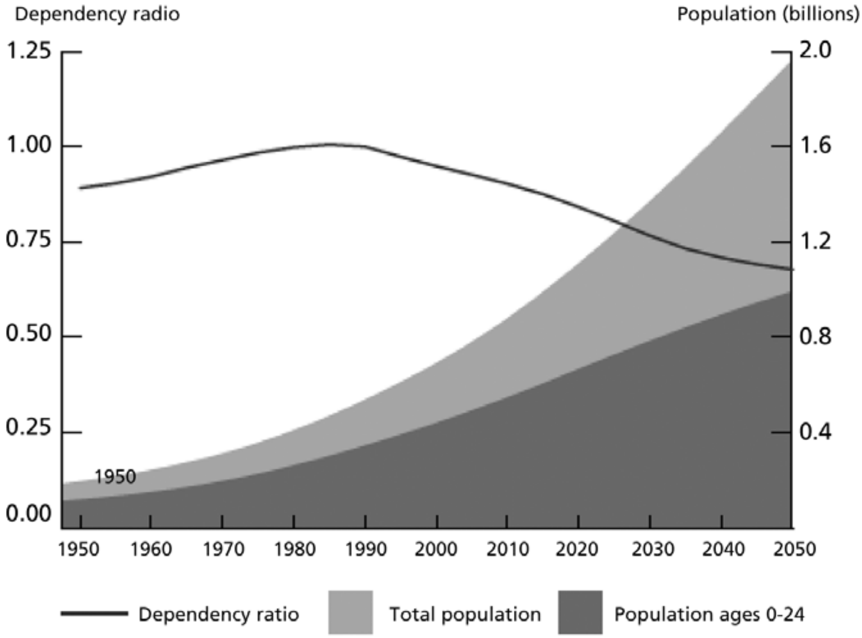
5.2.5. *The need for civil engineer graduates in Africa*

The need for civil engineering graduates in Africa is strongly linked to continent-wide demographic developments, the rapid urbanisation, and the regional integration resulting in ever-growing construction demands. Thus, civil engineering will continue to be one of the crucial subject areas in African higher education due to the constantly rising demand for civil engineering graduates for construction projects in both the public and the private sectors.

The demand has two dimensions: (1) quantitative: demographic developments, urbanisation and regional infrastructures; and (2) qualitative: the need for sustainable construction, preferably with local building materials, reduced dependency on cement and steel imports and the need to develop energy-efficient construction technologies.

The population of Africa has grown exponentially over the past century, and according to the United Nations Development Programme (UNDP), is expected to continue to grow rapidly. The Population Division of the United Nations Department of Economic and Social Affairs (UNDESA), projects nearly 2 billion inhabitants in Sub-Saharan Africa by 2050 (UNDESA, 2013, pp. xvi ff). "In Africa, the population is expected to grow by 1.8 billion during the second half of the century, substantially more than during the earlier period of 2013-2050, that is by 1.3 billion. During 2050-2100, Africa's population increase will surpass that of the world" (UNDESA, 2013, p. 1).

Population growth moves hand in hand with the rapid urbanisation, and Africa's cities are set to swell in size. In 2030, half of the African

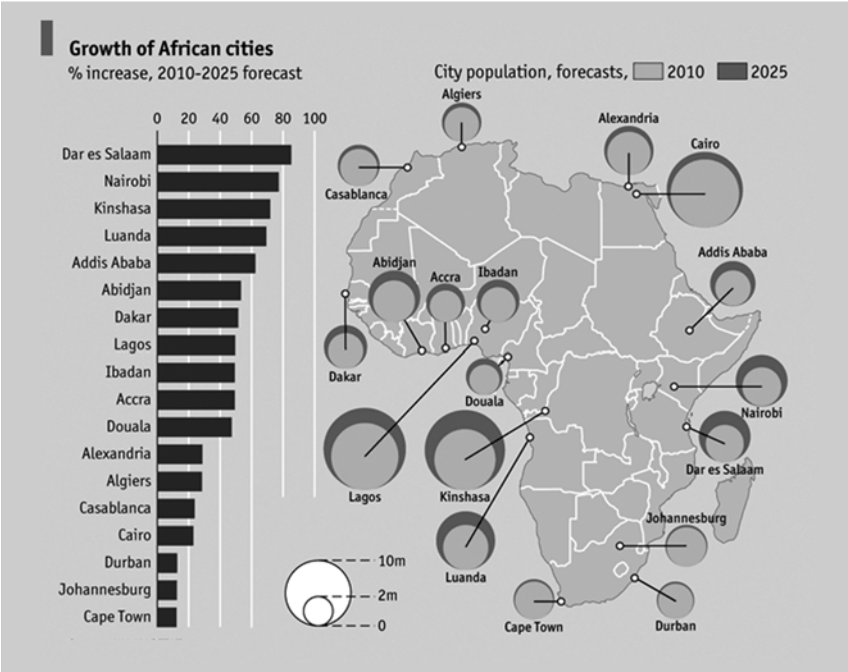


Source: UNDESA (2013).

Figure 5.1
Population growth rate in Sub-Saharan countries

population will live in urban centres. According to a recent report from the United Nations Agency for Human Settlements (UN-HABITAT), the population of some cities will grow by a projected 85 per cent in the next fifteen years. The most populous city in 2010, Cairo, will grow by 23 per cent to 13.5 million people. By 2025, however, it will have been overtaken by both Lagos (15.8 million) and Kinshasa (15 million). Food and water shortages, poor infrastructure and a lack of housing are amongst the problems faced by governments during such rapid urbanisation. Progress in meeting these challenges would be shown by a fall in the proportion of slum-dwellers, who currently account for 70 per cent of urban inhabitants.

This demographic development has a deep and intensifying impact on energy, water and climate. The built environment will need to grow exponentially in quantity but also in quality in both the public



Source: UN-HABITAT Report (2010).

Figure 5.2
Projected growth of African cities by 2050

and private sectors. Services must be provided to meet the needs of new millions of inhabitants, including housing, the upgrading of informal settlements, schools, hospitals, kindergartens, sanitation facilities, recreation centres, sports facilities, etc. New waste and water management systems, water and energy supply systems, wells, dams and desalination plants, etc. will be needed. Construction will also increase to accommodate a greater volume of traffic and transport (roads, bridges, railways and airports) and to meet the need for more industrial and office buildings, plants and production, processing and storage facilities.

African countries, especially Sub-Saharan francophone countries have been independent for less than sixty years, and many still lack such basic infrastructures as houses, roads, bridges, rails, dams, airports, seaports, industrial structures, etc. The importance of civil engineering is undeniable since, unlike developed countries, more than 90 per cent of the above infrastructures have yet to be built.

So far, major construction projects are primarily implemented by foreign companies employing foreign workers (e.g., Chinese workers), imported technologies and imported building materials. Many African countries, especially in the Sub-Saharan region, do not have their own large and competitive construction firms. Even existing medium-size companies are often not sub-contracted for huge construction projects. Furthermore, even in relatively stable countries such as Algeria, large infrastructure projects are carried out by Chinese contractors and workers. Hence, there is an urgent need to organise the civil engineering sector to facilitate the training and growth of emerging African construction firms and design offices.

Efforts are being made in many African countries to increase the number of engineers trained in Africa, in particular in the civil engineering sector. This goal can be achieved only if some financial strategies are well defined and implemented transnationally to encourage start-up civil engineering companies and if all the stakeholders (higher education, professional associations, civil engineering companies, international organisations, policy-makers, etc.) make a priority of enabling Africa be built by Africans.

The improvement of infrastructure on a regional level is part of the new strategic endeavours of the African Union with a corresponding adopting of specific infrastructure plans by some African countries. For example, even highly developed countries like South Africa have areas that are under-served in infrastructure. The South African government therefore adopted a National Infrastructure Plan in 2012 with the goal of transforming the economic landscape while simultaneously creating significant numbers of new jobs and strengthening the delivery of basic services. The plan also supports the integration of African economies. Ethiopia has adopted a National Growth and Transformation Plan, in which the improvement of infrastructure in all regions of the country plays a central role. As a consequence, the sector-crossing Engineering Capacity-Building Programme and its successor, the Labour-Market-Oriented Education Programme, have become core reform programmes to educate the needed engineers and technicians in this field.

African civil engineers are trained in Africa or abroad in many different higher education systems. Some graduate from four-year programmes in some countries and from five-year programmes in others, especially in francophone countries. These engineers, brilliant and well-trained though they may be, are seldom given opportunities to engage in major construction projects, since most of the funds and provisions are foreign.

Although civil engineers are organised in every country into professional associations, these associations often do not seem to be successful in lobbying for their interests. The role and capacity of lobbying in policy-making and government decisions are limited. Architects seem to be more successful in this endeavour, for example, in African francophone countries. In fact, national architects are required by law to sign off on every document for a given building project, which amounts to a guarantee of their fee. Architects' professional involvement is thus considered in every important building project. No such commitments are instituted for engineers because foreign enterprises, which are generally selected by the funding organisation or donor, usually own the technologies and provide the staff needed for construction.

It is now vital for Africa to train qualified engineers with management and entrepreneurial skills, state-of-the-art IT, practical skills and other generic competences so that they can set up small enterprises as the nuclei of larger African construction enterprises.

Many countries have started reforming their civil engineering curricula in order to make them more responsive to the demand of the labour market. However the numbers of graduates does not fill the gap, with the result that internationally experienced engineers are still needed.

5.2.6. *Civil engineering education in Africa*

The civil engineering profession is highly regulated in most African countries. Thus regulations, standards and quality assurance are of vital interest. Civil engineers in Africa typically earn an academic degree in a civil engineering programme lasting four or five years. An undergraduate degree in civil engineering normally provides successful students with an industry-accredited qualification. Thus, a bachelor's degree in civil engineering represents the first step towards professional certification, and the degree programme itself is certified by the professional body in each country. A registered or licensed professional engineer may prepare, sign and seal, and submit engineering plans and drawings to public authorities for approval or seal engineering works for public and private clients.

Engineering councils play an important role in maintaining ethical standards for the profession. Even in jurisdictions where certification has little or no legal bearing on work, engineers are subject to contract law. In cases where an engineer's work fails, he or she may be subject to the tort of negligence and, in extreme cases, the charge of criminal negligence. An engineer's work must also comply with numerous other rules and regulations such as building codes and legislation pertaining to environmental law for different countries.

Many reforms of civil engineering education in Africa have the goal of providing a comprehensive engineering education and competences to a diverse constituency in engineering and architecture, one that trains students to contribute effectively to the profession and society, prepares them for advanced study and for lifelong learning, teaches them to conduct research, instructs them in working with other academic disciplines in interdisciplinary teams and assures that they can contribute to the creation of areas of excellence. Reforms aim at technology transfer and practical internships that align civil engineering education to the demands of the labour market and make it more relevant to society.

However, in many countries, such reform efforts must overcome several bottlenecks and hurdles. Universities often cannot provide state-of-the-art teaching and research infrastructure and facilities like laboratories, seminar rooms and lecture halls, staff offices, a variety of well-equipped and maintained workshops, recreation facilities, libraries and studios for practical work. Other frequent gaps are the availability of computer labs and educational software, internet access and even e-mail addresses for staff and students.

The provision of postgraduate training programmes and research resources is likewise limited.

Although most African universities typically offer a rather unattractive salary structure, civil engineers are less affected by its limitations than, for example, academics in the humanities or social sciences. Most civil engineers have appealing "side" or main incomes in the public and industrial sector, while teaching and research frequently represent an extra asset. Because civil engineers are rooted in both the academic and the professional sectors, as teaching staff, they typically offer a diverse profile. Civil engineers bring a practical perspective into the academic sector and, in general, provide helpful internship opportunities for the students.

5.2.7. *Civil engineering programmes*

Civil engineering is the broadest engineering discipline. Amongst the important subdivisions of the field are: (1) construction engineering, (2) transportation engineering, (3) soils and foundation engineering, (4) geotechniques, (5) geodetic and hydraulic engineering and (6) structural engineering.

The diversity in scope and content of the civil engineering programmes is complemented by a diversity of further variables. The characteristics of the degree profiles vary with regard to degrees, duration and structure of the programmes, terms/semester, credits, professional registration and employability.

Table 5.1 lists the degree profiles of the ten universities that are part of the Civil Engineering Tuning and Harmonisation pilot project in Africa. These profiles reflect the structural diversity of the academic programmes

Civil engineering has the reputation of being a difficult programme. One of the reasons is that civil engineering requires a high level of knowledge and competences in mathematics and physics—subject areas in which many African school-leavers are underprepared.

In general, civil engineering is a highly regulated study programme in which many stakeholders play a crucial role. State agencies as well as professional associations and industry lobbyists regulate and/or influence standards and access to professional pathways. Efficient academic programme reform must therefore be closely coordinated with these agencies and lobbyists. This complexity in reform coordination is making curricular reform in civil engineering slightly more difficult than in purely academic programmes.

Table 5.1
Degree Profile of Civil Engineering in Participating Universities

	Study Programme (Typical 1st Degree)	Duration of Study Programme	Structure of Study Programme	Terms/Semester	Credits Year (in total)	Professional Registration after Graduation
Algeria	Licence	3 years	Unités d'Enseignement	2 semesters/year (6 semesters)	60 (180)	(Licence professional: yes, Licence académique + master's)
	Master	2 years	Unités d'Enseignement	2 semesters/year (4 semesters)	60 (120)	Registered professional, master's académique, master's professional
Botswana	BEng CE	5 years	Courses	9 semesters + 1 semester practical and industrial training	30 (150)	Yes, additional training required to be a professional
Cameroon	MEng CE	5 years	Unités d'Enseignement	10 semesters	300	Yes, directly considered as an engineer
DRC	MEng CE	5 years	Modules	10 semesters	Ca. 36 (180)	Yes, directly employable
Ethiopia	BSc CE	5 years	Modules	9 semesters + 1 semester practical and industrial training	161 (min 33 credits per year)	Yes, directly employable
Kenya	BEng C and structural engineering	5 years	Courses	10 semesters (+ 36 weeks of internship during vacation)	232 units	Yes, additional on-job training required to be a professional
Nigeria	BEng CE	5 years	Courses	9 semesters + 1 semester practical and industrial training	165 (minimum 30 credits per year)	Yes, additional on-job training required to be a professional
South Africa	BEng CE	4 years	Modules	8 semesters	150	Yes, additional training required to be a professional
South Sudan	BEng CE	5 Years	Courses	10 semesters	208	Yes, additional professional experience is required
Tanzania	BSc CE	4 years	Courses	8 semesters + 24 weeks of industrial training	146 units (minimum 30 per year)	Yes, additional on-job training required to be a professional

The Tuning Higher Education in Africa pilot project provides an opportunity for Africa to harmonise engineering curricula aiming at educating competent human resources in sufficient quality and quantity to provide future national and transnational African firms with adequate personnel. Not the least of Tuning Africa's advantages is that it provides a means of promoting curricula reform across the continent, while simultaneously recognising and accommodating the different stakeholders in each country who need to be informed and involved as appropriate for maximum efficiency when graduates of civil engineering programmes become employees. Doubtless the process of reform will be a complex one, but its complexities should not overshadow its promise.

Below is a list of the stakeholders in civil engineering for the ten different countries.

Table 5.2
The Diversity of Stakeholders of Civil Engineering
in African Higher Education

Country	Stakeholders
(1) Algeria	Association des Ingénieurs de Génie Civil Centre National de Recherche Appliquée en Génie Parasismique (CGS) École Nationale Supérieure des Travaux Publics Facultés de Génie de la Construction (30 Facultés) Ministère de l'Aménagement du Territoire Ministère de l'Eau Ministère de l'Habitat Ministère de l'Enseignement Supérieur et de la Recherche Ministère de l'Environnement Ministère de Logement et des Équipements Publics Ministère de l'Urbanisme Ministère des Travaux Publics Ministère du Transport L'Ordre des Architectes Organisme National du Contrôle Technique de la Construction (CTC)

Country	Stakeholders
(2) Botswana	Association of Consulting Engineers Botswana Bureau of Standards Botswana Institution of Engineers Botswana International University of Science and Technology Engineers Registration Board Faculty of Engineering and Technology, University of Botswana Ministry of Education Ministry of Science and Technology Ministry of Works Student Body in Engineering
(3) Cameroon	Engineering Schools Ministry of Education
(4) Democratic Republic of Congo	Association Congolaise des Diplômés (Alumni) Association des Anciens de l'Université de Liège Association des Femmes Ingénieurs du Congo Bureau d'Accréditation des Ingénieurs Civils Le Bureau Technique de Contrôle Commission Permanente des Etudes Conseil d'Administration des Instituts Supérieurs Techniques Facultés Polytechniques (Université de Kinshasa, Université de Lubumbashi, Université de Pays des Grands Lacs) Fédération des Bâtisseurs du Congo Fédération des Entreprises Congo L'Institut National des Bâtiments des Travaux Publics Ministère de la Recherche Scientifique et de Technologie Ministère de l'Énergie et de l'Eau Ministère de l'Enseignement Supérieur et Universitaire Ministère de l'Habitat et de L'Urbanisme Ministère de Transport Ministère des Mines Ministère des Travaux Publics et Aménagement du Territoire Office Congolais de Contrôle de Qualité L'Office National de Transport L'Ordre des Architectes du Congo Service Publique des Voiries et Routes Société Générale des Carrières et des Mines La Société Nationale des Chemins de Fer

Country	Stakeholders
(5) Ethiopia	Adama University of Science and Technology Addis Ababa Institute of Technology (AAiT) at Addis Ababa University Association of Construction Technology and Management Association of Ethiopian Architects Consultant and Practicing Engineers Engineering Capacity Building Programme (ECBP) – Bilateral Ethio-German reform programme Ethiopian Institute of Architecture, Building Construction and City Ethiopian Railway Authority Ethiopian Roads Authority Ethiopian Society of Engineers Ethiopian Society of Water Resource Development (EiABC) at Addis Ababa University Gondar University Haramaya University Hawassa University Higher Education Relevance and Quality Agency (HERQA) Higher Education Strategy Centre (HESC) Jimma University (JU) Mekelle Institute of Technology (M-EiT) – Mekelle University Ministry of Education Ministry of Housing Ministry of Science & Technology Ministry of Urban Development and Construction Ministry of Water and Energy Ministry of Water Works Student Council Engineering Capacity Building Programme (ECBP) – Bilateral Ethio-German reform programme

Country	Stakeholders
(6) Kenya	Association of Construction Engineers Commission of Higher Education Engineers Registration Board Institution of Engineers of Kenya Inter-University Council of East Africa (IUCEA; 6 universities with engineering schools) Kenya Bureau of Standards Kenya Industrial Research and Development Institute Ministry of Higher Education, Science and Technology Ministry of Housing Ministry of Local Government Ministry of Public Works Ministry of Roads Ministry of Water State corporations under the listed ministries Technology Students Association
(7) Nigeria	Association of Consulting Engineers Association of Professional Bodies Council for the Regulation of Engineering Engineering Schools Ministry of Education Ministry of Works National Association of Engineering Students National Universities Commission Nigerian Society of Engineers Standards Organization Nigeria

Country	Stakeholders
(8) South Africa	Association of Schools of Construction of Southern Africa (ASOCSA) Construction Industry Development Board Council for Science and Industrial Research (CSIR) Council for the Built Environment (CBE) Council on Higher Education (CHE) Durban University of Technology (DUT) Engineering Council of South Africa (ECSA, a statutory council responsible, amongst other things, for the registration of professional engineers and accreditation of academic programmes for engineers at South African universities) Ministry of Environment Ministry of Higher Education Ministry of Human Settlement Ministry of Local and Provincial Government Ministry of Public Works Ministry of Science and Technology Ministry of Transport Ministry of Water Affairs National Housing Builders Registration Council (NHBRC) Nelson Mandela Metropolitan University (NMMU) South African Association for Consulting Engineers (SAACE) South African Black Technical and Allied Career Organisation (SABTACO) South African Bureau of Standards (SABS) South African Federation for Civil and Electrical Contractors (SAFCEC) South African Institute for Civil Engineers (SAICE) South African Quality Authority (SAQA) Southern African Regional University Association (SARUA) Stellenbosch University Tshwane University of Technology (TUT) University of Cape Town (UCT) University of Johannesburg (UJ) University of Kwa Zulu Natal (UKZN) University of Pretoria (UP) University of the North West (UNW) University of Witwatersrand (Wits) Walter Sisulu University, East London

Country	Stakeholders
(9) South Sudan	College of Engineering and Architecture, University of Juba Engineering Council of South Sudan (ECOSS) Engineering Sciences Committee Ministry of Dams and Electricity Ministry of Energy and Mining Ministry of General Education Ministry of High Education, Science and Technology Ministry of Housing and Physical Infrastructure Ministry of Physical Infrastructure Planning Ministry of Public Service and Labour Ministry of Roads and Bridges Ministry of Transport Ministry of Water Resources and Irrigation South Sudan Engineering Society (SSES) Technical and Technological Studies Committee Vocational Training Centre
(10) Tanzania	Association of Consulting Engineers Commission for Science and Technology Contractors Registration Board Engineers Registration Board Institution of Engineers Tanzania Inter University Council of East Africa (IUCEA) Ministry of Education and Vocational Training Ministry of Energy and Minerals Ministry of Public Management Ministry of Transport Ministry of Water Resources Ministry of Works National Accreditation Council for Technical Education Planning Commission Seven engineering universities Tanzania Bureau of Standards (TBS) Tanzania Commission of Universities

5.2.8. *General reflections on curriculum reform in civil engineering*

Global competition, technological developments and international economic action have dramatically changed the need of modern societies. These changes have imposed new requirements on the civil engineering profession and have changed the profession considerably. During the last decades, changes were largely due to (1) the developments in ICT, (2) the development of new materials and technologies and (3) the increasing involvement of engineers in activities such as planning, administration, and management. These drivers have led to the diversification of the scope of civil engineering and have created profiles that differ from traditional academic programmes, which focus on structures, geo-technics, transport, sanitation, water resources, building construction and environment.

The major challenges of civil engineering curriculum reform in Africa include those posed by ongoing technological developments, changes in labour market demand for various skills and the impact of the economic crisis. Curriculum reforms thus are directed to meeting these challenges. Reforms are expected to contribute to the national development goals of making the national economies more efficient, competitive and responsive to regional, national and local needs.

On the institutional level, reforms in civil engineering curricula face the following challenges:

- Creating a platform for dialogue amongst different stakeholders to create a common understanding of goals and to focus work towards the same goal.

- Overcoming the current disconnection between higher education reform, curriculum development and teaching.

- Strengthening the ownership of civil engineering programmes for meta-profiles by assuring robust discussion within civil engineering departments and including other departments as appropriate.

- Coordinating common courses provided by schools of engineering that affect other departments and synchronising them using the Tuning Africa methodology.

Including the Tuning methodology and outputs as part of formal departmental reviews, which currently occur every 4-5 years.

5.2.9. *Reform of civil engineering curricula in participating countries*

Some countries are fostering curriculum reform and modernisation—in particular, those of engineering and sciences—as part of their national development strategies.

Ethiopia is one of the countries spearheading such efforts. Its Engineering Capacity-Building Programme is a sector-crossing reform programme that has, as its target, the expansion and reform of higher education in engineering and sciences. Seventy per cent of the enrolments were supposed to be in engineering and sciences, only 30 in humanities and social sciences (70:30). One component of the curriculum reform was the integration of a qualified internship programme and collaborative curriculum development with the stakeholders of the sector (including public and private employers as well as international experts). Civil engineering is one of the core programmes in Ethiopia expected to generate the graduates needed for boosting the Ethiopian construction industry and major national infrastructure projects.

In South Africa, national emphasis on engineering training will be complemented by other key skills: e.g., those of artisans, operators, planners, surveyors, project developers, financial experts, systems experts, etc.; Progress has been made in undergraduate engineering and enrolment figures (2008-2010). Now South Africa will address the gap in Stage Two learning—which involves mentored learning in the workplace to achieve professional designations.

In South Africa, the stagnation in numbers of new learners entering civil engineering programmes over the last three years suggests that the “economic capacity” for artisan training has been reached. Increasing the numbers of matriculants will require more funding and increased workplace opportunities. Hence, South Africa is developing an integrated skills plan for the next 20 years across all the South African Institution of Civil Engineering (SAICE) based on the demand and supply of skills in the current and anticipated building industries across the country. This plan will be used to inform training colleges, universities and artisan schools in the country and will ensure the smoother transition of construction workers from one stage to the next. Dedicated project training courses, which are modular in design and which are repeated throughout the year, will improve the capacity and standardisation in project implementation across the SIPs. Another strategy to meet the challenges is to develop a shared pool of scarce skills across and between public entities (SAICE 2011).

Botswana has also initiated endeavours to upgrade and expand its human resources and future workforce in engineering sciences. Behind these reforms is the need to diversify the economy, which still strongly relies on natural resources, especially diamonds (Teferra, 2012). The establishment of the Botswana International University of Science and Technology is one strategic element of the current reform.

Algeria has launched a strategy to create stronger links between engineering and the sciences to industry, to improve the employability of graduates and to foster technology transfer and entrepreneurship. The creation of innovation centres is the core of this strategy.

South Sudan has focused its post-conflict efforts in higher education reform on science and technology to provide the qualified labour force needed to reconstruct the country and to boost its economy. Its activities in the construction sector are, amongst other objectives, targeted to integrate South Sudan regionally.

5.3. Generic Competences in Civil Engineering

Presently, there is a growing demand for comparability and compatibility between the educational programmes of different universities, both within the same country and amongst different countries to foster the mobility and exchange of teachers and students. The reforms for harmonisation are linked to the endeavour of enhancing the quality and improving the employability of graduates. The concept of curricula based on competences implies a means of producing and transmitting knowledge, the relationship between education and society, the mission and values of the education system, the practice of teacher training and assessment and the activities and performance of students.

In Tuning Europe, “competence” is defined as a dynamic combination of knowledge, understanding, skills and abilities. Competences are articulated for various course units and are assessed at different stages. Two major divisions are generic competences (common to any degree course) and subject-specific competences (specific to the field of study).

Thus, generic competences identify shared elements common to all degrees, such as conceptual thinking, analysis and synthesis; and the ability to learn, to make decisions, to design projects, to exercise appropriate interpersonal skills, etc. They are complemented by subject-specific competences that a degree-holder in a given field of study is expected to possess as learning outcomes.

5.3.1. *Description of the process to define a set of generic competences*

The five Subject Area Groups (SAGs) of the pilot project each listed the generic competences an African bachelor's degree holder could be presumed to possess. The groups then met together in the Yaoundé meeting and agreed on eighteen generic competences:

1. Ability for conceptual thinking, analysis and synthesis.
2. Professionalism, ethical values and commitment to Ubuntu (respect for the well-being and dignity of others; good will).
3. Capacity for critical evaluation and self-awareness.
4. Ability to translate knowledge into practice.
5. Objective decision-making and practical cost-effective problem solving.
6. Capacity to use innovative and appropriate technologies.
7. Ability to communicate effectively in the official/national and local languages.
8. Ability to learn how to learn and capacity for lifelong learning (continued development).
9. Flexibility, adaptability and ability to anticipate and respond to new situations.

10. Ability for creative and innovative thinking.

11. Leadership, management and teamwork skills.

12. Communication and interpersonal skills.

13. Environmental and economic consciousness.

14. Ability to work in an intra- and intercultural and/or international context.

15. Ability to work independently.

16. Ability to evaluate, review and enhance quality.

17. Self-confidence, entrepreneurial spirit and skills.

18. Commitment to preserve African identity and cultural heritage.

The only issue that arose from the discussion in identifying the eighteen generic competences was that not all members of the group were familiar with the term "Ubuntu," as it is particular to Southern and Eastern Africa. However, after a discussion about the term's meaning as "respect for the well-being and dignity of others; good will," the group accepted the term and included it as one of the specifically African generic competences. A separate generic competence ("conflict resolution") was removed from the list as participants determined that it was comprised under "Ubuntu."

5.3.2. *Brief analysis of the eighteen generic competences from a civil engineering perspective*

1. Ability for conceptual thinking, analysis and synthesis. A key function of civil engineering, like many other disciplines, is to provide solutions to real-life problems. This competence corresponds to the ability to figure out mental representations of possible solutions to a problem (in this case, a civil engineering problem in a civil engineering context), taking into consideration the various dimensions and implications as well as the relevance of each possible solution.

2. **Professionalism, ethical values and commitment to Ubuntu** (respect for the well-being and dignity of fellow human beings). This competence is the ability to ensure compliance with accepted norms and guidelines, governing the practice of a profession, bearing in mind what is right and fair to all parties to a transaction, project or system from a legal, moral, ethical or human dignity perspective.

3. **Capacity for critical evaluation and self-awareness**. This competence is the ability to carefully and correctly assess and appraise identified projects, systems or situations with the view to determine their merits, value or shortcomings and present an overall picture of such systems (and, by extension, civil engineering projects) as a basis for decision making.

4. **Ability to translate knowledge into practice**. This competence relates to the capacity to adjust, modify or adapt acquired knowledge and connect it to a real-life problem or situation. In the civil engineering context, such knowledge must lead to the solution of a civil engineering problem.

5. **Objective decision-making and practical cost-effective problem-solving skills**. This competence is the ability to make straightforward, unbiased and cost-effective decisions, with the understanding that problem solving should not be influenced by friendship, emotion, retaliation or other factors that might otherwise cloud the process or reduce its validity in the eyes of the persons concerned.

6. **Capacity to use innovative and appropriate technologies**. This competence represents the ability to find or discover new technologies or follow up civil engineering-related developments thereof, put them to good use or adapt them to a given situation.

7. **Ability to communicate effectively in official/national and local language**. This competence is the ability to easily and effectively express or make known one's own or a group's thoughts and feelings, or give information either in writing, orally (in official, national or local language), or by some other means, such as diagrams, pictures or objects pertaining to a particular discipline, so that the target group can appraise and understand the message.

8. **Ability to learn and capacity for lifelong learning**. This competence is the readiness, willingness and capacity to assimilate, update, upgrade and enhance civil engineering knowledge on a continuing basis throughout one's professional life.

9. **Flexibility, adaptability and ability to anticipate and respond to new situations**. This competence is the ability to think fast and foresee how civil engineering systems or projects may change or new civil engineering challenges may arise and how to respond appropriately in order to protect or preserve the systems.

10. **Ability for creative and innovative thinking**. This competence is the ability to originate completely new ideas (or concepts in civil engineering), or ideas which, though not new, may be applied to new situations to solve problems.

11. **Leadership, management and teamwork skills**. These skills (including ethics, duty consciousness, personal integrity, efficiency and planning skills) underscore one's capacity to effectively work in a team or in a group (including civil engineering work groups and interdisciplinary teams), especially where one has the responsibility to steer and manage the group.

12. **Communication and interpersonal skills**. Universally, this competence comprises the ability to be clear and articulate in verbal and body language expression as well as the ability to relate smoothly with people. In the civil engineering context, communication extends far beyond verbal expression to include proficiency in communicating technical information through such media as engineering drawings, sketches, symbols and models, as well as the correct understanding and use of technical terms in verbal communication itself.

13. **Environmental and economic consciousness**. This ability is a keen awareness of the link between economic activity and environmental degradation and the competence to take measures within one's power to mitigate or limit such degradation where possible. For civil engineers, it means fully understanding the environmental implications of civil engineering projects, activities and installations and the responsibility that this places on them to ensure the preservation of the environment.

14. **Ability to work in an intra- and intercultural and/or international context**. This is the ability to work well with people of all races, ethnic, national or international backgrounds, whether in one's home region or in a foreign setting. It calls for understanding cultures other than one's own and may require adapting to the idiosyncrasies pertaining to those cultures. For civil engineers, this competence requires familiarity with local and national norms and standards as well as international standards governing civil engineering design and construction, such as those issued by national standards institutions and the International Standards Organization (ISO).

15. **Ability to work independently**. This competence requires the ability to work well, i.e., efficiently and effectively, under no supervision. It also requires being knowledgeable about one's work and which sources to consult for further information, the ability to plan and the ability to direct and manage time effectively to achieve desired results. For a civil engineer, this skill imperatively means knowing what sources —including handbooks, software, websites and databases—to consult for technical information without depending unduly on colleagues, especially on small projects.

16. **Ability to evaluate, review and enhance quality**. This is the ability to determine the quality status of an entity and take appropriate measures to enhance that quality. For a civil engineer, it is the capacity to use appropriate tools to assess the quality status of a civil engineering project and to use similar tools such as statistical quality control/assurance techniques to enhance the quality of those civil engineering projects.

17. **Self-confidence, entrepreneurial spirit and skills**. This is the quality of being sure of oneself in terms of acumen and ability to deliver good results from a business point of view. For civil engineers, such self-confidence is usually the result of the authority conferred by one's technical competence and professional skills. It therefore requires the ability to learn quickly on the job to overcome the self-doubts usually associated with being first-time practitioners and to progressively build the required authority which can ensure self-confidence without drifting into overconfidence.

18. **Commitment to preserve African identity and cultural heritage**. This quality is the pride of the African in his/her cultural

heritage and an enduring commitment to preserve that heritage through differentiation where possible or necessary so that the African identity can stand out boldly. For the African civil engineer, it means pride in bringing out this difference as and when appropriate, in order to reflect Africa's identity in civil engineering projects.

5.4. Subject-Specific Competences in Civil Engineering

5.4.1. *General application of Tuning Africa for civil engineering*

An initial topic of discussion for the civil engineering subject area group was whether apply the general concept and methodology of Tuning to the broader field of "the built environment" or whether to focus more specifically on civil engineering. The discussion identified "built environment" as a problematic term, since it comprises a number of professions such as architecture, quantity surveying, urban and regional planning and construction management, amongst others. After an extensive discussion, participants decided to focus on BSc civil engineering programmes only and, furthermore, to exclude design, quantification, and management. The group agreed that identifying core competences for the sub-specialisations would be appropriate at a later stage of the Tuning Africa process.

5.4.2. *Determining subject-specific competences*

The civil engineering working group used a two-step approach to identify subject-specific competences in civil engineering. The first was to identify the phases of a typical construction project, then to list the specific competences required for each phase. This approach was intended to deliberately link the identified competences to the needs of the labour market and the working environment of civil engineering graduates. The approach reflects the six project stages typical of a civil engineering project (see Table 5.3).

Table 5.3
The Six Project Stages of a Civil Engineering Project
and the Competences Required

Building Project Phases	Competences per Project Phase
Conceptualising the construction project (describing the scope of the project)	Ability to identify the need for construction of any type and structure (new, old) Ability to identify different options (e.g., the need to demolish, reconstruct, maintain, rehabilitate, renovate and plan those activities) Skills in cost, quality and time optimisation Skills in environmental and social impact assessment
Viability of the construction project	Skills in cost, quality and time optimisation Knowledge about the context and challenges of environment and development Ability to transmit project requirements into sketches and explain them to clients
Design and feasibility of the construction project	Ability to analyse, reconfigure and apply relevant drawings, data and technologies Ability to coordinate, supervise and control Capacity to model and simulate systems, structures, projects and processes Ability to interact effectively and professionally with other professions and to come to well-integrated solutions Ability to design Knowledge of plant and equipment Capacity to test the quality of building materials Skills in research on appropriate technologies Skills in developing new construction technologies and materials Skills in testing materials and technologies Skills in cost, quality and time optimisation Ability to calculate design parameters (mathematical skills) Ability to analyse (mathematical and abstract background as the basis for decision making) Ability to programme (to plan the process and allocate resources) Knowledge about national and international construction standards Ability to identify appropriate legal frameworks Skills in handling data/information (e.g., information about surveys, soils, materials, environment, social climate, etc.) Knowledge of maintenance of infrastructure

Building Project Phases	Competences per Project Phase
Documentation and procurement	Ability to calculate and quantify Ability to interact effectively and professionally with those from related professions and to reach well-integrated solutions Understanding of contracts, financial management, insurance and guarantees requirements (procurement) Ability to program (to plan the process and allocate resources) Skills in cost, quality and time optimisation Ability to translate, interpret data and/or drawings and carry them out in actual construction. Knowledge of plant and equipment
Construction (realisation, implementation)	Ability to translate, interpret data and/or drawings in the actual construction project Ability to interact effectively and professionally with those from related professions and come to well-integrated solutions Knowledge of basic construction management principles (work breakdown, time, risk, quality, resource, financial and HR management, monitoring, etc.) Ability to coordinate, supervise and control Knowledge of plant and equipment Commitment to health and safety Knowledge of maintenance of infrastructure Ability to reconstruct, maintain, rehabilitate and renovate Ability/skills to supervise construction Ability to program (to plan the process and allocate resources) Capacity to test the quality of building materials Skills in developing new construction technologies and materials Ability to supervise/manage Ability to control construction Quality management and skills in quality control techniques Skills in cost, quality and time optimisation Capacity to introduce and maintain health and safety measures in construction and materials handing. Skills in handling data/information from/about surveys, soils, materials, environment, social relations, etc.) Skills in resolving disputes

Building Project Phases	Competences per Project Phase
Close out of the construction project	Skills to finalise financial implications and legal responsibilities Skills to deal with dispute resolutions Skills to address defects and quality issues Skills in commissioning

The initial discussions began with the list of subject-specific competences that were developed by the civil engineering groups of the Tuning Latin America and Tuning Russia projects. Those competences were discarded that were not applicable or relevant to Africa. After this exercise, additional competences were formulated focusing on African requirements following the six construction project phases. These competences added up to fifty-four subject-specific competences. The doubled competences were eliminated in a second step. Through discussion and definition, the subject-specific competences in civil engineering were integrated and crystallised to thirty-seven. Next, in appraising the list of thirty-seven with regard to feasibility and practicability, the working group condensed the subject-specific competences further to twenty (see Table 5.4).

Table 5.4
Twenty Integrated Subject-Specific Competences

Rank	Ranked total	
1	36 (44, 45)	Ability to coordinate, manage, supervise and control construction
2	33	Ability to translate and interpret of data and/or drawings into actual construction
3	12 (26, 19, 10)	Ability to design, quantify and calculate parameters and capacity to model and simulate systems, structures, projects and processes
4	8 (7)	Ability to analyze, reconfigure and apply relevant drawings, data and technology and ability to transmit project requirements into sketches and to explain it to clients

Rank	Ranked total	
5	40 (39)	Knowledge to reconstruct, maintain, rehabilitate, and renovate infrastructure
6	3	Skills in cost, quality and time optimisation and quality control techniques
7	49	Skills in handling data or information (survey data, soil information...)
8	2 (1)	Ability to identify the need for construction of any type and structure and ability to identify different options
9	35 (21) (50)	Knowledge of basic construction and programme principles
10	38 (48)	Commitment to health and safety and capacity to introduce measures in construction and materials
11	42 (17)	Capacity to test the quality of materials
12	53 (46)	Quality management and skills to address defects and quality issues
13	20	Ability to analyze (mathematical abstract background as basis for decision making)
14	22	Knowledge about national and international construction standards
15	11	Ability to interact effectively and professionally with other professions and reach integrated solutions
16	43 (15)	Skills in developing new and appropriate construction technologies and materials
17	51 (23)	Skills to finalize financial implications and identify legal responsibilities and frameworks
18	37	Knowledge of plant and equipment
19	28	Understanding of contractual and financial management as well as of insurance and guarantee aspects
20	4 (6)	Skills in environmental and social impact assessment, knowledge about the context and the challenges of development

The working group next clustered these twenty competences into nine master groups: analysis, design, creativity, management, quality management, leadership, communication, sustainability and regulation. Some clusters combined two of the mentioned fields (see Table 5.5). The clusters were refined at a later stage.

Table 5.5
Final Subject-Specific Competences for Civil Engineering Africa Pilot Project, Identified by Cluster

	Subject-Specific Competence	**Cluster**
1	Ability to coordinate, manage, supervise and control construction	Management
2	Ability to translate and interpret data and/or drawings into actual construction	Communication
3	Ability to design, quantify and calculate parameters and capacity to model and simulate systems, structures, projects and processes	Design & analysis
4	Ability to analyse, reconfigure and apply relevant drawings, data and technology. Ability to transmit project requirements into sketches and explain them to clients	Design & communication
5	Knowledge to reconstruct, maintain, rehabilitate, and renovate infrastructure	Management
6	Ability to control costs, quality and time required for construction	Leadership
7	Ability to analyse data or information (e.g., data from surveys, soils, etc.)	Analysis
8	Ability to identify the need for construction by type and structure. Ability to identify different options for achieving construction	Analysis
9	Ability to manage basic construction and programme principles	Management
10	Commitment to health and safety measures. Ability to introduce and maintain safety measures in construction and materials	Regulations
11	Ability to test the quality of materials	Quality management
12	Ability to manage and address defects and quality issues	Quality management

	Subject-Specific Competence	Cluster
13	Ability to analyse and make decisions based on mathematics and other abstract principles	Analysis
14	Knowledge of national and international construction standards	Regulations
15	Ability to develop effective and professional interactions with experts in other professions and to achieve well-integrated solutions	Communication
16	Skills in developing new, appropriate and sustainable construction technologies and materials	Creativity
17	Ability to finalise financial implications, identify legal responsibilities and operate within appropriate frameworks	Management & regulations
18	Knowledge of plant and equipment	Management
19	Basic understanding of contractual and financial management, including insurance and guarantees	Management
20	Skills in environmental and social impact assessment, knowledge about the context and the challenges of development	Regulations & sustainability

5.5. Consultations and Reflections on Generic and Specific Competences in Civil Engineering

5.5.1. *Methodology of data collection*

According to the pilot project design, the civil engineering group decided to survey four groups: students, graduates, academics and employers. The group distributed the questionnaire in the ten participant countries by two methods: (1) printed questionnaires administered in short meetings during which the respondents received background information and explanations of how the data would be used; and (2) online questionnaires and email attachments in which briefing occurred via email to explain the generic and specific competences.

The survey asked participants to rate each competence on a four-point scale, in which 1 = "none," 2 = "weak," 3 = "considerable" and 4 = "strong". Respondents rated each competence according to (1) its perceived “importance” in the workplace and (2) their institution’s level of “achievement” in imparting this competence. In addition, the respondents ranked the five most important generic and subject-specific competences.

The numbers of responses were: 196 students, 164 graduates, 167 academics and 139 employers.

5.5.2. *Interpretation of generic results*

The civil engineering working group analysed the results of the questionnaires and identified the four top generic competences.

Employers	Academics	Graduates	Students
4	4	4	4
10	1	11	16
1	9	2	17
16	16	1	15
6	5	16	6

Figure 5.3
Top four generic competences in civil engineering

- G4: Ability to translate knowledge into practice.
- G16: Ability to evaluate, review and enhance quality.
- G1: Capacity for conceptual and critical thinking, analysis and synthesis.
- G6: Ability to use innovative and appropriate technologies.

The working group highlighted the importance of critical thinking and synthesis and therefore identified them as meta-competences.

According to a gap analysis, respondents perceived that current civil engineering programmes displayed gaps in five areas. These five generic competences are missing completely (or are only partially featured) in existing curricula; hence, the conclusion was that they did not lead the student to acquire the expected learning outcomes by graduation.

	Employers	Academics	Graduates	Students
1	6	2	18	6
2	13	6	13	2
3	2	18	9	14
4	17	2	6	18
5	18	14	17	17

Figure 5.4
Top five gaps in generic competences in civil engineering

- G6: Capacity to use innovative and appropriate technologies.
- G18: Commitment to preserve and to add value to African identity and cultural heritage.
- G13: Environmental and economic consciousness.
- G17: Self-confidence, entrepreneurial spirit and skills.
- G2: Professionalism, ethical values and commitment to Ubuntu.

Weak achievement in these five generic competences has a decided impact on individual professionals, on the profession of civil engineering as a whole, and also on a regional African level. The capacity to use innovative and appropriate technologies is basic for the construction of modern facilities and infrastructures and has a long-lasting effect because of their impact on quality. Self-confidence, entrepreneurial spirit and skills, as well as environmental and economic consciousness, are crucial in meeting the requirements of social development, in developing the labour market and in improving employment opportunities, particularly for African youth. Professionalism, ethical values and commitment to Ubuntu as well as the commitment to preserve and to add value to African identity and cultural heritage are core to the continental objectives of an integrated and prosperous Africa as promoted by the African Union.

Therefore, the working group highlighted the need for fostering the above competences in university-level civil engineering programmes in Africa.

Further discussion of the competences showing the greatest gaps between the competence's importance and its achievement in the curriculum focused on how to integrate these competences into the curriculum, teach them effectively and assess whether they have been achieved. The group agreed that a particularly important obstacle in achieving these goals was the lack in African universities of infrastructure to support innovative learning; as a result, they experienced handicaps in achieving the broader goal of reform of curricula, teaching and learning.

5.5.3. *Interpretation of the subject-specific results*

Table 5.6
Subject-Specific Competences Ranked by Importance
and Listed by the Most Important Competences

Academics		Employers		Students		Graduates	
33	3.73	36	3.77	36	3.75	45	3.8
8	3.71	33	3.77	45	3.72	40	3.79
40	3.7	26	3.69	3	3.72	33	3.78
19	3.7	8	3.68	26	3.71	12	3.78
12	3.69	44	3.68	8	3.7	49	3.75
7	3.69	35	3.68	44	3.69	36	3.74
36	3.68	38	3.67	42	3.69	44	3.74
3	3.66	46	3.67	12	3.68	26	3.72
45	3.65	12	3.66	7	3.65	8	3.7
2	3.65	7	3.66	19	3.65	19	3.7
20	3.65	39	3.66	39	3.65	3	3.7
26	3.64	45	3.65	21	3.65	35	3.7
49	3.64	19	3.63	49	3.64	53	3.69
44	3.63	49	3.63	35	3.64	11	3.69
1	3.62	22	3.63	1	3.64	7	3.68
39	3.59	53	3.62	48	3.63	10	3.68
21	3.58	2	3.61	33	3.62	39	3.67
53	3.58	42	3.61	40	3.62	2	3.67
38	3.56	51	3.61	2	3.61	21	3.67
22	3.55	40	3.59	38	3.61	38	3.66
43	3.54	11	3.59	37	3.61	46	3.66
51	3.53	3	3.58	11	3.6	1	3.65
35	3.52	43	3.58	20	3.59	42	3.64
42	3.52	21	3.57	22	3.59	20	3.63
46	3.5	48	3.57	43	3.59	43	3.61
48	3.5	50	3.56	46	3.58	51	3.59
28	3.48	1	3.55	17	3.58	37	3.59
6	3.47	20	3.55	53	3.56	50	3.59
11	3.46	37	3.52	50	3.53	28	3.59
10	3.44	52	3.51	15	3.53	22	3.58
37	3.42	10	3.5	10	3.52	15	3.58
4	3.42	6	3.5	4	3.51	48	3.57
50	3.41	54	3.43	51	3.5	52	3.53
15	3.39	28	3.42	28	3.49	17	3.46
52	3.35	17	3.42	6	3.44	23	3.45
17	3.29	23	3.38	52	3.42	6	3.43
23	3.28	15	3.37	54	3.38	4	3.34
54	3.2	4	3.37	23	3.32	54	3.34

Note: The subject-specific competences (C) have retained their numbering from the original list of fifty-four competences. Analysis of the survey results showed the top five competences in civil engineering, rated according to importance.

- C7: Ability to transmit project requirements into sketches and explain them to clients.

- C36: Ability to coordinate, supervise and control.

- C45: Ability to control construction.

- C44: Ability to supervise/manage.

- C49: Skills in handling data or information (data from surveys, soil, etc.).

Further analysis of gaps between the "importance" that respondents assigned to a particular competence and their perception of how well it was achieved in the curriculum shows the following results:

- C18: Ability to plan the process and allocate resources.

- C26: Commitment to health and safety.

- C32: Capacity to introduce health and safety measures in construction and materials.

- C35: Skills in resolving disputes.

- C37: Skills in commissioning.

Possible explanations of these gaps are:

- The content may not be taught at the university level since many civil engineering programmes spend a majority of the time on teaching students how to design and to analyse problems mathematically. The working group expressed their view that this focus on mathematics and science is appropriately taught at the university level while programming, health and safety, dispute resolutions and skills in commissioning may be best gained in the workplace.

- As mentioned above, these additional competences may be learned on-site as part of hands-on experiences or as extra courses offered by employers. They are not part of the core curriculum but could also be offered as additional courses at the university level.

- The competences are not part of the programme as issues like safety and health may have financial implications for the employers. Some participants noted that some employers tend to avoid costs in the areas of safety and health.

- Legal frameworks with their restricting elements, health, safety and security should be integrated into programmes or courses teaching environmental impact assessment methodology and frameworks.

- Rather than being part of the core content of civil engineering, these topics may be better treated in the more specialised programmes of construction technology and management.

- Governing bodies that set the course frameworks may leave little room to deal with topics not seen as core for the civil engineering programme.

In short, the civil engineering working group generally agreed that the survey results accurately reflect the reality in civil engineering courses in African universities. This agreement then generated the following questions: (1) How can the gaps thus identified be closed? and (2) How can the discrepancies be addressed between the importance of some generic and subject-specific competences and their lack of actual achievement in the present curriculum?

As suggested by the group, one of the solutions could lie in the course-practical attachment, the industrial attachment or the work-integrated learning approaches currently being used in South African universities. Another possible solution is the qualified internship under academic mentorship as practiced in Ethiopia's Engineering Capacity Building Programme.

Another best practice mentioned may be "service learning," which means that students provide service to the community, attached to but separate from the in-class courses. This model is practised in South Africa, which encourages student participation by allowing students to earn ten notional hours (per academic credit that can be earned) up to a maximum of eighty service-learning hours.

Multidisciplinary teams consisting of experts in health and safety could offer additional lectures on these topics while the relevant physical practices can be learned on-site. Other lectures could provide information regarding regulations, safety and project management, but most of these aspects should be learned on-site or by examining case studies.

5.6. The Meta-Profile of Civil Engineering in Africa

The Tuning Africa definition of a meta-profile is a representation of the structure and combination of knowledge and competences, which gives identity to a subject area. The civil engineering subject area group followed a multi-stage approach to develop its meta-profile of the subject area.

During the first round of discussion, participants mapped the context of construction engineering (later civil engineering) in Africa. To do so, group members displayed the educational programme of their participating university. From this discussion, the educational layout of each university was presented.

The working group identified three core clusters of required knowledge in civil engineering in Africa: (1) design and analysis, (2) construction and (3) project management. The group agreed that these three core clusters are central in most civil engineering curricula taught by the universities taking part in the Tuning project.

The group recommended that an appropriate weighting for each cluster would be: (1) 80 per cent for design and analysis, (2) 10 per cent for construction and (3) 10 per cent for project management. The reason for these proportions is that most universities offer separate degrees in construction management and project management. Therefore, the knowledge represented by the civil engineering degree is seen as basic (or as prerequisite) to construction management and project management. The group agreed that, in shaping future curricula, the same proportions should apply.

5.6.1. *Core clusters in civil engineering*

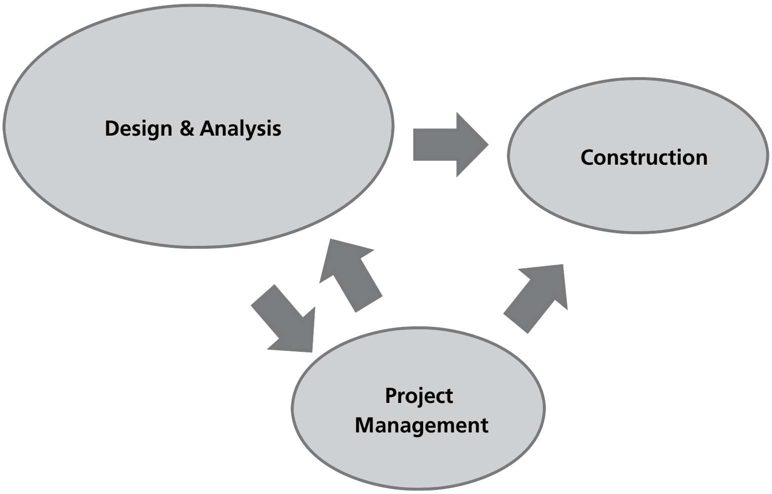


Figure 5.5
Core clusters in civil engineering

The figure shows a link between the three core clusters of (1) design and analysis, (2) construction and (3) project management. Civil engineers should acquire competences in these three core clusters.

The design and analysis cluster includes any type of design or analysis which is linked to the four main fields of civil engineering: (1) structural engineering, (2) geotechnical engineering, (3) transportation engineering and (4) hydraulics or water engineering.

5.6.2. *The six clusters of core competences of civil engineering*

As discussed above, the civil engineering working group applied the eighteen subject-specific competences of Tuning Africa to a degree in civil engineering. These eighteen competences were organised into six related clusters, which were refined out of a first clustering (see Table 5.7).

1. Critical thinking.
2. Professionalism.

3. Creativity.
4. Communication.
5. Leadership.
6. Regulation.

Table 5.7
Clusters of Generic Competences

	Generic Competences	Cluster
1	Ability for conceptual thinking, analysis and synthesis	Critical thinking
2	Professionalism, ethical values and commitment to Ubuntu	Professionalism
3	Capacity for critical evaluation and self-awareness	Critical thinking
4	Ability to translate knowledge into practice.	Critical thinking
5	Objective decision-making and practical cost-effective problem solving.	Critical thinking
6	Capacity to use innovative and appropriate technologies.	Creativity
7	Ability to communicate effectively in official/national and local languages.	Communication
8	Ability to learn how to learn and capacity for lifelong learning.	Communication
9	Flexibility, adaptability and ability to anticipate and respond to new situations.	Creativity
10	Ability for creative and innovative thinking.	Creativity
11	Leadership, management and teamwork skills.	Leadership
12	Communication and interpersonal skills.	Communication
13	Environmental and economic consciousness.	Regulation
14	Ability to work in an intra- and intercultural and/or international context.	Professionalism
15	Ability to work independently.	Professionalism
16	Ability to evaluate, review and enhance quality.	Critical thinking
17	Self-confidence, entrepreneurial spirit and skills.	Regulation
18	Commitment to preserve and add value to the African identity and cultural heritage.	Leadership

5.6.3. *Mega-clusters of generic and subject specific competences in civil engineering*

During a lengthy process of discussion and condensation, the civil engineering working group organised the twenty subject-specific competences into mega clusters. The working group retained the original numbers from the first list of fifty-four subject-specific competences during this synthesis—hence numbers above the twenty "final" subject-specific competences.

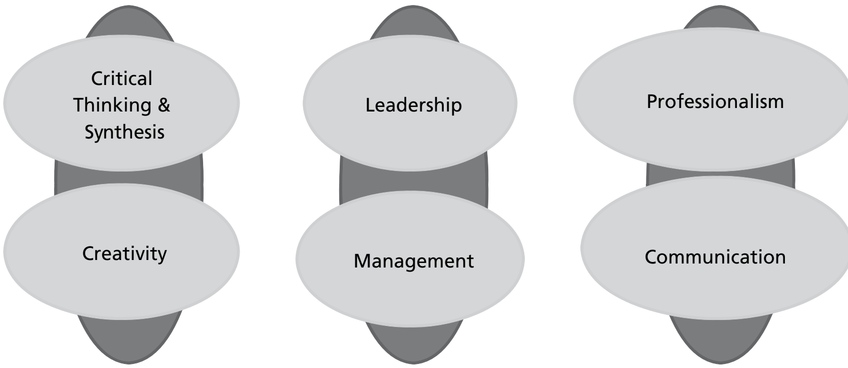


Figure 5.6
Mega-clusters of generic and subject-specific competences in civil engineering

Continuing their analysis below the core clusters, the civil engineering working group grouped the six clusters that are one level below the core clusters into three: (1) critical thinking & synthesis and creativity, (2) leadership and management and (3) professionalism and communication. These groupings were done to show that, for example, although "critical thinking and synthesis" seem to be the opposite of "creativity," the holder of a degree in civil engineering context should be expected to have skills in both mega-clusters.

Similarly, "leadership" and "management" have a complementary relationship. Graduates will become better managers if they obtain some leadership skills.

The civil engineering working group grouped "professionalism" and "communication" because a civil engineer should be able to communicate in a professional way with colleagues, stakeholders, peers from related specialties and staff. Once again these are skills that a graduate of civil engineering should obtain. It was stressed that these skills are particularly important learning outcomes on the postgraduate level.

5.6.4. *Combination of clusters into a meta-profile of civil engineering*

The working group's final step in setting up the civil engineering meta-profile was to combine the core clusters with the clusters as shown in Figure 5.7. The core clusters are grouped together in a knowledge sphere, which represents the knowledge that civil engineering students should gain in their undergraduate courses. This sphere includes learning the different ways and methods of designing in the four main fields of civil engineering: (1) structural engineering, (2) geotechnical engineering, (3) transportation engineering and (4) hydraulics or water engineering.

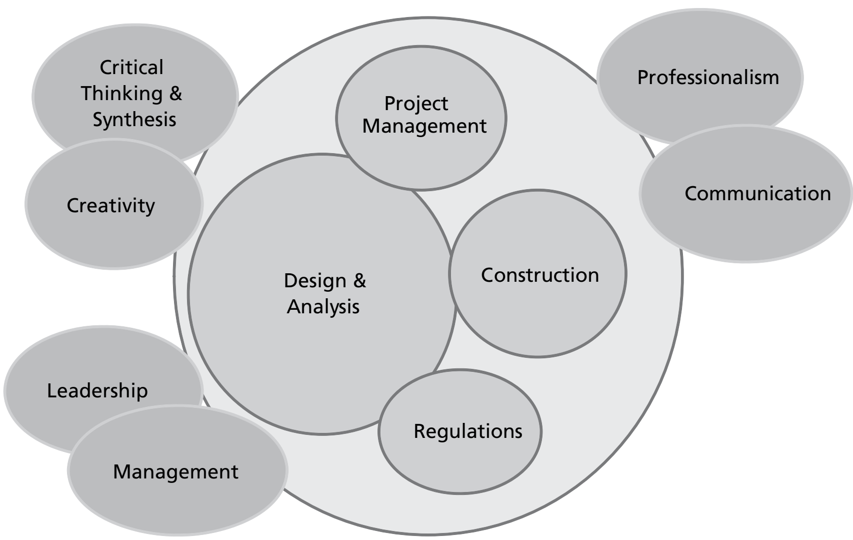


Figure 5.7
Civil engineering meta profile

5.6.5. *Reflections on the meta-profile of civil engineering and reform requirements*

The working group differentiated between the first core cluster identified and the final meta-profile upon which the group agreed, after reflecting on the generic and subject-specific competences required. This difference was the agreed-upon need for students to receive formal instruction as part of the curriculum about the regulations with which civil engineering degree-holders may be assumed to be familiar. The traditional assumption has been that civil engineering graduates would learn these regulations on-site; but given the need for degrees to be more portable and more equivalent internationally, an introduction to working regulations becomes an essential element of the curriculum, with the understanding that civil engineers will expand their knowledge, particularly about regional, national and local regulations in this area on-site.

Therefore, the working group's final recommendation on weighting the areas of the curriculum changes the 80 per cent devoted to design and analysis, the 10 per cent devoted to project management, and the 10 per cent focused on construction to the configuration below:

- Design and analysis: 80 per cent.
- Project management: 8 per cent.
- Construction management: 8 per cent.
- Regulations: 4 per cent.

As shown above, the clusters are weighted towards the knowledge sphere and are mutually inclusive, focusing on the goal of imparting these essential skills as the knowledge is transferred to the student. As the survey showed, however, there is a significant gap between the importance of the knowledge and the achievement of formal civil engineering programmes in imparting it, with skills being much more difficult to teach than knowledge. The six clusters were not prioritised in terms of the weight given to each (importance). (See Figure 5.8 for the civil engineering meta-profile, which groups the generic and subject-specific competences into the six above-mentioned clusters.)

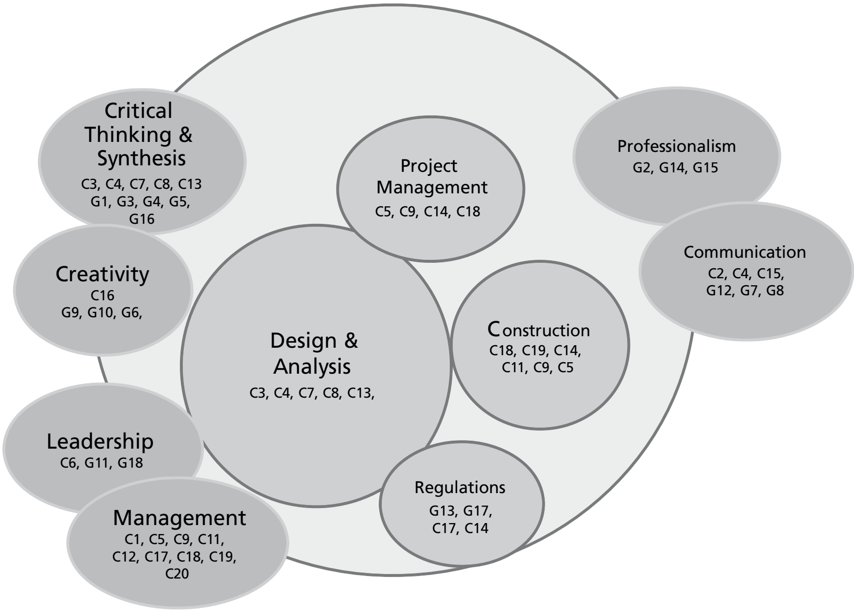


Figure 5.8
Final civil engineering meta-profile linking generic and subject-specific competences

The final step was to optically link the generic and subject-specific competences to their respective segment of the meta-profile. In Figure 5.8, numbers starting with "G" show the eighteen generic competences, while numbers preceded by "C" designate the subject-specific competences. Certain competences appear more than once in different clusters, reflecting the belief of the working group that the information can be transferred to the student in more than one field and/or in more than one way.

5.7. Contrast of the Civil Engineering Meta-Profile and the Existing Curricula at the Regional Level

The working group compared the agreed-upon civil engineering meta-profile with the existing curriculum at their respective universities. Table 5.8 shows the gaps between the proposed Tuning meta-profile and the current status of civil engineering curricula in participating African universities.

Table 5.8
Civil Engineering Meta-Profile and Existing Curricula at Regional Universities

	Algeria	Botswana	Cameroon	DRC	Ethiopia	Kenya	Nigeria	Tanzania	South Africa	South Sudan
Design and Analysis	C5						C4		NIL	
Project Management	C4					C5, C18	C5			
Construction	C4					C18, C5	C5			
Regulations	G13, C20	G17		G13, G17, C17, C14	C20		G13			
Critical Thinking and Synthesis	C16, G16						C4	C3		
Creativity				G6						
Leadership	G18	G18			G18	C6, G18				
Management	C5					C5, C18	C5	C18		
Profesionalism	G2			G2	G2	G2, G14				
Comunication	C4					G7, G8	C4			

A substantial number of members of the working group pointed out that their universities would identify generic competence #2 (professionalism, ethical values and commitment to Ubuntu) as problematic. Most of the universities already include lectures or modules on professionalism and ethical values, but the term "Ubuntu" required definition and explanation in the working group and would require the same explanations to faculty before they could teach it.

The meta-profile for the Tuning Africa Working Group in Civil Engineering is well aligned with the requirements of the Engineering Council South Africa (ECSA), the governing engineering body in South Africa. The working group's consensus was that distinguishing between knowledge and competences to be developed in the civil engineering field is a necessity as some of the competences cannot be applied if the student has not gained the relevant knowledge. The University of Pretoria civil engineering staff agrees that no key elements are missing from the meta-profile.

5.8. African Civil Engineering Meta-Profile Compared with Findings in Other Regions

Although civil engineering programmes are not identical over the different regions represented in the working group, a strong convergence was noted with regard to the undergraduate course content. Most civil engineering programmes represented one of two major models: (1) a broad-based programme that allows the graduate either to embark immediately on a profession, or (2) preparation for entering a specialised master's programme, such as road engineering.

Members of the Tuning Africa Working Group in Civil Engineering compared existing curriculum in Africa to the other existing Tuning models in Latin America, Europe and Russia. The following observations were made:

In Latin America, risk management is seen as an essential part of the civil engineering curriculum with a focus in the syllabus on construction. Latin American academic experiences are designed to provide a higher level of hands-on internships in conjunction with classroom instruction, while in Africa the practical experience mainly comes during professional on-the-job training. An exception is the qualified internship period currently employed in Ethiopia.

The African civil engineering group was much impressed by and interested in the Latin American and European approach of working with level descriptors related to the competences and defined according to study years. Latin America has a precise catalogue of defined competences for engineering in a broader sense.

Another characteristic of Latin America competences is that they were systematised in advance into social, cognitive, technological and ethical categories and groupings, while the African group formed clusters as a step following the identification of generic and subject specific competences.

The Russian Tuning experience has not yet included civil engineering but it does present its group work on environmental engineering. The Russian Tuning approach differentiates amongst three categories of competences. It uses the term "general" competences rather than "generic" competences.

- General competences for engineering (broadly based programmes).
- General competences for environmental engineering.
- Subject-specific competences for environmental engineering.

The large country of Russia (Federation) does not distinguish between its regions in its programmes and standards, so the programmes were widely homogenous. The Russian Tuning Environmental Engineering Working Group identified "quality" as a central issue.

5.9. Conclusions and Recommendations

5.9.1. *General conclusions on Tuning Higher Education Africa Pilot Project in Civil Engineering*

The civil engineering group considered the Tuning methodology as appropriate for higher education reform and the harmonisation of study programmes in Africa. It appreciated the continent-wide subject area's specific dialogue platform created to coordinate and discuss the further development of civil engineering education. The tools developed by the previous Tuning projects were considered helpful and the combined approach of generic and subject-specific competences to assess the meta-profiles of programmes seems to be supportive in the larger project of re-thinking the programmes, their quality and relevance as well their expected learning outcomes.

The Tuning Higher Education in Africa pilot project provides an opportunity for Africa to harmonise engineering curricula in order to produce competent human resources in sufficient quality and quantity to provide adequate personnel for future transnational African enterprises in the public and private construction sectors.

The pilot phase allowed for a first dialogue, meaningful networking, a stock-taking step and a shared understanding of the scope and core of civil engineering programmes. It also allowed useful discussions about the role of civil engineering education in the context of African development and both the generic and subject-specific competences a graduate is expected to have acquired by graduation. The Tuning Civil Engineering Pilot Project was considered as "a step towards closing the gap between higher education and the continent's needs. The networking opportunities created by the exercise and the success in achieving a common language and conception with regard to curricula reform can thus be perceived as a small, but relevant step towards harmonisation in higher education and the creation of an African academic identity and understanding" (Hahn and Teferra, 2013, p. 155).

5.9.2. *Civil engineering specific conclusions*

The Tuning Africa pilot project in civil engineering highlighted the positive observation that the majority of universities involved in the project show broad similarities in curricula. These similarities form a fruitful starting point in reforming the existing curricula and designing new civil engineering curricula for Africa.

It was commonly understood by participants that the pilot phase was only a starting point and that further collaboration and dialogue will be required to implement reform in civil engineering education. A follow-up project phase was proposed, continuing with the existing core expert group, but also widening to include more countries, universities and stakeholder groups.

The curricular reform efforts in professional academic programmes like civil engineering, is slightly more cumbersome, if not more challenging, than in mere academic programmes. The institutional stakeholder landscape of civil engineering in the participating African countries illustrates the complexity of meaningful higher education reforms in the respective field and highlights the importance of integrating stakeholders—in particular regulating or governing bodies and employer associations—into the reform process.

The Civil Engineering Group supports the idea of integrating "health", "safety" and "security" into environmental impact assessment methodology and frameworks. However, it is presumed that legal and regulating frameworks set by governing bodies may leave little room to manoeuver. This example indicates the sector-crossing challenge of higher education reform in civil engineering, as it also implies reform of legal and regulating frameworks. The close involvement and institutionalised dialogue of stakeholders and governing bodies is, hence, advisable to facilitate the complex reform.

The working group's final recommendation on weighting the areas of the curriculum changes focused on construction to the configuration below: design and analysis: 80 per cent; project management: 8 per cent; construction management: 8 per cent; and regulations: 4 per cent.

The Civil Engineering Working Group noted a definite difference between academic knowledge to be gained and competences to be developed amongst civil engineering students. In other words, the transfer of knowledge is easy; the building of competences is not. This situation raises the related questions: (1) How to teach to obtain the competences? and (2) How to assess these competences? The Tuning approach of integrating "level descriptors"—as practiced in other regions of the world—to describe the competences and knowledge to be gained at every stage of the study programme seemed to be an attractive option for further discussion and as a basis for programme reform.

5.9.3. *Validation of the process*

As the current Tuning Civil Engineering was designed only as pilot project with a limited number of universities, a validation will be necessary to make the results available for a larger regional and sector-crossing context. The validation will definitely imply a review of the preliminary meta-profile developed for civil engineering. The validation process should not only include stakeholders like leading universities in the field but also university associations, ministries, professional and regulating bodies, intermediary bodies, quality assurance agencies and student bodies as well as employer associations and further key actors. This comprehensive list of stakeholder of the civil engineering sectors indicates the complexity that may be expected in review, validation and reform.

5.9.4. *Dissemination*

The dissemination process will target the academic and professional sector as well as the political sector in all five African regions. It will not be limited to the national level but will be operational at the regional level as Regional Economic Communities (RECs), regional university associations, and professional associations; it will also operate at the continental level through such organisations as the Association of African Universities (AAU), Association for the Development of Education in Africa (ADEA), African Union (AU) and other pan-African organs and networks, as well as such pan-African projects as Pan-African University.

To achieve wider publicity, different media will be used for dissemination, including print media (e.g., civil engineering journals, the *Tuning Higher Education Journal*, and other higher education journals) and online media (e.g., the Tuning Higher Education in Africa website: www.tuningafrica.org). In addition, one thousand copies of the Tuning Africa report will be produced as well as a CD describing the Tuning methodology and the Tuning approach in general and the outcomes of the Tuning Higher Education in Africa pilot project. Short seminars and training sessions will support the dissemination.

5.9.5. *The way forward*

The future Tuning Civil Engineering in Africa project should be expanded to more participating key universities as well as to universities in the periphery. It should address the following issues that go beyond the pilot project:

- The difference of the meta-profiles in bachelor and master's programmes (e.g., four-year and five-year programmes, for example, in Algeria, Cameroon and DRC).
- The credit system and student workload.
- The issue of credit and degree transfer at they relate to student mobility.
- The mobility of staff and students.
- Developing a student-centred approach to teaching and learning, teaching methods and competence assessment by year of study.
- Deepening the reform dialogue by defining detailed learning objectives and outcomes (level descriptors).
- Carrying out an analysis of the gap between the existing curricula and the developed meta-profiles, as begun in the pilot phase.

The next Tuning Higher Education in Africa project should promote the dialogue of the four core engineering disciplines (mechanical, civil, electrical and chemical engineering) in order to define a core curriculum for engineering and its specific competences that are in common and could be shared within these engineering disciplines. Generic competences for the engineering programmes should be developed jointly to optimise shared curricula. In the African context, this approach could lead to a better understanding of the competences of engineer graduates and could better meet the broad labour market demands.

Curriculum reform should be regularly linked to an institutionalised dialogue with the stakeholders, employer associations and industry to ensure the employability of graduates and the relevance of the curriculum content and learning outcomes.

In a long-term perspective, the creation of regional Tuning centres in Africa linked to university associations (e.g., African Association of Universities, Inter University Council for East Africa) and professional bodies could serve as catalysts to promote quality enhancement, harmonisation and regional integration in the engineering programmes. The African Union could play a leading steering and coordinating role in facilitating the implementation of Tuning Higher Education in Africa on the political level and aligning it with a number of its own key strategies and plans (e.g., the Plan of Action for the Second Decade of Education for Africa, the post-2015 agenda, the implementation of the Arusha Convention and the strategy for the harmonisation of higher education programmes). Reform efforts should be closely linked to existing regional and continental quality assurance initiatives and networks in higher education.

Members of the Civil Engineering Subject Area Group (SAG) for this pilot project are:

Subject Area Coordinator: **Haddis Rebbi TEKLEMARIAM**	**Higher Education Tuning Expert:** **Karola Katherine HAHN**
Ethiopian Institute of Architecture, Building Construction and City Development, Addis Ababa University Ethiopia haddisreb@yahoo.com	Germany/Ethiopia karola.hahn@gmail.com

Algeria **Mohand HAMIZI** Université Mouloud Mammeri de Tizi Ouzou chamizi@yahoo.fr	**Nigeria** **Kabir BALA** Ahmadu Bello University balakabir@abu.edu.ng balakabir@gmail.com
Botswana **Oagile KANYETO** University of Botswana, kanyetoo@mopipi.ub.bw	**South Africa** **Karin JANSEN VAN RENSBURG** University of Pretoria karin.jansenvanrensburg@up.ac.za
Cameroon **Robert NZENGW** Université de Douala rnzengwa@yahoo.fr	**South Sudan** **James Janthana Bango TUKARI** Juba University jamesjanthana@gmail.com
Democratic Republic of Congo: **Lutimba Hubert MAKENGO** Université de Kinshasa, makengo238@ yahoo.fr	**Tanzania** **Ignas Aloys RUBARATUKA** University of Dar Es Salaam rignas1@uccmail.co.tz
Kenya **Stanley Muse SHITOTE** Moi University shitote@hotmail.com	**South Africa** **Inge Pieterse** University of Pretoria Vice President of the African Council for the Quantity Surveying Profession (SACQSP) Inge.Pieterse@up.ac.za (Support in the first two Tuning working sessions)

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Chapter 6

Mechanical Engineering

Charles AWONO ONANA, Shadreck CHAMA, Moses Phenias Mngwapa CHINYAMA, Béatrice DELPOUVE, Léonard KABEYA MUKEBA, Venant KAYIBANDA, Mohamed M. MEGAHED, Nawaz MAHOMED, Samuel Mensah SACKEY, Taoufik NASRI, Martin PANOU, Danwe RAIDANDI and Venkata Ramayya ANCHA

6.1. Introduction

The African Higher Education system is undergoing a tremendous transformation process. This includes a number of national, regional and continental initiatives among which are the Nyerere Mobility Scheme, the African Higher Education Harmonisation and Quality Assurance programme, and the Pan-African University. Moreover, at the institutional level, reform is underway in all countries.

One transformation initiative which links institutional, national, regional, continental and international endeavours is the African Higher Education Harmonisation and Tuning Project (Tuning Africa), which is part of the Africa-EU strategic partnership.

Tuning is a collaborative, consultative process involving academics working in subject groups with employers and other stakeholders in curriculum development to enhance student competences. Tuning projects in higher education in Africa help to:

- improve staff capacity to design and develop curricula

- provide opportunities for the generation of additional resources
- support effective and productive networking.

Tuning Africa concerns five subject areas, one of which is mechanical engineering, led by Central Africa. The following universities from eleven countries were selected to participate in the pilot project. In alphabetic order, they are:

1. Cameroon: University of Yaoundé.
2. Central African Republic: University of Bangui.
3. Democratic Republic of Congo : Institut Supérieur de Techniques Appliquées Kinshasa.
4. Egypt: Cairo University.
5. Ethiopia: Jimma University.
6. Ghana: Kwame Nkrumah University of Science and Technology.
7. Malawi: University of Malawióthe Polytechnic.
8. Rwanda: Kigali Institute of Science and Technology.
9. South Africa: Cape Peninsula Science and Technology and Stellenbosch University (as observer).
10. Tunisia: Ecole Nationale d'Ingénieurs de Tunis.
11. Zambia: Copperbelt University.

At a later stage, the observing Cape Peninsula University of Technology and Stellenbosch University in South Africa formally joined the group as a participant member.

Mechanical engineering deals with the design, development, manufacture, operation and maintenance of all forms of mechanical machinery and equipment as well as mechanical systems. Examples of machinery and equipment include: machine tools, process machinery, material-handling equipment, elevators and escalators, fluid machines, vehicles, aircrafts, etc. Examples of mechanical systems include piping networks for the supply of liquids, gas and processed heat, refrigeration and air conditioning, fire-fighting and energy conversion.

The indispensability of mechanical engineering (ME) and its derivatives to the socioeconomic development of the African continent, its sub-regions and all its constituent nations is an enduring fact that cannot be disputed in the least. This is because perhaps no other engineering discipline, or for that matter, area of endeavour, touches the lives of the peoples so thoroughly, so ubiquitously, and so perpetually in this modern world as does mechanical engineering. From the automobile to the airplane, from the locomotive to the ships that ply the seas, from the industrial plant and machinery that produce the household goods that we all enjoy to water and power generation and supply systems, mechanical engineering, as an engineering activity, impinges on nearly every sphere of human life.

The plight of much of Africa in light of changes on the international scene, including globalisation, teaches us that mere possession of natural resources is not a guarantee for development and prosperity; instead the knowledge economy has become the main driving force for inducing tremendous and progressive breakthroughs in the exploitation of nations' resources. This knowledge economy requires high-quality education based on well-defined reference standards. Good practise in education should encourage students to improve their innovative and creative capabilities, employ appropriate technologies and pursue independent and life-long learning. This quality education has become the main gate to human resource development. Development of human capital is thus counted as one of the most important determinants of national sustainable development.

The GDP per capita in most African countries is below the world average; hence, African countries need to generate far more wealth than they are currently doing. This achievement can occur only through a gradual shift from the current primary resource-based economy through beneficiation to a knowledge-based economy. This transitional zone is where the mechanical engineering profession-profession essential to all other types of economic activities-will play a paramount role in wealth generation.

Even though mechanical engineering is highly developed in advanced Western societies and, recently, in much of Southeast Asia as the underpinning factor of their industrial and socioeconomic development, in Africa as a whole, mechanical engineering is only now emerging as a field. Still, it stands out as the single discipline which, more than any other, holds the potential to lift Africa up from its current stagnation.

These arguments underscore the rationale for mechanical engineering's identification and selection as one of the subject areas whose reform and enhancement in African universities is essential for the technological and socioeconomic development of African countries.

6.2. Context for Curriculum Reform and Modernisation

Mechanical engineering (ME) is one of the oldest and broadest engineering disciplines. This breadth is evidenced by its overlapping, in varying degrees, with many other engineering disciplines such as aerospace, industrial, manufacturing, agricultural, marine, building services, metallurgical, chemical, civil, electrical, petroleum and mining engineering. In fact, several of the disciplines in the above list are actually offshoots or derivatives of mechanical engineering.

6.2.1. *Number of universities offering mechanical engineering programmes at the bachelor level*

In the past, the number and size of mechanical engineering programmes offered in African universities have been low. For example, in Ghana only one university offered mechanical engineering at the baccalaureate degree level for more than forty years but now, like Zambia and Egypt, has mechanical engineering programmes at three universities, and the number of mechanical engineering graduates has increased correspondingly. A similar picture can be painted of Ethiopia where great strides are being made in changing its science and technology/social science enrolment ratio from 30:70 to 70:30, translating directly into increases in the yearly enrolment in mechanical engineering programmes from an average of 800 annually to a projected 2,700 in the next few years. In Cameroon, general enrolment figures have exceeded existing capacities, now producing 150 degreed engineers per year. Even though Malawi has only one university offering a degree in engineering, there, too, the numbers have shot up. However, a few countries, such as Egypt and South Africa, have relatively high numbers of engineering bachelors per capita which places them not far behind countries like the USA and Germany. Even so, South Africa higher education plans to boost the numbers of engineering graduates from 7,888 to 15,000 per year by 2014. In 2009 alone, South African universities granted 1,459 mechanical engineering degrees at the BSc level plus 111 at the postgraduate level.

In summary, for many years, there have been relatively small and few mechanical engineering programmes in African universities, but recent years have seen increases in numbers, albeit slowly. There appears to be an interesting confluence of efforts in African universities to boost the number of mechanical engineering graduates by either increasing the number of universities offering such programmes or by increasing the intake into existing mechanical engineering programmes. This development signals progress and highlights the need to restructure mechanical engineering programmes and their curricula to meet future challenges. Countries that grow at a rapid economic rate are known generally to have higher engineer-to-population ratios. This ratio also determines the success (in extent and quality) of a country's infrastructure development programme. Comparatively speaking, African countries in general have engineer-to-population ratios that lag far behind those of developed and other developing countries. Africa owes this disproportion to two factors: (1) Its reliance on a predominantly agrarian economy and (2) Reliance on foreign technical expertise. Even though the number of engineering graduates is increasing, this growth is far from adequate and is not enough to meet Africa's need for mechanical engineering skills.

6.2.2. *Research groups and research culture*

Science and technology in Africa have unfolded since the dawn of human history, but progress has been slow. With few exceptions, the general research culture in African countries and universities needs improvement. The gap between Africa and the industrialised countries with respect to R&D activity continues to widen. Currently, 40 per cent of African-born scientists live in OECD countries, predominantly NATO and EU countries. This situation is popularly known as African "brain drain". Sub-Saharan African countries spent on average 0.3 per cent of their GDP on science and technology in 2007. Although technology parks have a long history in the United States and Europe, their presence across Africa is still limited. Only six countries (Morocco, Egypt, Senegal, Madagascar, Tunisia and South Africa) have made technology park construction an integral element of their development goals.

6.2.3. *Professional bodies*

One key to the development of any profession is the collective effort made by practitioners in that profession to organise themselves into associations or societies to promote and advance that profession. In this context, an engineering society is a professional organisation for engineers. Some of these societies are discipline-specific while others are "umbrella" types, accepting and embracing many different disciplines.

Even though engineering professional bodies exist in Africa, in many cases they are of the umbrella type. Ghana (Ghana Institution of Engineers) and Cameroon have umbrella-type organisations, while high-population countries such as Nigeria, South Africa (South African Institution of Mechanical Engineers), Ethiopia (Ethiopian Society of Mechanical Engineers), and Egypt (Egyptian Society of Mechanical Engineers) all have professional societies dedicated to mechanical engineering. South Africa stands out as having a fairly wide range of discipline-specific professional engineering bodies. Other groupings that might promote mechanical engineering on the continent include the African Technology Forum and the Information Source for Science and Technology in Africa.

However, lacking is a single body providing networking among the national institutions and producing the synergy of shared goals, efforts and achievements.

6.3. Mechanical Engineering in the Pan-African Context

A few initiatives exist with the aim of bringing African countries together to foster synergy in the area of engineering education. The African Engineering Education Association (AEEA) is one such example. Its main objectives, among others, are (1) To generally promote engineering education in Africa and (2) To bridge the North-South divide.

The few African countries that do not offer a mechanical engineering programme but depend on neighbouring or other African countries to train their mechanical engineers stand to benefit immensely from such initiatives.

The Pan-African University (PAU) initiative is another example. Its emphasis is on postgraduate training and research in a network of university "nodes" in the continent's five regions. East Africa has a regional node (located at the Jomo Kenyatta University of Agriculture and Technology) for the basic sciences, technology and innovation.

6.3.1. *Mechanical engineering education in Egypt*

A bachelor's degree in engineering sciences in Egypt takes five years (ten semesters) to complete. The five years include a preparatory year and four years of specialised engineering. Students enrol at universities to study engineering on a highly competitive basis after finishing their twelve years of basic education. Programme regulations are typically reviewed every five years by the National Authority for Quality Assurance and Accreditation of Education (NAQAAE). As of 2013, three mechanical engineering programmes have been accredited by NAQAAE and many more are in the process of being accredited. A master's degree takes a minimum of two years, and a PhD usually takes about three years. Each requires a thesis. A higher diploma in technology (a technology degree) is achievable in a minimum of two years of study after twelve years of basic education.

The total number of all engineering bachelors' degrees awarded annually in Egypt is about 30,000. It is reasonable to assume that mechanical engineers constitute about 15-20 per cent of this total, or about 5,500 new mechanical engineers annually. This figure would translate to a rate of one mechanical engineering degree awarded annually per every 15,000 Egyptians. Most of the degrees are awarded from the twenty-four public universities, with the rest graduating from private universities and higher institutes of engineering and technology.

6.3.2. *Mechanical engineering education in Ghana*

Ghana's system of mechanical engineering education and training is similar to South Africa's in terms of the different qualifications available:

- Engineers complete a four-year university degree programme (BSc Mechanical Engineering).
- Technologists (Bachelor's of Technology degree) earn a three-year qualification at a polytechnic.
- Technicians earn a three-year Higher National Diploma at one of the country's ten polytechnics.
- Craft tradesmen obtain certificates from technical schools.

The number of state-owned universities has increased from three to eight in the last twelve years. However, only two of them offer mechanical engineering programmes. For more than forty years, only one university in Ghana offered mechanical engineering at the degree level; but now there are three, and the number of mechanical engineering graduates has increased correspondingly.

This change represents a marked improvement from one annual mechanical engineering degree per every 140,000 Ghanaians to one annual mechanical engineering degree per every 42,000 Ghanaians. This sharp increase results from Top-Up programmes that are now available in the largest engineering university, allowing diploma holders to upgrade themselves to the BSc level in two and a half years. These programs result from higher education reforms, which place growing emphasis on internally generated funding of projects in the universities. Even though private universities have mushroomed in the last decade or so, only one of them is known to offer a mechanical engineering programme.

The Ghana Education Trust Fund (GETFUND) provides funding for faculty development and research and has the goal of supporting faculty members as they acquire higher degrees, undertake research and participate in conferences and seminars. The GETFUND also supports education infrastructural development. The Teaching and Learning Innovation Fund (TALIF), set up in 2004 with support from the International Development Association of the World Bank, is another. It ended in 2011 after supporting education infrastructural development, which included providing laboratory equipment for one of the mechanical engineering programmes.

6.3.3. *Mechanical engineering education in Zambia*

In Zambia there are four categories of engineering-related professionals: engineers, technologists, technicians and those in the craft-trades. Three institutions offer mechanical engineering degree programmes, five offer diplomas and ten offer craft and trade certificates. With the number of engineering degrees granted annually standing at 500, an estimated 100 mechanical engineering degrees are granted annually, which translates into one mechanical engineering degree granted annually per every 130,000 Zambian citizens.

A National Qualifications framework is in place and a Higher Education Authority began in 2013, while TEVET, a governmental authority, regulates engineering and technical education.

A person must obtain a degree from a recognised university to qualify him/herself to be called an engineer, and the title "engineer" is protected by law. All engineers, as well as engineering firms, must be registered with the Engineering Institute of Zambia to be allowed to practise. Membership is renewable on a yearly basis. In addition, a firm must reach a minimum number of engineers before it can be called an engineering firm.

6.3.4. *Mechanical engineering education in Malawi*

Engineering education in Malawi has undergone unprecedented changes since 2010. For many years in Malawi, engineering education experienced challenges due to lack of growth, unresponsiveness to industry needs and an inflexible monolithic system. In order to address some of these challenges, a wide range of reforms have been undertaken, including curricula review and programme restructuring adopting the multi-entry and multi-exit model, a credit-based structure, the modular system, a student-centred outcome-based approach and the incorporation of internship and entrepreneurship modules. All engineering programmes including mechanical engineering have now been upgraded from the ordinary five-year BSc programmes to the bachelor engineering honours level.

Engineering and science enrol about 4.3 per cent each of Malawi's total higher education enrolment, while Information and Communication Technology (ICT) enrols approximately 2.7 per cent. The highest enrolments are in the social sciences, creating concern about the comparatively low enrolments in engineering, science, and ICT—fields which are necessary for the diversification of the economy (World Bank, 2010). On average, about twenty degrees in mechanical engineering are awarded annually which, given Malawi's population of about 14 million, translates to 700,000 citizens per every mechanical engineer trained.

The Polytechnic is a constituent college of the University of Malawi-the only institution offering higher education in engineering since 1965. Initially, the engineering programme offered in 1965 was a three-year Diploma in Engineering with some limited measure of specialisation in civil, mechanical and electrical engineering. In 1980, a general six-year engineering degree was introduced accompanying a revised diploma programme. In 1987, the Faculty of Engineering revised both diploma and degree programmes to strengthen them and match them better to the needs of industry and society. Specialised diploma and degree programmes in civil, electrical and mechanical engineering were developed and implemented. The duration of the degree programme was reduced to five years. The diploma programmes were later phased out in 1998. The last batch of graduates from the six-year engineering programme and the first group of specialised five-year engineering degree programmes graduated in 1990. Since that time and to date, three specialised degrees have been offered in civil, electrical and mechanical engineering.

6.3.5. *Mechanical engineering education in South Africa*

An engineering professional in South Africa may be (1) An engineer who has completed a four-year university degree, (2) A technician who has earned a three-year national diploma or (3) A technologist who has gained a four-year qualification at a university of technology. The accreditation of engineering professional qualifications is carried out by the Engineering Council of South Africa (ECSA).

The manufacturing sector, together with its infrastructure building programme and the drive towards minerals beneficiation, has created a huge demand for the production of engineers, in particular, mechanical engineers. The government has the goal of increasing South Africa's engineering graduates from the 2008 record of 7,888 students to 15,000 students annually by 2014. However, the institutions in South Africa offering qualifications for mechanical engineering cannot accommodate this demand. This situation is worsened by low throughput rates. About 54 per cent of students complete their four-year engineering degree in four to five years, about 19 per cent take longer, whilst 27 per cent do not complete their studies at all. Added to this, graduates with engineering skills frequently emigrate. About 15,000 to 20,000 South African engineering professionals work outside South Africa, compared to a total local registry of 38,000 professionals.

As for the particular discipline of mechanical engineering, South Africa produced 1,571 mechanical engineers in 2009, which included 7.1 per cent at the postgraduate level. This translates into about one mechanical engineering degree awarded annually per every 32,000 South African citizens.

At present a new Higher Education Qualifications Framework (HEQF) is being developed in South Africa, aimed at harmonising qualifications across the spectrum of traditional and technical universities and at providing articulation between the different types of degree/diploma qualifications. This goal requires curriculum reform and thus presents an opportunity for modernising the curriculum. Other stakeholders that will need to be drawn into this process include the industry associations, multi-national companies, foreign original equipment manufacturers (OEMs) with manufacturing bases in South Africa that have been awarded infrastructure-building contracts, state-owned enterprises and the various science councils (e.g., the Council for Scientific and Industrial Research). Mechanical engineering curricula reform, in particular, will impact on a number of sectors, besides those mentioned before, including defence, aerospace, nuclear and renewable energy, among others.

6.3.6. *Mechanical engineering education in Cameroon*

There are eight state-owned universities and three private universities in Cameroon. Quality assurance has been virtually non-existent in the universities; but each university is now required to undertake forward planning through a well-thought-out strategic plan. The Ministry of Higher Education recently enlisted UNESCO experts to help produce a global strategic plan for the ministry.

Three classes of mechanical engineering professionals are recognised in Cameroon: (1) engineers, (2) higher technicians and (3) technicians. Earning an engineering degree requires five years (ten semesters, each lasting fifteen weeks), including two training periods of industrial attachment (or internships).

The number of mechanical engineering graduates produced annually is 150, supplemented by 200 higher technicians and technicians. Ten colleges have mechanical engineering programmes: four at the master's/PhD level, and seven with three-year programmes. Thus, one mechanical engineering degree is awarded annually per every 130,000 Cameroon citizens.

6.3.7. *Mechanical engineering education in Democratic Republic of Congo*

DR Congo's system of mechanical engineering education and training is similar to that of Belgian universities in terms of its range of qualifications.

The first stage of qualification is "Technician in Engineering". In this programme, students complete one year of preparatory classes followed by three years of study in mechanics. Their qualification is "Technician".

The second branch of qualification is the Engineer in Mechanics, consisting of one year of preparatory classes, followed by five years of specialised study. Their qualification is "Engineer".

These two branches, despite the difference in the number of years of study required, belong to the first cycle. Nevertheless, the jobs for which the graduates are qualified differ by responsibility and conception.

The DR Congo's higher education system also offers a master's degree in engineering. This programme requires a minimum two years of study after the bachelor's degree (or after earning the title "Engineer").

A PhD requires a minimum of three years of study after achieving the master's and requires writing a research thesis.

The total number of "engineer" degrees awarded in DR Congo is about 200 annually and that of "technician in engineering" is 1,200 annually. The Faculty of Polytechnic of Kinshasa and ISTA-Kinshasa have a common project for achieving a bachelor of engineering degree and also a master's programme in collaboration with Belgian universities.

The National Pedagogic University has the first PhD in sciences oriented toward mechanical engineering. In 2013, the Ministry of Higher Education and Scientific Research authorised eighteen public institutions in DR Congo to offer master's and PhD programmes.

6.3.8. *Mechanical engineering education in the Central Africa Republic*

The University of Bangui is the only university in the Central Africa Republic, which has 4.5 million inhabitants. The total enrolment is 6,500 students, and its mechanical engineering programme is limited to three years. The first two years lead to the awarding of a Technician Diplôma (DUT, Diplome Universitaire de Technologie). After a third year of work, students can obtain the title "Technologist" (ingénieur des travaux). The designation "mechanical engineer" is not used in the Central Africa Republic.

6.3.9. *Mechanical engineering education in Ethiopia*

The government in Ethiopia has initiated several policy reforms in the higher education sector, one of which involves changing the student enrolment ratio of science and technology to social and humanities streams from 30:70 to 70:30. As a result, there has been an order of magnitude of an increase in enrolment in mechanical engineering degree programmes. From an annual mechanical engineering graduate strength of around 800 previously, it is expected that about 2,500-3,000 students per annum will be graduating in the next few years. The Institutes of Technology (IOTs) in different universities are being made autonomous to foster fast-track development. For example, Jimma Institute of Technology at Jimma University is projected to have an enrolment of 20,000 students in various undergraduate engineering programmes, with 1,500 undergraduates in mechanical engineering alone.

In Ethiopia, the bachelor's degree (B.Sc in mechanical engineering) requires five years (ten semesters) of study, which includes a one-year pre-engineering course common to all engineering undergraduate programmes. A full semester is reserved for an industrial internship. A prerequisite for enrolment is completing twelve years of basic education.

6.4. Mechanical Engineering in the Sub-Regional Context

For the purposes of the United Nations, Africa is customarily divided into five sub-regions: Northern Africa, Southern Africa, Eastern Africa, Western Africa and Central Africa.

The Pan-African University (PAU) initiative places emphasis on post-graduate training and research in a network of university nodes in these five regions. The region with the area of specialisation most closely related to mechanical engineering is East Africa, with its regional node for the basic sciences, technology and innovation located at the Jomo Kenyatta University of Agriculture and Technology in Kenya.

In most francophone African countries, the tendency is to rely on the Bologna Process division into three cycles: licence-master-doctorat (LMD), generally but not always with the following durations: 3-5-8 years. There are no specific divisions per sub-regions.

In anglophone countries, the trend is the same: bachelor-master-doctorate (Ba-Ma-D), with a greater disparity in the duration of study at the bachelor and master levels.

6.4.1. *An overview of mechanical engineering programmes*

In many African universities, mechanical engineering programmes at the first-degree level typically take four to five years, and result in a bachelor of science in mechanical engineering degree (BSc Mech. Eng.). In some countries, such as South Africa and Nigeria, a four-year bachelor of science (BSc) or bachelor of engineering (Beng/BE) degree with honors (Hons) in mechanical engineering is offered and requires three to five years of study. A BE degree differs from a BSc degree in that the students obtain a broader education consisting of information relevant to various engineering disciplines. A bachelor of engineering degree will usually be undertaken in one field of engineering, such as in the degree post-nominals, BE (Aero) or BEng (Elec).

Regarding commonalities, mechanical engineering programmes generally cover the same fundamental subjects. African universities offering accredited programmes in mechanical engineering are required to offer several major subjects of study, as determined by the parent nation's accreditation board. This is to ensure a minimum level of competence among graduating engineers and to inspire confidence in the engineering profession as a whole. The specific courses required to graduate, however, may differ from programme to programme. Universities will often combine multiple subjects into a single class or split a subject into multiple classes, depending on the faculty available and the university's major area(s) of research.

As Table 6.1 shows, except for South Africa and Egypt, the number of bachelor's mechanical engineering degrees per capita is far below the world average, pointing to a severe need for African governments to deploy resources in and place greater emphasis on developing the technical skills vital to support the nation's industrialisation.

Table 6.1
Estimation of Numbers of Yearly Mechanical Engineering Graduates in Eight African Countries

8 African countries	Population (million capita)	Engineering Degrees Granted Annually	ME Degrees Granted Annually	Thousand Capita per 1 ME degree granted Annually[1]
Egypt	83	30,000	5,500	15
Ghana	25	1,000	180	139
Zambia	13	500	100	130
Malawi	14	100	20	700
South Africa	51	7,888	1,570	32
Cameroon	20	700	150	133
Ethiopia	91	20,000	800	114
DR Congo	71	200	ND	ND

6.4.2. *Reforms in mechanical engineering higher education*

In Malawi, as noted above, a wide range of reforms have been undertaken including curricula review and programme restructuring adopting the multi-entry and multi-exit model, a credit-based structure, a modular system, a student-centred outcome-based approach and the incorporation of internship and entrepreneurship modules. Mechanical engineering has been upgraded from the ordinary five-year bachelor of science degree to the bachelor of engineering honours level.

[1] The figure presented in the last column is the number of 1,000 capita per each mechanical engineering degree granted annually in that country. It is calculated by dividing the total population (in millions) by the total number of annually granted mechanical engineering degrees in thousands. For example, the last column in Table 6.1 for Egypt will be = 83/5.5 = 15 thousand capita per each mechanical engineer degree granted annually. By means of the last column, one can view a country's degree of self-sufficiency in mechanical engineers. The higher that number, the greater the country's insufficiency in meeting its own need for mechanical engineers.

In Cameroon the Ministry of Higher Education recently enlisted UNESCO experts to help produce a global strategic plan for the ministry that will enable and advance reform. In Egypt the government is highly committed to the reform and enhancement of higher education. Its reform plan, as articulated in the Declaration of February 2000, identified twenty-five specific reform initiatives addressing all the reform domains, to be implemented over three phases and concluding in 2017.

In Ethiopia the Ministry of Education controls the universities and other higher education institutions. Several programmes have been launched such as its Education Sector Development Programme (ESDP), Engineering Capacity Building Programme (ECBP) and UCBP (University Capacity Building Programme). The current reform in its higher education sector is guided by the Growth and Transformation Plan, 2010-2015 (GTP).

The Ghana government, for its part, is highly committed to the reform and enhancement of higher education. The National Council for Tertiary Education (NCTE) has the role of overseeing higher education reform and quality assurance. The NCTE works hand-in-hand with the National Accreditation Board (NAB) to ensure that quality objectives for higher education are achieved.

6.4.3. *Degree and qualifications structure*

In Egypt, a bachelor of engineering science results from twelve years of basic education (six primary + three preparatory + three secondary), followed by five years of specialised study. A higher diploma in technology (a technology degree) is achievable after two years of study.

Zambia universities offer four categories of engineering-related professionals: engineers, technologists, technicians, and those in the craft-trades. In Malawi higher education, policies regarding the mix of engineering professionals and their degree structure are still evolving. Currently three specialised degrees are offered in civil, electrical and mechanical engineering. In South Africa, the levels of mechanical engineering professional are: engineer, technician and technologist.

Two classes of mechanical engineering professionals are recognised in Cameroon: (1) engineers, and (2) higher technicians. The mechanical engineering-related professionals recognised in Ghana are: (1) engineers, (2) technologists, (3) technicians and (4) the craft trades.

Table 6.2 summarises data for population, GDP, GDP per capita, and distribution of economic activities, as well as the number of engineering and mechanical engineering degrees granted annually for eight African countries: Egypt, Ghana, Zambia, Malawi, South Africa, Cameroon, Ethiopia, and DR Congo. These eight countries are participants in Tuning Africa for the discipline of mechanical engineering.

Table 6.2

Summary of Population, GDP, and Higher Education Data Relating to Mechanical Engineering for Eight African Countries

Country	Population (million)	GDP (billion $)	GDP/capita ($)	GDP Composition by Sector (%)	Labour Force by Occupation (%)	HE Profile	Annually Awarded Engineering Degrees	Annually Awarded ME Degrees	Accreditation
Egypt	83 (2012)	255 (2012) 1.8% rate (2011) (ppp) 537.8	6,600 (ppp) 6,600 (2012)	Agric14.7 Ind. 37.4 Serv. 47.9 (2012)	Agric32 Ind. 17 Serv. 51 (2001) 12.5% (2012) unempl 20% below poverty (2005)	5-year BSc (Eng.) 2-year min MSc 3-min year PhD	30,000	5,500	National Authority for Quality Assurance and Accreditation (governmental)
Ghana	25 (2011)	40.2 (2012) 14.3% rate (2011) (ppp) 83.2 (2012)	1,560 (ppp) 3,300 (2012)	Agric24.6 Ind. 27.4 Serv. 47.9 (2012)	Agric56 Ind. 15 Serv. 29 (2005) 11% unempl (2000) 28.5% below poverty (2007)	4-year BSc (Eng.) 2-year min MSc 3-min year PhD	1,000	180	National Accreditation Board (governmental)
Zambia	13	20.68b 6.5% rate (ppp) 23.68 (2012)	1,700 (ppp) (2012)	Agric.20 Ind. 33.5 Serv. 46.3	Agric85 Ind. 6 Serv. 9 (2004) 14% unempl (2006) 64% Below poverty	5-year Bsc (Eng.) 2 year Msc 3 year min PhD	500	100	—
Malawi	14	4.49 (2012) 4.3% rate (2012) (ppp) 14.58 (2012)	$900 (ppp) (2012)	Agric29.6 Ind. 16.9 Serv. 53.5 (2012)	Agric 90 Ind. & Serv.10	5-year BE (Eng.)	100	20	
South Africa	51	390.9 (2012) 2.6% rate (2012) (ppp) 578.6 (2012)	11,000 (ppp) 11,300 (2012)	Agric 2.4 Ind. 32.1 Serv. 64.9	Agric 9 Ind. 26 Serv. 65 (2007) 24.4% unempl. 50% below poverty	4 year BSc (Eng.) 2 year min MSc 3 min year PhD	7,888 (2008)	1,570	Engineering Council of South Africa (Governmental)

Country	Population (million)	GDP (billion $)	GDP/capita ($)	GDP Composition by Sector (%)	Labour Force by Occupation (%)	HE Profile	Annually Awarded Engineering Degrees	Annually Awarded ME Degrees	Accreditation
Cameroon	20	24.51 (2012) 4.7%rate (2012) (ppp) 50.32 (2012)	2,450 (ppp) 2,300 (2012)	Agric19.8 Ind. 30.9 Serv. 49.3 (2012)	Agric70 Ind. 13 Serv. 1730 % unempl 48% below poverty	5 year BSc (Eng.)	700	150	National Accreditation Body (Governmental)
Ethiopia	91.2 (2012)	41.89 (2012) 7% rate (ppp) 103.1 (2012)	1,100 1,200 (ppp) (2012)	Agric46.6 Ind. 14.6 Serv. 38.8 (2012)	Agric85 Ind. 5 Serv. 10 (2009) % unemplN/A 29.2% below poverty	5 year BSc	20,000	800	National HE Relevance and Quality Agency (governmental)
DR Congo	71 (2011)	17.3 (2012) 6.5% rate (ppp) 27.5	400 (ppp) (2012)	Agric 38.4 Ind. 25.9 Serv. 37.5 (2012)	N/A N/A N/A % unempl N/A 71% (2006) below poverty	3 years for technicians 5 years for BSc in Eng. 2-years min for the master's, 3-years min for the PhD	1,200 for Tech 200 for Eng.	-ND	Ministry of Higher Education

Source: GDP, ppp, employment and poverty data obtained from https://www.cia.gov/library/publications/the-world-factbook/geos/et.html oer, based on exchange rate

Note on abbreviations:

HE - higher education
BE - bachelor of engineering
ME - mechanical engineering
QA - quality assurance
Ind. - industry
Serv. - service
Agric. - agriculture

6.4.4. *Mechanical engineering programme review, quality assurance and accreditation*

In Africa, accreditation of mechanical engineering programmes is carried out in most cases by a government regulatory body. This is the case in, for example, Ghana, South Africa and Egypt; but in a few cases, this service is performed by professional societies. In Egypt programme regulations are typically reviewed every five years by the National Authority for Quality Assurance and Accreditation of Education (NAQAAE). Zambia instituted a National Qualifications Framework overseen by its Higher Education Authority starting in 2013, while TEVET, a governmental authority, regulates engineering and technical education.

In South Africa, accreditation of mechanical engineering professional qualifications is undertaken by the Engineering Council of South Africa (ECSA). A new Higher Education Qualifications Framework (HEQF) is being developed in South Africa, aimed at harmonising qualifications across the spectrum of traditional and technical universities, and to provide articulation between the different types of degree/diploma qualifications. Mechanical engineering curricula are broad-based and impact a number of sectors.

Quality control is virtually non-existent in Cameroonian universities.

Ethiopia now has a nodal agency called Higher Education Relevance and Quality Agency (HERQA) that performs external audits and accreditation of educational programmes with a Higher Education Strategy Center within the Ministry of Education to provide guidance.

6.4.5. *Licencing/certification for practise*

After earning their degrees, engineers may seek to be licenced by a professional body or by a national governmental agency. The purpose of this process is to ensure that engineers possess the necessary technical knowledge and real-world experience to conduct engineering tasks and services safely. Once certified, the engineer is given a recognised title—for example, in South Africa, he/she would be called "professional engineer". Not all mechanical engineers choose to become licenced; those that do can be distinguished as chartered/professional engineers by the post-nominal title "PE" or "Ceng".

Procedures and criteria to become a licenced professional engineer vary according to jurisdictional requirements. For example, in the United States, an engineer must pass a comprehensive examination on the fundamentals of engineering, work a given number of years (the number varies by state) as an engineering intern or engineer-in-training and pass the principles and practise (practicing/professional engineer) examination. Africa needs a supra-regional organisation representing all of its countries to standardise and harmonise the requirements and steps of a similar process.

In the United Kingdom, current graduates holding a master's of science, a master's of engineering, or a bachelor of engineering (honours) degree may be chartered through the Institution of Mechanical Engineers. In most modern countries, certain engineering tasks, such as the design of bridges, electric power plants, and chemical plants, must be approved by a professional engineer or a chartered engineer. In the USA and Canada, only a licenced engineer may seal engineering work for public and private clients. This requirement is enforced by legislation. In other countries, such as Australia, no such legislation exists; however, practically all certifying bodies maintain a code of ethics, independent of legislation, by which members must abide or risk expulsion.

In Zambia, the title "engineer" is protected by law. All engineers, as well as engineering firms, must be registered with the Engineering Institute of Zambia to be allowed to practise the engineering profession. In Ghana, the Ghana Institution of Engineering, though not a governmental body, has the backing of legislation to register all classes of engineering professionals and regulate the practise of engineering.

6.5. Global Trends in Mechanical Engineering

In addition to the traditional core mechanical engineering curriculum, globally a few mechanical engineering programmes are beginning to offer more specialised programmes and classes such as mechatronics/robotics, advanced manufacturing, safety, reliability and risk, micro- and nano-systems engineering and packaging, transportation systems and logistics, cryogenics, fuel technology, automotive engineering, biomechanics, optics and others. Such programmes and classes give promise of developing into separate departments.

Some of these trends are now being adopted by African universities. For example, South Africa, Ethiopia, Cameroon and Ghana now have incorporated mechatronic elements or programmes in their mechanical engineering curriculum.

A second global trend is the rapid adoption of ICT and the creation of networks of knowledge generation and dissemination. Compared to the global profile, a serious and growing gap exists with respect to African nations. Higher education institutions in Africa are ill prepared and ill equipped to play a leading role because of the inadequate development of their own information infrastructure.

Still, a growing number of African countries have embraced ICT technology as a medium for teaching/learning delivery. Almost all countries are encouraging such innovations as the Black Board platform, Moodle, interactive boards in classes, PowerPoint presentations, Internet connectivity, uploading of lecture notes, lecture delivery via U tube, group projects and industrial attachments.

These efforts are commendable, but the status of higher education in Africa remains serious. According to the Association of African Universities (AAU)

> Higher education in Africa has been affected by a range of economic and social problems: comparatively low enrolment at all levels; stretched institutional facilities and capacities; insufficient economic, political and logistical support for higher education from African Governments and corporations; weak private sector support and an undeveloped culture of private contributions to universities; underdeveloped linkages among universities, industry and governments, and the social and productive sectors of the economy; and human capacity issues such as an ageing faculty and the "brain drain". (AAU, n.d)

This is the environment within which the development of mechanical engineering programmes in an African country must occur. Table 6.3 is an extract from Table 6.2, highlighting the connection between the structure of African economies and the continent's overall unemployment and poverty levels.

Table 6.3
Connections between the Structure of African Economies
and Overall Unemployment and Poverty Levels for Eight Countries

Countries	Egypt	Ghana	Zambia	Mala.	S. A.	Camero	Ethio.	DRCongo
Industry's portion of GDP (%)	37.4	27.4	33.5	16.9	32.1	30.9	14.6	25.9
Agriculture's portion of GDP (%)	14.7	24.6	20.0	29.6	2.4	19.8	46.6	38.3
% of labour force in agriculture	32.0	56.0	85.0	90.0	9.0	70.0	85.0	N/A
% of population below poverty	20.0	28.5	64.0	—	50.0	48.0	29.2	71.0

With the notable exception of South Africa and Egypt, the other six countries possess economies in which most of the labour force is employed in the agricultural sector, but the contribution of that sector to the total GDP is disproportionately low. The proportions of the populations in the respective countries below poverty level are unacceptably high and are linked to the low figures for industrialisation.

Progress in altering these relations depends on a huge degree of mechanisation and a shift in Africa's economy in which manufacturing, industry-based, value-adding industrialisation plays a larger role. The development of an engineering culture through a conscious effort to increase the engineer-to-population ratio can play a significant role in making this change happen.

6.6. The Tuning Project and Mechanical Engineering

An analysis of the mechanical engineering programmes considered in the Tuning Africa project reveals the variety and extent of national aspirations: better service to African nations, assistance and support in meeting higher education goals, self-sufficiency, effective and efficient implementation of core programmes and contribution to development. The Tuning consultations provide a foundation on which to (1) Identify strategic goals, objectives and actions and (2) Build a robust and far-reaching curriculum reform.

The diversity of mechanical engineering programmes in Africa represents both a challenge and an opportunity for the Tuning Project to set the pace and standard for curriculum harmonisation, quality assurance, enhanced coordination and more effective networking. The broad nature of mechanical engineering means that effective and efficient curriculum reform would have far-reaching outcomes for many other engineering disciplines, contributing significantly to development.

The main strategic focus of curriculum reform and modernisation should be to build the capacity of African universities to provide quality higher education and to facilitate access to increasing numbers of students who will become mechanical engineers. Increasing the engineer-to-population ratio will require developing strong relationships among regional and sub-regional bodies, and among university communities within and outside Africa. A new emphasis on university-industry linkages has the potential to meet the educational and development needs across the continent.

In these education reform efforts, an optimum balance must be found between the knowledge and skills that students are required to learn (e.g., such higher order thinking skills as problem solving and industry relevance) and basic engineering skills and subject theory.

The following areas of implementation should be considered:

- Identify goals of engineering curriculum change.
- Identify barriers and key success factors in those change efforts.
- Identify attributes of new engineering graduates.
- Assess the success programmes have had instilling those attributes in graduates.

Among the benchmarks of skill acquisition are:

- Graduates' mobility within and outside of Africa.
- Recognition of curricula in Africa and abroad.

- Global and social dimensions of engineering curricula.
- Quality assurance programme.

The main objective is to train more engineers who are prepared to meet global needs, not only local ones. In addition to technical aspects, mechanical engineers should have the following competences:

- Managerial skills.
- Respect for others.
- Innovation and new products.
- Adaptability nationally and internationally.
- Flexibility in problem-solving.
- High professional ethics.

6.7. Generic Tuning Competences

The Tuning process began its work of defining generic competences by the Mechanical Engineering Subject Area Group (SAG) at the level of the bachelor or master's degree (five years of study). This SAG first held a round-table meeting at which extensive brainstorming defined mechanical engineering, generated a professional profile of a mechanical engineer and broadly described the required competences.

The working group then compared its list of generic competences with those of earlier Tuning projects in Europe, Latin America and Russia as well as with other reference standards like the American Accreditation Board for Engineering Training (ABET). The group included perspectives from Ethiopian programme profiles and Egypt's NARS regulations. This exercise produced a list of thirty-two generic competences as the group's initial proposal.

The mechanical engineering working group presented its thirty-two competences in a plenary session of Tuning Africa (January 2011) along with similar proposed generic competences from the other four SAGs (agricultural sciences, civil engineering, medicine and teacher education).

Next, the five coordinators of the subject-area groups met to pool, consolidate, and rationalise submissions from all five SAGs. This process ensured that there was no repetition and that the most important generic competences relevant to Africa were identified. This exercise took place with the full involvement of and contributions from the Management Committee and yielded the eighteen generic competences that were deemed relevant to all of the subject areas:

List of Eighteen Generic Competences for All Tuning Africa Subject Areas

1. Ability for conceptual thinking, analysis and synthesis.

2. Professionalism, ethical values and commitment to Ubuntu (respect for the well-being and dignity of fellow human beings).

3. Capacity for critical evaluation and self-awareness.

4. Ability to translate knowledge into practise.

5. Objective decision-making and practical cost-effective problem solving.

6. Capacity to use innovative and appropriate technologies.

7. Ability to communicate effectively in both the official/national and the local languages.

8. Ability to learn how to learn and capacity for lifelong learning.

9. Flexibility, adaptability and ability to anticipate and respond to new situations.

10. Ability for creative and innovative thinking.

11. Leadership, management and teamwork skills.

12. Communication and interpersonal skills.

13. Environmental and economic consciousness.

14. Ability to work in an intra- and intercultural and/or international context.

15. Ability to work independently.

16. Ability to evaluate, review and enhance quality.

17. Self-confidence, entrepreneurial spirit and skills.

18. Commitment to preserve African identity and cultural heritage.

This list of generic competences was distributed to all participants from all sixty universities during the process of consultation as preparation for surveying four stakeholder groups (academics, students, graduates and employers)

6.7.1. *Analysis of the eighteen generic competences from a mechanical engineering perspective*

1. *Ability for conceptual thinking, analysis and synthesis.* A key function of mechanical engineering, like many other disciplines, is to provide solutions to real-life problems. This competence corresponds to the ability to construct mental representations of possible solutions to a mechanical engineering problem, taking into consideration the various dimensions and implications as well as the relevance of each possible solution.

2. *Professionalism, ethical values and commitment to Ubuntu (respect for the well-being and dignity of fellow human beings).* This is the ability to ensure compliance with accepted norms and guidelines governing the practise of a profession, bearing in mind what is right and fair to all parties to a transaction, project or system (including a mechanical engineering system) from a legal, moral or human dignity perspective.

3. *Capacity for critical evaluation and self-awareness.* This is the ability to carefully and correctly assess and appraise identified systems or situations with a view to determine their merits, value

or shortcomings and present an overall picture of such systems (and, by extension, mechanical engineering systems) as a basis for decision-making.

4. *Ability to translate knowledge into practise.* This relates to the capacity to adjust, modify or adapt acquired knowledge and connect it to a real-life problem or situation. In the mechanical engineering context, such knowledge must lead to the solution of a mechanical engineering problem.

5. *Objective decision-making and practical cost-effective problem solving.* This is the ability to make straightforward, unbiased (mechanical engineering) and cost-effective decisions, with the understanding that problem-solving should not be influenced by friendship, emotion, retaliation or similar factors that might otherwise cloud the process or reduce its validity in the eyes of the persons concerned.

6. *Capacity to use innovative and appropriate technologies.* This competence represents the ability to find or discover new technologies or follow up (mechanical engineering-related) developments thereof, put them to good use or adapt them to a given situation.

7. *Ability to communicate effectively in both the official/national and local languages.* This is the ability to easily and effectively express or make known one's own thoughts and feelings or those of a group or to give information either in writing, orally (in official, national or local language), or by some other means, such as diagrams, pictures or objects pertaining to a particular discipline, so that the target group can appraise and understand the message.

8. *Ability to learn how to learn and capacity for lifelong learning.* This is the readiness, willingness, and capacity to assimilate, update, upgrade and enhance (mechanical engineering) knowledge on a continuing basis throughout one's life.

9. *Flexibility, adaptability and ability to anticipate and respond to new situations.* This is the ability to think fast and foresee how (mechanical engineering) systems may change or how new (mechanical engineering) situations may arise, and how to respond appropriately in order to protect or preserve the systems.

10. *Ability for creative and innovative thinking.* This is the ability to originate completely new ideas (or concepts in mechanical engineering), or ideas which, though not new, may be applied to new situations to solve problems.

11. *Leadership, management and teamwork skills.* These skills (including ethics, consciousness of duty, personal integrity, efficiency and planning skills) underscore one's capacity to effectively work in a team or in a group (including mechanical engineering work groups), especially when one has the responsibility to steer and manage the group.

12. *Communication and interpersonal skills.* Universally, this is basically the ability to be clear and articulate in verbal and body language expression as well as the ability to relate smoothly with people. In the mechanical engineering context, communication extends far beyond verbal expression to include proficiency in communicating technical information through such media as engineering drawings, sketches, symbols and models, as well as the correct understanding and use of technical terms in verbal communication itself.

13. *Environmental and economic consciousness.* This is the ability to develop a keen awareness of the link between economic activity and environmental degradation and exercise the measures within one's power to mitigate or limit such degradation where possible. For mechanical engineers, this means fully understanding the environmental implications of mechanical engineering products, activities and installations and the responsibility that this places on them to ensure preservation of the environment.

14. *Ability to work in an intra- and intercultural and/or international context.* This is the ability to work well with people of all races or ethnic backgrounds, whether in one's home country or in a foreign setting. It calls for understanding cultures other than one's own and may require adapting to the idiosyncrasies pertaining to those cultures. For mechanical engineers, this ability requires familiarity with local and national norms and standards as well as international standards governing mechanical engineering design and manufacturing, such as those issued by national standards institutions and ISO.

15. *Ability to work independently.* This is the ability to work efficiently and effectively without direct supervision. It requires being knowledgeable about one's work and which sources to consult for further information, the ability to plan, and the ability to direct and manage time effectively to achieve desired results. For a mechanical engineer, this means imperatively knowing what sources, including handbooks, to consult for technical information without depending unduly on colleagues, especially on small projects.

16. *Ability to evaluate, review and enhance quality.* This is the ability to determine the quality status of an entity and take appropriate measures to enhance that quality. For a mechanical engineer, it is the capacity to use appropriate tools to assess the quality status of a mechanical engineering system or product and to use similar tools such as statistical quality control/assurance techniques to enhance the quality of those mechanical engineering systems/products.

17. *Self-confidence, entrepreneurial spirit and skills.* This is the quality of being sure of oneself in terms of acumen and ability to deliver good results from a business point of view. For mechanical engineers, such self-confidence is usually the result of the authority conferred by one's technical competence and professional skills. It therefore requires the ability to learn fast on the job to drive out the self-doubt syndrome usually associated with first-time practitioners and to progressively build the required authority, which can ensure self-confidence without drifting into overconfidence.

18. *Commitment to preserve African identity and cultural heritage.* This is the pride of the African in his/her cultural heritage and an enduring commitment to preserve that heritage through differentiation where possible or necessary so that African identity can stand out boldly. For the African mechanical engineer, this means pride in bringing out this difference as and when appropriate, in order to reflect Africa's identity in mechanical engineering products.

6.7.2. *Other important competences*

In addition to the eighteen generic competences identified above, the mechanical engineering SAG identified four additional competences as important.

- *Commitment to safety.* This competence was initially proposed by the mechanical engineering group for inclusion in the list of generic competences but was not chosen. Perhaps this decision reflects the generally low safety awareness in most African societies. However, the mechanical engineering group later included it in its list of subject-specific competences to highlight its importance in mechanical engineering systems.

- *Ability to negotiate and resolve conflicts.* This aspect is not explicitly addressed in the eighteen competences. However, it could be argued that the possession of good managerial and interpersonal skills, which are adequately addressed by the selected generic competences, suggest that conflict situations can be minimised or effectively handled appropriately when they arise.

- *Ability to undertake research at an appropriate level.* Research skills in African societies are generally undeveloped and should receive high priority and urgency. Because of the low importance accorded to research and development, product-related innovation capacity is correspondingly low in most African cultures.

- *Skills in the use of ICT.* Though the set of eighteen generic competences did not comment on the importance of ICTs, the mechanical engineering group included it in its list of subject-specific competences to underscore its importance in mechanical engineering product conceptualisation, design, analysis and manufacturing.

6.8. Subject-Specific Competences in Mechanical Engineering

The Mechanical Engineering Subject Area Group identified nineteen subject-specific competences. They are listed and briefly defined below.

1. Ability to apply knowledge of the basic and applied sciences of mechanical engineering. This is the ability, first, to draw, and,

second, to understand a connection between a real-life situation or problem and the mechanical engineering sciences and how these sciences can be used to model and or solve those real-life problems.

2. Ability to identify, evaluate and implement the most appropriate technologies for the current project's context. It is the ability to recognise the needs of any given situation with a capacity not only to assess the mechanical engineering requirements of such situations but also to be able to apply the simplest, most efficient and cost-effective mechanical engineering solutions to them.

3. Capacity to create, innovate and contribute to technological development. This is the ability to contribute to the improvement of technology through the introduction and implementation of new concepts or ideas that will have the effect of making the technology better.

4. Capacity to conceive, analyze, design and manufacture mechanical products and systems This competence enables a mechanical engineer to originate the idea for a new mechanical engineering product or system and to take it systematically through the full gamut of product realisation activities/procedures until a real mechanical engineering product or system is actualised.

5. Skills in planning and executing mechanical engineering projects. These are such skills in project management as planning, scheduling and logistics mobilisation applied to mechanical engineering works and assignments.

6. Capacity to supervise, inspect and monitor mechanical engineering systems. Ability to be in full charge and control of active mechanical engineering systems with the capability to track closely the behaviour of such systems to effect appropriate adjustments meant to maintain the system at a desired level.

7. Capacity to operate, maintain and rehabilitate mechanical engineering systems. Given an existing mechanical engineering system, this is the capability to cause the system to function properly as designed and to retain it in a state fit for continual use.

8. Skills in evaluating the environmental and socio-economic impact of mechanical projects. This is the ability to understand

and appreciate the environmental degradation potential and implications of mechanical engineering products, activities and installations and the adverse environmental effects that can be caused by the end-of-life retirement of such systems.

9. Capacity to model and simulate mechanical engineering systems and processes. This is the ability to evolve acceptable representations of real mechanical engineering systems that can be studied for the purposes of optimizing the key performance parameters of such systems.

10. Skills in selecting, mobilizing and administering material resources, tools and equipment in a cost-effective way. Possession of practical knowledge of the properties, structure and behaviour of mechanical engineering and related materials, components and equipment enable the mechanical engineer to properly select and mobilise them for acceptable functionality while achieving cost and quality optimisation.

11. Capacity to integrate legal, economic and financial aspects in decision-making in mechanical engineering projects. Capacity to design, manufacture or operate mechanical engineering products or systems within legal constraints while ensuring that the design for economic manufacture and assembly principles is followed.

12. Capacity for spatial abstraction, graphic representation and engineering drawings. Capacity to conceptualise two- and three-dimensional mental representations of mechanical systems and to translate them into solid and other models using either the computer or manual engineering drawing methods.

13. Providing mechanical engineering solutions to societal problems for sustainable development. Ability of the engineer to relate and connect well with his/her socio-economic setting as a foundation for offering practical real solutions to real problems in the community.

14. Skills in safety and risk management in mechanical engineering systems Skills in safety management imply an ability to appreciate and anticipate the safety weaknesses in a mechanical engineering system and to take appropriate, systematic steps to ensure their

elimination or to protect against them by actual action. Risk management skills involve identifying all possible risks, classifying or rating them in terms of their magnitude and frequency and taking appropriate steps to mitigate them, paying attention to the most threatening ones.

15. Skills in using information technologies, software and tools for mechanical engineering. This is the ability to leverage information and communication technologies, including computer software, to impact the mechanical engineering function in its dimensions for the purposes of achieving speed, higher quality, consistency and repeatability as well as cost reduction.

16. Capacity to interact with multidisciplinary groups towards developing integrated solutions. This competence is the ability to learn quickly and to have a fair knowledge of the disciplines that commonly interact with mechanical engineering systems so that, when working within a multi-disciplinary environment, the mechanical engineer will be literate enough to communicate effectively with engineers and professionals from other disciplines.

17. Skills in employing quality-control techniques in managing materials, products, resources and services. They include an appreciation and understanding of total quality principles that assure the building of quality into mechanical engineering products and systems from conceptualisation to system realisation. These must include knowledge of statistical methods of quality assurance and control.

18. Capacity to conduct life-cycle assessment for products and systems. This is the ability to consider in detail all the important stages in the life of mechanical engineering systems in terms of their individual, as well as their collective and total impact on issues such as product development, acquisition, installation and usage costs, as well as product/system end-of-life retirement and disposal costs and how these activities might impact adversely on the physical environment.

19. Capacity to employ mechanical engineering skills to transform local natural resources into products or services through value addition. Ability to indigenise mechanical engineering by working with other

engineers to produce mechanical engineering systems that exploit local natural resources by converting them into commercially useful products and systems.

6.8.1. *Methodology of developing the subject-specific competences*

Starting from a definition of mechanical engineering, members of the mechanical engineering group held extensive deliberations conducted during the "Tuning Africa" meeting held at Yaoundé, Cameroon, on 23-25 January 2012. The group thus developed an appropriate professional profile of the graduate mechanical engineer.

Earlier Tuning projects (Europe, Latin America and Russia) did not include mechanical engineering, so the Mechanical Engineering SAG used, as its key institutional reference, the set of competences for mechanical engineering training employed by the American National Accreditation Board for Engineering Training (ABET, 2020). In addition the working group also consulted specific programme profiles from Ethiopia and NARS regulations from Egypt.

The list of nineteen subject-specific mechanical competences (listed above) were distributed to stakeholder groups in all sixty participating universities during the process of consultation as preparation for surveying four stakeholder groups (academics, students, graduates and employers).

The working group also defined specific learning outcomes for mechanical engineering first-cycle degrees. First-cycle degrees facilitate professionally qualifying studies in mechanical engineering with early professional careers (professional qualification) and qualify graduates for advanced scientific degree programmes or for additional degree programmes other than mechanical engineering.

Table 6.4 summarises the abilities identified by the mechanical engineering working group as expected outcomes of (1) basic engineering sciences, (2) engineering analysis, (3) engineering design and (4) engineering practise.

Table 6.4
Summary of Results Expected from Mechanical Degree Holders in Four Areas

A	The ability to demonstrate knowledge and understanding of the basics of:	Basic and Engineering Sciences
	Mathematics including differential equation, integral calculus, linear algebra, vector algebra, numerical methods, probability and statistics	
	High-level programming	
	Solid and fluid mechanics; statics and dynamics	
	Material science and engineering, and strength of materials	
	Thermal science : thermodynamics and heat and mass transfer	
	Principles of turbo-machinery, reciprocating engines and machines, and material handling equipment, ... etc.	
	Electrical and electronic circuits, electrical machines and drives	
	Control systems	
B	The ability to analyse:	Engineering Analysis
	Mass, momentum and energy balances and efficiency of systems	
	Hydraulic and pneumatic systems	
	Machine elements and mechanical systems	
C	The ability to carry out design of machine elements and mechanical systems using both traditional means and computer-aided tools	Engineering Design
D	The ability to demonstrate the safe use of workshop and laboratory equipment	Engineering Practise
	The ability to operate and maintain mechanical equipment and systems	
	The ability to understand and apply safe systems, codes and standards at work	
	The ability to select and use control and production systems	

6.9. Consultation and Reflections

6.9.1. *Survey methodology*

The consultation process involved identifying four groups of stakeholders (academics, employers, students and graduates) to respond to the list of eighteen generic and nineteen subject-specific competences and to rate (1) the "importance" and (2) the current level of "achievement" of each. They were also asked to rank all competences from the top (most important) down to the least important. The rating used a four-point scale in which 4 = "strong", 3 = "moderate", 2 = "weak" and 1 = "none."

A total of 4,323 respondents provided answers to the generic competences questionnaire including 579 mechanical engineering stakeholders. A total of 3,812 respondents provided answers to the subject-specific competences including 494 from the Mechanical Engineering Subject Group (see Table 6.7). Responses from the mechanical engineering subject group represented about 13 per cent of all responses to the questionnaires.

Table 6.5
Responses to Questionnaires of Generic and Mechanical Engineering Competences

Number of Respondents to Questionnaire of Generic Competences					
Subject Area	**Academics**	**Employers**	**Students**	**Graduates**	**Total**
Agriculture	312	204	381	306	1,203
Teacher education	335	318	310	307	1,270
Medicine	164	88	203	150	605
Mechanical engineering	152	89	214	124	579
Civil engineering	167		196	164	666
Totals	1,130	838	1,304	1,051	4,323

Number of Respondents to Questionnaire of Specific Competences					
Subject Area	**Academics**	**Employers**	**Students**	**Graduates**	**Total**
Agriculture	258	196	314	253	1,021
Teacher education	288	305	277	297	1,167
Medicine	130	83	184	145	542
Mechanical engineering	129	83	178	104	494
Civil engineering	123	105	210	150	588
Totals	928	772	1,163	949	3,812

6.9.2. *Analysis of consultation results*

The project managers statistically analysed data generated from the consultation process and presented the results in two documents: (1) An analysis of the common eighteen generic competences and (2) An analysis of the subject-specific competences for the five subject groups (agricultural sciences, civil engineering, medicine, teacher education and mechanical engineering). Consultation responses of all-areas stakeholders regarding the three variables of competence importance, achievement and ranking were analysed for the four groups of stakeholders and compared to each other.

Analysis of consultation data for all-areas stakeholders of generic competences yielded a number of important general observations with comparisons between the level of importance and the level of achievement for each competence highlighting the current gaps. In general, the levels of importance were much higher than the levels of achievement. Most stakeholders rated the majority of the proposed generic competences as highly important. Additionally, there was general agreement among the various stakeholder groups on the top-to-bottom ranking of the eighteen generic competences.

Analysis of consultation data for mechanical engineering stakeholder groups of the proposed nineteen subject-specific competences yielded similar results. There was general agreement among all stakeholders on the high levels of importance of most subject-specific competences.

6.9.3. *Further analysis of consultation results*

In order to get more refined results from the consultation data, the mechanical engineering group conducted analyses focusing on levels of importance, achievement and ranking, as expressed by the following three groups of stakeholders for the designated competences:

- Views of all-areas stakeholder groups in the eighteen common generic competences.
- Views of mechanical engineering stakeholder groups in the eighteen generic competences.
- Views of mechanical engineering stakeholder groups in the nineteen subject-specific competences.

The procedure below was employed for each set of data and for each stakeholder group:

- Competences were ordered top-down by ranking of importance.
- The corresponding levels of achievement were recorded for each competence. The comparison identified the size of the gap between importance and achievement.
- The ranking of each competence was then recorded.
- For the eighteen common generic competences, the top-seven, bottom-seven and middle-four generic competences were identified.
- Similarly, the top-seven, bottom-seven and middle-five mechanical engineering competences were identified.

Based upon the tabulated data, the following indicators were identified (see Tables 6.6 and 6.7):

- Competences with importance level >= 3.5 out of 4.

- Competences with achievement level <= low 2.8 out of 4.

- Competences with highest gap between levels of importance and achievement.

- Common competences in top-five and bottom-five ranking of importance.

- Common competences in top-five and bottom-five lists.

A careful reading of these five categories of competences yielded observations that helped in grouping and classifying the competences necessary to develop a graduate profile in mechanical engineering. The following parts of this section, present detailed observations drawn from the tabulated data.

6.9.4. *Analysis of consultation results for generic competences*

Table 6.6 shows the numeric data of the views of all-areas stakeholders in the common generic competences and the indicators obtained from the data.

Table 6.6
Main Features of All-Areas Responses
to the Questionnaire of Generic Competences

	Data of All Areas Stakeholders Reponses to the Questionnaire of Generic Competencies																			
	Academics					Employers					Students					Graduates				
	Competence #	Importance	Achievement	Gap	Ranking Top-Down	Competence #	Importance	Achievement	Gap	Ranking Top-Down	Competence #	Importance	Achievement	Gap	Ranking Top-Down	Competence #	Importance	Achievement	Gap	Ranking Top-Down
Top 7	4	3.76	2.8	0.96	4	4	3.69	2.73	0.96	4	4	3.63	2.79	0.84	4	4	3.68	2.81	0.87	4
	1	3.74	2.79	0.95	1	1	3.67	2.83	0.84	1	1	3.57	2.83	0.74	1	1	3.65	2.89	0.76	1
	2	3.64	2.63	1.01	2	2	3.64	2.72	0.92	2	17	3.56	2.71	0.85	2	11	3.58	2.76	0.82	5
	15	3.6	2.74	0.86	5	10	3.61	2.63	0.98	5	11	3.55	2.86	0.69	10	17	3.58	2.63	0.95	2
	10	3.6	2.6	1	10	17	3.58	2.64	0.94	11	10	3.52	2.72	0.8	17	5	3.56	2.72	0.84	11
	17	3.58	2.55	1.03	6	5	3.58	2.62	0.96	10	12	3.52	2.84	0.68	5	2	3.56	2.68	0.88	10
	3	3.58	2.61	0.97	11	16	3.58	2.68	0.9	9	6	3.5	2.56	0.94	11	10	3.56	2.66	0.9	17
The 4 in the Middle	16	3.57	2.57	1	9	9	3.58	2.66	0.92	6	2	3.5	2.74	0.76	6	15	3.55	2.85	0.7	6
	6	3.57	2.54	1.03	17	11	3.57	2.68	0.89	17	5	3.49	2.78	0.71	9	16	3.55	2.71	0.84	9
	5	3.56	2.59	0.97	3	6	3.57	2.6	0.97	8	9	3.48	2.76	0.72	15	6	3.53	2.85	0.68	3
	11	3.56	2.65	0.91	15	15	3.55	2.77	0.78	3	16	3.48	2.79	0.69	3	12	3.52	2.78	0.74	15
Bottom 7	12	3.56	2.68	0.88	8	3	3.53	2.66	0.87	15	15	3.47	2.87	0.6	8	3	3.51	2.7	0.81	8
	9	3.55	2.55	1	12	12	3.52	2.67	0.85	12	7	3.47	2.87	0.6	12	9	3.5	2.66	0.84	12
	7	3.54	2.77	0.77	7	7	3.5	2.74	0.76	7	8	3.45	2.84	0.61	7	7	3.47	2.8	0.67	7
	8	3.48	2.7	0.78	16	8	3.5	2.68	0.82	16	3	3.44	2.74	0.7	18	8	3.47	2.79	0.68	18
	14	3.43	2.45	0.98	18	13	3.39	2.47	0.92	18	13	3.41	2.68	0.73	13	14	3.38	2.56	0.82	16
	13	3.37	2.45	0.92	13	14	3.39	2.56	0.83	13	14	3.35	2.53	0.82	16	13	3.35	2.54	0.81	13
	18	3.25	2.27	0.98	14	18	3.24	2.43	0.81	14	18	3.28	2.5	0.78	14	18	3.24	2.39	0.85	14

	Academics	Employers	Graduates	Students
# Competences with importance level >= 3.5 out of 4	14	15	13	8
# Competences with achievement level <= low 2.8 out of 4	17	17	12	14
Competences with Highest Gap between Importance and Achievement Levels				
	#6 Capacity to use innovative and appropriate technology	#6 Capacity to use innovative and appropriate technology	#6 Capacity to use innovative and appropriate technology	#10 Ability for Creative and innovative thinking
	#17 Self-confidence, entrepreneurial spirit and skills	#10 Ability for creative and innovative thinking	#17 Self-confidence, entrepreneurial spirit and skills	#17 Self-confidence, entrepreneurial spirit and skills
Rating of Importance Level				
Common competences ranked in top five	#4 Ability to translate knowledge into practise #1 Ability for conceptual thinking, analysis and synthesis			
Common competences ranked in bottom five	#14 Ability to work in intra- and intercultural and/or international context #13 Environmental and economic consciousness #18 Commitment to preserve and to add value to African identity and cultural heritage			
Competence Ranking				
Common competences ranked in top five	#4 Ability to translate knowledge into practise #1 Ability for conceptual thinking, analysis and synthesis #2 Professionalism, ethical values and commitment to Ubuntu			
Common competences ranked in bottom five	#18 Commitment to preserve and to add value to African identity and cultural heritage #13 Environmental and economic consciousness			

Table 6.7
Main Features of Mechanical Engineering Stakeholders' Responses to Questionnaire of Generic Competences

	Data of Mechanical Engineering Stakeholders Reponses to the Questionnaire of Generic Competencies																			
	Academics					Employers					Students					Graduates				
	Competence #	Importance	Achievement	Gap	Ranking Top-Down	Competence #	Importance	Achievement	Gap	Ranking Top-Down	Competence #	Importance	Achievement	Gap	Ranking Top-Down	Competence #	Importance	Achievement	Gap	Ranking Top-Down
Top 7	4	3.81	2.85	0.96	1	5	3.74	2.47	1.27	1	4	3.76	2.6	1.16	1	1	3.75	2.84	0.91	4
	10	3.66	2.94	0.72	4	4	3.74	2.38	1.36	4	10	3.74	2.81	0.93	4	4	3.74	2.6	1.14	1
	1	3.63	2.77	0.86	6	12	3.7	2.51	1.19	6	11	3.69	2.94	0.75	10	5	3.64	2.81	0.83	11
	6	3.59	2.82	0.77	10	17	3.69	2.49	1.2	5	6	3.65	2.49	1.16	11	6	3.63	2.63	1	10
	2	3.58	2.61	0.97	5	11	3.69	2.64	1.05	2	17	3.63	2.53	1.1	17	10	3.63	2.61	1.02	5
	17	3.57	2.8	0.77	2	1	3.69	2.81	0.88	9	5	3.63	2.79	0.84	5	17	3.61	2.48	1.13	17
	11	3.53	2.84	0.69	11	10	3.67	2.53	1.14	8	9	3.6	2.73	0.87	6	11	3.6	2.81	0.79	6
The 4 in the Middle	15	3.52	2.74	0.78	3	16	3.66	2.62	1.04	10	16	3.6	2.69	0.91	2	16	3.59	2.66	0.93	12
	16	3.49	2.76	0.73	17	6	3.66	2.66	1	11	12	3.52	2.87	0.65	9	12	3.56	2.67	0.89	15
	5	3.47	2.67	0.8	8	2	3.64	2.51	1.13	13	1	3.52	2.91	0.61	12	3	3.53	2.54	0.99	8
	7	3.45	2.7	0.75	18	9	3.62	2.7	0.92	7	3	3.48	2.75	0.73	3	2	3.51	2.52	0.99	2
Bottom 7	9	3.43	2.73	0.7	9	8	3.56	2.75	0.81	17	7	3.47	2.9	0.57	13	15	3.48	2.75	0.73	9
	3	3.42	2.56	0.86	15	7	3.47	2.64	0.83	3	15	3.47	2.86	0.61	8	9	3.46	2.77	0.69	3
	12	3.37	2.66	0.71	12	15	3.47	2.67	0.8	12	2	3.46	2.55	0.91	7	7	3.46	2.76	0.7	7
	13	3.33	2.65	0.68	14	3	3.43	2.44	0.99	16	13	3.4	2.56	0.84	18	8	3.38	2.83	0.55	13
	8	3.27	2.77	0.5	16	14	3.41	2.48	0.93	14	8	3.38	2.76	0.62	15	14	3.35	2.4	0.95	18
	14	3.25	2.38	0.87	13	13	3.36	2.4	0.96	18	14	3.26	2.39	0.87	14	13	3.35	2.44	0.91	16
	18	3.18	2.32	0.86	7	18	3.05	2.4	0.65	15	18	3.22	2.25	0.97	16	18	3.2	2.1	1.1	14

	Academics	Employers	Graduates	Students
# Competences with importance level >= 3.5 out of 4	8	12	11	10
# Competences with achievement level <= 2.8 out of 4	13	17	14	13
Competences with Highest Gap between Importance and Achievement Levels				
	#2 Professionalism and ethical values	#4 Ability to translate knowledge into practise	#4 Ability to translate knowledge into practise	#4 Ability to translate knowledge into practise
	#4 Ability to translate knowledge into practise	#5 Objective decision-making and practical cost-effective problem-solving	#17 Self-confidence, entrepreneurial spirit and skills	#17 Self-confidence, entrepreneurial spirit and skills
Rating of Importance Level				
Common competences ranked in top-five	# 4 Ability to translate knowledge into practise			
Common competences ranked in bottom-five	#14 Ability to work in intra- and intercultural and/or international context #13 Environmental and economic consciousness #18 Commitment to preserve and to add value to African identity and cultural heritage			
Competence Ranking				
Common competences ranked in top five	#4 Ability to translate knowledge into practise #1 Ability for conceptual thinking, analysis and synthesis			
Common competences ranked in bottom five	#14 Ability to work in intra- and intercultural and/or international context #16 Ability to evaluate, review and enhance quality			

Based on Table 6.6, the following observations can be made:

- Generally, levels of achievement are ranked lower than their importance. The number of competences with importance levels exceeding 3.5/4 varies between thirteen-fifteen/eighteen for employers, academics and graduates, while the number of competences with achievement levels less than 2.8 ranged from twelve to seventeen out of the eighteen generic competences

- The highest gaps between importance and achievement levels were identified in competences related to use of innovative technologies, ability for creative and innovative thinking and «self-confidence and entrepreneurial skills».

- Competences related to conceptual thinking, analysis, synthesis and translation of knowledge to practise were identified by all groups at the top of importance and ranking lists.

- Competences related to environmental and economic consciousness, preservation of African cultural heritage, and the ability to work in intra/inter-national contexts were identified by all groups at the bottom of importance and ranking lists.

Table 6.7 shows the numeric data of the views of mechanical engineering stakeholder groups in the common generic competences and the indicators obtained from the data. Based on these tabulated data, the following observations can be made:

- Levels of achievement are lower than levels of importance. The number of competences ranked with an importance level exceeding 3.5 out of 4 varied between (ten-twelve)/eighteen for employers, students and graduates, while the number of competences with an achievement level ranking of less than 2.8/4 ranged from thirteen to seventeen out of the eighteen generic competences

- The highest gaps between importance and achievement levels appeared for competences related to «translation of knowledge into practise», «self-confidence and entrepreneurial skills», «professionalism and ethical commitment», and «objective decision-making».

- Mechanical engineering stakeholders ranked competences related to conceptual thinking, analysis, synthesis and translation of knowledge to practise at the top of the list in importance and ranking.

- Competences related to environmental and economic consciousness, preservation of African cultural heritage, the ability to work in intra/inter-national contexts, and the ability to evaluate, review and enhance quality were ranked lowest in importance and ranking.

- Mechanical engineering graduates ranked generic competences related to abilities of conceptual thinking, analysis, synthesis and the translation of knowledge into practise as the two most important competences. Employers and academics ranked the use of innovative and appropriate technologies (#6) much higher than students and graduates did. Out of all areas, only the mechanical engineering respondents ranked competence #6 highly, indicating that innovation is an inherent feature of the discipline. In contrast, competence #6 was not included in the top-five list of highly ranked competences by "All-Areas" stakeholders.

- A possible overlap could have occurred between competence #10 (ability for creative and innovative thinking) and competence #6 (use of innovative and appropriate technologies). Employers ranked the *use* of technology much higher than its *creation,* which probably reflects the fact that most technology in Africa is imported, not created on site. On the other hand, students and graduates ranked the creation of technology much higher than its use.

- Students and graduates of the mechanical engineering discipline ranked competence #11 (leadership and teamwork skills) much higher than academics and employers. Students and graduates of "All Areas" ranked leadership and teamwork skills much lower than their "mechanical engineering" counterparts. It is puzzling that employers give leadership and teamwork skills low rankings.

- Mechanical engineering graduates identified competence #17 (self-confidence and entrepreneurial skills) as manifesting the largest gap between "importance" and "achievement". This finding identifies competences that need rectification, improvement and reinforcement in current curricula.

- Competence #7 (ability to communicate effectively in national/local languages) was ranked very low by students, graduates and academics. This feature reflects the fact that local/national languages are not typically employed in technical communications and reports in the mechanical engineering discipline. Perhaps effective communication in local languages should be included in future curricula.

6.9.5. *Analysis of consultation results for mechanical engineering competences*

Table 6.8 provides the raw data of responses to the questionnaire about mechanical engineering specific competences with regard to how the various categories of stakeholders assigned "importance" and "achievement" of each competence in current curricula, and how they ranked the nineteen subject-specific competences. Based on the data of Table 6.8, the following observations can be made:

- Levels of achievement were generally viewed lower than levels of importance. The number of competences with an importance level higher than 3.5 (out of 4) ranged from ten to sixteen competences out of nineteen. The number of competences ranked less than 2.8 in achievement ranged from twelve to fifteen competences out of nineteen.

- Academics, students and graduates have commonly identified the capacity to employ mechanical engineering skills to transform local natural resources into products through value addition (competence #19), as the competence with largest gap between importance and achievement. Employers and students have also commonly identified the skills in safety and risk management in mechanical engineering systems (competence #14), as a competence showing a large gap between levels of importance and achievement.

- Capacities to conduct life-cycle assessment, to interact with multidisciplinary groups, and to create, innovate and contribute to technological development were identified by academics, employers and graduates as manifesting large gaps between levels of importance and achievement.

- The most highly ranked competences were associated with abilities to apply knowledge of the basic and applied mechanical engineering sciences (competence #1), capacity to conceive, analyse, design and manufacture products and systems (competence #4), ability to identify, evaluate and implement appropriate technologies (competence #2), capacity to create, innovate and contribute to technological development (competence #3) and skills in planning and executing mechanical engineering projects (5). However, there appears to be some overlap between competence #1 addressing the application of knowledge and competence #4 addressing analysis and design as analysis and design would, by definition, encompass application of knowledge.

- Students, employers and academics agreed upon the most highly ranked competences as #1, #4 and #2. Competence #3 (creation and innovation) is ranked high by all stakeholders except employers. This ranking probably reflects employers' desire to use technology but not to "waste time" in R&D projects that would create technology. On the other hand, graduates rank design higher than application of knowledge, conceiving application of knowledge as a subcategory of design. In line with this reading of consultation results, it is worth noting that academics assigned a much higher level of importance to the "capacity to create, innovate, and contribute to technological development" than employers did.

- Most of the stakeholders also identified a second grouping of related competences as ranking high. These include competences that address "providing mechanical engineering solutions to societal problems for sustainable development (competence #13)" and "capacity to transform local resources into products" (competence #19). All stakeholders ranked competence #19 on the high side. However, students and graduates perceived a large gap between the importance of this competence and its achievement. This observation should receive attention when rectifying current curricula.

- Competences related to quality assurance (competence #17), life-cycle assessment (competence #18), safety and risk management (competence #14) were ranked very low by almost all stakeholders. This finding reflects the low level of technological development in the continent, with the result that issues related to quality culture are not given a high priority.

Table 6.8
Mechanical Engineering Stakeholders Responses
to Questionnaire on Subject-Specific Competences

	Data of Mechanical Engineering Stakeholders Reponses to the Questionnaire of ME Specific Competencies																			
	Academics					Employers					Students					Graduates				
	Competence #	Importance	Achievement	Gap	Ranking Top-Down	Competence #	Importance	Achievement	Gap	Ranking Top-Down	Competence #	Importance	Achievement	Gap	Ranking Top-Down	Competence #	Importance	Achievement	Gap	Ranking Top-Down
Top 7	1	3.82	3.11	0.71	1	15	3.72	2.8	0.92	1	1	3.82	3.03	0.79	1	1	3.74	3.16	0.58	4
	4	3.69	2.9	0.79	4	14	3.71	2.3	1.41	4	15	3.78	2.72	1.06	4	5	3.67	2.85	0.82	1
	15	3.66	2.85	0.81	2	1	3.69	3.07	0.62	2	4	3.78	2.89	0.89	2	19	3.65	2.57	1.08	3
	3	3.65	2.83	0.82	3	6	3.67	2.94	0.73	5	3	3.74	2.5	1.24	3	4	3.64	2.82	0.82	5
	12	3.63	2.86	0.77	19	4	3.66	2.71	0.95	19	2	3.72	2.62	1.1	5	7	3.64	2.73	0.91	2
	2	3.62	2.69	0.93	13	12	3.64	2.75	0.89	3	9	3.71	2.62	1.09	13	2	3.63	2.65	0.98	19
	19	3.62	2.55	1.07	5	19	3.64	2.42	1.22	7	5	3.71	2.84	0.87	19	3	3.62	2.63	0.99	13
The 5 in the Middle	5	3.61	2.84	0.77	9	2	3.63	2.59	1.04	8	14	3.7	2.69	1.01	15	14	3.62	2.57	1.05	7
	6	3.53	2.83	0.7	10	5	3.6	2.73	0.87	15	12	3.69	3.06	0.63	9	6	3.61	2.83	0.78	6
	7	3.52	2.74	0.78	7	17	3.56	2.52	1.04	12	13	3.67	2.66	1.01	7	13	3.6	2.7	0.9	15
	13	3.48	2.64	0.84	15	7	3.56	2.56	1	11	6	3.67	2.7	0.97	12	15	3.59	2.81	0.78	9
	10	3.47	2.73	0.74	16	10	3.55	2.48	1.07	6	19	3.65	2.46	1.19	8	12	3.53	2.93	0.6	16
Bottom 7	9	3.4	2.66	0.74	8	18	3.48	2.25	1.23	9	7	3.62	2.66	0.96	6	16	3.51	2.52	0.99	14
	17	3.4	2.67	0.73	11	16	3.44	2.18	1.26	14	10	3.62	2.54	1.08	10	9	3.49	2.67	0.82	12
	8	3.39	2.47	0.92	12	3	3.43	2.43	1	13	17	3.54	2.57	0.97	16	17	3.49	2.65	0.84	10
	14	3.37	2.4	0.97	6	13	3.43	2.41	1.02	16	11	3.51	2.52	0.99	14	11	3.45	2.42	1.03	8
	18	3.36	2.38	0.98	17	9	3.37	2.92	0.45	10	16	3.47	2.38	1.09	11	10	3.42	2.72	0.7	11
	16	3.34	2.39	0.95	14	11	3.3	2.15	1.15	17	18	3.44	2.41	1.03	17	18	3.4	2.47	0.93	17
	11	3.3	2.39	0.91	18	8	3.27	2.52	0.75	18	8	3.4	2.43	0.97	18	8	3.39	2.57	0.82	18

	Academics	Employers	Graduates	Students
# Competences with importance level >= 3.5 out of 4	10	12	16	13
# Competences with achievement level <= 2.8 out of 4	12	15	15	13
Competences with Highest Gaps between Importance and Achievement Levels				
	#19 Capacity to employ mechanical engineering skills to transform local national resources into products or services through value addition	#14 Skills in safety and risk management in mechanical engineering systems	#3 Capacity to create, innovate and contribute to technological development	#19 Capacity to employ mechanical engineering skills to transform local national resources into products or services through value addition
	#18 Capacity to conduct life-cycle assessment for products and systems	#16 Capacity to interact with multidisciplinary groups towards developing integrated solutions	#19 Capacity to employ mechanical engineering skills to transform local national resources into products or services through value addition	#14 Skills in safety and risk management in mechanical engineering systems
Rating of Importance Level				
Common competences in top-five list	#1 Ability to apply knowledge of the basic and applied sciences of mechanical engineering #4 Capacity to conceive, analyse, design and manufacture mechanical products and systems			
Common competences in bottom-five list	#8 Skills in evaluating the environmental and socio-economic impact of mechanical projects #11 Capacity to integrate legal, economic and financial aspects in decision-making in mechanical engineering projects			

	Academics	Employers	Graduates	Students
Competence Ranking				
Common competences in top-five list	#1 Ability to apply knowledge of the basic and applied sciences of mechanical engineering #4 Capacity to conceive, analyse, design and manufacture mechanical products and systems #2 Ability to identify, evaluate and implement the most appropriate technologies for the context of the current project			
Common competences in bottom-five list	#17 Skills in employing quality control techniques in managing materials, products, resources and services #18 Capacity to conduct life-cycle assessment for products and systems			

- Graduates ranked the capacity for spatial abstraction, graphic representation and engineering drawings (competence #12) very low, while the ability to design (competence # 4) was ranked very high, despite the fact that drawing is the tool by which designers express their thoughts. The working group's analysts concluded that graduates and students tend to rank competences according the degree of their level of complexity and the difficulty of acquiring them during their period of study at the university. Students and employers also share this view but to a lesser degree.

- Employers estimated a small gap between importance and achievement levels for the competences related to application of knowledge in mechanical engineering field (competence #1) and the capacity to model and simulate mechanical engineering systems and processes (competence #9). This indicates that, in the eyes of employers, academics have performed their task properly.

6.10. Elaboration of Meta-Profile

6.10.1. *Core elements of mechanical engineering curriculum*

As a result of deliberations in the Yaoundé meeting, the Mechanical Engineering SAG agreed that first-cycle degrees (bachelor) provide professionally qualifying studies in mechanical engineering. Graduates with this degree can enter early professional careers (professional qualification) and/or are qualified for advanced scientific degree programmes or for additional degree programmes other than mechanical engineering. The professional profile of mechanical engineering was discussed in detail for width and depth concerning specialisations within the field. The core specialisations in mechanical engineering are found in most of the universities and are displayed in Figure 6.1, along with their associated key professional tasks. Completing the core tasks that appear on the profile of the mechanical engineering curriculum require the student's acquisition of knowledge (integrative capability).

After taking an overview of the degree profiles from the participating universities and considering specific learning outcomes that graduates of mechanical engineering first-cycle study programmes can be

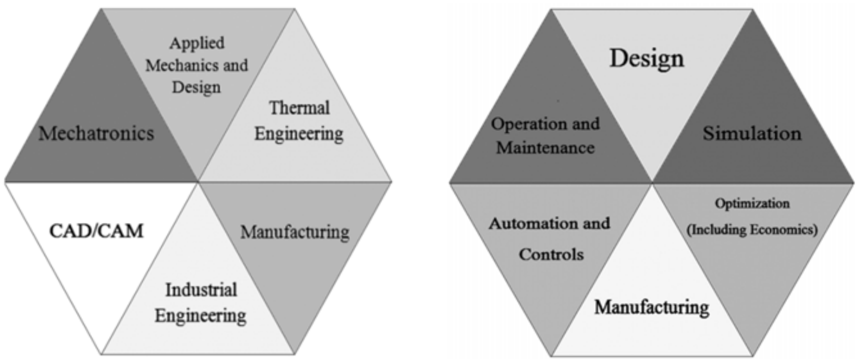


Figure 6.1
Core specialisations in mechanical engineering

expected to possess, a consensus emerged with regard to the core elements of mechanical engineering curriculum. These are depicted in the form of a pyramid, with their weightings in averaged percentages. "Core elements" are defined as the structured combination of competences that gives identity to a discipline.

The working group's task at this stage was to aptly summarise the key professional tasks constituting the core competences in mechanical engineering and to help conceive the meta-profile, defined as a mental conception for visualisation to help in constructing a degree profile. The group assigned a high priority to consideration and analysis of possible and diverse real degree profiles. Therefore, we extensively used the conclusions and inferences drawn from the stakeholder consultation process.

It was agreed that the three core elements can be characterised as the competences of the designing, manufacturing and operating mechanical systems. Design (synthetic activity) is aimed at the realisation of new or modified artifacts or systems, with the intention of creating value in accordance with predefined requirements and desires. Manufacturing involves translating digital design to physical reality while operation inherently involves the safe and efficient functioning in production enterprises, process industries and maintenance centres. Specifically, design can focus on mechanical, thermal, fluidic, aerodynamic and production line lay-out within sub-specialisations of mechanical engineering. At least some of these tasks will involve crosscutting and overlapping issues.

The competence-based method enjoined by Tuning aids in conceptualising the relation between education and the world of work The approach followed by the mechanical engineering group for developing its meta-profile is in line with the development of a competence-based curriculum. It begins with the formulation of a professional profile that identifies key occupational tasks. This stage is followed by a graduate profile with selected core competences that relate directly to the professional profile and, subsequently, to the curriculum profile in which the graduate's final attainment levels are defined in standards for both generic and specific competences. For greater clarity, "competence" is understood as the capability to choose and use (apply) an integrated combination of knowledge, skills and attitudes with the intention of completing a task in a certain context that meets professionally set standards. Personal characteristics such as motivation, self-confidence and will power are part of that context.

Based on the ranking of the generic and mechanical engineering specific competences that the working group arrived at in following up on the consultation process, clustering was done in terms of cognitive attributes: the drivers (providing the drive) and the driven (the attainment or realisation of the mechanical engineering core tasks) while the drivers themselves were grouped under such categories as "knowledge," "skills" and "attitudes" (see Table 6.9). The drivers and the driven are conceptualised in terms of gears, while highlighting the competences they address:

Table 6.9
Generic and Subject-Specific Competence Clusters
("S" designates specific competences, "G" generic competences)

Core	Design, manufacture and operation of mechanical systems	S	Capacity to conceive, analyse, design and manufacture mechanical products and systems
		S	Capacity to create, innovate and contribute to technological development
		S	Capacity to operate, maintain and rehabilitate mechanical engineering systems
		S	Capacity to interact with multidisciplinary groups in developing integrated solutions
		G	Ability for creative and innovative thinking
		G	Capacity to use innovative and appropriate technologies
		G	Ability for conceptual thinking, analysis and synthesis
Knowledge	ME sciences	S	Ability to apply knowledge of the basic and applied sciences of mechanical engineering
		G	Ability to translate knowledge into practise
	Innovation and creativity	S	Capacity to model and simulate mechanical engineering systems and processes
		S	Ability to identify, evaluate and implement the most appropriate technologies for the context of the current project
		S	Capacity to employ mechanical engineering skills to transform local national resources into products or services through value addition
		S	Using information communication technologies, software and tools for mechanical engineering
	Quality	S	Employing quality-control techniques in managing materials, products, resources and services
		G	Ability to evaluate, review and enhance quality
		S	Safety and risk management in mechanical engineering systems

Skills	Managerial and behavioural skills	G	Leadership, management and teamwork skills
		G	Objective decision-making and practical cost-effective problem-solving
		G	Flexibility, adaptability and ability to anticipate and respond to new situations
		S	Skills in planning and executing mechanical engineering projects
		S	Capacity to supervise, inspect and monitor mechanical engineering systems
		S	Skills in selecting, mobilising and administering material resources, tools and equipment in a cost-effective way
	Communication and interpersonal skills	S	Capacity for spatial abstraction, graphic representation and engineering drawings
		G	Ability to communicate effectively in official/national and local languages
		G	Communication and interpersonal skills
		S	Skills in using information communication technologies, software and tools for mechanical engineering
	Professionalism and ethics	G	Professionalism, ethical values and commitment to Ubuntu (respect for the well-being and dignity of fellow human beings)
		G	Capacity for critical evaluation and self-awareness
		G	Ability to learn to learn and capacity for lifelong learning
		G	Ability to work independently
		S	Capacity to integrate legal, economic and financial aspects in decision-making in mechanical engineering projects

Attitudes	Entrepreneurial skills	G	Self-confidence, entrepreneurial spirit and skills
		G	Ability for creative and innovative thinking
		G	Capacity to use innovative and appropriate technologies
	Community engagement	S	Providing mechanical engineering solutions to societal problems for sustainable development
		G	Ability to work in an intra- and intercultural and/or international context
		G	Commitment to preserve and add value to African identity and cultural heritage
		S	Capacity to employ mechanical engineering skills to transform local national resources into products or services through value addition
	Sustainability	S	Capacity to conduct life-cycle assessment for products and systems
		G	Environmental and economic consciousness
		S	Skills in evaluating the environmental and socio-economic impact of mechanical projects
		S	Capacity to integrate legal, economic and financial aspects in decision-making in mechanical engineering projects

6.10.2. *Core and knowledge clusters*

As can be seen from Table 6.9, each of the competence clusters, including the mechanical engineering core, consists of both specific and generic competences with the exception of innovation and creativity and entrepreneurial skills. Broadly, this overlap suggests that they aid and reinforce each other. Ability for creative and innovative thinking as well as the capacity to create, innovate and contribute to technological development are adjoined with the core competence cluster. This relationship is especially important in the African context, which is characterised by a low level of technological development and should be emphasised not only for cost-effective utilisation of scarce resources but also for acquiring competitiveness in the global context. This role is also highlighted by the separate competence cluster under the knowledge cluster grouping for innovation and creativity. Several mechanical engineering specific competences address this aspect, and the ability to transform local national resources into products or services through value addition is central. Even under the mechanical engineering sciences cluster, the ability to translate knowledge into practise suggests that the mere acquisition of knowledge is not sufficient. More important is understanding what can be done or realised with that knowledge. The role of ICT is mentioned under this cluster, as well as other clusters, suggesting that these skills are transferable one to another. The quality cluster completes the knowledge grouping of competence clusters, where, apart from quality-related aspects, safety and risk assessment are appropriately highlighted.

6.10.3. *Skills cluster*

A plethora of skills encompassing resource management (both material and human), practical problem-solving, leadership, teamwork, cost-effective decision-making, planning, supervision and the monitoring and execution of mechanical engineering projects are especially needed by mechanical engineering graduates. These skills are grouped in the managerial and behavioural cluster.

Communication (technical drafting/drawing as well as oral communication) is given due importance in the communication and interpersonal skills cluster, which includes the ability to use ICT. The need for "learning to learn" and "life-long learning" are required to stay abreast of the latest technological developments in the current knowledge society.

Complying with professional and ethical codes and standards (technical, legal, financial and their integration) appear in the professionalism and ethics cluster. The commitment to Ubuntu included under this cluster is seen as relevant in the African context. This competence symbolises the need and commitment for professional and ethical values in the spirit of a true professional.

6.10.4. *Attitudes cluster*

Positive attitudes about serving society and influencing sustainable development form the central theme under the attitudes cluster grouping. The entrepreneurial skills cluster, which aligns with the innovation and creativity cluster, have as a common thread the ability for creative and innovative thinking. This cluster communicates the need for entrepreneurial spirit, self-confidence and the capacity to use innovative and appropriate technologies for the context of the current mechanical engineering project. Considering the need for graduates who are job creators rather than mere job seekers, the importance of this cluster in the African context scarcely needs to be emphasised.

The community engagement cluster is an embodiment of the need for leveraging mechanical engineering solutions to societal problems and local community development, the ability to work in different socio-cultural contexts and a commitment to preserve and add value to African culture and identity.

The need for a sustainability approach is portrayed by the ability to make environmental and socio-economic impact analyses for mechanical engineering projects. Also included as a separate competence cluster under this grouping is the ability to assess the life cycle of products and systems. The integration of legal and financial aspects is again grouped here, due to its relevance. A strong emphasis on sustainability is especially called for in the curriculum profile given the modern context.

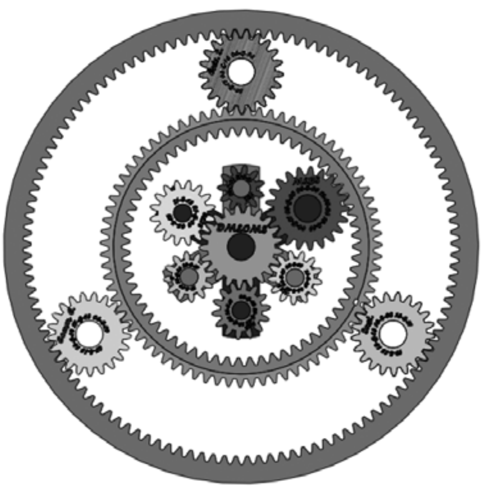


Figure 6.2
Pictorial representation of the mechanical engineering meta-profile

With all the gears (drivers and the driven) assembled as shown in the pictorial representation in Figure 6.2, the linkages and the relation between different factors as well as the synergy among various competence clusters in delivering and realising the mechanical engineering core (the design, manufacture and operation of mechanical systems) can be easily understood. The intermeshing gear teeth show the common sub-set space between the two competence clusters, which is extended by the other gears that also make contact. (See the animated version of this figure in the electronic version of this report.)

In Figure 6.3, the hexagonal space is presented to reveal the core specialisations as well as the core professional tasks presented earlier. In order to construct the meta-profile, the mechanical engineering core represented by that space is conceived as inter-connected and serviced by the six planets and the three outer spaces (apexes of each triangle). The six planets are (1) mechanical engineering sciences, (2) innovation

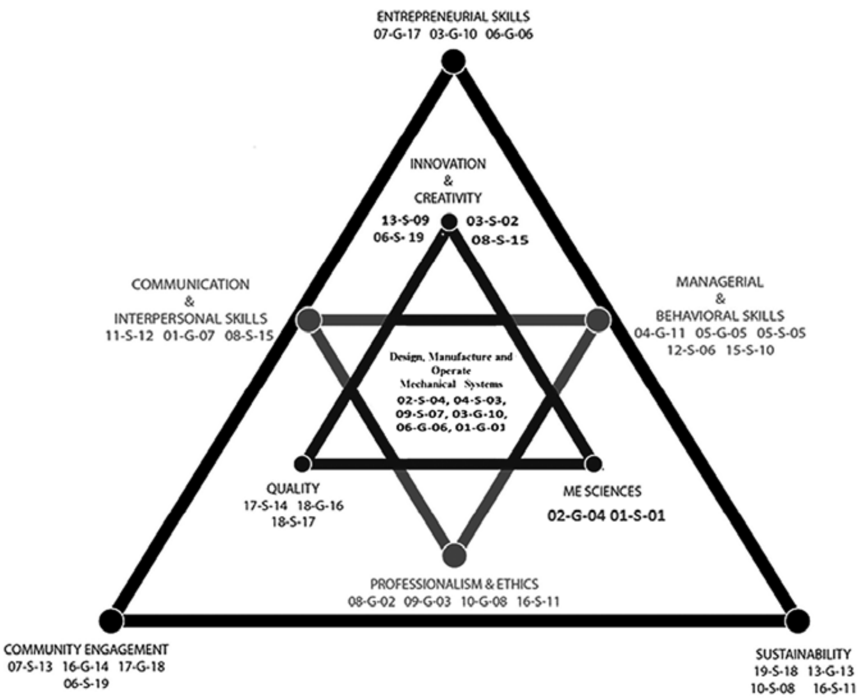


Figure 6.3
Graphical representation of mechanical engineering meta-profile

and creativity, (3) quality, (4) managerial and behavioural skills, (5) communication and interpersonal skills and (6) professionalism and ethics while the outer spaces represent (1) community engagement, (2) entrepreneurial skills and (3) sustainability.

6.11. Review and Contrast of Meta-Profile at the Regional Level

6.11.1. *The need for harmonisation*

Socio-economic development in Africa is fast emerging as a fundamental policy driver amongst many African countries, and part of the mandate of the African Union. Traditionally, African countries have failed to exploit intra-African trade for a number of reasons, although organisations such as CEMAC, ECOWAS and SADC have been established to improve regional cooperation.

Africa's extensive mineral resources provide ample opportunities for wealth creation through beneficiation. This, together with the need for large-scale infrastructure development, will require considerable emphasis on requisite human capital development in engineering-related disciplines. However, the development of expensive education and research facilities will require rationalisation of expensive resources-hence the need for mobility and harmonisation.

Recent intra-African technology development initiatives, such as the satellite technology programme for establishing an African satellite constellation, the Square Kilometre Array (SKA) Programme, the Africa Laser Centre, regional hydropower building programmes, etc., have emphasised the need for the harmonisation of engineering programmes across Africa and the development of curricula that are specific to the technological needs of the continent.

It is envisaged that future transport networks and shared infrastructure projects will require cooperation amongst engineers from different African countries. The need for technology transfer and reception will further advance the harmonisation of engineering curricula across Africa. Such harmonisation will aid intra-Africa mobility at various levels, namely: high-level research in areas of specialisation which necessitates the use of scarce and expensive resources, post-graduate programmes in specialist areas and joint engineering programmes based on intra-African meta-profiles.

After the Tuning meeting at Cape Town in South Africa in May 2012, the generic competences and specifics defined in Yaoundé were used to build the meta-profile in mechanical engineering. The consultation process and the meta-profile agreed upon at the Cape Town meeting have greatly helped in comparing the existing profiles in the selected universities.

6.11.2. *Contrasting the meta-profile with real profiles at the university level*

After building the meta-profile, the working group's follow-up task was to compare it against existing regional profiles, the objective being to establish differences and coincidences. At the same time, this process allowed the participating regions/universities to reflect on their respective curricula and introduce changes accordingly. A very constructive approach in this exercise was to use the same competence clusters defined in the meta-profile to establish the regional profiles, thereby establishing their relative differences and coincidences. This exercise required regions to examine their respective curricula currently offered against all of the general and specific competences defined through the Tuning Africa project.

This process was undertaken through exchanges and discussions with academics of the respective departments and, in some cases, recent graduates. Careful consideration was given to the existing subject offerings, learning units and learning outcomes, which were developed over many years of consultation with industry advisory committees and engineering accreditation bodies.

At Jimma University, it was found that all of the general and specific competences on which the meta-profile had been constructed are adequately addressed through different subject offerings and their respective learning units. Overall, the coincidence with the meta-profile is striking.

However, there are some differences due to the curriculum being a broad-based mechanical engineering programme with a limited degree of streamlining through the introduction of elective subjects. For example, subjects like total quality management, product design and development (where product life-cycle costs are included) are elective subjects. Hence, to improve the competences related to "innovation and creativity" and "quality", some of the electives need to be made mandatory. In addition, a comparison of the weightings under the different competences indicates inadequate emphasis on "quality" and "environmental consciousness." Even though environmental impact analysis is covered under different subjects, there is a need to introduce a dedicated subject on sustainable development that includes sustainability metrics.

When the curriculum of the National Graduate School of Engineering in Yaoundé is compared to the meta-profiles, areas of improvement become visible by taking into account all the significant elements for the training of a mechanical engineer.

In Cape Town Peninsula, the core of the meta-profile is slightly different: Graduates are expected to have the ability to design and manufacture mechanical systems, integrating their knowledge of mechanical engineering sciences and quality standards, while graduates are expected to operate manufacturing systems (CNC machines, conventional metal-removal machines, welding machines, etc.) However, graduates do not necessarily master the operation and maintenance of mechanical equipment such as compressors, heat exchangers, pumps, etc. Such mechanical systems form part of the curriculum but only for the purpose of designing systems.

Concerning Cairo University, competences with high degree of coincidence but also a high degree of discrepancy with Tuning Africa competences have been identified. The areas of highest difference are related to quality, commitment to African identity, mechanical engineering solutions aimed toward sustainable development, environment and socio-economic impact, product life-cycle management and the integration of legal and financial aspects in mechanical engineering projects. The African dimension is also lacking.

6.11.3. *Analysing the weights of the different dominant elements*

Across the participating institutions profiled, a high degree of synergy has been encountered with respect to the core competences—particularly those related to mechanical engineering sciences, quality and innovation and creativity, and, to a lesser degree, quality. These include modelling and simulation. It may be the case that the weighting on mechanical engineering sciences (including subjects covering basic sciences, mechanics, thermodynamics, etc.) receives greater emphasis at the expense of neglected competences related to sustainability, which is fast emerging as a core competence globally. This competence includes the ability to analyse the product life-cycle.

While competences related to "entrepreneurial skills," "community engagement" and "professionalism and ethics" are relatively under-weighted, it is evident that curriculum modernisation is necessary to adequately cover these competence clusters. On the other hand, a good correlation in general seems to prevail regarding community engagement.

6.12. Contrast of Meta-Profile with Findings in Other Regions

In Brussels in November 2012, the African Mechanical and Construction Tuning groups had the opportunity to meet with other Tuning Groups of engineering from Latin America and from Russia. Because these regional groups used the same Tuning method, participants expected to see the different results and compare their meta-profiles.

The Latin America experience concerns civil engineering and did not include mechanical engineering. Its competences were systematised in advance into four groups: social, cognitive, technological and ethical.

The comparison became more complicated because the African group had formed clusters of competences after identifying the generic and subject-specific competences. It took this step to approach the clustering from the expected outcome. The resulting discussion clarified the need for definitions to explain the meaning of competences expected. The Latin American competences, for instance, might need to define "cognitive" as "the ability to apply theory in practise" because the experimental aspects of engineering could be seen as a case study carried out in the classroom, not as on-site training while employed by a company. Thus, in Latin America, academics consider this ability as a cognitive competence.

The Russian Tuning experience did not include mechanical engineering but instead focused on environmental engineering. Russia differentiates among three competences, while relabelling "generic" competences as “general” competences. It produced these three divisions: (1) General competences for engineering (broad scope of programmes), (2) General competences for environmental engineering and (3) Subject-specific competences for environmental engineering. The large country of Russia (Federation) does not distinguish between its regions with the result that its programmes and standards cover the entire country. Quality is a central issue.

With this approach, the Russian participants were able to identify all competences needed in engineering as a sort of “generic competences”. Russian engineering students develop specific competences in the final year of their programme, thus qualifying for unique qualifications.

The Latin American and the African groups concluded that all engineering general competences should be identified for each region in order to facilitate the comparison of the curricula.

In addition, it was quite important to understand that the Russian academics give priorities and importance to some competences (such as “ability to learn”) because they are integrated into their regional culture.

In the comparison between the regions, it was clear that the way to define competences is linked to each region’s needs. For instance, in Latin America many courses should have links to “construction” while in Africa the need concerns “design”. In the meantime, it is difficult to know the level of achievement of each competence and how to describe it.

Finally the groups concluded that the similarities between regions are probably close to achieving 80 per cent of the desired harmonisation. Academics use common language and share universal ideas but the concepts of activities are different. In order to compare the programmes equitably, flexibility is a prerequisite. The comparison should take into account: (1) the local environment and the need of societies, (2) the local working conditions, (3) the possibility (or not) of individuals’ mobility and (4) ethical values.

All groups were aware of the need for quality assurance; however, quality universally poses questions of compromise that differ according countries, priorities and problems to face.

When drafting descriptions of competences, it seems important to understand the level to be achieved and the complexity required so that the wording will communicate with appropriate clarity.

Russian, Latin American and African groups agreed to define the title of "engineer" as requiring a study programme of four or five years. Although such a graduate would receive a "bachelor's degree," it does not correspond to a bachelor degree in a classical way. It is like an "honours degree" or "a graduate degree". If some universities award a title after three years of study, all regions agreed to consider the qualification at a level as "technician". Then in carrying out higher education reforms, a specific study should be done at the three-year stage.

6.13. Conclusions and Recommendations

6.13.1. *The Tuning approach and the meta-profile*

After one year of work, the exercise can be said to be an enriching process. The impact on existing curricula is very important. Some conclusions can be set out:

- Five subject area groups have been worked on, and the Tuning method is well understood.
- There is agreement on the importance of the Tuning methodology and on allowing academics to talk about their subject to find a consensus. The Tuning project gives Africa an instrument that will improve teaching and learning methods in higher education and result in improving curriculum in higher education institutions.

Having developed and defined eighteen generic competences, nineteen specific competences and detailed meta-profiles for mechanical engineering, the working group then compared the developed meta-profiles with existing degree profiles. The SAG drew the following conclusions:

- There exists a remarkable correlation between the developed meta-profiles and the existing degree profiles, especially in the mechanical engineering core area of designing, manufacturing and operations of mechanical engineering systems. There also exists a very high coincidence in the general area of mechanical engineering sciences between the developed meta-profiles and the existing degree profiles.

- There was, however, poor correlation between the developed meta profiles and the existing degree profiles. The existing degree profiles lack appropriate emphasis in the three areas of innovation and creativity, managerial and behavioural skills and quality. Further, the existing degree profiles also show a serious lack of emphasis in the areas of professional ethics, community engagement, environment and social economic impact assessment and product life-cycle assessment.

- Other areas of important differences between the developed meta-profiles and the existing degree profiles included commitment to African identity and the provision of mechanical engineering solutions towards sustainable development.

- Whereas a number of the degree programmes evaluated as part of this process incorporated some integration of legal and financial issues into mechanical engineering projects, there were others in which such integration was totally absent.

- There was unanimous agreement in the Mechanical Engineering SAG of the need to review and harmonise existing degree profiles with the identified meta-profiles. It was also agreed that the developed meta-profiles were better than existing profiles in that the developed meta-profiles not only addressed current societal expectations of a mechanical engineering graduate but also took account of future expectations.

- It was further agreed that, despite the agreement in the group concerning the developed meta-profiles, it was imperative that the developed meta-profiles be validated by other key stakeholders. It is important to note that the competences (both generic and specific) from which the meta-profiles were finally developed were obtained following a survey of four groups of stakeholders: academics, students, employers and graduates. It therefore follows that these groups and others should be consulted in the validation of the meta-profiles in their final form.

From the Tuning documentation, the next step in the process will be to develop the curricula that will produce the above generic and specific competences, taking into consideration the levels of importance, i.e. the meta-profile developed.

6.13.2. *Validation process*

The validation process will be country-dependent as the situations may differ from country to country depending on readiness. Some countries had just completed a process of thorough curriculum reform, while others were just beginning such reforms. In still others, the process of review to prepare recommendations for reform was yet to be done. Further, some countries like the DRC and Ethiopia had already embarked on a process of validation and harmonisation as the Tuning process coincided with their national curriculum reforms, while in others consultations were underway.

During the validation process, it is important that the process owners-in this case, members of the various SAG groups-have a clear understanding of the motivation for Tuning in general and validation in particular. Some of the issues of which various stakeholders may require further explanation and discussion include the following;

- The need to establish a framework for African mobility.
- How Tuning can be used as a vehicle for establishing a framework for mobility of African scholars.
- The need for an overarching system or drive for Africa such as the Bologna Process in Europe.
- A clear demonstration of how Tuning can be used to improve curricula.
- The potential for credit-transfer enhancement and the facilitation of mobility among scholars.
- The enhancement of partnerships across African universities.
- The enhancement of admitting graduate students from across Africa.

- Enhancement for employability.
- Improvement of relations across African universities.

6.13.3. *Target groups for validation*

The following groups were identified as possible targets for the validation process:

- Experts in mechanical engineering in the country, Head of Departments, and professors.
- Representatives of national professional engineering bodies.
- Students and graduate students.
- Supreme councils of universities (e.g., like Egypt's).
- Consortia of universities where these exist.
- Ministries of higher education and permanent secretaries.
- Engineering alumni.
- Commissions for university education.
- Engineers registration boards.

6.13.4. *A proposed dissemination process*

The dissemination process may differ from country to country, but dissemination may be achieved through the following suggested avenues:

- Annual national and regional engineering networks.
- National and regional engineering research conferences.
- Meetings of policy-makers.

- Commissions for higher education.
- Discussions on national radio and TV platforms.
- Briefs to ministries of education.
- Briefs to agencies for higher education relevance and quality assurance.
- Internal conferences for stakeholders.
- Research conferences at the university, national and regional levels
- Employers.
- Syndicates of accreditation bodies and engineering societies.
- Conferences of rectors.
- Economic community meetings such as COMESA, SADC, ECOWAS etc.

6.13.5. *Dissemination instruments*

For the dissemination process to be effective, appropriate instruments must be used. These may include but are not limited to the following:

- Tuning journal.
- On-line resources.
- 1,000 copies of the Tuning Africa report that will be produced.
- A CD-ROM describing Tuning methodology and the Tuning approach in general.
- Journal articles on the Tuning methodology in mechanical engineering journals.
- A four-page leaflet outlining the history of Tuning, methodology for Tuning, and information highlighting the bigger picture of Tuning in general.

6.13.6. *The implementation process*

The Mechanical Engineering SAG realised that the implementation process was far in the future as the process of meta-profile adoption was still a work in progress. The group, however, agreed that a systematic approach should be developed and adopted for effective implementation. Again systems may differ from country to country depending on existing situations. In general, a needs assessment should be carried out, followed by a detailed analysis of the gap between the existing and the proposed meta-profiles. Detailed curriculum development and programme design must be done, augmented by the introduction of new and novel teaching methodologies.

It was further agreed that achieving these goals depended on a critical need to have champions at all levels, including institutional and national levels.

6.13.7. *Future developments*

The mechanical engineering group agreed on the following future developments. These steps should assume a high priority in the Tuning Africa project.

- Deepen the mechanical engineering process by defining detailed learning objectives and outcomes.
- Carrying out gap analysis between the existing curricula and the developed meta-profiles.
- Broadening the engineering areas to reflect the four core engineering disciplines: mechanical, civil, electrical and chemical engineering.
- Develop generic competences for engineering disciplines.
- Extending the general process of Tuning to other subject areas existing in higher education institutions, involving new institutions and inviting the participation of new countries.

- Creating National Tuning Centres in each of the participant countries as a concentration of Tuning experience for the other universities of the country.

- Establishing closer relations between industries and universities in Africa where curriculum design is concerned and disseminating Tuning result and detailed meta-profiles to stakeholders.

List of Mechanical Engineering Subject Area Group members

Subject Area Coordinator **Charles AWONO ONANA** Ecole Nationale Supérieure Polytechnique, Université de Yaoundé I (Cameroon) awonoonana.charles@gmail.com	**Higher Education Expert-Tuning** **Béatrice DELPOUVE** France beatrice.delpouve@univ-lille1.fr
Cameroon **Raidandi DANWE** Ecole Nationale Supérieure Polytechnique, Université de Yaounde I rdanwe@yahoo.fr	**Malawi** **Moses Phenias Mngwapa CHINYAMA** University of Malawi-The Polytechnic mchinyama@poly.ac.mw
Central African Republic **Martin PANOU** Université de Bangui marti_panou@yahoo.fr	**Rwanda** **Venant KAYIBANDA** Kigali Institute of Science and Technology kayive@yahoo.fr
Democratic Republic of Congo **Léonard KABEYA MUKEBA** Institut Supérieur de Techniques Appliquées Kinshasa leonardkabeyamukebayakasham@gmail.com	**South Africa** **Nawaz MAHOMED** Cape Peninsula Science and Technology mahomedn@cput.ac.za
Egypt **Mohamed M. MEGAHED** Cairo University mmegahed47@yahoo.com	**South Africa** (observer) **Christoff PAUW** and **André MÜLLER** Stellenbosch University (Observer) ccpauw@gmail.com aemuller@sun.ac.za

Ethiopia **Venkata Ramayya ANCHA** Jimma University venkata9999@yahoo.com dra.venkata@ju.edu.et	**Tunisia** **Taoufik NASRI** Ecole Nationale des Ingénieurs de Tunis de l'Université El Manar nasri.taoufik@gmail.com
Ghana **Samuel Mensah SACKEY** Kwame Nkrumah University of Science and Technology sackeysm@yahoo.com	**Zambia** **Shadreck CHAMA** Copperbelt University schama@cbu.ac.zm kayive@yahoo.fr

Chapter 7

Medicine

Mahmoud BENALI ABDELLAH, Olusegun Olusina AKINYINKA, Abdelhaq ALAQUI YAZIDI, Moussa ARRADA, Loko Abraham BONGASSIE, Ali CHEDLI , Ahmed Magdy Ibrahim A. EL GOHARY, Abdourahmane DIA, Jean Rosaire IBARA, A Eprem Tekle LEMANGO, lain Khassim Jacques N'DOYE, Charles Odero OMWANDHO, Jennifer Elizabeth RAMESAR, John E. REILLY and Hanneke VAN BRUGGEN

7.1. Introduction

Ten countries from the five African regions—North, East, South, West and Central are represented in the Tuning Africa Medical Group: Algeria, Congo, Egypt, Ethiopia, Kenya, Morocco, Nigeria, Senegal, South Africa and Tunisia.

7.1.1. *Members of the Tuning Africa Medical Group*

Chair: Mahmoud Benali Abdellah is Professor and Vice-Rector—International Relations and Cooperation, University of Algiers I and former President of the Scientific Council of the Faculty of Medicine of Algiers.

University of Algiers I: Benyoucef Benkhedda. Founded in 1909, it now comprises seven Faculties, one of which is the Faculty of Medicine of Algiers I. Inaugurated in 1833, the School of Medical Sciences was the first Algerian higher education institution. Medical education was delivered by army doctors and was initially restricted to European students. Subsequently, courses were opened to Turkish students, Moors and Jews. In 1909, it obtained its independence from the Faculty of Montpellier (which until then delivered the diplomas), and the Faculty of Medicine and Pharmacy of Algiers was established. The language of instruction is French. The faculty has ca. 20,000 students; 1,200 graduate in medicine, 300 in dental surgery and 500 in pharmacy. There are 2,000 full-time members of the academic staff. Professor Laveran (1845-1922), Nobel Prize in Medicine, was educated in Algeria, where he focused his research on malaria and its agents.

Algeria: Moussa Arrada is Professor and Dean of the Faculty of Medicine, University of Algiers I.

Congo: Jean Rosaire Ibara is Professor at the Faculty of Medicine, University Marien Ngouabi.

The University Marien Ngouabi was founded in 1971 followed by the inauguration of the University of Brazzaville. In 1977 it was renamed Marien University Ngouabi (UMNG). In 1978 the Higher Institute of Health Sciences (INSSSA) was founded. Between 1985 and 1992, several university establishments underwent change and the INSSSA became the Faculty of Health Sciences (FSSA). In 2006, *t*he French university campus in Brazzaville, in collaboration with the Francophone University Agency (AUF) was opened. It has 575 academic staff and about 10, 000 students.

Egypt: Co-Coordinator: Ahmed Magdy Ibrahim A. El Gohary is Professor of Clinical Pathology and Vice-President for Graduate Studies and Research at Suez Canal University, and former President of Fayoum University.

The Suez Canal University was inaugurated in 1976 as a community-oriented university with ca. 35,000 students and twenty-four Faculties on four campuses. The branches at Port-Said and Suez became independent public universities in 2009 and 2013 respectively. Its Faculty of Medicine was established in 1978 as the first community-oriented, problem-based, student-centred medical school in Egypt (www.fom.scuegypt.edu.eg). It is a Centre of Excellence for students from Egypt, Africa and the Eastern Mediterranean Region and a pioneering, innovative school with ca. 1,250 students in the first cycle, ca. 2,000 in the second and third cycles and ca. 640 academic staff.

In 1988, the Faculty was designated a WHO collaborating centre in medical education and health research for its innovative and pioneering work. It is one of ten founding schools of the "Network of Community-Oriented Educational Institutions for Health Sciences"—"Toward Unity for Health"

Ethiopia: Ephrem Tekle Lemango is Doctor of Medicine (MD) at the Faculty of Medicine, Mekelle University. He holds an MA in Health Management, Planning and Policy and is Head of Quality Assurance for the Medical and Health Sciences Education office in the College of Health Sciences.

Loko Abraham Bongassie is Professor at the Faculty of Medicine, Mekelle University. He is a Doctor of Medicine (MD) specialising in pediatrics and a member of the Department of Pediatrics and Child Health; He is Chair of the School of Medicine and committee chair for a group working on the development of competence-based medical curriculum.

Mekelle University is a relatively young university in Ethiopia which has undergone massive expansion in the last few years. The university has eight institutes and colleges, one of which is the College of Health Sciences. Mekelle University currently enrols ca. 28,000 students in different undergraduate and graduate programs.

The College of Health Sciences consists of one school and seven departments. The School of Medicine is the only school in the college. The college enrols ca. 5,000 students in different departments, ca. 3,400 of them in the School of Medicine. There are four specialty programs and six master's programmes in the school. There are fifteen departments in the School of Medicine. The school has ca. sixty specialists in the clinical departments and ca. fifty resident physicians. There are nine clinical departments.

Kenya: Charles Odero Omwandho is Professor and Dean of the Faculty of Medicine, University of Nairobi (UON).

The largest university in Kenya, the UON was founded in 1956 and became an independent university in 1970 when the University of East Africa was split into three universities. In 1983 the university underwent major restructuring, resulting in decentralization and the creation of six campus colleges, which included the College of Health

Sciences. In 2011 the university had ca. 61,900 students (ca. 49,500 undergraduates and ca. 12,400 postgraduates).

In its College of Health Sciences, the Faculty of Medicine was founded in 1967. Since then it has developed into a college comprising the schools of: medicine, pharmacy, dental sciences, nursing sciences, the Institute of Tropical and Infectious Diseases and the Centre for HIV/AIDS Prevention and Research. The Faculty of Medicine has 14 departments, 239 members of academic staff and ca. 2,250 undergraduate and postgraduate students.

Morocco: Abdelhaq Alaoui Yazidi is Professor and Dean of the Faculty of Medicine and Pharmacy and Head of Pneumology, Ibn Nafis Hospital, Marrakesh.

University Cadi Ayyad (UCA), Marrakesh, Morocco, was created in 1978. It has thirteen establishments in four university towns: Marrakesh, Kalaa des Sraghna, Essaouira and Safi in two regions of Morocco: Marrakesh Tensift Elhaouz and Abda Doukkala. It has 62,155 students, including ca. 500 foreign students representing ca. 37 nationalities. There are 1,361 academic staff, 926 administrative staff and ca. 300 international partners. In January 2013, Webometrics ranked the university as first in Morocco, third in the Maghreb, 35th in Africa, and 2,631 from ca. 20,000 universities and research institutes in the world.

Established in 1994 and operational in 1999, the Faculty of Medicine and Pharmacy of Marrakesh is built on a site of over 2 hectares and 17,000 m^2 buildings. It awards (1) the doctorate in medicine (seven years of study) and diplomas in areas of medical specialization (four-five years of study) and forty medical, surgical and biological specialities. Students (number in progress until 2020): 1,855 (1,149 of them young women); teachers: 148 (56 of them women); administrative personnel 80 (42 of them women). Diplomas in medicine awarded between 2007 and December 2012: 715 prize-winners (479 young women). Specialists graduating between November 2004 and July 2012: 258 (119 women).

Nigeria: Olusegun Olusina Akinyinka is Provost of the College of Medicine, University of Ibadan and Professor of Paediatrics and a Clinical Pharmacologist.

University of Ibadan is the oldest in Nigeria. Founded in 1948 as a College of the University of London, it received its charter in

1962 as the University of Ibadan. It has since grown to 13 faculties with 13,000 undergraduate students and 8,000 postgraduate students. Its College of Medicine, established in 1948, is the oldest faculty of medicine in West Africa. Restructured into the College of Medicine in 1980, the college consists of four faculties: basic medical sciences, clinical sciences, public health, and dentistry offering undergraduate programmes in medicine, dentistry, physiotherapy, nursing, biochemistry, physiology, human nutrition, medical laboratory sciences and environmental health sciences. The college has undertaken a revision of curricula to address the healthcare needs of Nigeria. The new curricula are system-based and reflect global standards. The University College Hospital (UCH) established in 1952 has a symbiotic relationship with the college in training, research and clinical services.

Senegal: Abourahmine Dia is Professor of Anatomy and Dean of the Faculty of Medicine, Pharmacy and Odonto Stomatology. He is the President of Medicine, Pharmacy and Odonto Stomatology as well as the International Francophone Conference of Deans of Faculty of Medicine.

Alain Jacques N'Doye Kassim, is Professor of Urology and Head of the Department of Surgery at the Faculty of Medicine, University Cheikh Anta Diop.

University Cheikh Anta DIOP, Dakar (also known as University of Dakar) was established 24 February 1957 and officially opened in December 1959. The university is the main university in Dakar. In the Shanghai university ranking, it is ranked as the highest francophone university in Africa. The university consists of six faculties with ca. 60,000 multi-national students, from south of the Sahara, the Maghreb, the Comorians, the Middle East, Europe and Asia.

Its Faculty of Medicine, Pharmacy and Dentistry is the oldest francophone faculty of medicine south of the Sahara. It was established in 1916 as the School of Medicine and Pharmacy. The faculty has 350 teachers and ca. 7,000 students—two-thirds of whom are trained as generalists. The remaining third specialize for a PhD. There are forty nationalities. Women represent 37 per cent in the overall number, and their number is growing. A hundred and fifty students graduate each year. Teaching methods integrate face-to-face courses with distance learning, which is developing an increasing number of on-line courses.

Videoconferencing is becoming increasingly important. The mission of the Faculty is: (1) to train competent generalists, (2) to provide scholars, teachers and researchers in health, (3) to respond to the health care needs of society, (4) to support the continuing professional development of health professionals and (5) to contribute to the scientific reputation of the country.

South Africa: Jennifer Ramesar is Professor of Medicine and a Medical Virologist at the Faculty of Medicine, University of Cape Town.

The University of Cape Town was founded in 1829 and established as a university in 1918. It has ca. 28,000 students in six faculties supported by the Centre for Higher Education Development which coordinates studies In the fields of commerce, engineering and the built environment, law, health sciences, humanities and science. In the various world-ranking lists, it is the highest ranked African university. Its Faculty of Health Sciences has the oldest medical school in Southern Africa, established in 1912. Its core business is research in medical and allied fields and teaching undergraduate and postgraduate students over a wide range of health-care-related disciplines. The world's first successful heart transplant in 1967 and research leading to the development of the CAT scanner confirmed the faculty and Groote Schuur Hospital as an academic institution of international quality.

Tunisia: Ali Chedli is Professor and Dean of the Faculty of Medicine, University of Monastir.

Created in 2004, the University of Monastir includes sixteen institutions in the regions of Monastir and Mahdia. They collectively enrol ca. 26,000 students and have ca. 2,000 academic staff. Its Faculty of Medicine was established in October 1980. The current number of students is 1,558 and of professors is 271.

7.1.2. *Composition and selection of the Tuning Africa Medical Group*

Medicine was identified in the feasibility study as a priority subject throughout Africa. Information about the pilot project was circulated widely, and universities with an interest in participating were invited to apply.

Applications were reviewed by a group of experts with advice from the Association of African Universities (AAU). The group took into account the following criteria in their selection: (1) at least one university should be chosen from the five regions; (2) the "hub" represented by North Africa should be well represented; (3) the two main language groups (French and English) should be roughly equally represented (there was no suitable application from a lusophone country); (4) the medical faculties should represent a diversity of learning and teaching approaches, (5) relatively new as well as older established faculties should be represented and (6) evidence of a genuine commitment both from the university and the medical faculty was essential.

The final selection by the managing committee also had to take into account the proposals of the other four subject areas (agricultural sciences, civil engineering, mechanical engineering and teacher education) to ensure a good regional and country representation in the pilot project as a whole.

The ten universities selected for the medicine group each had strong and distinctive features, a good national and regional reputation and, for a number, a strong international profile as well. The individual members of the group are senior members of the profession and cover a diverse range of subject-specialties which has given real breadth and understanding of all aspects of medical education and practice.

7.1.3. *The subject "hub" for medicine*

The pilot project specification determined that there should be a regional subject "hub" for each of the five subject areas and that each region should host one hub. North Africa was designated as the medicine hub. The region is distinguished by a relatively large number of large medical faculties that graduate significant numbers of doctors each year. Overall the region has a higher number of trained medical graduates per capita than in Sub-Saharan Africa. Many of the North African faculties provide training courses for graduates from all over Africa. Four members of the group are from North Africa-Algeria, Egypt, Morocco and Tunisia-which has helped to reinforce the concept of the hub.

7.1.4. *The study of medicine*

Medicine is possibly one of the oldest subjects taught in contemporary universities; and although the history of medicine tends not to be a component of contemporary medical education, it is nevertheless true that modern medicine still draws on the insights and understanding of scholars from ancient times in the East as well as the West. Perhaps a testimony to the ancient roots of medicine lies in the concept of an oath associated with Hippocrates. While this has been variously interpreted throughout time and in different regions of the world, there remains a sense that a doctor has an effective commitment to core values and attitudes in the practice of the profession of medicine.

The UK Quality Assurance Agency Benchmark statement for medicine published in 2002 gives a broad definition of medicine and the objectives of medical education:

> Medicine is concerned with the maintenance and promotion of good health and the origin, diagnosis, treatment and prevention of disease and injury, and the impact of illness and disability on patients, their families and on populations. This includes understanding normal human structure and function at all stages of development, understanding the abnormalities of structure and function that occur in the common diseases, and recognising how illness affects both physical and psychological function and the patient's interaction with the environment and society.
>
> Medical education imparts the knowledge and skills required for the prevention, diagnosis and assessment of common and important diseases in a variety of settings, and patient management with respect to control, cure, rehabilitation and support, and palliative care. Students must understand how diseases affect both the individual and the overall population, and how the environment interacts with disease and impairment to produce disability and handicap. They must understand the principles of disease prevention and be able to undertake health promotion. The medical course also seeks to impart appropriate professional and personal attitudes and behaviour, including critical evaluation, curiosity and lifelong learning skills as well as the ethical and legal framework of medical practice. Courses in medicine must produce graduates able to undertake the pre-

> registration house officer year. They must also be prepared to undertake postgraduate training for their chosen careers and to participate in continuing education and professional development throughout their working lives. <http://www.qaa.ac.uk/Publications/InformationAndGuidance/Pages/Subject-benchmark-statement-Medicine.aspx> (accessed 2 January, 2014)

Medicine is now a highly regulated profession. In many countries regulation is a direct government responsibility through a ministry. In others, a legally recognised and publicly responsible professional body is the regulatory authority. There are also supra-national regulations in the field of medicine such as the EEC Council Directive 93/16/EEC of 5 April 1993 to facilitate the free movement of doctors and the mutual recognition of their diplomas, certificates and other evidence of formal qualifications and the subsequent Directive 2005/36/EC of the European Parliament and of the Council of 7 September 2005 on the recognition of professional qualifications <http://ec.europa.eu/internal_market/qualifications/policy_developments/legislation/index_en.htm> (accessed 2 January 2014).

In all cases, the professional regulator specifies the competences which a graduate in medicine must achieve in order to be licensed to practice medicine. These competences cover knowledge, understanding and clinical skills and, because of the nature of the subject, as recognised by Hippocrates, the values and attitudes which should be manifest in a qualified physician.

The ways in which learning and teaching are structured in order to enable the medical graduate to achieve these competences varies considerably. Some countries have sought to standardise curriculum in all their medical schools, but most countries allow universities and medical schools considerable freedom in how they choose to structure the curriculum and assess students, subject to effective internal and external quality assurance. This degree of autonomy has fostered the development of a variety of curriculum structures and learning and teaching methodologies.

In the past, there was a broad division between the pre-clinical two-to-three-year basic science courses (biomedical sciences) typically including anatomy, physiology, biochemistry and subsequent clinical study during which formal teaching was combined with practice-led teaching in clinical settings. More recently a more integrated learning and teaching approach to the basic biomedical sciences and clinical training has tended to become the norm.

Typically medical education for the primary qualification is six to seven years, the final year normally being a full-time internship in one hospital or more. In some programmes, the final formal qualification as a doctor requires the submission of a research project.

Following the award of the basic qualification, doctors who wish to specialise in a branch of medicine are required to undergo "specialist" training, which can last for a number of years. The minimum is normally three years, but most specialties require from four to ten or more years. The content and duration of specialist training is also regulated in much the same way as basic medical education.

7.2. Medicine in the African Context

Any consideration of the role of medicine in Africa has to be set in the wider context and understanding of health and health policy. In 1948, the World Health Organisation (WHO) defined health in simple terms: "Health is a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity" (*Preamble to the Constitution of the World Health Organization as adopted by the International Health Conference, New York, 19-22 June, 1946; signed on 22 July 1946 by the representatives of 61 States [Official Records of the World Health Organization, no. 2, p. 100] and entered into force on 7 April 1948).*

This definition has remained unchanged, but numerous commentaries and developments on the theme have since been made by the WHO and other bodies such as UNESCO. UNESCO (2010) issued a document, "Teaching and Learning for a Sustainable Future," which states: "The issues of development, environment and health are closely entwined. This reflects the complex links between the social, economic, ecological and political factors that determine standards of living and other aspects of social well-being that influence human health. A healthy population and safe environments are important pre-conditions for a sustainable future."

The Ottawa Charter of 1986 lists as one of the strategies for health: **"**Broadening the role of health services from being authoritative and individualistic to shared responsibilities and partnerships for health, and shifting from a dominant clinical and curative orientation to one that emphasises prevention with a focus on the social, political, economic and environmental components connected to health" <http://www.unesco.org/education/tlsf/mods/theme_b/mod08.html> (accessed *3 January 2014).*

The European WHO added in September 1998: "As stated in the 1998 World Health Declaration the enjoyment of health is one of the fundamental rights of every human being. Health is a pre-condition for well-being and the quality of life. It is a benchmark for measuring progress towards the reduction of poverty, the promotion of social cohesion and the elimination of discrimination. Good health is fundamental to sustainable economic growth. Inter-sectoral investment for health not only unlocks new resources for health but also has wider benefits, contributing in the long term to overall economic and social development. Investment in outcome-oriented health care improves health and identifies resources that can be released to meet the growing demands on the health sector." <http://www.euro.who.int/en/who-we-are/policy-documents/health21-health-for-all-in-the-21st-century> (accessed 3 January 2014).

The practice of medicine and the education and training of medical doctors play a key role in the realisation of all aspects of health policy and are thus of central importance and relevance to the daily life of all people in the continent. Medical practice and education throughout Africa share many common features; but at the same time, there are significant differences arising from the linguistic, historical and geographical contexts in the 55/56 states in the continent of Africa.

The World Health Organization has a regional office for Africa, and the regional committee at its meeting in November 2012 published a "Road Map for Scaling Up the Human Resources for Improved Health Service Delivery in the African Region 2012-2025" <http://www.afro.who.int/en/sixty-second-session.html> (Document AFR/RC62/7) (accessed 3 January 2014). Not all African countries are represented in the regional office for Africa, but the remaining countries are covered by the Regional Office for the East Mediterranean.

The "Road Map" identifies issues and challenges faced in the 46 countries it covers in of the African region, and states: "Of the 46 countries in the region, 36 have a critical shortage of HRH [Human

Resources for Health] with only about 0.8 physicians, nurses and midwives per thousand population; while the minimum acceptable density threshold is 2.3 per thousand population." There are significant disparities between rural and urban areas: "86% of Medical specialists and 63% of general physicians serve mainly in urban areas."

"The region has currently 134 Medical Schools . . . and trains 6,000 Medical Doctors annually." In order to reach the target of 2.3 health workers per thousand population, the Road Map estimates that an additional 600 medical and nursing schools are required.

In 2012 *The Economist* Intelligence Unit published a report: "The Future of Health Care in Africa". The report stresses the need for Africa to "reassess its health care systems to ensure that they are viable over the next decade ... while grappling with the uniquely broad range of health care, political and economic challenges. ... [T]he continent ... is confronting multiple epidemiological crises simultaneously. High levels of communicable and parasitic disease are being matched by growing rates of chronic conditions. Although the communicable diseases—malaria, tuberculosis and above all HIV/AIDs—are the best known, it is chronic conditions such as obesity and heart disease that are looming as the greater threat. These are expected to overtake communicable diseases as Africa's biggest health challenge by 2030". <www.managementthinking.eiu.com> (accessed 12 January 2014).

Both the *Economist* Intelligence Unit report and the WHO Road Map stress the need for reform while also emphasising the substantial achievements of the region in recent years in tackling grave health challenges and in striving to meet the eight Millennium Development goals:

- To eradicate extreme poverty and hunger.
- To achieve universal primary education.
- To promote gender equality and empower women.
- To reduce child mortality rates.
- To improve maternal health.
- To combat HIV/AIDS, malaria and other diseases.

- To ensure environmental sustainability.

- To develop a global partnership for development.

Health care systems and, in particular, medical education in Africa are undergoing reform and modernisation to address the specific needs of individual countries. It should be stressed that the scale of the challenges faced varies significantly among different African countries and regions, with an important distinction to be drawn between the challenges in Sub-Saharan Africa and those in North Africa.

7.2.1. *The Sub-Saharan African Medical Schools Study*

Recognising this distinction the Bill and Melinda Gates Foundation has funded a Sub-Saharan African Medical Schools Study (SAMSS). "The goal of SAMSS is to increase the level of practical knowledge about medical education in Sub-Saharan Africa in order to inform educators, policy makers and international donors about the challenges and opportunities for increasing the capacity of African medical Schools and the retention of their graduates" <http://samss.org/> (accessed 2 January 2014).

The Sub-Saharan African Medical Schools Study: Data, Observation and Opportunity, undertook an in-depth study of ten medical schools in different African regions and also made a wider survey of African medical schools. It points out that "Africa suffers 24% of the world's total burden of disease but has only 3% of the world's health workforce". It continues: "Sub-Saharan Africa has an estimated 145,000 physicians to serve a population of 820,000,000. As a whole SSA has a physician to population ratio of 18:100,000 as compared to other countries such as India (60:100,000), Brazil (170:100,000) and the United States (270:100,000). Africa's poorest countries face even greater physician workforce shortages".

The SAMSS identifies fourteen key results which are relevant throughout Africa:

- Many countries are prioritizing the scale-up of medical education as part of overall health-sector strengthening.

- Physician “brain drain” is a special problem for medical education.
- Accreditation and quality measurement are important developments for standardizing medical education and physician capabilities challenges.
- The status of the country’s health system affects medical education and physician retention.
- Coordination among ministries of education and ministries of health improves medical schools’ ability to increase health workforce capacity.
- Shortages of medical school faculty are endemic and problematic.
- Problems with infrastructure for medical education are ubiquitous and limiting.
- Variability in secondary school quality creates challenges in medical school admissions.
- Educational planning that focuses on national health needs is improving the ability of medical graduates to meet those needs.
- International partnerships are an important asset for many medical schools.
- Impressive curricular innovations are occurring in many schools.
- Beyond the creation of new knowledge, research is an important instrument for medical school faculty development, retention and infrastructure strengthening.
- Private medical schools hold promise for adding to physician capacity development.
- Post-graduate medical education is an important element of a national health system development strategy.

7.2.2. *Areas of curricular innovation*

The SAMSS report identifies the following areas of helpful innovation:

"Community-based Education (CBE) and service oriented learning ... including elements ... such as 'family attachment' in which students follow a patient as part of a family for two or three years, visits to rural homes and health centres where students engage in patient counselling, community and home needs assessment and consultations with schools, local school teachers and small group discussions of community and public health topics. ... These innovations address regional needs by teaching problem-solving skills for work in any setting and by taking learning to communities where health needs are greatest. Other advances include the teaching of family medicine and public health and plans for the use of tele-health and distance learning when bandwidth problems can be solved."

Problem-based learning is "often incorporated with CBE and rural or service-based learning".

The use of ICT in medical education is identified as potentially revolutionary in medical education in many countries, particularly the use of web-based course tools (Web CT).

A key problem area identified by the SAMSS report is the retention of physicians, not only in terms of migration but also in what is described as "internal drain and rural distribution", partly as the result of the incidence of HIV/AIDs among healthcare workers and an unwillingness to work in remote rural areas.

It should be evident from this brief review that the challenges and need for the development, and continuing review of the curriculum and methods of learning and teaching in Faculties of Medicine throughout Africa are of paramount importance.

Informing and overarching the initiatives for reform and development in medical education is the commitment of the African Union Commission to the Harmonisation Strategy for Higher Education, which is designed to promote more transparency of qualifications and their compatibility in order to improve continent-wide recognition and support intra Africa mobility.

7.3. The Tuning Approach to Medical Education in Africa

The Tuning Approach seeks to support the Harmonisation Strategy for Higher Education in Africa. The Medicine Subject Group in its work has been informed by the Harmonisation Strategy for African Higher Education, the Tuning approach and the general and specific contexts for medical education in the different countries and regions of Africa as well as international developments in medical education.

7.3.1. *Meetings and working methods*

The Medicine Group met on four occasions: (1) in Yaoundé, Cameroon, in January 2012; (2) in Cape Town, South Africa, in May 2012, (3) in Brussels, Belgium, in November 2012, and (4) in Nairobi, Kenya, in January 2013.

Between these meeting, members of the group worked on aspects of the report with colleagues in their own and other universities in their country, and also with students, graduates and employers. Drafts of reports were circulated to all members of the group for comment and amendment and were subsequently discussed and agreed upon in the meetings. The meetings were characterised by the open and positive participation of all the members, a shared sense of a common purpose and an inspiring commitment to provide the best possible medical education experience for the benefit of students and the community in which they live and work.

During the first two meetings and in the final meeting the group benefitted from the plenary meetings and presentations from and discussion with the other four pilot subject groups.

In Brussels a meeting with colleagues from Latin America and international experts from the University of Edinburgh, Scotland, provided further insights and topics for discussion.

The membership of the group was fairly constant but, inevitably, because of the nature of the subject area and the fact that members are practicing medical specialists with senior teaching and management responsibilities, there was some variation in/substitution of members, which is reflected in the list of members.

7.4. Generic and Specific Competences for Medicine

In the first meeting in Yaoundé, the group agreed on the first draft of the Generic Competences and the Subject-Specific Competences for Graduates in Medicine in Africa.

In preparing this draft, the group wishes to acknowledge that its participants drew heavily on the structure, headings and outcomes defined in the Tuning Project (Medicine)—Learning Outcomes/Competences for Undergraduate Medical Education in Europe prepared by A.D. Cumming and M.T. Ross (2008) at The University of Edinburgh. <www.tuning-medicine.com> (accessed 5 January 2014).

The group also wishes to acknowledge the competences drawn up by the Tuning Latin America Medicine Subject Area Group and the UK General Medical Council publication *Tomorrow's Doctors,* both of which significantly informed their discussion. <http://www.gmcuk.org/education/undergraduate/tomorrows_doctors.asp> (accessed 5 January 2014).

Although these three publications informed and helped the group, the members stress that, in their review of outcomes, they sought to focus on outcomes of particular relevance for medical graduates in Africa derived from their own experience and knowledge of the teaching and practice of medicine in Africa.

7.4.1. *Generic competences*

In seeking to determine what generic competences should be expected from a graduate in medicine in Africa, the group adopted two approaches. Each member briefly outlined the organisation and objectives of medical education in his/her faculty and identified particular distinctive national and/or regional factors. There was a useful and provocative discussion on whether the study of medicine should be viewed simply in terms of international criteria or whether there are challenges and needs in Africa which should be reflected in the curriculum and which would therefore give an African identity to medical education in the continent.

The broad consensus expressed in the group is that, inevitably, there is and must be an active recognition and reflection of the international nature of the subject in the knowledge, understanding and ability of African medical graduates but that simultaneously there are imperative African requirements and values which should permeate the medical curriculum in African faculties of medicine.

Following the valuable tour de table and debate, the group concluded that common understandings had been developed which facilitated an open "brain-storming" session to identify generic competences for an African graduate. This exercise provided a long list, which was then examined in detail.

An area of debate arose about whether some of the competences might also be reflected in the subject-specific competences but it was agreed that this was not a reason to exclude them from the generic list. A final list of fifteen competences resulted, all of which are relevant to the medical graduate but which also have wider applicability. The fifteen competences are:

1. Understanding of and ability to apply ethical principles.
2. Ability for conceptual thinking, analysis and synthesis.
3. Practical, cost-effective problem-solving and objective decision-making.
4. Flexibility and adaptability.
5. Capacity for continuous learning.
6. Leadership, management and teamwork skills.
7. Interpersonal and communication skills.
8. Capacity to use appropriate and innovative technologies.
9. Sensitivity to diversity.
10. Sensitivity to safety and the environment.
11. Effective communication in the official/national and relevant local languages.

12. Ability and initiative to apply knowledge in practice.

13. Ability to evaluate, review and enhance quality.

14. Sensitivity to social responsibility.

15. Recognition of personal limitations.

Representatives of the five subject groups met to compare and discuss their lists of generic competences and agreed on the list of eighteen generic competences that is published in Chapter 3. Fourteen of the medicine group competences are accommodated in the overall list. The fifteenth—"Sensitivity to social responsibility" is effectively expressed in competences 2, 13 and 18 in the list of generic competences.

The medicine group did not include three of the competences in the general list: (1) Ability for creative and innovative thinking, (2) Ability to work independently and (3) Self-confidence, entrepreneurial spirit and skills. However, the group agreed that they are highly appropriate for a graduate in medicine.

7.4.2. *Subject-specific competences*

The group identified fourteen core subject-specific competences and, within each of these, a subset of the related key competences and skills essential for a graduate in medicine.

In its discussion, the group was conscious of the need to acknowledge and recognise international standards, while at the same time emphasising and identifying core African values and requirements. The competences are set out below.

Graduates in medicine in Africa will have the specific competence to:

1. Carry out a consultation with a patient:

   - Take a patient's history.

   - Carry out a full physical clinical and symptomatic examination of adults (male and female) and children, including the ability to listen to and interpret heart beats, palpate the abdomen, undertake rectal and vaginal examinations and undertake ear, nose and throat examinations.

- Make clinical judgements and decisions.
- Assess communicable diseases.
- Provide explanation and advice.
- Provide reassurance and support.
- Assess the patient's mental state.

2. Assess clinical presentations, order investigations, make differential diagnoses and negotiate a management plan:

- Order appropriate investigations and interpret the results.
- Make differential diagnoses.
- Consider endemic and communicable disease.
- Negotiate an appropriate, practical and therapeutic management plan with patients and families.
- Provide care of the terminally ill and their families.
- Manage chronic illness.
- Identify vulnerable children and adults.

3. Provide immediate care of medical emergencies, including first aid and resuscitation:

- Recognise, assess and as appropriate refer acute medical emergencies.
- Treat acute medical emergencies.
- Provide basic first aid.

- Provide basic and advanced life support according to current standard guidelines.

- Provide trauma care according to current standard guidelines.

- Perform appropriate emergency surgical and obstetric procedures.

4. Prescribe drugs clearly and accurately, explain potential benefits and risks:

   - Prescribe clearly and accurately.

   - Match appropriate drugs and other therapies to the clinical context.

   - Review the appropriateness of drug and other therapies.

   - Evaluate and explain potential benefits and risks.

   - In prescribing, take careful account of the socio-economic context of the patient.

   - Manage pain and distress.

   - Understand, consider and explain drug-drug/food interaction.

5. Carry out practical procedures:

   - Measure blood pressure.

   - Venepuncture and veins cannulation.

   - Administer IV therapy and use infusion devices.

   - Subcutaneous and intramuscular injection.

   - Perform a lumbar puncture move and handle patients.

   - Bladder catheterisation.

   - Bougienage.

- Otoscopy.
- Fundoscopy.
- Foreign body removal.
- Carry out non- or minimally invasive ENT procedures.
- Reduction of fractures/dislocation.
- Application of plaster of paris.
- Surgical suturing.
- Exchange and normal blood transfusion.
- Administer oxygen.
- Electrocardiography.
- Basic respiratory function tests.
- Urinalysis.
- Manage a normal delivery (birth).

6. Communicate effectively and sensitively in a medical context:
    - With patients and colleagues.
    - With empathy in sharing bad news with families.
    - With people who are physically and/or mentally challenged.
    - In seeking informed consent.
    - In writing (including medical records) and in non-verbal communication.
    - In dealing with aggression.
    - By telephone.

- With those who require an interpreter.
- With authorities.

7. Apply ethical and legal principles in medical practice:

   - Maintain confidentiality.
   - Apply ethical principles and analysis to clinical care.
   - Obtain and record informed consent.
   - Certify death.
   - Request autopsy.
   - Apply national law to clinical care.
   - Where appropriate refer a patient for specialist care.

8. Assess the psychological and social aspects of a patient's illness:

   - Assess psychological and social factors in the presentation and impact of illness.
   - Detect stress in relation to illness.
   - Detect substance abuse, dependency.

9. Apply the principles, skills and knowledge of evidence-based medicine:

   - Apply evidence to practice.
   - Define and carry out an appropriate literature search.
   - Critically appraise published medical literature.

10. Use information and information technology effectively in a medical context:

    - Be committed to the effective use of up-to-date, relevant and effective technology.

- Keep accurate, complete and detailed clinical records.
- Be able to access information sources.
- Be able to store and retrieve relevant data.

11. Engage with population in the promotion of health and health education:

    - Recognise the health needs of the community.
    - Engage in health education and promotion for the individual and the community.
    - Provide patient care which minimises the risk of harm.
    - Apply measures to prevent the spread of infection.
    - Recognise own health needs so as not to interfere with professional responsibilities.
    - Conform with professional regulation and certification to practise.
    - Receive and provide professional appraisal.
    - Make informed career choices.

12. Demonstrate professional attributes:

    - Interpersonal skills.
    - Probity.
    - Honesty.
    - Ethical commitment.
    - Commitment to maintain good practice and quality.
    - Critical and self-critical abilities, reflective practice.

- Empathy.
- Creativity.
- Initiative.

13. Work effectively as a professional:

    - Ability to recognise limits and ask for help.
    - Flexibility and capacity to deal with uncertainty and adapt to new situations.
    - Ability to lead.
    - Ability to work autonomously.
    - Ability to solve problems.
    - Ability to make decisions.
    - Ability to work in a multi-disciplinary team and communicate with experts in other disciplines.
    - Capacity for management, organisation and planning (including time management).
    - Recognise the need to take action if a colleague's health, performance or conduct is putting patients at risk.

14. Demonstrate expert qualities:

    - Capacity for analysis and synthesis.
    - Capacity to learn (including lifelong self-directed learning).
    - Capacity for applying knowledge in practice.
    - Ability to teach others.
    - Research skills.

7.5. Consultation Process

Following the tried and tested practice of previous Tuning projects in other regions of the world, the Medicine Subject Group carried out an extensive consultation process by means of questionnaires widely circulated among participant universities, employers, students and graduates.

The questionnaires included a single list of the generic competences, which was compiled on the basis of the generic competences (see 7.4.1) proposed by each of the five subject groups in the project. The majority of these reflected those agreed upon by the Medicine Group and the group accepted that the wording and additional competences were relevant to a graduate in medicine in Africa.

However, in publishing its report, the medicine group is anxious that its original list of generic and detailed subject-specific competences should be included so that the fourteen overarching subject-specific competences (see 7.4.2) with their associated key competences and skills can be fully understood and appreciated and at the same time set in the context of the generic competences for graduates in medicine in Africa which were agreed by the group.

7.5.1. *Outcomes of the consultation*

Each member of the group was responsible for the circulation of the questionnaires to academic colleagues within the university and in other (usually) neighbouring universities. Students and graduates were mainly within the university participating in the project. Group members invited a range of employers to complete the questionnaire. They included heads of hospitals, heads of hospital clinical departments, heads of primary care centres and senior colleagues in ministries of health.

At its meeting in Cape Town in May 2012, the group was pleased to have the detailed results of the consultation process and considered that the size and range of the survey gave validity to the results. For the number of responses, see Tables 7.1 and 7.2.

Table 7.1
Generic Competences Questionnaire—Number of Responses

Subject area	Academics	Employers	Students	Graduates	Total
Medicine	164	88	203	150	605

Table 7.2
Subject-Specific Competences Questionnaire—Number of Responses

Subject area	Academics	Employers	Students	Graduates	Total
Medicine	130	83	184	145	542

7.5.2. *Generic competences: Review of consultation*

Reviewing the results of the consultation on generic competences, it was evident that, although the rankings of the different groups of respondents—academics, employers, students and graduates—might vary, they all agreed in ranking four of the competences in their top five. They were:

- Ability for conceptual thinking, analysis and synthesis.
- Professionalism, ethical values and commitments to Ubuntu (respect for the well-being and dignity of fellow human beings).
- Ability to translate knowledge into practice.
- Objective decision-making and practical, cost-effective problem solving.

As their fifth choice (not necessarily ranked fifth), academics included the ability to learn to learn and capacity for lifelong learning.

Employers included leadership, management and teamwork skills.

Students included capacity to use innovative and appropriate technologies.

Graduates included flexibility, adaptability and the ability to anticipate and respond to new situations.

A disturbing feature of the replies is the marked difference in the scores assigned to "importance" and those assigned to "achievement," achievement scores being consistently and significantly lower for all groups and in relation to each competence.

7.5.3. *Subject-specific competences: Review of consultation*

There was slightly less consensus in the choice and ranking of the subject-specific competences, although all four groups ranked three competences in their top five: (1) Take a patient's history, (2) Assess clinical presentations; order investigations; make differential diagnoses and negotiate a management plan and (3) Carry out a full physical, clinical and symptomatic examination of adults (male and female) and children.

It should be noted that, in relation to #1 (taking a patient's history), the group's view is that it would be appropriate to interpret the questionnaire's results as endorsing the overarching competence "Carry out a consultation with a patient". In relation to #3 (clinical examination), the group perceived this competence as an aspect of #1, "Carry out a consultation with a patient".

The faculty, students and employers (but not the graduates) also included: "Use information, information technology and up-to-date relevant and effective technology effectively in a medical context". However, it should be noted that, in responding to the generic competences, graduates included this competence in their top-five ranking.

Academic and students included: "Recognise the health needs of the community and engage with the community in the promotion of health and health education." The medical group in their original document expressed this particular competence under the overarching competence (# 11) of "Engage with the population in the promotion of health and health education."

Two groups (employers and graduates) included: "Apply the principal skills and knowledge of evidence-based medicine".

Only one group, graduates, included: "Provide immediate care of medical emergencies including first aid and resuscitation."

Having analysed the ranking of the five top competences, the group reviewed the consultation outcomes of the evaluation of the importance of each of the competences and was pleased to note that all competences were ranked as having high importance. No competence obtained an average score lower than 3.51 and the majority averaged 3.7. (For the generic competences, the lowest score was an average of 3.35).

However, as the ratings show, respondents perceived a serious gap between the rating of the competence's importance and its level of achievement.

While academics tended to be more generous in their assessment than employers, students and graduates, the results from all four groups recorded a much lower score for achievement in relation to perceived importance.

This gap presents a serious learning, teaching, assessment and curriculum challenge which medical schools will need to take into account.

The group felt that the process of consultation had been most valuable and had helped to highlight areas on which the group should focus in its further consideration of the competences that should be expected from a graduate in medicine in Africa. However, it also recognised the inevitable limitations in a process which asks for a *ranking* of competences on a scale of 1-5. The medical group for Tuning Africa wishes to stress that the ranking needs constantly to be set against the contrasting high *rating* of the importance of each of the fourteen competences that they identified (on the scale 1-4). The high score given to the importance of each of the competences is considered to be an effective validation of the competences.

The group also wishes to stress that medicine is, at one and the same time, an academic and a strongly vocational subject. It is a subject area, which is multi-disciplinary and interdisciplinary. It requires knowledge and understanding not only of basic bio-medical sciences, social sciences and humanities (e.g., philosophy, ethics, language) but an ability to combine and integrate these, together with effective technical skills.

In this context, all four groups of stakeholders (academics, employers, students and graduates) need to be aware of the perspectives, needs and objectives of each of the other groups. Thus, when employers give a low rating to achievement in a particular competence, academics need to respond appropriately, since, together with recent graduates, employers are probably in the best position to assess the actual level of achievement as well as the importance of the competence for the effective practice of medicine.

At the same time, academics need to initiate a more open dialogue with each of the groups. For example, the consultation seems to suggest that employers do not rate creativity highly, but it could be argued that creativity is not only an important life or generic skill but, for a graduate in medicine in Africa, could be of critical importance.

It is also a matter of concern that while graduates attach considerable *importance* to the competence "Provide immediate care of medical emergencies, including first aid and resuscitation" (average score 3.83) they rate their *achievement* in this competence as only "satisfactory".

7.6. Defining the Profile of a Medical Graduate in Africa

Following the review of the consultation outcomes, the group focused on developing and defining the profile of a medical graduate in Africa.

A key point of consensus is that, while the detailed curriculum in medicine should and will vary from institution to institution, and between regions and countries, the competences that are required of a graduate in medicine at the end of the basic education and training are effectively universal. Consequently, although ranking is a useful indicator of priorities, in effect, all graduates in medicine must be expected to have achieved an effective competence in each of the core areas of the subject.

At the same time, medicine is a highly dynamic subject with its curriculum constantly requiring review, updating and revision to cope with contemporary social, economic and scientific needs and in response to changing political perspectives.

In reviewing the outcomes of the consultation and in drawing on their own experience, members of the group explored the potential architecture for a profile of a medical graduate in Africa.

A brainstorming session identified “clusters” of skills and competences. Following intensive transnational and trans-language working groups (i.e., mixing francophone and anglophone), a consensus was reached. Using the clusters, the group established the concept of “pillars” which are essential to establish and support the “architecture” of a graduate in general medicine. It identified seven pillars that provide the basis for the meta-profile of a medical graduate in Africa. These are:

- Clinical expertise and knowledge.
- A focus on community and environmental health.
- Professionalism.
- Effective and sensitive communication.
- Teamwork-leadership-management.
- Engagement in a “learning journey” or continuing professional development.
- Adaptability to ICT and new technology.

The group wishes to highlight specific African features of these seven pillars. Hence “a focus on a community and environmental health” is considered to be particularly relevant for African graduates who will find themselves working in challenging urban and rural contexts which will demand that they focus on the particular and specific needs of that community.

Similarly, “effective and sensitive communication” has particular resonance in Africa. It recognises not only language and educational differences but also social, economic and cultural factors. Communication in many African countries can present challenges because of the number and variety of languages that are spoken. This means that the medical practitioner has to be particularly thoughtful about the way in which information is conveyed and understood.

“Adaptability to ICT and new technology” involves not simply the need to be competent in ICT and new technology but also to recognise the

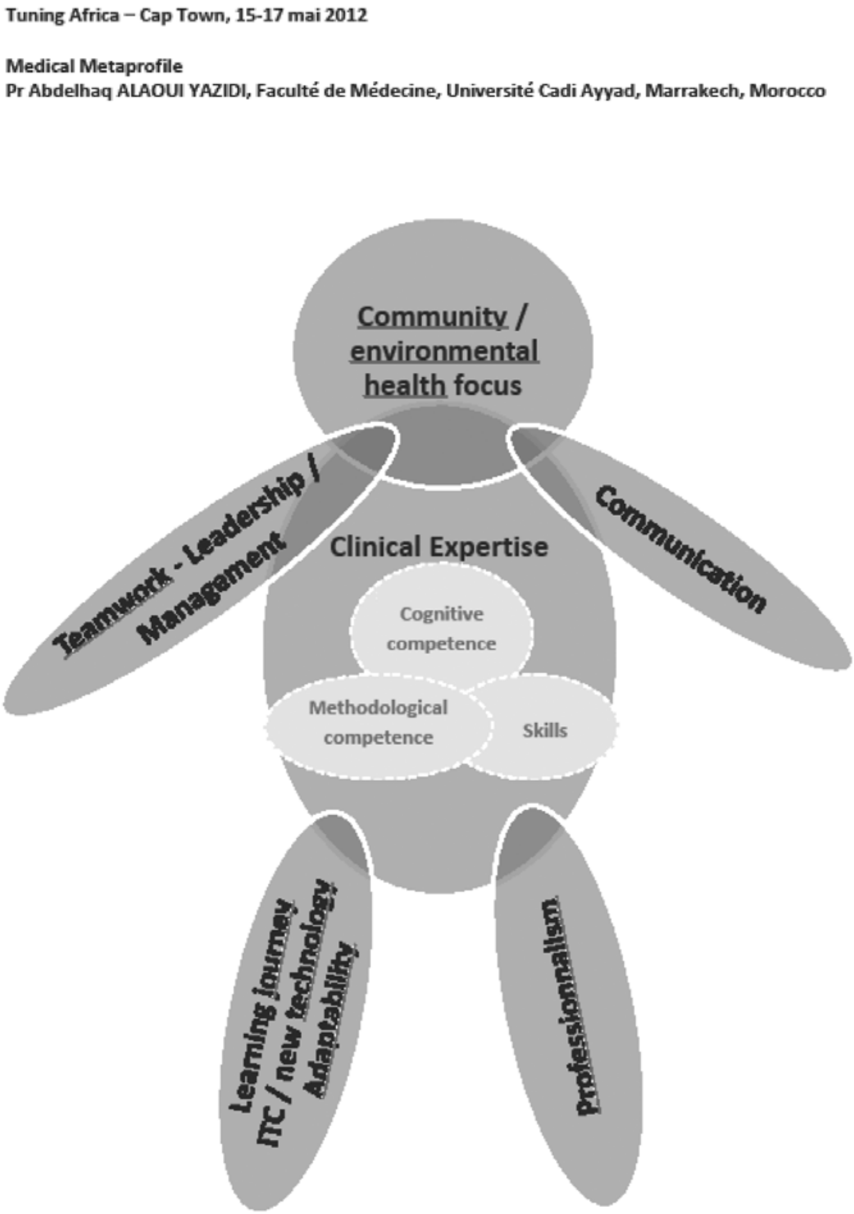


Figure 7.1
Meta-profile of the medical practitioner in Africa

variety of practical challenges, in the use, access, availability of ICT and new technology, that can arise in rural and urban contexts in Africa.

While the concept of "pillars" provides a valuable starting point for establishing the profile of a graduate in medicine in Africa, participants in the Tuning Africa medical group felt that it did not reflect either the complexity or the integrated nature of the requirements that a medical graduate should be expected to possess, namely, a combination of academic knowledge and understanding with strong technical competences.

All the skills and competences are essential and interdependent. Consequently the group sought to represent this complex relationship in an integrated way with clinical expertise and knowledge at the core (see Figure 7.1).

7.7. The Meta-Profile of the Medical Practitioner in Africa

The meta-profile produced by the deliberations of the Tuning Africa Medical Group reflects the elements that should be manifest in a graduate in medicine in Africa. He/she should always respond to the needs of the community, be open and sensitive in interpreting and communicating, be able to work as a member of a team, remain committed to a life-long learning journey and professional development and manifest all the attributes of professionalism.

7.7.1. *Validation and review of the meta-profile*

Members of the group conducted a review and evaluation of the elements of the meta-profile in their own institution. The methods chosen for the reviews varied but all of them involved consultation with senior colleagues, students, stakeholders and, in a number of cases, reports to relevant national bodies and a comparison with the existing curriculum in order to identify coincidences and differences. In each case, this consultation produced a broad consensus on the profile and the competences. The next stage was to examine the extent to which the existing curriculum addressed the profile and the competences and to identify gaps or areas in which achievement was not satisfactory.

In the third meeting in Brussels in November 2012 and again in the meeting in January 2013 in Nairobi, the medical working group presented and discussed the reports from the validation reviews.

7.7.2. *Reports from individual countries*

In Nigeria final-year students at the end of their programme were given exit questionnaires listing the meta-profile competences and the generic and subject-specific competences. They were asked (anonymously) to evaluate each competence according to both its importance and its achievement on a scale of 1 to 5. The process will be repeated for the next cohort of graduates. The validation and the exit questionnaires have revealed areas that will be addressed by the Curriculum Planning Committee. At the same time, the Deputy Vice-Chancellor is planning to introduce the Tuning approach to subjects outside the medical faculty.

A full report on the Tuning approach and the outcomes (the meta-profile, the generic and subject-specific competences) has been given to other medical schools in Nigeria and to colleagues in an international consortium in which the university is involved. A further meeting of the five medical faculties in Nigeria involved in the Medical Education Partnership Initiative will provide an opportunity for discussing the outcomes of the pilot project.

A Nigerian Tuning Group has been established involving colleagues from the other African Tuning Subject Groups in Nigeria. A report will be made to the National Universities Commission.

The executive secretary of the National Quality and Accreditation Board has sent the curricula for fourteen other subjects to the Tuning Group to evaluate the extent to which they conform with the Tuning Approach.

In Egypt a similar process has been followed. The review of the meta-profile, generic competences and subject-specific competences enabled the medical faculty to identify gaps in the curriculum. A working group has been established to address areas of concern. The National Agency for Quality Assurance and Accreditation will be a key partner in the validation and dissemination of the Tuning Approach. It is also proposed that the outputs of the study should be presented to the

Higher Education Council and subsequently to the other medical schools in the country.

In Morocco the old meta-profile is based essentially on clinical expertise. The project of curriculum medical reform, in the course of elaboration, has identified a new training profile for the general practitioner based on three fields of activity: (1) clinical approach, (2) communication with patients, (3) management of a centre of care and a doctor's practice and associated with these six skills "pillars":

- Management of primary health care and first aid.
- Specific capacity in the resolution of problems.
- A global approach coordinated, integrated and centred on the patient and strengthened by a permanent continuing medical education.
- Orientation towards the family and community context.
- Capacity for long-term follow-up (providing continuous and longitudinal care).
- Capacity in the coordination of the care.

The comparison between the Tuning meta-profile and the current approach being used in Morocco noted that the skills of communication, professionalism and teamwork are considered to be insufficiently developed. The report will be presented to the National Commission for the Reform of Medical Studies which is expected to take appropriate measures to meet expectations in training future general practitioners and to address the areas of concern which have been identified.

In Senegal the situation is more complicated. There are four faculties of medicine in Senegal, one of which is the faculty involved in the Tuning project. Three of the faculties have only recently been established; however, all four faculties are implementing a reform agenda that mirrors the Bologna Process and provides three degree cycles (licence/master's/doctorate). It is probable that validation of the Tuning outcomes and profiles will be integrated in the implementation of the new reforms.

In South Africa at the University of Cape Town, the curriculum is already competence-based and has undergone radical reform in recent years. The Faculty of Medicine is in a transitional period. The term of office of the current dean is coming to an end, with a potential interregnum before a new dean takes up the post. Nevertheless, the meta-profile and the generic and subject-specific competences have gone through a process of validation. This validation process identified areas of concern referred to elsewhere in the report. In particular colleagues recognised that “professionalism” represents a crucial characteristic of the medical graduate. The curriculum seeks to address this characteristic, but developing appropriate and effective methods and criteria of assessment have proved challenging. Reports have made to the acting dean of the faculty. It is anticipated that a report of the Tuning outcomes will be made at the regular meeting of the deans of medical faculties in South Africa.

In Tunisia there are two projects to which the Tuning outcomes can contribute and which will, in turn, have impact on the implementation of the Tuning Approach. The World Bank is funding a major project for Quality Improvement in Higher Education in Tunisia. The implementation of the Tuning approach is highly relevant to this project and will be validated through the project.

The Faculty of Medicine in Tunisia moved to a competence-based curriculum in 2011. It is a Centre of Excellence in Medical Education with a partner in the USA—Northwestern University. At an annual forum of all staff in the medical faculty, the Tuning project outcomes will be presented. The faculty has a strong focus on “social accountability” and how this value should be reflected in the medical curriculum. The validation of the meta-profile and the generic and subject-specific competences for medicine will contribute to strengthening this approach. The faculty is to undergo international validation and assessment in 2013 in the near future and will report to the international team on how it is addressing the Tuning outcomes.

The four medical faculties in Tunisia work closely together and the deans meet each month. The project will be further disseminated through the Maghreb Council of Medical Education.

In Algeria, University of Algiers I, a detailed evaluation of the meta-profile and the generic and subject competences has taken place. This evaluation involved academic colleagues, students and employers. It is considered that the profile provides a good reference document for Algeria. The detailed content of medical curriculum in Algeria has not been reformed although all universities are implementing the three-cycle system of awarding degrees. There is a major European Union project on Quality Assurance and Enhancement in Higher Education in Algeria, and the outcomes of the Tuning project will contribute to this project.

The Republic of Congo has one Faculty of Medicine in Brazzaville. This is a small faculty with an entry cohort of ca. sixty students and a graduating class of ca. thirty-eight. There are ca. sixty academic staff members. In 2012 a new curriculum was introduced. Because it is a new curriculum and a small medical school, it is possible to introduce the Tuning Approach and a meeting has already been held with colleagues to this effect.

In one of the countries where medical education has been harmonised, it seems that elements of the meta-profile, as well as the subject-specific competences, may not be covered effectively by the harmonised curriculum. This condition might result partly because the curriculum is in a stage of transition. It is attempting to develop a more holistic approach to the patient, working from a prescriptive to a competence-based approach, which is challenging for the academic staff as well as for the students.

Another area of concern expressed in one review relates to weakness in the ability to use information and information and communication technology effectively.

7.7.3. *Consideration of basic bio-medical sciences*

The explicit need for basic understanding of the normal structure and function of the body, which relates to the discussion of basic bio-medical sciences referred to elsewhere in this chapter, proved to be a subject of disagreement. One of the validation reports stated that those reviewing the meta-profile considered that the absence of an explicit reference to bio-medical sciences was a significant omission from the profile of a medical graduate. The disagreement centres on whether competence in this field should be explicit or assumed as an integral element of the meta-profile and in the subject-specific competences that have been identified.

This topic arose both in the subject group meetings and in the meeting with colleagues from Latin America and the UK. In essence there was no fundamental disagreement between the two schools of thought about the essential importance of bio-medical sciences in medical education. One view was that the bio-medical sciences were effectively integrated in the specific competences and that they therefore informed learning and teaching at all stages. The other school considered that there should be an explicit recognition of bio-medical sciences within the subject-specific competences. At the end of the discussion, it was resolved to leave the competences as previously agreed upon.

Although basic bio-medical sciences are perceived to be vital in developing the core competences of a medical graduate, there is great difficulty in doing so in some countries because of a lack of staff with suitably high-level qualifications to teach these subjects.

7.7.4. *Areas of consensus and concern*

As might be expected, the degree of consensus was high. Colleagues in different institutions are able to identify with all the features of the meta-profile, i.e., that they represent characteristics which should be expected from a medical graduate in Africa.

The validation reviews each endorsed the meta-profile and demonstrated its value. It has enabled the institutions to confirm that they are addressing core aspects of medical education and to identify gaps or areas of weakness in the curriculum or in the assessment of core competences.

The interest in the meta-profile and the subject-specific competences emanating from the reviews suggests that, in each of the countries concerned, a more concerted effort should be made to pursue the Tuning methodology.

On the other hand, while colleagues were able to identify ways in which the features of the meta-profile and the generic and subject-specific competences are addressed in their curriculum, the validation process highlighted areas for concern. Gaps were identified. A concern frequently expressed was that a competence, recognised as essential, was either not assessed or not adequately assessed. This finding confirms the more detailed replies to the survey questionnaires, in which achievement is consistently rated lower than the importance attached to it.

Three shared areas of concern are: (1) Teamwork-leadership-management, (2) Effective and sensitive communication, and (3) Professionalism.

Management as a core competence was the first area of concern. The reviews highlighted management as a serious area of curriculum and assessment weakness, which needs to be addressed. There was unanimity about the importance of this core competence stemming from the emphasis on primary medical care and from the fact that many graduates in Africa are expected, on graduation, to manage a health centre in a rural environment. This area of concern was considered to be effectively represented in both the generic and subject-specific competences as revised following the discussion. This skill was #6 on the list of generic competences ("Leadership, management and teamwork skills") and #13 on the list of subject-specific competence ("Work effectively as a professional-Capacity for management, organisation and planning, including time management").

The second area of concern, "Specific language competences in communication," can pose a serious challenge in most African countries because of the multiplicity of languages and the need to translate key medical terms into the mother tongue. It was suggested that the formulation of the competence "Communicate effectively and sensitively in a medical context" should refer explicitly to the need to be able to communicate in the mother-tongue of the patient.

While, sympathetic to this view, the colleagues recognised the practical challenges for countries where there are multiple official languages and/or multiple languages spoken by large segments of the community. This situation makes it difficult either to acquire or to require fluency in the relevant language in communication with the patient. Nevertheless, the ability "to communicate effectively and sensitively in a medical context" is perceived as a core competence which needs to be addressed and assessed in the formation of a medical graduate.

Table 7.3
Implementing Competences for Graduates in Medicine in Africa

Implementing a Competence	Methodology (May Include Some or All of Methods Listed)	Location of Teaching and Learning	Student Workload to Achieve the Learning Outcomes	Forms of Assessment	Points in the Programme, e.g., Year or Semester	Credits	Level
1. Communicate effectively and sensitively in a medical context	Formal lectures Seminars Role playing Simulation Group work Reading textbooks and articles Observation Clinical work Video Blended/mixed mode	Faculty Library Private space Hospital or other clinical setting Laboratory including computer laboratory	Need to take detailed account of all aspects of student work	Oral examination Written examination Group project work Portfolios OSCE Peer evaluation Group simulation and role playing	Teaching and learning of core competences may be expected to continue throughout the curriculum in each year of study but should be explicitly recognised	These will be determined by the workload and associated learning outcomes	This will require the development of level descriptors to clarify what is expected as a student progresses from year 1 to the final year of the programme
2. Demonstrate professional attributes							
3. Work effectively as a professional							
4. Demonstrate expert qualities							
5. Use information and information technology effectively in a medical context							
6. Teamwork-leadership-management							

The third area of concern, “Professionalism”, is manifest in a range of attributes, which are expressed under three subject-specific competences: #12 Demonstrate professional attributes, #13 Work effectively as a professional and #14 Demonstrate expert qualities.

All of the validation reports endorsed the importance of the overarching quality of “Professionalism” and the subject-specific competences that seek to define the associated skills. However, they recognised that the way in which this characteristic is addressed in the curriculum and assessed requires more reflection and work.

The group developed the draft template in Table 7.3 to help in the development of the curriculum and to address, in the first instance, those competences in which the validation exercise revealed gaps or weakness. An example of how the template might be used is given for the first of these competences.

7.7.5. *Further validation and dissemination*

- The Tuning Group-Medicine considers that the further validation and dissemination of the pilot project outcomes should involve:

- Implementation of the Nigerian exit questionnaire in all ten institutions in the Medicine Subject Group. The same questionnaire will be used in all ten participating Faculties of Medicine. Each faculty will collate the results and share them with the group.

- Presentation and discussion of the Tuning outcomes at meetings of deans of medical faculties.

- Meetings and presentations at Ministries of Health and other regulatory bodies.

- Meetings with National Higher Education Councils.

- Countries engaged in the early stage of curriculum reform should integrate the Tuning Approach in their curriculum planning and development.

- Presentations at meetings of a wide-range of bodies including inter alia: the Maghreb Council on Medical Education; Student Councils (medical); African Health Sciences Congress; African Academic Conferences; Arab Medical Associations and East African Inter-Universities Council.

The group also intends to inform the following organisations about its Tuning work:

- The African Students Union.
- WHO Africa Office.
- WHO East Mediterranean Office.
- SAMSS Project.
- CAMES.
- SADC.
- Regional Economic Councils.

The Tuning website should embrace the Harmonisation with Tuning African Pilot Project.

Articles should be prepared for the Tuning journal and medical educational journals. Posters on the Tuning approach should be prepared for conferences.

The medical working group considers that social media are powerful change engines and that more consideration should be given to how student groups, Facebook, Twitter and blogs might be utilised to disseminate and validate the Tuning Approach and that serious consideration should be given to the development of a Tuning App. Student engagement in the dissemination process will be a key factor for success.

7.7.6. *Meeting with colleagues from Latin America and the UK*

The medicine subject group in Latin America had used the Tuning approach to identify competences in medicine for Latin America. In its first iteration, it defined sixty-three competences which were subsequently reduced to eight core competences.

Following the success of the first stage of the Latin American project, it became apparent that an essential building block for developing the new curriculum was a common credit system based on workload and learning outcomes.

A key difference identified between the Latin American profile and competences was the absence of an explicit reference in the Latin American version to "Professionalism".

In discussion, colleagues from the UK suggested that it would be valuable to seek to develop a convergence and agreement on top-level reference points, an important step that would probably require an agreement on common terminology.

Commenting on the competences specified by African colleagues, the two experts from the UK felt that it would be appropriate to include a specific reference to basic bio-medical sciences and to research (both applied research and research-based education). They also suggested the need for explicitly mentioning social accountability.

It is evident that there is a good deal of agreement between the Latin American, the European and the African approaches, although the absence of a reference to bio-medical science in the African description is seen as an area of divergence. However, it may be covered by the competence "ability to apply biomedical science in patient care."

It was agreed that it would be valuable to have further international meetings on the Tuning approach with the objective of seeking to develop a global meta-profile.

7.7.7. *Assessment methods appropriate in medicine*

In a brief brainstorming session, colleagues identified a range of assessment methodologies that have proven to be appropriate in assessing the generic and core competences: practical clinical assessment, written examinations, oral examinations, continuous assessment, teamwork projects, internships, placements, portfolio assessment, reflective learning journals, simulation, role playing, group role playing, journal clubs, observation, video analysis and debriefing, mini-conferences and seminars, IT projects (individual and group) and peer assessment (formative and summative).

This list is limited and requires more detailed discussion, linking with the core competences and the level of achievement to be expected at each stage of a student's education.

7.8. Implementing the Profile

The meta-profile of a medical graduate in Africa is a valuable high-level tool for beginning the process of evaluating outcomes in medical education. However, it is a high-level instrument that needs to be translated into an institutional context. Hence, each institution (in this case, each Faculty of Medicine) will need to formulate its own profile for its medical graduates.

The implementation process will involve wide discussion and persuasion, engaging the Rectorate, the Faculty and the students. The development of the institutional profile will take into account the meta-profile and the generic and subject-specific competences developed in the pilot project by the medicine Subject Area Group (SAG). The development of the institutional profile for a medical graduate will entail:

- A gap analysis in relation to the meta-profile and the generic and subject-specific competences.

- A comprehensive needs analysis, which encompasses the institution, the students, the locality, the region and the country.

- Identifying the specific strengths and areas of specialisation in teaching and research, which will add a specific character to the degree.

This process should also reveal challenges and how these might be addressed. It should be noted that the challenges may include infrastructure, facilities, lack of staff with relevant high-level skills and the level and qualification of the students at admission.

A key feature of change management is that key personnel must "believe" in the change. This means that champions must be sought at each level--the Rectorate, the Faculty, among the students and other key stakeholders.

Factors which may contribute to persuading colleagues, students and managers of the desirability of generating such a meta-profile for each institution include social accountability, internationalisation and mobility, discussed below.

- Social accountability. Medicine touches the lives of people of all ages and in all sectors of society in intimate and profound ways. As indicated in reports from UNESCO, WHO, and the World Bank, it is an essential ingredient in health promotion and improvement, thereby contributing to the economic, social and political development of societies.

- Internationalisation. No university and, in particular, no medical faculty, can escape the process of internationalisation. It relates to the speed of change in the field, to knowledge and scientific development, to the expectations of society and to the wider recognition of qualifications. All of these are critical for graduates and for the institution if it wishes to attract able and committed staff to research and teach in medicine.

- Mobility may be perceived as a threat but the reverse-i.e, the inability of graduates to be mobile and to have their qualifications recognised-is an even greater threat to the institution, to the quality of its learning and teaching, to the motivation of students and staff and above all to the society in which the graduates will work.

An essential ingredient for the development and implementation of a new degree profile is the establishment of a multi-disciplinary team which should include students and graduates and involve consultation with stakeholders, including employers and regulatory bodies.

The development and implementation of the profile requires clear and inspiring leadership and motivation among staff and students, supported by external stakeholders. A key element in the management and delivery of change is continuing staff development.

Since this is a continent-wide need, the Tuning Africa Medical Group wishes to work together to develop an African joint master's degree in medical education. This degree will involve mixed-mode teaching, combining blocks of intensive teaching, when participants will meet physically in one of the partner institutions, with distance learning.

Following the development of the institutional profile, curriculum teams will need to plan and develop the detailed curriculum and the methods of learning, teaching and assessment, which are required to achieve the detailed learning outcomes.

7.9. Next Steps

A model curriculum

The next steps for the project should be to attempt to develop a model curriculum and associated assessment based on the meta-profile and the generic and subject-specific competences for Africa.

An African Credit System

The group recognises that, in the planning and development of new curricula, it would be a great advantage to develop a common African credit system and considers that this step should receive a high priority. Such a system would be valuable for students, academic staff, institutions, and countries for the realisation of the African harmonisation strategy.

7.10. Conclusion

The synergies and advantages of a trans-national group of academics working together have been demonstrated by this pilot project.

The validation which has been conducted confirms that the profile and the competences represent a desired objective for graduates from African medical schools and should be more widely disseminated at national and regional levels.

The group confirms that the definition of the meta-profile, the generic and subject-specific competences outlined in this report, represent a basis for evaluating the extent to which the current curricula in African medical schools equip medical graduates with the necessary competences and characteristics.

Africa has considerable strengths. Many of the institutions are young and consequently are untrammelled by tradition. In them is found a hunger for knowledge, a demand for medical graduates and challenging needs represented by the numbers of patients and the range of disease. There is a commitment to health reform, development and governance, coupled with, in many areas, growing economic development and a strong will to change.

Potential weaknesses or threats lie in an innate conservatism, often among more senior colleagues; a lack of motivation for change which requires re-skilling and reassignment of resources; a lack of resource in terms of personnel funding and equipment; political instability and change; the rapid growth in the number of students and a poor staff-student ratio; poor overall management; a lack of staff development and training, a lack of high-level ICT facilities and low mobility.

Opportunities are offered by the Harmonisation Strategy, the Tuning Project, the WHO Road Map and other projects and budgets for cooperation. Also providing reason for optimism is a will to change, particularly among young staff, the development of good leaders, social demand and community expectation, regional and international reform movements, commitment at senior management levels to quality enhancement including external evaluation and accreditation, the incentives of internationalisation and the recognition of shifting paradigms.

7.10.1. *The future*

The Tuning Africa Medicine Group:

- Welcomes the prospect of the Tuning 2 project and hopes that it will provide an opportunity to increase the membership of the group.

- Considers it essential that students, recent graduates and young staff be represented since their perspective is essential in the development of detailed programmes.
- Wishes to develop a model African first degree in medicine.
- Wishes to develop a joint master's degree in medical education ("Learning to Teach") using a mixed-mode delivery that combines blocks of face-to-face teaching plus distance learning.
- Wishes to develop joint or double master's and PhD degrees in specialist areas such as biomedical sciences, medicine in industry, biomedical ethics, toxicology, clinical biology and global health.
- Considers that it will be particularly valuable to support health policy, promotion and improvement through work with the wider area, e.g., specialist nurse education and development of interdisciplinary team programmes (for example, in health promotion).
- Has particularly valued the insights provided by the other subject groups on all aspects of the Tuning approach and considers it essential that there are one or more cross-discipline topics in which groups can work together. It may be, for example, that the proposed master's programme in medical education might become a generic master's in higher education with a common core and specialities for particular subject areas.
- Has valued working with colleagues from Europe and would like this relationship to continue and, if possible, be expanded through presentations from Tuning experts from other parts of the world.

7.11. Recommendations

The Tuning Africa Medicine Group makes the following eight recommendations:

1. That the Tuning meta-profile and generic and subject-specific competences should be widely compared with the current curriculum and practice at an institutional level to identify ways in which a new, reformed curriculum could be developed, improved, appropriately assessed and quality-assured.

2. That a national change strategy should be initiated through organisations such as the Higher Education Councils or equivalent bodies, national conferences of deans of medical schools, student organisations and other key stakeholders who will champion and disseminate the Tuning approach.

3. That regional conferences should receive national reports on the implementation of the Tuning approach and best-practice case studies.

4. That at a Pan-African level, contact should be established with key organisations such as the African Medical Schools Association, the Sub-Saharan African Medical School Study, the WHO Regional Office for Africa, the WHO Regional Office for the East Mediterranean (EMRO) and the World Federation for Medical Education.

5. That students and graduates should be involved and contribute to the development of new curricula at national, regional and Pan-African levels.

6. That in order to develop a more transparent and compatible curriculum for recognition, an agreed-upon, shared African credit system based on workload and learning outcomes is essential. To this end, the medicine group wishes to work with colleagues in the four other pilot subject areas to develop the basis for an African credit system, which could be tested and evaluated in the sixty universities represented in the pilot project.

7. That recognising that the Tuning approach provides a framework for a detailed African medical curriculum, the project should be expanded rapidly to the next stage to develop a full medical curriculum designed to provide the competences which have been defined and to develop a wide range of innovative and appropriate forms of assessment to demonstrate the achievements of the competences.

8. That the group should be augmented by ten additional colleagues representing different countries in order to enhance the acceptability of the outcomes and to facilitate the widest possible dissemination.

List of Medicine Subject Area Group Members

Subject Area Coordinator **Mahmoud BENALI- ABDELLAH** Université d'Alger I (Algeria) drmahmoudbenali@yahoo.fr	**Higher Education Expert-Tuning** **John E. REILLY** United Kingdom J.E.Reilly@kent.ac.uk
Algeria **Moussa ARRADA** Universite d'Alger I arrada.moussa@hotmail.com	**Morocco** **Abdelhaq ALAQUI YAZIDI** Université Cadi Ayyad de Marrakesh A.Yazidi@gmail.com
Congo **Jean Rosaire IBARA** Université Marien Ngouabi jribara@yahoo.fr	**Nigeria** **Olusegun Olusina AKINYINKA** University of Ibadan asegun@hotmail.com
Egypt **Ahmed Magdy Ibrahim A. EL GOHARY** Suez Canal University aelgohary28@gmail.com	**Senegal** **Abdourahmane DIA** **Alain Khassim Jacques N'DOYE** Universite Cheikh Anta Diop de Dakar abdarahmane.dia@ucad.edu.sn alainndoye@hotmail.com
Ethiopia **Ephrem Tekle LEMANGO** **Loko Abraham BONGASSIE** Mekelle University eplemango@gmail.com lokab77@yahoo.com	**South Africa** **Jennifer Elizabeth RAMESAR** University of Cape Town jennifer.ramesar@uct.ac.za
Kenya **Charles Odero OMWANDHO** University of Nairobi deanmedic@uonbi.ac.ke	**Tunisia** **Ali CHEDLI** Faculty of Medicine of Monastir ali.chadly@topnet.tn
Higher Education Expert-Tuning **Hanneke van Bruggen** The Netherlands j.e.van.bruggen@gmail.com	

Chapter 8

Teacher Education

Matete MADIBA, Eugenia Flora Rosa COSSA,
Zubeida Khatoom DESAI, Shaheed HARTLEY,
Birhane Sime GERESSU, Arlene GILPIN, Mohamed HASSAN NOOR,
Babatunde Joseph IPAYE, Pauline Lyonga LYONGA,
Therese MUNGAH SHALO EPSE TCHOMBE,
Théophile MAGANGA, Rosemary MOYANA,
Stanley Gathogo MUKURIA, Honoratha Michael Kisenge MUSHI,
Mugagga Anthony MUWAGGA, Rotimi Joshua OGIDAN,
Emmanuel Chukwugozie OSINEM and Charmaine Benite VILLET

8.1. Introduction

Africa is the world's "youngest" continent in demographic terms. In less than fifteen years, one-quarter of the world's under-25 population will be African. This demographic reality presents exceptional opportunities as well as significant challenges for Africa as a whole. The Civil Engineering Subject Area Group (SAG) in this project pointed out that Africa faces huge challenges in meeting the needs and aspirations of such a rapidly growing, youthful population. The potential stresses associated with this growth have already been signalled in the north with the "Arab Spring", a movement at least partially motivated by the need for jobs for the young people. In other parts of Africa, joblessness among the young has reached challenging levels, which could continue in spite of the promising economic growth experienced in most African countries. In Sub-Saharan Africa alone, the group of young men and women between ages fifteen and twenty-four will increase from 170 million to 360 million by mid-century. The population of some cities is set to swell by up to 85 per cent in the next fifteen years. The most populous city in 2010, Cairo, is predicted to grow by 23 per cent to 13.5 million (m) people. By 2025, however, it will have been overtaken by both Lagos (15.8 m) and Kinshasa (15 m) to mention only two. Such a demographic leap puts pressure on all aspects of social and economic development, but the impact of providing adequate and quality schooling and education puts teacher education on the front line with health services.

According to the World Development Report 2007, three key features contribute towards a successful policy response to youth unemployment. These are: (1) Expanding opportunities for the accrual and preservation of human capital (i.e., access to formal education and training); (2) Enhancing the capacity of the youth to take advantage of job opportunities; and (3) Creating programmes and mechanisms to equip youth with the tools and/or skills needed to do the same (Elder, Schmidt and Sparreboom, 2010). Youth unemployment is a challenge alongside many others for Africa, including post-war conflict and the building of democratic governance across the continent. Teacher education for teachers at all levels is central to policies for increasing opportunities for youth of the present and the future in Africa.

Each of the five subjects or discipline areas in the pilot project is located primarily in one region of Africa. Teacher education was mentioned in all regions as a prime area of concern; however, as a result of the feedback obtained during the feasibility study, it was agreed that the hub for the Teacher Education Subject Area Group would be Southern Africa. The Southern Africa Development Community (SADC) represents a group of countries which has realised the crucial role that higher education must play in development and is seeking more sustained engagement with its universities, forging new ways through which higher education in the region can be revamped to meet pressing national, regional and continental needs (SARUA, 2012). However, the challenges faced by education and training in the sub-region of Southern Africa are largely common to all countries. These are access, equity, quality, efficiency, relevance and democracy in their educational and training policies (SADC, 2007). So while the majority of the countries in the Tuning pilot project are located in this region, all of the other regions are also represented.

From the southern region, there are representatives from Namibia, Mozambique, South Africa, Tanzania, and Zimbabwe; from Central Africa, Cameroon and Gabon; from Northern Africa, Egypt; from East

Africa, Kenya, Uganda, Somalia and Ethiopia, and from West Africa, Nigeria. The group thus has within it representatives from the three major historical foreign language groups in Africa, as well as the Arabic-speaking lands of the north.

There is a strong representation of distance education in the group, from the Open Universities of Tanzania and Nigeria and others, as well as through the participation of The African Council for Distance Education (ACDE), the professional body for distance education in Africa. Distance education is seen as an effective way of expanding the reach of formal education and training through distance-learning strategies that integrate print-based material, remote study and access centres, and face-to-face components (ILO, 2012), and most universities now provide open or blended learning options.

While distance education may well have great potential for increasing the numbers of teachers across Africa in general, the focus on technical and vocational education (TVE) is likely to assume greater prominence in the future, in order to address the training needs of the young and the economy needs of the countries in Africa. Teacher education for TVET is represented by the specialist faculties in the Adama Science and Technology University, Ethiopia, and The University of Nigeria, Nsukka. Other universities are also beginning to offer specialist programmes for TVET teacher educators.

8.2. The Members of the Teacher Education Group

The members of the teacher education group are briefly identified below. The universities are the participants, and the persons nominated by them are the actual members of the group. In some cases, there is more than one member, funded by the university, or alternating with another.

8.2.1. *Southern Africa*

The Faculty of Education at the University of Namibia (UNAM) has the mandate for training all teachers in the formal education sector in Namibia. Before 2010, the faculty was responsible only for training senior secondary teachers. During a teacher education reform in 2008, it was decided to task the university with improving all teacher education programmes and enhancing the quality of primary education in particular. Tuning Africa provided the opportunity for the UNAM Faculty of Education to hone its skills with the best teacher educators on the continent as well as in other parts of the world. The member of the Teacher Education SAG is Dr. Charmaine Benita Villet, Dean, Faculty of Education.

Since 1980 the University Eduardo Mondlane (UEM) in Mozambique, through its Faculty of Education has been responsible for training teachers for junior and secondary schools in Mozambique. In addition to this task, the Ministry of Education has also assigned it in-service teacher training and designing programmes for academic staff development for higher education through the Centre for Academic Development (CDA), which is part of the Faculty of Education. The UEM through the Faculty of Education has the role of training the academic staff from all the higher education institutions, including the staff from UEM itself, to design curriculum and to provide training in other areas related to higher education pedagogies and the design of competence-based curricula. Taking part in the Tuning project helps the UEM to improve the knowledge and skills concerning the competences that can be expected of a well-qualified teacher in Mozambique.

Furthermore, teachers trained in Mozambique can be harmonised with teachers from other African institutions and worldwide in terms of their competences. As a result, participation will thus open access to mobility and employability throughout Africa. Student mobility and improvement of the competences of the student teachers of the UEM are only some of the benefits gained through the Tuning Africa project. The member of the Teacher Education SAG is Dr Eugenia Flora Rosa Cossa, Assistant Professor of Natural Sciences and Mathematics Education, Faculty of Education, UEM, Dean of the Faculty of Education since 2008.

The Faculty of Education at the University of the Western Cape (UWC) in South Africa has a long history of productive engagement with the key issues facing education in South Africa. It is a national leader in language education, mathematics and science education, educational support, educational studies and educational leadership and management. As a faculty, it is committed to research, offers innovative, research-based training of teachers and runs a major postgraduate programme. Its dedication to the improvement of the education system has led to the presentation of significant in-service programmes for the UWC's Department of Basic Education and Department of Higher Education and Training. It also engages with schools in research and school improvement projects. The faculty hosts a number of research and teaching centres, including the Centre of Science Learning in Africa. The UWC has a proud history of struggle against the apartheid regime. It is for these reasons that the faculty was included in the Tuning Africa Project. The members of the Teacher Education SAG are Professor Zubeida Desai, PhD, Dean, Faculty of Education, and Professor Shaheed Hartley, Director, Centre for Science Learning in Africa.

The Open University of Tanzania provides teacher education programmes through distance education, commonly referred to as Open and Distance Learning (ODL). Hence, the institution has the capacity to reach more teacher education students than any other university in the country. The Open University's role in graduating more teachers is opportune at this time when the nation is experiencing rapid increases in the number of primary and secondary schools and of teacher education colleges in Tanzania. This growth is part of a deliberate government policy to positively respond to Education for All (EFA) goals, the Millennium Development Goals (MDGs) and the nation's 2025 vision of eradicating illiteracy, poverty and the HIV/AIDS pandemic. Education is regarded as a major contributing factor in addressing these endemic problems in the country.

The Open University of Tanzania reaches other parts of Africa and has a centre in Kenya at Egerton University and another centre in Rwanda. It also trains SADC members in the area of ODL through the SADC Centre of Specialisation in Teacher Education (COS). The member of the Teacher Education SAG, who also serves as SAG co-coordinator, is Professor Honoratha Michael Kisenge Mushi, Dean, Faculty of Education.

The University of Zimbabwe (UZ) offers degree programmes in teaching and post-graduate diploma programmes at the university itself. It also collaborates with the two Ministries of Education in a "scheme of association" in which fifteen teachers' colleges associate with the University of Zimbabwe, whose regulatory framework ensures the quality of training programmes for student teachers. Thus, the bachelor of education degree really begins in these teachers' colleges where students receive a University of Zimbabwe diploma.

In joining Tuning Africa, the university felt that students in this faculty, who enter as practising teachers, will, upon graduation, become better-qualified teachers at all levels from primary to tertiary level, as institutional administrators, as policy and curriculum developers, as adult educators, as science and mathematics teachers and so on. Competences developed in the Tuning project will, it is planned, be factored into their programmes to enhance quality assurance. Graduates from UZ have been found to be highly employable in the African sub-region and other countries, with the UZ's "scheme of association" playing a major role in ensuring the proper education of teachers. The faculty has a balanced mix of part-time and fulltime, residential and distance, and pre-service and in-service students.

Recently the faculty has introduced a degree programme by Open Distance and e-Learning (ODeL) methodology in how to teach science and mathematics subjects in collaboration with the AVU in Nairobi. Zimbabwe currently has fourteen additional younger universities, five of which developed from beginnings as UZ colleges and which have now evolved as independent institutions of higher learning. UZ is therefore in a key position to disseminate the Tuning project in Zimbabwe. The member of the Higher Education is Professor Rosemary Moyana, Dean, Faculty of Education.

8.2.2. *Central Africa*

The University of Buea (UB) in Cameroon was founded in 1993 following wide-ranging university reforms in that country. UB is the only English-speaking University in Cameroon. The University of Buea is made up of five faculties (arts, education, health sciences, science and social and management sciences) and one professional school, the Advanced School of Translators and Interpreters, (ASTI) The university prepares educational personnel, promotes excellence at all levels of schooling, undertakes professional training and advanced studies in educational sciences, conducts research and offers community services in three areas: (1) curriculum studies and teaching, (2) educational foundations and administration and (3) educational psychology. It offers a wide range of programmes at bachelor, master's and doctoral levels.

During the first meeting of Tuning Africa, which was held in Yaoundé, Cameroon, in January 2012, Nalova Lyonga, then Deputy Vice-Chancellor in charge of Teaching, Professionalism and Information

Technology and Communication at UB and now its Vice-Chancellor, attended. In that capacity, she was charged with the responsibility for ensuring quality in academic programmes and professionalisation to address not only achievement in the academic programmes but also the employability and quality performance of the graduates in the field. As a result, the launching of Tuning Africa was not only timely but also addressed the mission and vision of the university.

The university therefore wished to share in the development of harmonisation and the Tuning project through the conceptualisation and identification of best practices with other universities in Africa. The university also participated with the goal of being part of promoting networking among African universities for the creation of knowledge on competences and the dissemination of quality education that will allow for credit transfer, employability and students' and teachers' mobility in Africa. By so doing, the university takes an active role in being part of the Pan-African vision for higher education in Africa in the twenty-first century. The members of the Teacher Education SAG are Professor Pauline Lyonga Lyonga, UB Vice-Chancellor, and Professor Therese Mungah Shalo Epse Tchombe, Professor Emeritus, Honorary Dean and UNESCO Chair for Special Needs Education.

The National University of Gabon (Université Omar Bongo, UNG) was created on 12 August 1970. It became the Université Omar Bongo (UOB) in 1978 and has seven faculties. Its École Normale Supérieure (ENS), which is its higher education institution, is responsible for the training of secondary school teachers and of supervisors teaching pre-primary, primary and secondary school for the whole country.

The subjects taught are French, English, Spanish and pure sciences (mathematics, physical sciences and life and earth sciences). Training programmes also include the arts, humanities and social sciences, which comprise arts education, literature, home economics, history, geography, philosophy citizenship education, science education.

Reform of the State's General Education Research and Training-Employment Adequacy (EGERAFE) in May 2010, provided for the consolidation of all training programmes from primary to secondary and higher education to reflect the socio-economic situation in the country, the introduction of English at the primary school level, the use of local languages in pre-primary and the ownership of information technology and communication in education (ICT) in the Gabonese education system (Law No. 21/2011 February 14, 2012) Guidance on General Education Training and Research. The ENS applies the three-cycle system of degrees—licence, master's and doctorate (LMD)—and will introduce the competence approach (CPA) in high school. This approach is currently in use in primary, technical and vocational schools. For this reason, the UOB, acting as the pilot university, saw the relevance of participating in the Tuning Africa group for the project of the harmonisation of profiles of its graduates. The member of the Teacher Education SAG is Professor Théophile Maganga, Ph.D. Teacher-researcher and ENS Director of the National Institute of Education.

8.2.3. *Northern Africa*

The University of Alexandria in Egypt is the second oldest university in Egypt after Cairo University. In 1938, the nucleus of the Alexandria University (formerly known as Farouk University) had its beginning in the form of two faculties: arts and law. In the light of the need for developing more disciplines for higher learning and with a view to meeting the needs of the people of Alexandria, Alexandria University became a separate entity in August 1942 with four additional faculties: science, commerce, medicine and agriculture. In 1952, it became "Alexandria University". Since then, the university has witnessed growth and expansion in several fields with its number of faculties and higher education institutes now numbering twenty-two. In 2012, Alexandria University won the award of excellence in scientific publishing from the Continuous Improvement and Qualifying for Accreditation Project of Egypt's Ministry of Higher Education.

Alexandria University's Faculty of Education is the third oldest institution in Egypt among twenty-eight faculties affiliated to Egypt's twenty universities. The Faculty of Education consists of fourteen departments: seven for educational sciences, three for the basic sciences, three for linguistic sciences, and one for social sciences. It offers three different programmes leading to five different degrees.

The undergraduate level offers the General Programme for secondary school teachers; graduates of this programme obtain (1) the degree of bachelor of arts and education in Arabic, English or French and the social sciences or (2) the degree of bachelor of science and education in one of four fields: mathematics, physics and chemistry, biology or geology.

Graduates of the Basic Education Programme for primary and middle-school teachers obtain the Bachelor of Arts degree in basic education in Arabic or English in social studies, or the Bachelor of Science degree in basic education in mathematics and sciences.

The Childhood Education Programme for Kindergarten teachers offers a Bachelor of Arts degree in childhood education.

The graduate level is a one-year programme for graduates from Faculties of Arts and Sciences. Graduates of this programme are awarded the degree of "General Diploma in Education". They are eligible to teach in both middle and secondary schools.

The member of teacher education SAG is Professor Hani Abdelsattar Mohamed Farag, Professor of Philosophy of Education and Head of the Foundations of Education Department.

8.2.4. *East Africa*

Makerere University in Uganda is the oldest university in East and Central Africa. Started in1922 as a humble technical school, in 1963 it became the University of East Africa offering courses leading to general degrees from the University of London. It became an independent national university in 1970 when it was split into three independent universities: the University of Nairobi (Kenya), University of Dar es Salaam (Tanzania) and Makerere University in Uganda. Today Makerere University consists of seven colleges and one school offering programmes for about 40,000 undergraduates and 3,000 postgraduates. Makerere University is home to many prominent post-independence East African political leaders.

It is also a home to much of the pre- and post-independent literary activity in East and Central Africa. Some of Africa's most prominent writers were educated there, including Nuruddin Farah, Ali Mazrui, David Rubadiri, Okello Oculi, Ngugi wa Thiongo, John Ruganda, Paul Theroux, Okot P'Pitek, Mahmood Mamdani and John Mbiti. In the years immediately after Uganda's independence, it was a focal point for the literary activity that was central to African nationalist culture. This history gives the university status among other higher education institutions and will facilitate dissemination of the Tuning work. The College of Education and External Studies School of Education are responsible for teacher training.

The member of Teacher Education SAG is Dr. Mugagga Anthony Muwagga, Coordinator of the Centre for Teaching and Learning Support.

Mogadishu University (MU) in Somalia is a non-governmental, non-profit institution for higher learning. MU has a two-year diploma programme to prepare primary school teachers and a four-year undergraduate programme which prepares secondary school teachers. It also has a post-graduate partnership teaching programme.

The MU undergraduate programme covers five specialisations: Arabic language, social sciences, Islamic studies, mathematics and physics and bio-chemistry. Other teaching institutions in Somalia make contact with the MU for its experience in the teacher education field, and these links help make Mogadishu University a significant institution in teacher education. It is also already well networked to disseminate the work of the Tuning Africa project. The member of the Teacher Education SAG is Professor Mohamed Hassan Noor, Assistant Professor of Curriculum and Methodology, Chief Registrar and Lecturer in the Faculty of Education.

Kenyatta University in Kenya has a large and flourishing Faculty of Education. Of the 40,000 students enrolled at the university, more than 15,000 are students of education. It is a national centre for teacher education and a hub of excellence. Approximately 40 per cent of teachers working in Kenya are graduates of Kenyatta University. The Education Faculty has seven teaching departments, a university-wide directorate of teaching practice and an excellent Basic Education Resource Centre.

In addition to its vibrant teacher education networks in-country, the faculty enjoys strong links with other countries in Africa. Thus, it was already well positioned to be a significant participant in the Teacher Education SAG in Tuning Africa. The member of the Teacher Education SAG is Professor Gathogo Mukuria.

Adama Science and Technology University in Ethiopia is a recently established institution of higher education and the first university in the country to offer programmes of professional development for technical and vocational education. It is a public university and has two faculties focussed on the training of teachers or the professions of business teacher education and technical teacher education. While the business faculty is the larger, the technical faculty offers seven specialities in the teaching of engineering, technology and ICT. The member of the Teacher Education SAG is Birhane Sime Geressu.

8.2.5. *West Africa*

The National Open University of Nigeria (NOUN), has one of the most rapidly developing Faculties of Education in the country. The university is the only Open University in the West African sub-region and has adopted open and distance learning approaches in providing education to a large population. The Nigerian government looks to the university to help address the problem of access to higher education for a larger segment of its population. The Commonwealth of Learning (COL), in turn, expects the university to help other countries within the sub-region commence their own open and distance learning programmes. The Nigerian government thus expects its offerings and certificates to be of high quality, increasing the mobility of its graduates within the African continent and globally.

Its participation in Tuning Africa supports the continental role of the Open University; it is also well placed to play a major role in future developments in Tuning Africa as the project expands to include distance education. The member of the Teacher Education SAG is Emeritus Professor Babatunde Joseph Ipaye, Director of Learner Support Services.

The University of Nigeria at Nsukka has, as its focus of teacher education, the specialties of vocational and technical education. The Department of Vocational Teacher Education was established by a Ford Foundation grant in 1963 with the goal of providing leadership in vocational education in Nigeria. This department was the first of its type to be established in the Nigerian university system. The department has since been instrumental in the establishment of vocational teacher preparation programmes in universities all over the country and has graduated a number of students from other African countries.

Currently degrees are offered to prepare teachers for teaching agriculture, business, ICT, home economics and industrial technical education. A range of master's and doctoral programmes are also offered.

The department has strong links with business and industry, including well-established relationships with Anambra Motor Manufacturing Company (ANAMCO) in Enugu, Nigeria; with Vacentric Technologies Ltd. in Lagos, Nigeria; with joint cooperative research/training programmes underwritten by the Industrial Training Fund (ITF), which operates training centres all over the country; with the Federal University of Technology (FUT) in Minna Niger State, Nigeria; with

Yaba College of Technology, Lagos University of Uyo, Akwa-Ibom State, Nigeria; and with State University of New York (SUNY) Oswego, New York State, USA. This network makes the contribution of the department particularly valuable for dissemination throughout the world of work.

The Centre for Technical Vocational Education, Training and Research (CETVETAR), housed in the Department of Vocational Teacher Education, is a recognized UNESCO-UNEVOC Centre (the International Centre for Technical Vocational Education and Training). CETVETAR is also a centre of excellence in TVET, currently implementing a World Bank-assisted Science and Technology Education Post-Basic (STEP-B) Project. The project covers a number of innovative elements in vocational teacher preparation and workforce skills improvement.

The African Development Fund (ADF) is currently working with the Department of Vocational Teacher Education for implementing an intervention project, FME/ADB Skills Training and Vocational Development Programme, through the Federal Ministry of Education, Abuja, Nigeria. The member of the Teacher Education SAG is Professor Emmanuel Chukwugozie Osinem, Professor of Agricultural Education and Training, Department of Vocational Teacher Education and Research and Training Facilitator.

8.2.6. *Supra-regional representation*

The African Council for Distance Education (ACDE) is a continental non-governmental organisation that co-ordinates the activities of universities and higher education institutions that provide quality education through distance learning in Africa. ACDE is involved in the Tuning project with a particular interest in further enhancing the quality of the instructional delivery services in African universities and in promoting harmonisation that will improve credit transfer and sharing of quality resources through distance education. The member of the Teacher Education SAG is Professor Rotimi Joshua Ogidan, Senior Programme Officer for Monitoring and Evaluation. The Teacher Education SAG coordinator is Dr Matete Madiba, Director of Student Support Services. The Tuning Adviser to the Teacher Education SAG is Arlene Gilpin, Senior Tuning Adviser.

8.3. Context for Curriculum Reform and Modernisation

In an important document titled "Second Decade of Education for Africa (2006-2015)", the African Union describes its vision for Africa, which is that of an "integrated, peaceful, prosperous continent that manages its own initiatives in order to occupy its rightful place in the world community and in the knowledge economy". For the Pan-African organisation, the realisation of this vision must of necessity require "the development of African human resources", a process that must be based on the establishment of a quality education for all, in order that all African citizens should fully contribute, within the means available to them, to the economic and socio-cultural development of their country and the continent.

The Second Decade of Education action plan underscores the necessity of strengthening mutual collaboration between African states in order to ensure, when the second decade ends in 2015, the establishment of efficient information management systems in education at the national, regional and continental levels.

The changes in social affairs currently taking place in many countries in Africa are of a scope and intensity that never before experienced. The search for an understanding of the essence of these changes is compelling, for failure may lead to catastrophe. The issue of "modernisation" as a general term describing the processes of rapid change in African lives, as well as denoting the quality of the contemporary society being sought, has become central to the volatile and controversial debates taking place. However, the revolution in science and technology has, without question, fostered the most dramatic changes in people's lives, in addition to the application of science to practical human affairs in terms of technology.

Here lies the paradox: How should one reconcile these changes with the intellectual, cultural, political, and economic aspects of life? The challenges posed by modernisation are profound: How can modernisation be sought while the population is already growing faster than agricultural and industrial production, when illiteracy is rapidly increasing, and while the social status of women remains questionable? The conflict between tradition and modernity causes what has come to be known as the agony of modernisation: How is it possible to reconcile both through the production of quality teachers as agents for sustainable development? The desire to be modern, opponents claim, has often led to the glorification of the transitory and to the frequent rejection of the most cherished and fundamental values and traditions.

8.3.1. *Characteristics of the African learner*

Reforms in teacher education must begin by considering the characteristics of Africa's learners and the conditions in which they are learning.

A common aphorism of the past was that "the African child is seen and not heard". In the formal classroom, the African child rarely asked questions, rarely argued with the adult (and all teachers were adults), rarely questioned authority and rarely sought for explanations. Teacher education programmes in Africa reinforced this position; and in spite of the popularity of theories of individual differences, individualised instruction, participatory learning, mastery learning, etc., most African teachers regarded the child as a *tabula rasa*, a view of the child as a blank slate, ready to be written upon as the teacher wished, or as an empty gourd into which water should be poured. This form of teaching was, in essence, a "banking" approach in which the teacher deposited knowledge in the child. Banking education is domesticating if not indoctrinating. The children are regarded as passive listeners, whose role in the classroom is limited to taking orders rather than to negotiating meanings by means of asking questions, exploring ideas and postulations and collaboratively and collectively producing knowledge (see Tessema Kedir, 2006; Freire, 1984).

These perceptions are changing. The African child today is both seen and heard. "Education during the colonial era had its specific mission and teachers were trained to respond to that mission. Today there are new expectations for education where the focus is on having teachers be visionary leaders to ensure sustainable education. The paradigm shift is from teacher dominated classroom practices to that of partnership between the teacher and the learners and their peers" (Tchombe, 2010). This calls for classrooms "where the learner is seen as an active, socially constructed agent and learning and literacy as creative activities through which learners can begin to analyse and interpret their own lived experiences, make connections between these experiences and those of others, and in the process, extend both consciousness and understanding" (Kedir, 2006).

However, this development does not occur automatically; it requires the transformation of African teachers, current and future, to enable them to work in ways that drive forward the development of relevant competences. The Tuning collaboration with the AU harmonisation strategy is therefore a welcome innovation at this point in the history of education in Africa.

Furthermore, the context may be a classroom where the language of education is foreign to students and in which they must master a different language even as they struggle to master the subject matter. In many African schools, classrooms are over-crowded. In some, due to political hostilities and wars, overburdened teachers must alternate the days of the week when learners can come to school.

In addition, another frequent characteristic of African schools is that children receive little academic support at home because their parents lack education of their own or, struggling with poverty, do not have the economic means to assure high-quality education.

8.3.2. *The structure of teacher education*

Teacher education programmes in Africa are very diverse. Before the establishment of regulatory bodies in some countries, each teachers' college was highly autonomous, following only the goals of the school's proprietor. Even within countries, great diversity was noticeable as teacher education developed. For example, Nigeria had Grade III Teachers Colleges, Grade II Teachers Colleges, Advanced Teachers Colleges, Colleges of Education, Institutes of Education, a National Teachers Institute and Faculties of Education in universities.

Today, Grade III, Grade II and Advanced Teachers Colleges have been phased out in Nigeria. The lowest teaching qualification today is the Nigeria Certificate in Education (NCE) obtained from Colleges of Education. All teachers in the senior secondary schools are expected to be degree holders. A similar process of reform can be seen across Africa, where the number of institutional levels has decreased as countries strive to create a teaching force in which all teachers hold degrees.

Table 8.1 is a summary of a short audit conducted in the group to highlight differences in teacher education in a number of African countries.

Table 8.1
Summary of SAG Participants' Programmes

Country	Length (in years)	Exit Level	Varieties/Specialisation	Credit Total
Namibia	4	8/Honours	1 bachelor degree with 3 specialisations: Pre- and lower-primary, upper-primary and secondary	480 120 per year (1 credit 10 notional hour)
Mozambique	4	Undergraduate honours	Education: chemistry, biology, physics, mathematics, languages (Portuguese, French and English, Bantu); 3 specialisations in psychology, environmental education, organisational and management ed, ECE	240 60 per year 1 credit = 30 hours
South Africa: UWC	4	Undergraduate	B.Ed. psychology, B.Ed. honours Post-grad diploma after a bachelor's	480 120 per year 1 credit = 10 hours
Tanzania	3	Undergraduate	B.Ed BA Ed. BSc. Ed. BusEd—Curriculum and instruction, adult ed, and distance ed, policy planning and admin, psych and special needs, core: foundations of ED	360 120 per year
Zimbabwe	2 years in the university; 3 years in the primary colleges; 2 to 3 years in secondary colleges	Undergraduate	B.Ed degree with many options, such as: ECD, primary education, curriculum and arts education, maths and science education, adult education, educational foundations, educational administration, technical education, teacher education	360 240 in university and 120 from colleges (15 course units 60 contact teaching hours per semester).

Country	Length (in years)	Exit Level	Varieties/Specialisation	Credit Total
Cameroon: Buea	3	Undergraduate	B.Ed. curriculum studies and teaching B.Ed. Education (by distance ed for nursery and primary teachers) & B.Ed. special education B.Ed. educational psychology	180 60 per year 1 credit = 10 hours Graduation requirements: At least 180 credits Compulsory courses 108 Electives 54 University courses 18
Gabon	3 for primary and secondary 5 for high school	Undergraduate	B.Ed. in counselling and various subject areas, and languages.	180: primary and secondary 300: high school 60 per year
Egypt	4 divided into 8 semesters	Undergraduate	B.A. & education in Arabic, English, French, social sciences. B.Sc. & education in mathematics, chemistry+physics, biology + geology B.A. in CE. B.A. in basic education: Arabic, English, social sciences. B Sc in Basic Education: Math, Sciences.	Total courses required: 65-70 Total teaching hours required: 220-256 hours
Makerere in Uganda	3	Undergraduate	B.A. (Ed.) B.Sc. (Ed.) = sec, BEd (prerequisite diploma) for secondary and primary/arts and science. B.Sc. technical education.	120: B.A. (Ed) 3 years 160: B.Sc. (Ed) 4 years 40 per year
Somalia	4	Undergraduate	B.Ed. in Arabic language, social science, math and physics, biology and chemistry for primary and secondary	168 42 per year

Country	Length (in years)	Exit Level	Varieties/Specialisation	Credit Total
Kenya	4	Undergraduate	B.Ed. music, history B.Sc. Ed. business education, environmental science B.Ed. special education	300 240 500 200
Ethiopia	3	Undergraduate	B.Ed 3 years add-on programme in different fields such as, chemistry, biology, physics, mathematics, civic and ethical education, psychology, educational planning and management, curriculum studies, adult and life-long learning B.Sc. Ed: in technical and vocational education, such as construction, manufacturing, automotive, electrical & information technology	120 40 per year
Nigeria	3 years for direct entry, 4 years for secondary school entrants	Undergraduate	B.Sc. education in biology, chemistry, physics, integrated science, maths, social studies. B.A. / Ed in English, French, Nigerian languages, arts and music B.Ed. in primary and secondary education, guidance and counselling B.A. Ed: agriculture, biology, chemistry, physics, integrated science, computer science, mathematics, business ed, ECE, primary, English, French B.Sc. vocational, agricultural education, business education, home economics education, computer education, industrial technology education	90 for 3 year programme 120 for 4 year programme 30 per year

8.3.3. *Context and challenges in teacher education programmes in Africa*

There are many challenges facing teacher education in Africa, and many of them derive from the context in which education has to be offered on the continent. Although colonialism began to unravel in the 1960s as country after country achieved independence, its legacy remained, supported in part by the desire of the former colonial administrations to help develop educational facilities that they had not themselves provided. During the colonial period, education supported minority populations, so that, at independence, all countries found themselves needing to increase educational opportunities for the majority of their citizens. Invariably, school enrolments increased. For example, in Zimbabwe, "the number of secondary schools increased by 245% while enrolments increased by 100% within one year after independence [in 1980]" (Government of Zimbabwe, 1987; Zengeya, 2011, p. 16). School candidates "increased from 5,400 in 1980 to peak at 185,730 in 2001" (Zengeya, 2011, p. 17; Government of Zimbabwe 1987, 1993, 2003, 2005). Zimbabwe is a typical example of what happened in many former colonies when they became responsible for providing education for all citizens. However, the model of schooling adopted was normally that of the colonial heritage, which may or may not have been appropriate for the context.

There had always been and still are traditional ways of learning entrenched in all African cultures. Historically, *du'ti fa'* (work learning) has been the main strategy for developing life skills; even today, the advent of institutional learning has not displaced it. The learning content of *du'ti fa'* (work learning) derives from the sociocultural and economic realities of the community. This system can nowadays be equated to the student-centred learning that many countries have introduced under reforms of school curricula. It has also close links with TVE. A gap may occur at the level of teacher education, where an emphasis on book learning and a focus on declaratory rather than functional knowledge have certainly taken precedence in some countries with but few links forged with work learning.

8.3.4. *The demand for education*

The demand for education is not simple. It is a demand for an education that can lead to development and employment. In many

African countries, young people are leaving full-time schooling and going straight into unemployment. This is a complex problem, but part of the solution may lie with schools providing a more relevant work-oriented education, providing youngsters with the skills of language, numeracy, teamworking and technical skills that will access the labour market. In Egypt, for example, roughly 600,000 young people leave school each year, while there are only 200,000 jobs available-a problem of economic infrastructure. However, the situation is made worse by skills mismatches which create an on-going barrier for the school-to-work transition of young adults. It prevents employers from hiring young people.

Similarly, lacking skills constitutes a major constraint in terms of business creation. Findings from a School Transition Survey in 2007 show that 60 to 70 per cent of all employers interviewed complained that first-time job seekers lacked appropriate skills for the work place (Angel-Urdinola, Semlali and Brodmann, 2010).

Kendzia (2012) indicates that in "the vast majority of Middle East and North Africa (MENA) countries, secondary education is the standard education, and fewer than 10 per cent of secondary students are involved in vocational or technical training. Syria, Lebanon, Bahrain, Libya and Egypt constitute exceptions with more than 10 per cent of secondary school students taking part in vocational training. Nevertheless, as the World Bank notes, the picture of VET across MENA countries is mixed—that is, VET systems are operating without taking into account market needs or any closer connection to the private sector. The country reports in the Teacher Education SAG show that two African countries have strong vocational teacher education strategies to enhance school achievement for employment. Nigeria is an example of a country that has made a major investment in TVE. Similarly, Ethiopia is investing in specialist institutions for the training of technical teachers.

In virtually every African country, investigative commissions have recommended ways to review, modernise and broaden the scope of teacher education curricula in order to cope with the new challenges. Posner, Strike and Hewson postulate in their 1982 model for curriculum reform (quoted in Chiromo, 2011):

> Four conditions must be met for the successful implementation of a curriculum reform, namely, stakeholders (students, parents,

employers and educators) must be dissatisfied with the existing curriculum . . . and start to agitate for an alternative curriculum; for the stakeholders to accept the alternative curriculum, it must be intelligible, i.e., it should make sense to the stakeholders; the alternative curriculum must be plausible and appear to have the capacity to solve the problems generated by its predecessors; and the alternative curriculum must be fruitful, opening up new areas of inquiry. (p. 43)

8.3.5. *Language of instruction*

Africa is a continent in which there are sometimes literally dozens of mother tongues within the same state. For example, almost all Senegalese speak an indigenous language, of which Wolof is the most widely used. About 50,000 Europeans (mostly French) and Lebanese and Vietnamese reside in Senegal, mainly in the cities. However, schooling takes place in the official language of French, and current plans call for introducing English as the language of instruction from the primary level. Cameroon also reveals a varied population consisting of 24 major African language groups and over 279 ethnic groups with a distinct dialect, as well as four colonial languages-Arabic, English, French and German (www.nationsencyclopedia.com/Africa/ Cameroon.html, 2010). Rarely are indigenous languages adopted as languages of instruction from the level of early childhood education through the university level as happens in some developed countries-although it is inaccurate to think that countries like the United Kingdom or France, for example, have only one language, indigenous or otherwise.

It was often the colonial language that was adopted as the language of instruction because no indigenous language was sufficiently developed to serve as a lingua franca. Swahili is a different case, developed from a creole that itself developed over time in pre-independence East Africa and which was later subject to considerable research and development to accommodate academic and economic discourses. Swahili is thus faring well, as Torill Aagot Halvorsen's research shows. Maya Kiesselbach (2012) reports:

> Based on her research into staff and students' participation in information and communication technology (ICT at the University of Dar es Salaam ... Torill Aagot Halvorsen reports a gradual

> increase in academic online use of Kiswahili even though English remains the dominant medium of instruction in Tanzanian higher education. She points out that one sizeable colonial legacy is its continuing influence on modern education and languages. ... Halvorsen makes the case for establishing Kiswahili as a language of instruction in Tanzanian universities and introducing English as a foreign language subject. This would end discrimination against students who currently have to attend lectures and produce coursework in a language they are not proficient in.
>
> Language acts as a barrier for many African students in that they are unable to access the curriculum, and Halvorsen further argues for Kiswahili as she says, "without the language barrier ... students would be enabled to engage much more with the content of their studies." (p. 309)

Zimbabwe is another country in which the language of instruction acts as a barrier against education. As Chisaka (2011) writes, among the social dynamics that work against children and that deny them access to education "has been the maintenance of the English language as a medium of instruction in Zimbabwe's education system. With the language of transnational capital in command, the competence of which is used to measure knowledge and skills for one to engage in economic activities, the majority of the people are confined to poverty and deprivation" (p. 4). A teacher trainee in Uganda commented on this issue: "In the college we learn to teach reading in English, but I prefer to teach reading in Luganda because most children of lower primary age come to school when they are competent in it" (in *Tuning, 2013,* p. 180).

There are other viewpoints, of course. One limiting factor is the huge cost of language development, with the concomitant cost of producing materials. Students who progress to higher education must acquire the ability to access literature in some of the major languages of the world. Some parents and many students may wish to learn a world language. As noted above, Senegal is going to introduce English in schools, and it is also being considered in Gabon, both countries with many indigenous languages, and both with an external official language, French.

The language issue is an important one, but it is not easy to discuss in short paragraphs. Another problem may lie in the focus of the curriculum for teacher education: Does it focus on language development, or on knowledge of grammar and vocabulary? It is a subject that can be pursued in Tuning II, the name applied to the phase of implementing programme planning.

8.3.6. *Resources and infrastructure*

Another challenge, not only for higher education, but also for the entire education system in Africa has been limited resources and infrastructure. Most African countries bear a burden of economic hardships resulting from continued dependence on an unbalanced global economy. In that economy, Africa has been partly disadvantaged because of its colonial and neo-colonial legacies, leaving the education sector under on-going constraints in revenue and other resources. Omwami and Keller (2010) have discussed this issue of economic challenge eloquently. They argue convincingly that "a prerequisite of providing access to public education is funding. African nations have signed up to the United Nations (UN) Millennium Development Goals (MDGs) declaration, which guarantees, among other things, universal access to education by the year 2015 ... [yet] today, as in 1990, a significant number of children remains out of school." This situation of lack of funding does not spare the higher education sector. It is also affected negatively.

Omwami and Keller (2010) analyse data from the UNESCO Institute for Statistics (2007) for thirty-six countries to demonstrate the difference between net enrolment rate and gross enrolment with the latter being less than the former. The UNESCO statistics show the economic growth of twenty-five countries[1] between 1999 and 2004 inclusive. Seven of these countries recorded negative economic growth in 1999 and 2000. By 2004, there was an improvement with only two of the seven-Comoros and Zimbabwe-still posting negative growth (–0.24 and –3.80 respectively.). With such struggling economies, it is not likely that education would be funded adequately; and it is not a surprise to find that budget allocations in twenty-five countries indicate such major

[1] The twenty-five countries are: Benin, Burundi, Cameroon, Chad, Comoros, Congo, Côte d'Ivoire, Eritrea, Gabon, Ghana, Guinea, Kenya, Lesotho, Madagascar, Malawi, Namibia, Niger, Nigeria, Sao Tomé and Principe, Sierra Leone, South Africa, Swaziland, Togo, Zambia and Zimbabwe.

challenge (Omwami and Keller, 2010). Adequate funding for education is very important. In order to engage in relevant programme design, development and implementation, each institution of higher education requires major investments in the acquisition of such resources as, among others, hiring and retaining competent staff, purchasing or developing high-quality, relevant books or texts, effective machinery such as ICT hardware and software, science and laboratory equipment, furniture, reliable electronic libraries, laboratories, lecture rooms, dining rooms, hostels, reliable water and food supplies, and so on. All these resources constitute prerequisite infrastructure for the provision of relevant quality education and meaningful expansion of a country's education system.

Members of the Joint Africa-European Union Strategy Tuning Seminars recommended enhancing the mobility of staff and students to ensure a greater exchange and sharing of ideas, expertise, talents, facilities and activities. Greater staff and student mobility would also encourage publication and research to address or expose common challenges and opportunities. This improved activity is essential since Africa's contribution to research and publication as a share in the world currently remains the lowest at the rate of only 1 per cent. Collaborations in research and publication initiatives would trigger more contributions from the continent in this area. If members have greater facility in movement, conducting research or publishing and enjoy the availability of relevant resources, it would be more meaningful, relevant and beneficial to the continent. Many higher education institutions are recent foundations; the older, more experienced higher education institutions can mentor the newer institutions at the same time while, simultaneously, the young institutions may have adopted innovations that older institutions could adapt to their own needs. Whichever way one looks at it, funding is still crucial for any meaningful research, growth and development to take place in either old or new universities.

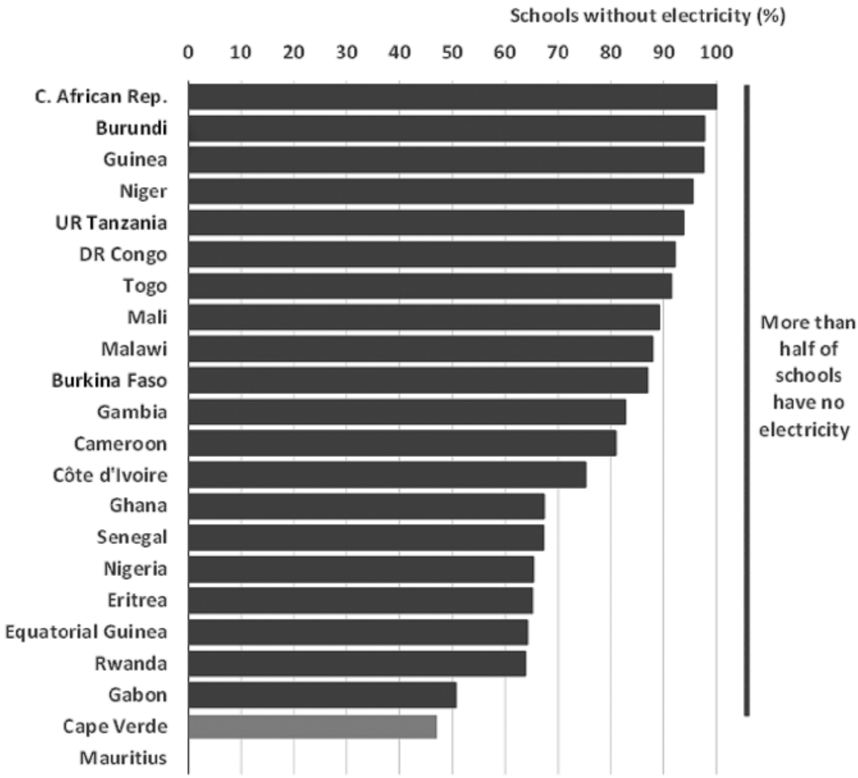
Participants in the Tuning's Teacher Education SAG acknowledged that knowledge of the shortfalls in the system as discussed above is widespread but that most countries in Africa have competing priorities for the sustainability of socio-cultural operations, a fact also acknowledged by UNESCO (2010). Many higher education institutions in Africa have failed to reach expected standards. In many cases, teaching staff are inadequately trained-or not trained at all in pedagogical practices for their professional work. Some staff may have practised their profession for very long periods while receiving little or no in-service training. Many still need to acquire doctoral degrees in order to continue to teach in universities. As with educators in all countries, they face tight budget constraints on public funding for research, with the result that very few staff have had sufficient financial support to conduct research that could inform improvements, changes and innovation to match with global, regional and local development requirements.

8.3.7. *Information and communication technology (ICT) for learning*

In spite of the limited access to connectivity or even electricity in many African countries, there are great demands for ICT to be a feature of learning. Indeed, in many cases for the education of teachers, ICT may prove to be the most effective way to improve teacher numbers at the entry level and to foster continuing professional development for working teachers.

ICT will continue to shape and determine the direction and manner in which teacher education is carried out, even if today we do not know exactly how this will happen. The challenges in Africa are many. The broadband issue, the worsening digital divide, even including intra-institutional divides and problems with adequate infrastructure for the operation of ICTs (such as poor and irregular electricity supply) all contribute to making accessibility problematic. The high cost of computers and the Internet also add to the causes of inaccessibility. In many countries, there is no guarantee of access to a steady supply of electricity, particularly in rural areas. Distance learning thus still has to rely on paper-based materials and face-to-face sessions in many places. However, mobile phones are widespread, and this technology is increasingly being used successfully in some countries for the training of professionals. An example is Sweden's success in training nurses in the use of new equipment. At present, mobile phones have greater capability than in the past and are not prohibitively expensive. Thus, they may be a promising technology of the future.

As Figure 8.1 suggests, in an era where the use of ICT in teaching and learning may be widely recommended, there are many schools in Africa where basic electricity provision is limited. Even in universities, connectivity may be intermittent.



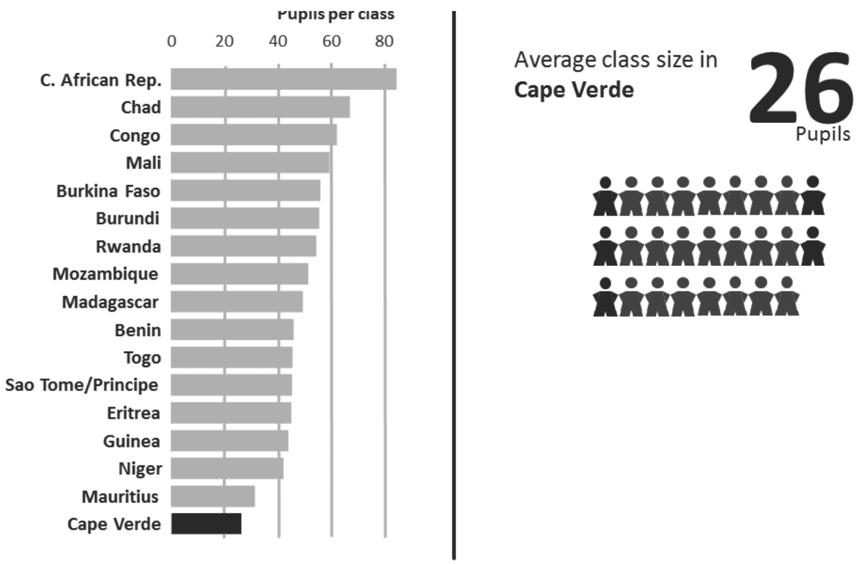
Source: UNESCO (2012)

Figure 8.1
Electricity availability for schools in twenty-two African nations

As noted above, even universities often lack very basic facilities. This is even more the case with primary and secondary schools, many of which are stark. There may be scant facilities, few textbooks and little developed infrastructure, let alone Internet connectivity and computers for the children to use in learning and exploring the world. What constitutes the African context for education in many cases in rural areas is a gathering place under the shade of trees. If a school building exists, children often have to sit on bare floors since there is no furniture. Nevertheless matters are improving, and the education of teachers must look forward not back. Teachers must be educated in such a way that they become computer literate and versatile in order to lead and guide their own students in the use of technologies.

8.3.8. *Teacher availability*

In the drive to achieve universal primary education as one of the Millennium Development Goals, there is an increasing recognition of the urgency of focusing on teacher education to meet the demand for more than one million qualified teachers required to achieve this goal within Sub-Saharan Africa, as well as to combat the sometimes poor quality of educational experience reported in schools. Currently, approximately only one third of teachers are qualified to teach. This dearth of qualified teachers also means that secondary and tertiary education must be improved to provide an educated cohort of graduates (Griffin, 2012). Figure 8.2 compares class sizes in African countries.



Source: UNESCO (2012)

Figure 8.2
Class sizes compared in seventeen African countries

The issue of teacher unemployment in some African countries and teacher shortages in others is a real one. As Figure 8.2 illustrates, in some countries class sizes in schools are excessive. It is not simply a matter of employment, either, but of the need for plural employment in many countries, since the salary from a single job is too low for a family to survive on. This fact also affects students in many places where the demands of the local economy may require them to absent themselves from school. Girls may be particularly affected by sporadic schooling because of domestic duties.

8.3.9. *Maintaining and sharing good practices*

One challenge for teacher education programmes in Africa is to identify and document "good practices" which could be adopted or adapted by others continentally without having to re-invent the wheel. Across the African continent, great efforts have been made; not only to enhance the quality in teacher education programmes, but also to ascertain good practices that could be of general use and adoption across the board. Still, the provision of teacher education is not in any way uniform. Within and across nations, it is marked by variations in the structure and organisation as well as by the mode of curriculum implementation. In others, individual teacher education Institutions try out what they feel are the best ways of producing teachers, thereby determining how they operate, and translating the broader curriculum layout the way they feel best suits their vision and mission. The totality of what makes sense, what works, what produces results, what is effective and what makes for efficiency is summed up in the term "good practices." The harmonisation project of the African Union, supported by projects like Tuning, creates an opportunity to systematically document good practices in teacher education and make them freely available to all.

8.3.10. *Some conclusions*

While teacher education programmes in Africa face many challenges, it is gratifying to note that none of the challenges is insurmountable. The challenges of context and content and the issues of diversity, language of instruction, funding and even that of curriculum reform are gradually being addressed by each country as most appropriate.

In virtually every country in the continent, commissions and reports recommend the review and modernisation of the education curriculum with a broadening of the view of the teacher education curriculum. Many such reports emphasise the need for teachers to acquire skills in analysis and reflection and to achieve greater articulation between theory and practice. Some stress the need to give greater value and relevance to teaching practice while others, consonant with the Harmonisation and Tuning objectives, call for a more competence-based approach to teaching/learning and assessment of quality. Yet others call for experimentation with more diversified types of professional development appropriate to a competence-based approach.

Taken together, a large proportion of African children learn under very difficult conditions; yet because of their zeal to learn, because parents emphasise to them that education is the key to the future and because Africans believe in the power of education, the children, no matter how difficult their circumstances, learn and, in many cases, learn well. Should the same child not have the best-trained teachers? An African belief states that "parents give birth to the bodies of their children but not always to their character". Having given birth to the bodies, parents join with society to birth the character. This is why among other things, traditional indigenous African education believed strongly in character training, in the use of the hand as well as the head and in a utilitarian focus in education and training.

The African context is a communal context where things are done together, created together and shared together. This approach could be reflected in our teacher education programmes. It is, at present, an ideal that has not yet been fully realised that the role of the teacher in the classroom has shifted from the primary role of information giver to that of facilitator, guide and co-learner. As a facilitator, the teacher provides the rich environments and learning experiences needed for collaborative learning. The teacher also is required to act as a guide-a role that incorporates mediation, modelling, and coaching. The teacher is also a co-learner and co-investigator with the students.

"Ubuntu" featured strongly in discussions throughout the Tuning pilot project, both in the Teacher Education Subject Area Group and in other projects. The concept of Ubuntu is found in diverse forms in many societies throughout Africa. Desmond Tutu (1999), the chair of the Truth and Reconciliation Commission (TRC) in South Africa, defined the Ubuntu philosophy as a methodology for reconciliation: "A person with Ubuntu is open and available to others, affirming of others, does not feel threatened that others are able and good, based from a proper self-assurance that comes from knowing that he or she belongs in a greater whole and is diminished when others are humiliated or diminished, when others are tortured or oppressed" (p. 35).

The philosophy stems from an African idiom that says "A person is a person because of others" or "I am because of others". The philosophy reinforces the notions of "community" or "communal learning" within which teacher education reforms can be affected. The level of consciousness about "others" or the "other" suggested in the concept of Ubuntu ties closely with the recent concepts of peer education or learning communities, where learners do not recognise only the teacher as the source of knowledge, but also learn from each other.

A recent report of the World Economic Forum Annual Meeting (2013) argues that "the mark of a good leader with strong personal resilience is the ability to bounce back in times of adversity and rise to the occasion, adapt to adverse conditions and find opportunities in the most trying situations" (p. 10). The report connects adversity to resilience and points out that those who survive adversity emerge from it with an added attribute of resilience in their character. The same can be said of African learners. Because of the level of adversity in the living and learning conditions they face, teacher education programmes should recognise the social capital that these learners bring to the classroom and build on their resilient character.

8.4. Definition of Generic Competences: A Thematic Perspective

8.4.1. *Competences in Tuning*

In Tuning two different sets of competences are the focus. First, groups try to identify competences which would be expected of any graduate in any subject area and which are considered important by other academics, employers, students and graduates. These are competences such as the capacity to learn or the capacity for analysis and synthesis—capacities, in short, which are common to all or most degrees. (See Chapter 3.) In a changing society, these generic competences are very important because they can give students greater flexibility when seeking employment.

Second, the Tuning Africa working groups examined those competences which are subject-area related. These are intimately related to specific knowledge in a field of study. These subject-specific competences give identity and consistency to the particular degree programmes and link them to the world of broader professional practice.

Thinking on competences has evolved in conceptual terms in higher education in the last two decades, particularly with regard to generic competences, largely as a result of demands to make graduates better equipped for the rapidly changing world of work. The nomenclature to describe this constellation of desirable traits has evolved over time and includes personal transferable skills (Drummond, Nixon and Wiltshire, 1998), core and generic skills (Bennett, Dunne and Carré, 1999), generic capabilities (Bowden and Marton, 1998), graduate capability development (Kift, 2002), graduate attributes movement (Chanock, 2003), and graduate skills (Chanock, 2004) . García-SanPedro and Sallán (2011) argue that "conceptions of competencies have evolved over time into more complex models that take into account the person, tasks, workplace and context of work as well as the interaction between these elements". They agree that specific differences for their formulation in the context of higher education would assume the four traits proposed by Bowden and Marton (2002): They would (1) be agreed upon by a "university community"; (2) be developed during students' time spent at a university; (3) transcend disciplinary knowledge and (4) prepare graduates as "agents for the social good in an uncertain future". They point out that competence is a construct that brings together knowledge, skills and public and private behaviour. In this way, the term "competence" is more encompassing than "skills." It is a construct that brings together the content of a subject and the outcomes into the world of real life.

Many programmes in teacher education have used—and indeed many still use—the term "learning objectives" in their course design, particularly since this term was frequently used in school-based learning. Objectives are sometimes confused with competences.

To remove this possible confusion, Tuning distinguishes between learning outcomes and competences. The intended learning outcomes of a programme or unit of learning are formulated by academic staff. They may also be informed by the input of internal and external stakeholders, including—ideally—student representatives, but essentially they are what academics intend the students to learn. Learning outcomes are thus statements of what the teacher intends that the learner know, do, understand and be able to demonstrate after the completion of learning. Competences, on the other hand, are developed by students during the process of learning and represent a dynamic combination of knowledge, understanding, skills and abilities that the student builds on and develops during a period of study. Fostering competences is the object of educational programmes. Competences will be developed over the course of a number of units and assessed at different stages.

Competences can be developed, and this development can be assessed. This means that, normally, persons do not either possess or lack a competence in absolute terms, but command it to a certain level. That level of achievement can be positioned on a continuum and can be developed through practice and education. The important point for curriculum planning is that both learning outcomes and competences are accessible to assessment. The notion of competence is a useful grouping of capabilities and capacities that students acquire or develop during a programme into a number of broad skill sets. They are useful because they are broadly described, and the staff of a programme can use them as starting points for the development of graded programme and unit outcomes, which become precise, achievable guidance for students and assessment.

8.4.2. *Defining generic competences*

The process of defining the generic competences started with this question: "What are the generic competences that graduates from African higher education or the development of education need to acquire?" All five subject area groups (agricultural sciences, civil engineering, mechanical engineering, medicine and teacher education) worked separately to define what they saw as the expected profile of a typical graduate, then jointly reached consensus on a final list of eighteen competences as indicated below. Reaching consensus was not problematic; only one or two items demanded lengthier discussion and elaboration.

1. Ability for conceptual thinking, analysis and synthesis.

2. Professionalism, ethical values and commitment to Ubuntu (respect for the well-being and dignity of fellow human beings).

3. Capacity for critical evaluation and self-awareness.

4. Ability to translate knowledge into practice.

5. Objective decision-making and practical cost-effective problem solving.

6. Capacity to use innovative and appropriate technologies.

7. Ability to communicate effectively in both the official/national and the local languages.

8. Ability to learn how to learn and capacity for lifelong learning.

9. Flexibility, adaptability and ability to anticipate and respond to new situations.

10. Ability for creative and innovative thinking.

11. Leadership, management and teamwork skills.

12. Communication and interpersonal skills.

13. Environmental and economic consciousness.

14. Ability to work in an intra- and intercultural and/or international context.

15. Ability to work independently.

16. Ability to evaluate, review and enhance quality.

17. Self-confidence, entrepreneurial spirit and skills.

18. Commitment to preserve African identity and cultural heritage.

8.4.3. *Competences in teacher education programmes*

Typically in the past the emphasis in designing teacher education programmes was on the subject content: knowledge of the subject(s) to be taught, and basic educational theories related to the psychology of education, methodology and so on. However, teacher education programmes have always had to have a practical element as well, since the outcomes of learning would have to be a person who not only *knew*, but could also *do*. The notion of a competence-based approach to teacher education is not new and has been in use in teacher education in a number of countries for some considerable time. It has, however, often led to exaggeratedly long lists of competences to be achieved by the trainees. Coolahan (2007) has argued in his review of EU and OECD policy on teacher education that, depending on the mode devised, the competence approach can be "professionally positive and benign" or it can be of a narrow, "check-list" type that can be "professionally malign".

The process of defining competences within the context of teacher education in Africa was inspired by the words from Nelson Mandela: "Education is the most powerful weapon which you can use to change the world". These words suggest that teachers have a great responsibility: to serve as agents of change. In this regard, in the process of defining the subject-specific competences, the teacher education working group kept the following questions in mind: (1) What change is needed in Africa? (2) What change do teachers need to mediate?

There are at least two areas where change is greatly needed in the continent: (1) For socio-economic development and growth, with a precise focus on fighting poverty, and (2) For conflict resolution and reconciliation that will create sustainable and peaceful living environments across the continent.

The process of defining the subject-specific competences started by painting the contextual landscape of the fourteen universities represented in the group. After the description of the contextual landscape, the group conducted an exercise aimed at defining components of the teacher education bachelor's degree. This exercise resulted in the eleven core components listed below:

1. Subject content.
2. Educational theory.
3. Methodology.
4. Practice.

5. Assessment.
6. Planning.
7. Values and ethics.
8. Communication and ICT.
9. Health and safety.
10. Research.
11. Quality assurance.

From these eleven core components, the working group identified seventeen key competences:

1. Having mastery of the subject knowledge/understanding the discipline.
2. Applying ICT.
3. Developing resources and instructional materials.
4. Having ability for critical thinking, problem solving, creativity and reflection.
5. Ability to assess and evaluate, including self and others.
6. Providing counsel, guidance and conflict resolution (peace education) for c complex situations.
7. Interpreting curriculum documents, information and sources, and seeing them as a roadmap.
8. Managing projects.
9. Being able to choose, use and design innovative teaching and learning strategies.
10. Being able to research (observe, describe, analyse, etc.).

11. Understanding and applying policies and regulations.
12. Ability to identify and deal with students with special needs, gifted and otherwise.
13. Ability to work in a team.
14. Exercising professionalism, ethics and values; ability to understand and abide by the ethics and values of the teaching profession.
15. Ability to become a lifelong learner.
16. Ability to develop competences for employability in students (ability to enhance employability in one's own profession).
17. Ability to inspire self-confidence in the learners.

8.5. Identification of Subject-Specific Competences

In developing the lists of subject-specific competences that guided the research and discussion to produce the subject-specific competences, the Teacher Education SAG borrowed references from the existing competences in partner African universities, regulations and teaching standards in the member countries, the national frameworks of those participating in the Tuning Africa project, professional agencies, Tuning-compliant competences from other parts of the world and the Arusha Convention. From these sources, it was decided to group the competences under four broad categories: (1) knowledge, (2 educational practice and skills, (3) values and ethics, and (4) interpersonal attributes. This arrangement, it was felt, would make the descriptions more widely understandable to mixed audiences.

The subject-specific competences identified are:

8.5.1. *Competences related to knowledge*

Understanding of:

- The subject(s) to be taught.
- The underlying principles of the foundations of education.

- Pedagogical knowledge of specific subject areas.
- The local and international social, political, economic, cultural and environmental contexts of education.
- National and institutional policies relating to education.
- The language(s) of instruction.

8.5.2. *Competences related to educational practice and skills*

Teacher education graduates will be able to:

- Develop schemes of work and teaching plans (#7).
- Select, adapt and use appropriate teaching methods and learning activities (#8).
- Use a range of assessment skills to set, mark and grade learners' achievement (#9).
- Develop and use teaching, learning and assessment materials, including appropriate ICTs (#10).
- Identify and attend to learners' needs (#11).
- Manage learners both inside and outside formal classroom contexts (#12).
- Develop own and learners' entrepreneurial skills (#13).
- Create conducive learning environments that encourage learning (#14).
- Use language appropriately in the classroom and in the subject (#15).
- Conceptualise and analyse situations to solve problems (#16).
- Participate in basic educational research (#17).

- Manage time effectively (#18).
- Critically reflect on their work to improve practice (#19).
- Adapt to change (#20).

8.5.3. *Competences related to values and ethics*

Teacher education graduates will be able to:

- Care for and support the well-being of all learners (#21).
- Respect socio-cultural diversities (religious, ethnic, linguistic, gender, economic, etc.) (#22).
- Adhere to the rules and regulations of the profession and institution (#23).
- Maintain equity and fairness among learners and promote inclusive education (#24).
- Continuously upgrade their own knowledge and skills (#25).
- Be a role model (#26).
- Inspire self-confidence and appreciation of cultural heritage in learners (#27).

8.5.4. *Interpersonal competences*

Teacher education graduates will:

- Be sensitive to the feelings of others (#28).
- Collaborate and network with others, including peers, head teachers, professional groups and parents (#29).
- Communicate effectively with different audiences and use appropriate tools, including ICTs and relevant forms of discourse (#30).
- Lead and manage groups (#31).

8.6. Consultation and Reflection

In order to validate the lists of competences that had evolved from the work of the Tuning groups, it was necessary to consult with a sample of relevant stakeholders. As discussed in Chapter 2, cluster sampling was chosen as a system and a sampling design, in keeping with other Tuning Projects across the world. Consequently, four categories or clusters of informants were consulted: (1) Graduates who had satisfactorily completed a full programme of studies/degree programme and had been taught at the university, and who had received a corresponding qualification; (2) Employers of university graduates and people and/or organisations which, although not currently employers of such graduates, appear to have relevant jobs for them; (3) Academics who teach the subject area; and (4) Students in the last two years of a degree programme at university or who have finished their studies and are waiting to graduate. The consultation happened across all subject areas, including teacher education.

Each participant consulted at least 30 informants from each of the four categories for the subject area. The informants were asked to rate each competence, using a scale of 1 to 4, on (1) the importance of each competence and (2) the level at which it was achieved during the programme of study. The consultation was done through an on-line questionnaire. This format was very practical in those cases where project participants/assistants had e-mail addresses, an option more common for academics and students. Where e-mail addresses were not available, members of the working group used an alternative approach—viz., a face-to-face meeting with groups separately representing the four groups of stakeholders (e.g., employers) in which the SAG participant gave an introductory orientation to and lecture on the Tuning Africa Project and its importance for the education system. Having set out the aims and characteristics of the survey, the Tuning representative handed out the questionnaire in print format, which the participants filled out before leaving. This procedure facilitated information gathering, given that both tasks (explanation and survey) could be completed in just a short time. The questionnaires were returned to one central point for analysis.

For the purposes of the questionnaire, the variables to be considered by respondents were on the degree of importance; and the level of achievement of the competences as a result of having completed a university degree. In order to evaluate using the two variables (degree of importance and level of achievement), a four-point scale was used: 1 = "none", 2 = "weak", 3 = "moderate" and 4 = "strong".

Each participant in each subject area was expected to gather information from at least 30 respondents. The total number of questionnaires received back across all subject area groups were 4,323. These were from the four categories of stakeholders: academics, graduates, students and employers. The responses came from 33 participating universities. Agriculture and teacher education attracted the most respondents; the two together account for more than half of the total number of respondents (2,496).

Overall, it was striking to note that for the generic competence, professionalism, ethical values and commitment to Ubuntu (#2) was placed in the top five most important competences across all subject areas while environmental and economic consciousness (#13) was ranked among the least important competences by all groups. Tables 8.2 and 8.3. show the ratings for the teacher education specific competences.

Table 8.2
The Highest and Lowest Rated Subject-Specific Competence in Terms of Importance

	Highest	**Lowest**
Academics	1	13
Employers	1	4
Students	6	4
Graduates	1	4

Table 8.3
The Highest and Lowest Rated Subject-Specific Competence in Terms of Achievement

	Highest	**Lowest**
Academics	1	13
Employers	1	13
Students	6	13
Graduates	1	13

The specific competences are:

- #1. Understanding of the subject(s) to be taught.
- #4. Understanding of the local and international social, political, economic, cultural and environmental contexts of education.
- #6. Understanding of the language(s) of instruction.
- #13. Ability to develop one's own and learners' entrepreneurial skills.

The above results imply that the academics, employers and graduates perceived a similarity both in which competences were the most important and how successfully they were achieved. However, the students' data show a discrepancy between what they considered important and how well they felt it was achieved during their teacher education programs. The average ranking for all competences was 3.5 but achievement was 2.5. This finding implies that teacher education programmes have gaps in instructional service delivery.

The respondents singled out as poorly achieved (1) professionalism, (2) ethics and values, (3) ability to understand and abide by the ethics values of the teaching profession and (4) ability to develop one's own and the learners' entrepreneurial skills. Yet these are some of the most important competences a teacher should possess. The most striking revelation in the findings is that academics rate "develop one's own and learners' entrepreneurial skills" as both of least importance and least successfully achieved.

It is worth noting that, in all subject areas and in all the different groups, there are significant gaps between what is deemed important and what is deemed as the level of achievement for the competences. This is an indication that effort and intentional strategies need to be put in place to minimise the gaps.

The findings seem to suggest that the teacher trainees are keen on being professionals by adhering to lessons of work, whereas the employers and graduates were more keen on performance in the field. However, in order to validate the findings, further research is needed.

8.7. The Teacher Education Meta-Profile

8.7.1. *Methodology of the Teacher Education SAG to define the meta-profile*

To recapitulate the Teacher Education SAG's working method, the process began during the first Tuning seminar in January 2012 when academics representing sixty tertiary education institutions across Africa identified 31 specific competences of the ideal teacher education graduate from an African institution of higher education. These specific competences, as well as those identified by similar Tuning processes in other regions (e.g., Latin American and Russia) were used by the Teacher Education SAG to describe four categories of teacher education competences: (1) knowledge and understanding, (2) practice and skills, (3) values and ethics and (4) interpersonal skills. The group took care to ensure that the four categories encapsulated the eighteen generic competences.

Following the consultation process to validate the competences, the Teacher Education SAG was able to distil and identify four areas that together form the essence of the teacher education. The SAG was able to construct the African teacher education meta-profile. See Figure 8.3 for a Venn diagram representing the elements of the teacher education meta-profile.

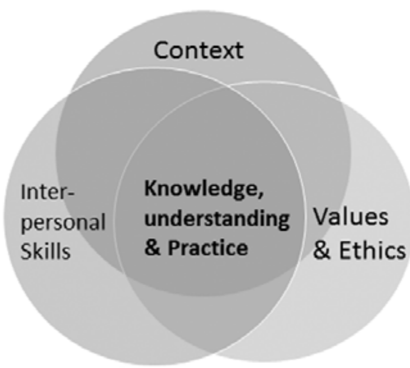


Figure 8.3
Venn diagram representing the four categories comprising the teacher education meta-profile

8.7.2. *Main elements of the meta-profile*

A meta-profile within the context of the tuning project is defined by González (2012) as "a group's representation of the structure and combination of competences which gives identity to a thematic area". She further elaborates that meta-profiles "are referential elements and they are always mental constructions, destined to reflect and analyse possible classifications behind the reference points". Figure 8.3 is a representation of the teacher education SAG's meta-profile with its four components: (1) context, (2) knowledge, understanding and practice, (3) interpersonal skills and (4) values and ethics.

The advantage of representing the meta-profile with a Venn diagram is that it highlights the interconnectedness of the four areas/referent points: (1) context, (2) knowledge/understanding and practice, (3) interpersonal skills and (4) values and ethics. The intersections in the Venn diagram stress that these areas should not be treated in isolation and should not be taught in a fragmented manner. Rather, the specific pedagogies used in teacher education should be informed by an integrated approach.

Figure 8.4 expands the Venn diagram to show how both the specific and generic competences are spread across the integrated referent

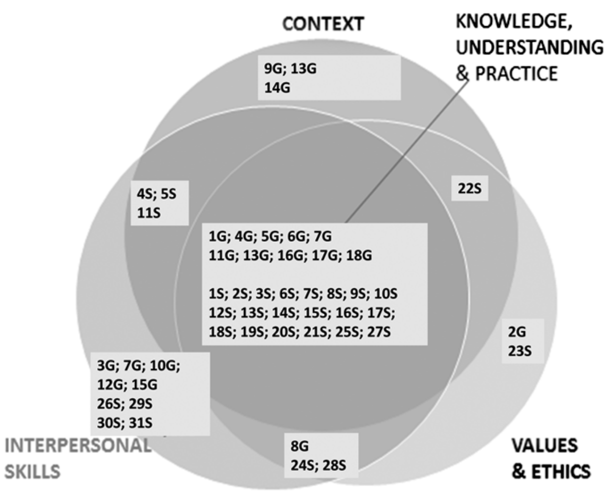


Figure 8.4
Expanded Venn diagram of the meta-profile of teacher education

points: G = the generic competences developed by the whole Tuning Africa group and enumerated in Section 8.4.2. S = the subject-specific (teacher education) competences.

Competence 18G is an example of how a generic competence intersects all four categories in the meta-profile. 18G is "the commitment to preserve African identity and cultural heritage". 27S reads "Inspire self-confidence and appreciation of cultural heritage in learners," and is related to 17G, "Participate in basic educational research." Similarly, competences 4S and 5S indicate the interrelatedness between interpersonal skills and context. (For the list of generic competences, see 8.4; for the subject-specific competences, see 8.5.)

8.7.3. *Comparison of the meta-profile at Africa regional level*

Members of the teacher education SAG conducted practical investigations in their own institutions and countries as a second-level consultation following the Cape Town meeting in May 2012. It was agreed to consult only institutional-level participants, but a number of members consulted more widely at the country level, thus enabling the dissemination of the Tuning Harmonisation work as well as collecting valuable data for analysing the meta-profile.

The following processes were used to consult with individuals/groups selected to participate in developing the Africa regional-level meta-profile for the teacher education specialisation. In many cases, these methods were used in combination.

Face-to-face sessions: Tuning members met with selected individuals to discuss the identification and development of the teacher education meta-profile. At the university level, consultants included administrators, faculty/ departmental board members representing various degree programmes, academic staff, and students at four levels: undergraduates, master's degree candidates, PhD candidates and candidates for a diploma of education. At the ministerial level, Teacher Education SAG members consulted ministers, permanent secretaries and teacher education directorate staff. One SAG member took special leave and relocated to another institution (Cape Town) to obtain reflective moments for developing the ensuing consultation documents.

The face-to-face sessions took place in a variety of settings such as meetings with individual peoples, doing group interviews, conducting seminars, holding conferences and hosting workshops. In each setting, SAG members first introduced participants to the Tuning Africa concept and summarised the meta-profile process conducted at Cape Town. After the introduction, groups conducted interactive discussions that included questions and answer sessions about their institutional and/or programme profile.

Documentary reviews or paper-based analysis: Members identified and reviewed relevant documents as one of the methods for collecting data/information. Some of the major documents that were reviewed included frameworks for curriculum design, institutional and programme profiles for degrees, strategic plans and institutional regulations. The information from the documents was compared with the profile for teacher education specialisations.

Checklists: Some members developed checklists from the documents and compared emerging meta-profile items with the profile identified at the Cape Town meeting to determine differences and similarities.

Validation teams: After developing institutional or programme meta-profiles, validation teams were constituted in order to validate the institutional/programme meta-profile that emerged.

Discussion papers: Members who engaged ministerial-level participants developed discussion papers to enhance the interchange with ministerial-level staff. The papers also served as part of the dissemination process.

Except for a few competences that were slightly extended, modified or observed/seen as being non-existent in some of the teacher education programmes in African universities, most of the competences identified at the Cape Town coincided with those being taught or developed. The analysis revealed further coincidences between Tuning competences and those existing within some of the regulatory boards such as the Namibian Teachers Standards (NTS) and the Tanzanian Commission for Universities (TCU). The Zimbabwe University Tuning participant observed, "When this degree [i.e., the teacher education programme in Zimbabwe] is analysed in comparison with the meta-profile done in Cape Town there were more coincidences than differences". The Open University of Tanzania (OUT) representative indicated, "There are only slight differences between the Tuning Africa meta-profile and that of teacher education programme at the Faculty of Education at OUT".

Despite this general agreement between the competences lists developed by the SAG, most universities identified a few competences that were either non-existent or not given adequate emphasis at their institution. The most common items on this profile of differences were (1) the ability to mediate conflict resolution and reconciliation for a sustainable and peaceful living environment; (2) the ability to learn to learn and capacity for lifelong learning; (3) commitment to Ubuntu (respect for the well-being and dignity of fellow human beings); (4) environmental and economic consciousness; (5) respect for social-cultural identities and (5) the ability to develop one's own and learners' entrepreneurial skills. It is not surprising that all consultants agreed that the fifth quality was the competence perceived as being least achieved by all informants and that, furthermore, academics rated it as the least important.

The consultation at the University of Western Cape in South Africa made specific analysis of the forty-six combined generic and specific competences and established that thirty-one fit well under the general category of knowledge, understanding and practice. Nine fit under the category of interpersonal skills. Five were seen as subsets of the context category, while only one fit under the category of values and ethics.

The most obvious implication is that teacher training in Africa gives the strongest emphasis to knowledge, understanding and practice. The low emphasis accorded to values and ethics could fittingly be interpreted as accurately representing Africa's widespread conflicts due to limited or lack of education and training in valuing and respecting others.

Members noted that identification of the competences constituting the meta-profile at universities was arrived at through in-depth analysis of the course on offer at the different universities providing teacher education. Prior to the Tuning project, there has been no specifically organized forum by African higher education institutions to develop competences and meta-profiles to guide the adaptation of such important competences and ensure their quality. Hence, the Tuning Africa project has provided a model for institutions to emulate.

8.7.4. *Analysis of additional observations*

Analysis of the comparison consultations reports revealed some important issues that could not be directly captured through a mere comparison report. Members decided to report such observations in the interests of enhancing the outcomes of the Tuning consultation exercise. These added observations include:

8.7.4.1. Building capacities for existing course structures to incorporate new competences

It was learned that some existing course structures in teacher education programmes can incorporate the identified competences but some currently lack that ability given their current structures and staff perspectives. For example, at Zimbabwe University, members of the Department of Educational Administration indicated that they did not see the need for incorporating the competence of "pedagogical knowledge of specific subject areas" as one of the competences for their programme. However, a critical analysis of courses generally offered in its education administration stream shows that courses relating to planning are taught alongside courses in policy and administration.

One would realize the need for specific pedagogical approaches to the different strands of the courses where such a combination exists. It is suggested that, for those courses which currently have no inbuilt structures to accommodate important competences, the Tuning project initiative should exert some influence to encourage staff members to ensure adaptation of the competences for the sake of realizing the harmonisation target. New courses with structures that can incorporate necessary competences should be initiated, and existing courses can be restructured to provide space for including the competences.

8.7.4.2. The need to provide adequate emphasis for identified competences in existing courses

Through the consultations, members found out that, although some subject-specific competences were incorporated in existing courses, they were not accorded adequate emphasis. There was a need to encourage teaching staff to give each competence adequate emphasis.

One example of little-emphasized competences that appear to need more prominence comes from University of Zimbabwe:

1. Develop and use teaching, learning and assessment materials, including engagement of appropriate ICTs.
2. Develop own and learners' entrepreneurial skills.
3. Care for and support of the well-being of all learners.
4. Respect of social-cultural diversities.
5. Adherence to rules and regulations of the profession and institution.
6. Maintain equity and fairness among learners and promote inclusive education.
7. Continually upgrade their own knowledge and skills.
8. Become role models.
9. Inspire self-confidence.

8.7.4.3. Special varieties of teacher education programmes

The Tuning consultation exercise explored the competences in special varieties of teacher education programmes and related profiles. This was specifically the case with University of Nigeria, Nsukka; Adama Science and Technology University, Ethiopia; Makerere University, Uganda; and Zimbabwe University where technical teacher education programmes were offered. It was suggested that teacher education programmes for TVE do not follow the pattern of traditional subject teacher education because the development of vocational skills differs so significantly. This variety of teacher education should be given special attention to successfully address the issue of youth unemployment which exists across all African countries.

Many of the competences that were considered appropriate for the technical teacher education programmes were adopted from both the civil and mechanical engineering, and agriculture lists of competences. Among such competences were: ability to adapt and transfer technology, ability to create new technologies; ability to improve quality and safety along the agricultural value chains; skills in developing new construction technologies and material; ability to operate, maintain and rehabilitate mechanical engineering systems; capacity to supervise, inspect and monitor mechanical engineering systems; and capacity to integrate legal, economic and financial aspects in decision-making in mechanical engineering projects.

This finding reinforces the need for collaboration among institutions as well as among programmes and courses in Africa Higher Education and for further research into the curricula for teacher education for TVE.

8.7.4.4. Competences not featured in the Tuning meta-profile identified at the Cape Town meeting

Another finding from the consultation activity was that some competences that were deemed essential did not appear in the Tuning meta-profile. Some such competences were:

- The ability to continuously enhance quality in the field of practice.
- Sensitisation, lobbying and mobilisation skills.
- The ability to effectively use assistive devices and technologies for people with disabilities in inclusive settings.
- The ability to effectively use research and evaluation skills in education settings.
- Visionary thinking and foresightedness.

8.8. Contrast of Meta-Profile Findings with Russia, Latin America and Africa

At the Tuning meeting held in Brussels in November 2012, the African Teacher Education SAG had an opportunity to interact with its counterparts from Latin America and Russia. The meeting focused on comparing and contrasting meta-profiles of the groups from the three different continents.

With regard to the three regions' different categories of subject-specific competences, comparison shows both similarities and differences. The differences are mainly derived from the contexts within each country with respect to socio-cultural, socio-historical, socio-political, socio-economic and climate conditions. These differences give rise to different emphases in the subject area competences of the three regions.

Similarities between the three regions can be seen in their emphasis on knowledge and practice. Another similarity is the focus on the ability of a teacher to interact with others. (See Table 8.4.) Both Africa and Russia emphasise the interrelatedness of the competences. Some of the differences in the areas of context can be seen in what the Russians phrase as "ability to work," which is not necessarily highlighted in Africa and Latin America. The emphasis on the social context in teaching in Africa and Latin America is not necessarily emphasised in Russia.

Table 8.4

Comparison among Meta-Profiles of Africa, Latin America and Russia

Latin America and Russia focus on the professionalisation of teacher education, whereas it does not appear to be an emphasis in Africa.

Africa, in contrast, emphasises moral and ethical issues in teaching, whereas such issues appear less salient in the other two regions.

A collapse of the three meta-profiles results in this combination:

- (Cognitive) Knowledge: subject + pedagogical knowledge.
- Interpersonal skills.
- Ability to learn.
- Life-long learning.
- Role of the teacher in society/teacher as an agent of change (capturing the emphasis on values and ethics).

The questions that remain are: (1) How to teach and assess values and ethics? (2) What good practices exist in these areas?

8.9. Conclusions

What has been developed in this process is a broad competence-based framework for teacher education programmes. This framework will assist in programme design but it will not necessarily influence programme implementation. It is relatively easy to develop programmes using the broad competence-based framework and the meta-profile; it is the detailed work that needs to happen that often appears as tedious: to further break down the programme-level competences into learning outcomes. If competences are not further broken down into learning outcomes that are thoughtfully distributed across the units of the programme, and if the teaching and acquisition of these competences are not accurately assessed, then it seems unlikely that teaching will become student-centred, and that learning activities will develop functional knowledge as opposed to learning declarative knowledge which is not accessible to practice.

The results of the consultation survey in which achievement was invariably ranked lower than importance is suggestive in this connection. In developing the (Tuning) project further, attention will have to be given to how the gap between importance and achievement is closed. This is a need across all subject areas. Even at this early stage, the project provides evidence for the comparison of programmes across regions. The similarities that exist in the generic and specific competences across regions serve as evidence that mobility can be enabled with further planning. The project further prepares the ground for joint programmes across countries and regions.

One very interesting issue that emerged is the observation from those working in technical and vocational teacher education that substantial differences exist between the teacher education subject-specific competences as established in this SAG and those in technical and vocation teacher education. They found that the subject-specific competences from civil and mechanical engineering, and agriculture provide more relevant scope, that is, beyond those produced by the Teacher Education SAG. This is clearly an important area where further research and discussion are needed.

Another issue emerging from this pilot project is the difference among the structures and focus of programmes in teacher education across countries. These differences must be considered during the later discussions about the viability of a credit system for Africa. A system of interchangeable credits works logically only if the key criteria of learning are shared across counties and universities. At this stage, institutions reveal considerable variation in the number of credits allocated to programmes and years.

Many other practical differences have emerged from this pilot study. Entry points, length of programmes, credits systems and types of programmes all vary within the continent. For example, while many bachelor degrees are of three-year duration, in South Africa and Mozambique a bachelor's degree for teacher education requires four years of work. Namibia has a two-tiered system, in which initial teacher education (non-degree) takes place in teacher education colleges and then is completed in the university where the degree is awarded.

Not all countries have national standards for teachers. Even where an evaluative or standards body exists, there may be no enforcement mechanisms. It appears to be the case that there are frequently different regulatory bodies for primary and secondary teacher education. In some cases, universities as autonomous bodies exercise a great deal of independence in the design of programmes. Again, these are areas where more detailed research will be useful in the future.

8.9.1. *Recommendations for validation*

As noted above, colleagues in the SAG undertook validation exercises within their own institutions and also within relevant institutions in their countries. The consideration of further validation in the consolidation period between the pilot project (Tuning Africa) and the proposed second step (Tuning II) highlighted different levels of conducting such validation: at an individual level (within an institution), at the level of a group within the same country (across institutions), at a regional level involving a group of countries, and at an intercontinental level. The various steps of consultation and validation have to be well documented so as to reap the maximum benefits.

The competences developed provide a language of comparison and collaboration across institutions and countries and participants should take advantage of it to strengthen their own programmes.

- At an individual level, all members can address their own departments and faculties and share the generic and subject-specific competences; they can also network with colleagues in other universities. This latter activity is particularly important because, during the Tuning II stage, group participants should seek contacts as part of collecting best-practices examples of assessment, learning tasks, teaching techniques and other functions.

- The students are also an important group for validation. An interesting suggestion from the Medical SAG is to organize an exit questionnaire, based on the teacher education survey to administer to students in their final year. The Teacher Education SAG members could develop the questionnaire as a collective project and administer it individually in their institutions.

- All members in education faculties can also make contact, where possible, with professional associates such as individuals or groups of head teachers, parents, inspectors, etc. and ask them to validate the profile. They can also contact teacher education-related government bodies and compare the competences with national standards where they exist; this could be done through dissemination of the Tuning report or through meetings.

- It would also be helpful for individuals to take advantage of any links to neighbouring countries through their faculty or university, such as a research link, external examination of doctoral candidates, etc. The value of such outreach would be to establish and maintain contact with some of the countries in Africa that have not participated in the pilot project, disseminate the work of the Teacher Education SAG and gain allies for the future.

- Country groups (in Nigeria, Ethiopia, South Africa, Cameroon, Egypt, Kenya and Tanzania, more than one institution is currently participating in Tuning) can work together to target committees of rectors/vice chancellors, ministries of higher education, quality assurance agencies, etc. Where there is only one representative from the country (as in Gabon, Mozambique, Namibia, Somalia, Uganda and Zimbabwe), the project participant will have to broaden consultation and involve relevant stakeholders.

- The intercontinental group would be the Teacher Education SAG, or the Coordinator of the Teacher Education SAG with the other four coordinators, who would consult bodies that operate at the Pan-African level. Such bodies include COMEDAF, (the Committee of Ministers of Education in Africa), the AAU Vice Chancellors committee, and other professional organisations operating at the all-Africa level, etc.

8.9.2. *Recommendations for dissemination*

Many of the validation activities listed above would also serve as dissemination activities. However, a number of helpful initiatives would also focus directly on dissemination.

- A simple tri-fold brochure could describe and summarise the purpose and goals of sums up the intentions of the Harmonisation/Tuning project, set out the profiles we have reached and identify future plans both during the consolidation period and during the second phase, now being called Tuning II.

- The project must reach the agenda of the African Ministers of Education (COMEDAF) with sponsorship at a level that will stress its importance, encourage discussion and further validate the meta-profile (generic and subject-specific competences).

- Similarly, the meta-profiles must receive attention on the agenda of the AAU Vice Chancellors' meetings for discussion and validation.

- Research and scholarship associated with this project should be supported and strengthened.

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List of Education Subject Area Group members

Subject Area Coordinator: **Matete MADIBA** South Africa, matetemadiba@gmail.com	**Higher Education Expert-Tuning:** **Arlene GILPIN** United Kingdom arlenegilpin@gmail.com
Cameroon: **Pauline Lyonga LYONGA** **Therese MUNGAH SHALO EPSE TCHOMBE** University of Buea nalova_cameroon@yahoo.com tmtchombe@yahoo.co.uk	**Nigeria:** **Emmanuel Chukwugozie OSINEM** University of Nigeria, Nsukka ecosinem@yahoo.com emma.osinem@unn.edu.ng

Egypt: **Hani Abdelsattar Mohamed FARAG** Alexandria University dr.hani199@yahoo.com	**Nigeria:** **Babatunde Joseph IPAYE** Formerly of the National Open University of Nigeria, Deceased 2013.
Ethiopia **Birhane Sime GERESSU** Adama Science and Technology University birhane_200@yahoo.com	**Somalia** **Mohamed HASSAN NOOR** Mogadishu University xoosh1@hotmail.com mogadishuuniversity@mogadishuuniversity.com
Gabon **Théophile MAGANGA** Université Omar Bongo theomaganga@ymail.com	**South Africa** **Zubeida Khatoom DESAI** **Shaheed HARTLEY** University of the Western Cape zdesai@uwc.ac.za, shartley@uwc.ac.za
Kenya **Gathogo MUKURIA** Kenyatta University gathogomiringu@gmail.com	**Tanzania** **Honoratha Michael Kisenge MUSHI** The Open University of Tanzania honorathamushi@gmail.com honoratha.mushi@out.ac.tz
Mozambique **Eugenia Flora Rosa COSSA** University Eduardo Mondlane eugenia.cossa@gmail.com	**Uganda** **Mugagga Anthony MUWAGGA** Makerere University, College of Education and External Studies School of Education amugagga@educ.mak.ac.ug
Namibia **Charmaine Benite VILLET** University of Namibia cvillet@unam.na	**Zimbabwe** **Rosemary MOYANA** University of Zimbabwe rosemarymanasemoyana@gmail.com
Kenya **Rotimi Joshua OGIDAN** African Council For Distance Education (ACDE) rjogidan@acde-africa.org	

Chapter 9

Conclusions

Charles AWONO ONANA

The pilot project of Tuning and Harmonisation Africa was undoubtedly a success. It paved the way for major improvements on issues that seem dauntingly complex for the establishment of a higher education area in Africa. It is therefore necessary to make a retrospection that will lead us to think deeply on how to identify clearly the lessons learned and the paths of the future for higher education on the continent.

The objective of higher education in Africa has always been to provide an appropriate response to the specific needs related to the states' sovereign nature and duties, including public administration, education, security, diplomacy and judicial control. Over the years, the needs of the state and society have become more diverse and complex. The need for territorial planning and the industrial sector development has led to an immense demand for engineers, agronomists and senior technicians with different profiles. Taking care of the health of the growing population has led to a surge in the need for doctors and other medical and paramedical staff. The higher education system has therefore greatly expanded and diversified over time.

More than fifty years after the independence of African states, higher education in the continent has greatly evolved. There are now more than a thousand universities in Africa, including five hundred public universities. One of the problems raised by this exponential growth in higher education is the professionalisation of teaching to ensure that higher education is in accordance with the needs of their respective countries. In fact, higher education in Africa now has to face the contradictions it has developed and fostered over the years. The various forums organised on the issue of graduates' employability alone adequately shows the importance of this issue for the relevance of higher education in Africa. African states face the adverse consequences of uncontrolled development of higher education, which leads to the increasingly visible unemployment of students who are pressing toward graduation.

On the other hand, the continent has greatly opened up to globalisation, and its resulting free-movement policies have strongly impacted its higher education. These policies are highly consistent with the will of the African Union to strengthen harmonisation frameworks in higher education in order to ease the understanding and development of improved interuniversity cooperation. In particular, the major initiatives to support the Intra-ACP mobility, implemented with the support of the European Union and the African Union, call for convergence on the concepts of student curriculum and recognition of skills acquired throughout this curriculum. The great mobility initiatives in the continent are an innovation that carries high hopes because, as was the case in Europe with the Bologna Process, the greatly desired African Union will be built around higher education.

Therefore, inter-university cooperation frameworks that have been created in recent years have given rise to new issues. They will certainly result in a specialisation of higher education within the regions in order to preserve the quality and promote increased student and teacher mobility. It therefore becomes vital to establish a new rhetoric and a new methodology for universities to learn how best to identify the signals from each other and to intensify the movement of inter-university cooperation in the continent.

During the last twenty years, a remarkable evolution has been witnessed in African higher education, not only in terms of quantity, but also at academic and organisational levels. Institutional governance has received special attention throughout this tortuous period. It is easy to see the hopes that this development raises, as well as the concerns that it properly creates. All states follow with understandable excitement the actions of universities that struggle to find an acceptable language for socio-economic milieux that seek trained specialists to meet their needs but who, despite thousands of young graduates, fail to provide the skills they need. The issue of training to adequately meet employment needs has remained a dream for a long time, and the resulting unemployment causes some people to say that African higher education could become a source of social instability if it continues to be seen as a machine to produce unemployed people.

It is also clear that, over the past twenty years, following troubles caused by unemployed graduates, several states have undertaken major reforms to make higher education more likely to give an appropriate response to the pressing demands of society. It is equally true that these reforms, whose scope vary from one country to another, have generally brought back to the table the main principles of professionalisation, which was set as early as the mid-1970s when, with a saturated public service, the states absorbed fewer higher education graduates. These reforms have significantly affected the governance of universities; in some cases, reform led to the introduction of business representatives onto the boards of universities. They have encouraged universities to develop vocational training courses that, statistically, have affected a limited number of students, because of their high cost and the need to work with a small number of students.

This analysis seeks to highlight (1) the milestones that have marked the evolution of academic and management systems of university governance, (2) the perception by the main actors in higher education that these universities have, with time and events, become much more complex, and (3) that universities have reached this point without finding truly convincing solutions on how to tackle the thorny issue of training-employment adequacy even as access has brought a larger segment of the population into universities.

This is why the project Tuning and Harmonisation Africa has raised so many hopes and created an enthusiasm that is obviously going to increase in the coming years. Without claiming to solve all of higher education's problems, it is a strong step forward in the continuing search for solutions related to graduates' employability and the reasonable management of students' increased mobility with its concurrent need of establishing a framework for harmonisation.

The diversity of universities involved in this pilot project reflects a huge disparity in educational systems, a diversity that originates mainly from the historical colonial legacy by France, Belgium, Germany, Great Britain and Holland and their higher education systems deployed in Africa. These important features, sometimes convergent but often divergent, are sufficient justification for the establishment of a frame of reference for higher education in Africa that harmonises the framework of consensus and acknowledges the convergence of multiple traditions from the different historical legacies of African countries.

This pilot phase project was led with sixty universities representing the five sub-regions of Africa, with their great linguistic (French, English, Arabic and Portuguese) and cultural diversity. The project's aim is to build the capacity of universities to develop curricula, tailored to the needs expressed by society in relation to a particular job. These expectations are expressed in terms of general and specific skills and can therefore bring the universities together, not on the issue of the duration of courses and titles of certificates, but rather on the value of these courses in terms of acquired skills and ability to better match the training received with the predefined general and specific skills needed by a given profession.

The diversity of historical heritage has created multiple training profiles, if one considers the duration of courses and content of specific curricula that each university has decided to apply. It is obvious that one of the challenges posed by this historical status is the actual discouragement of convergence, since it would be greatly to the advantage of each university to extol its approach as "the best" and make every effort to persuade its fellow universities to adopt its model, rather than changing its own.

The strength of Tuning and Harmonisation Africa lies precisely in its ability to achieve consensus. By gathering at the same table specialists from different countries who are working in the same field, it has been relatively easy to reach an agreement if the purpose of the thorny issue of harmonisation is not phrased in terms of determining who is "better" than the others but rather to know what competences are expected of a student who has received training is a specific area. In this case, the question of the duration of courses is secondary and so is the title of the certificate, the meaning of which varies from one country to another. These are simple terms, and it is this very flexibility in reasoning typical of this project that creates a new perspective of constructive dialogue for all universities of the continent.

In fact, this is an important result because of its implications. Since the creation of universities in Africa, the basic tool for comparison was the duration of studies and not the skills acquired. It was widely accepted in some countries that the longer studies last, the more value they have.

Each country, relying on its own legislation, ultimately produced a wide variety of training profiles. Some countries have aligned themselves with the Bologna Process while others have chosen models closer to the U.S. system. From this perspective, all of the elements were present to produce a clash of cultures that contradicts the new frameworks of intra-African mobility.

Throughout this work, the possibility of facing up to the major initiatives conducted in other parts of the world helped to reinforce the qualities that can be identified with this methodology. For example, comparing the results obtained in Latin America and Russia as part of its Tuning projects has highlighted the convergence of both generic skills and subject-specific skills that has emerged from both groups with the documents produced by the Africa group. Based on this observation, can we now dare to think of a global harmonisation of curricula? Should one think that the Tuning methodology generally opens the door to greater recognition of a need for universities in a context of rapid globalisation and an acceptance of what will be required to more efficiently manage mobility in the world? Can one now hope to see a positive impact from this initiative on higher education in the world?

Each project builds its own future, and Tuning and Harmonisation Africa is no exception to this rule. To have a glimpse of this future, the expectations for the future should be stated. It seems obvious that the issue of identifying generic and subject-specific skills is an essential point of the Tuning methodology developed. This essential point is now mastered and accepted as foundational.

What is less fully mastered is related to the construction of meta-profiles and their use in building a curriculum. This point is crucial because competence-focussed curriculum is inevitably the real engine for the harmonisation of curricula that is the ultimate goal. The next steps will deal with this issue from all angles and lead to case studies on the production of curricula from these meta-profiles. At that point, one could then talk of the construction technology curriculum and later of the optimal design of curricula or computer-assisted design of curricula. Obviously, the impact on the whole education sector is enormous, and many questions about the system of education in universities would need a scientific arbitration.

It is now necessary to focus on the issue of capacity. It is certain that the pilot phase has revealed a relatively large number of participants who can now spread the Tuning Africa methodology. But these stakeholders, once in their universities, have to deal with many daily tasks that will compete for time with the demanding task of publicising Tuning Africa. In the future, it will be necessary to address this issue with more caution. One of the clauses for participating universities could be to set up support centres for excellence in teaching whose primary mission will be to spread the message in universities and even steer Tuning projects within these institutions. The universities may be requested to use Tuning as a research project to enrich this methodology and support its implementation. The creation of such institutional infrastructure seems to be a condition for the success of Tuning Africa that all we expect.

If this condition is implemented, it would address the now-recognised need for the harmonisation and standardisation of concepts. The development of the fundamental aspects of Tuning Africa would undoubtedly raise the need to create a Continental Academy to manage standards and design concepts to harmonise the Tuning languages. The Tuning Academy would be a scholarly society whose role would be to promote research on theoretical aspects of Tuning and its most relevant applications. The next phase of this project should address this inevitable issue that will influence the harmonisation of concepts around Tuning Africa.

As discussion shows, it leads rapidly toward thinking of continent-wide approaches to solutions. This was necessary for the pilot phase. Sixty universities were selected and five scientific fields have been successfully studied. The question is how to implement the project at the level of the state? In the absence of financial appropriations by states, it is feared that the system will crash and turn into another academic exercise with no impact on national education systems. However, it is important to ensure that Tuning Africa continues to sustain its momentum and play its role in transforming higher education in Africa.

What should be done in this case? Discussions within the Tuning Africa group provide an overview of acceptable solutions. The first promising proposal is to strongly involve the Association of African Universities in the design and implementation of the next project, including the selection of beneficiary universities. The second step will be to work more effectively with the African Union to strengthen the continental scope of the project. The third step is to involve states, through the ministers in charge of higher education in these countries. This third step also emphasises the need for a policy statement for the states to implement specific Tuning projects and to support the implementation of this methodology. To be convincing at this level, it will be necessary to conduct a study of the economic impact of Tuning Africa on the employability of graduates.

The future is now. The question is whether the next step should not include a field study on these issues of curriculum design. Obviously, a variety of mathematical and computer tools could be developed to implement this approach, including discrete optimisation and artificial intelligence. Such a study would radically change the nature of Tuning Africa meetings. This idea has been advocated in Tuning Africa milieux for quite some time; now the issue is to shape it as a tool to support the development of mobility and the subsequent acknowledgment of training courses.

To implement the question of a theoretical study on the design of curricula, it is advisable to design a specific research project that will provide insight on the interuniversity, international and multidisciplinary stages. On the one hand, such a research project will strengthen the supranational scope of this concept on the continent and, on the other hand, will allow some involved universities to become focal points of this research in the world.

Another important step would be to guarantee the continuity of this new branch of knowledge that we see emerging before our eyes, with our hearts carrying the hope that its beam, which is already visible in the distance, will one day grow into a sun which enlightens the minds and brings together people. All this is expected from Tuning Africa.

List of Acronyms

AAiT	Addis Ababa Institute of Technology
AAU	Association of African Universities
ABET	American Accreditation Board for Engineering Training
ACDE	African Council for Distance Education
ACP	African, Caribbean and Pacific countries
ADB	African Development Bank
ADEA	Association for the Development of Education in Africa
ADF	African Development Fund
AEEA	African Engineering Education Association
AfriQAN	African Quality Assurance Network
ANAFE	The African Network for Agriculture, Agroforestry and Natural Resources Education
ANAMCO	Anambra Motor Manufacturing Company
ASOCSA	Association of Schools of Construction of Southern Africa
ASTI	Advanced School of Translators and Interpreters
AUF	Francophone University Agency
AVU	African Virtual University
B.Ed	Bachelor of Education

BA Ed	Bachelor of Arts with Education
BE(Aero)	Bachelor of Engineering in Aeronautics
BEng	Bachelor of Engineering
BEng (Elec)	Bachelor of Engineering in Electronics
BSc	Bachelor of Sciences
BSc Ed	Bachelor of Sciences in Education
CAAST-Net	Network for the Coordination and Advancement of Sub-Saharan Africa-EU Science & Technology Cooperation
CAMES	African and Malagasy Council for Higher Education
CAT	A computed tomography
CBE	Council for the Built Environment
CBE	Community-based Education
CDA	Centre for Academic Development
CE	Civil Engineering
CEMAC	Community of Central Africa
Ceng	Chartered Engineers
CETVETAR	Centre for Technical Vocational Education, Training & Research
CHE	Council on Higher Education
CHU	University Hospital Center
CIDA	Canadian International Development Agency
CLS	Clinical Laboratory Sciences
CNC	Computer-Numerically Controlled
COL	Commonwealth of Learning
COMEDAF	Committee of Ministers of Education in Africa
COMESA	Common Market for Eastern and Southern Africa
COS	Centre of Specialisation in Teacher Education (Tanzania)
CPA	competence approach
CSIR	Council for Scientific and Industrial Research

CT	Course Tools
DAAD	German Academic Exchange Service // Deutscher Akademischer Austauschdienst
DFID	Department for International Development
DRC	Democratic Republic of Congo
DUT	Durban University of Technology
DUT	Diplome Universitaire de Technologie (DRC)
ECBP	Engineering Capacity Building Programme (Ethiopia)
ECE/ECD	Early Childhood Education/Early Childhood Development
ECOSS	Engineering Council of South Sudan
ECOWAS	Economic Community of West African States
ECSA	Engineering Council of South Africa
EEC	European Economic Community
EFA	Education Funding Agency; also Education for All (Tanzania)
EGERAFE	Reform of the State's General, Education Research and Training-Employment Adequacy
EI	Engineering Intern
EiABC	Ethiopian Institute of Architecture, Building Construction and City Development
EIT	Engineer-in-Training
EMRO	Regional Office for the East Mediterranean
ENS	École Normale Supérieure
ENT	Ears, Nose, Throat Procedures
EQF	European Qualification Framework for Higher Education
ERAfrica	ERA-Net with Africa
ESDP	Education Sector Development Programme (Ethiopia)
EU	European Union
FARA	Forum for Agricultural Research in Africa
FUT	Federal University of Technology

GCC	Gulf Cooperation Council
GER	General Education Requirements
GDP	Gross Domestic Product
GETFUND	Ghana Education Trust Fund
GNP	Gross National Product
GTP	Growth and Transformation Plan (Ethiopia)
HAM	Associated Myelopathy
HCV	Hepatitis C Virus
HE	Higher Education
HEQF	Higher Education Qualifications Framework (South Africa)
HERQA	Higher Education Relevance and Quality Agency (Ethiopia)
HESC	Higher Education Strategy Center
HOD	Head of department
HR	Human Resources Management
HRH	Human Resources for Health
HTLV-1	Human T-lymphotropic virus - 1
ICT	Information and Communication Technologies
IHE	International Higher Education
Intra-ACP	Africa, the Caribbean and the Pacific
IOTs	Institutes of Technology (Ethiopia)
ISO	International Organisation for Standardisation
ITF	Industrial Training Fund
IUCEA	Inter University Council for East Africa
JAES	Africa-European Union Strategy
JU	Jimma University
LA	Latin America
LMD	Licence-Master-Doctorat/Licence Maîtrise Doctorat
MD	Doctor of Medicine

MDG	Millennium Development Goals
ME	Mechanical engineering
MENA	Middle East and North Africa
MEng	Master of Engineering
MEPI	Medical Education Partnership Initiative
MIT	Mekelle Institute of Technology
MOE	Ministry of Education
MU	Mogadishu University
NAB	National Accreditation Board (Ghana)
NAQAAE	National Authority for Quality Assurance and Accreditation of Education (Egypt)
NARS	National Academic Reference Standards (Egypt)
NATO	North Atlantic Treaty Organisation
NBA	National Accreditation Board (Ghana)
NCE	Nigeria Certificate in Education
NCTE	National Council for Tertiary Education (Ghana)
NERNs	National Educational and Research Networks
NHBRC	National Home Builders Registration Council
NMMU	Nelson Mandela Metropolitan University
NOK	Norwegian Kroner
NORAD	Norwegian Agency for Development Cooperation
NOUN	National Open University of Nigeria
NTS	Namibian Teachers Standards
OBHE	Observatory on Borderless Higher Education
ODeL	Open Distance and e-Learning
ODL	Open and Distance Learning
OECD	Organisation for Economic Co-operation and Development
OEMs	Original Equipment Manufacturers

OSCE	Objectively Structured Clinical Examination
OUT	Open University of Tanzania
PAU	Pan-African University
PE	Practicing Engineer or Professional Engineer
PG	Postgraduate Certificate
PHEA	Partnership for Higher Education in Africa
QA	Quality Assurance
R&D	Research and Development
RECs	Regional Economic Communities
Ruforum	Regional Universities Forum for Capacity Building in Agriculture
S&T	Science and Technology
SAACE	South African Association of Consulting Engineers
SABS	South African Bureau of Standards
SABTACO	South African Black Technical and Allied Careers Organisation
SADC	Southern Africa Development Community
SAFCEC	South African Federation for Civil Engineering Contractors
SAG	Subject Area Group
SAICE	South African Institution of Civil Engineers
SAMSS	Sub-Saharan African Medical Schools Study
SAQA	South African Qualifications Authority
SARUA	Southern African Universities Association
SARUA	Southern African Regional Universities Association
SIDA	Swedish International Development Agency
SKA	Square Kilometre Array
SRFL	French Intensive Care Society
SSA	Sub-Saharan Africa
SSC	subject specific competences

SSES	South Sudan Engineering Society
STEP-B	Science and Technology Education Post-Basic
SUN	Stellenbosch University
SUNY	State University of New York
TALIF	Teaching and Learning Innovation Fund (Ghana)
TBA	Tanzania Buildings Agency
TCU	Tanzanian Commission for Universities
TEVET	Technical Education, Vocational and Entrepreneurship Training Authority (Zambia)
TRC	Truth and Reconciliation Commission
TUT	Tshwane University of Technology
TVE	Technical and Vocational Education
TVET	Technical and Vocational Education and Training
UB	University of Buea
UCA	Université Cadi Ayyad
UCBP	University Capacity Building Programme (Ethiopia)
UCH	University College Hospital
UCT	University of Cape Town
UEM	University Eduardo Mondlane
UG	Undergraduate
UJ	University of Johannesburg
UK	United Kingdom
UKZN	University of Kwa-Zulu Natal
UNAM	University of Namibia
UMNG	Université Marien Ngouabi
UN	United Nations
UNDESA	United Nations Department of Economic and Social Affairs
UNDP	United Nations Development Programme

UNESCO	United Nations Educational, Scientific and Cultural Organisation
UNEVOC	International Centre for Technical Vocational Education and Training
UNG	National University of Gabon
UN-HABITAT	United Nations Agency for Human Settlements
UNO	University of Nairobi
UNW	University of the North West
UOB	University Omar Bongo
UP	University of Pretoria
USAID	United States Agency for International Development
UWC	University of the Western Cape
UZ	University of Zimbabwe
VLIR-UOS	Flemish Interuniversity Council—University Development Cooperation
WHO	World Health Organisation
Wits	University of Witwatersrand

For more information about Tuning

Tuning General Co-coordinators	
Julia González juliamaria.gonzalez@deusto.es	**Robert Wagenaar** r.wagenaar@rug.nl

Pablo Beneitone (Director)

International Tuning Academy
Universidad de Deusto
Avda. de las Universidades, 24
48007 Bilbao
Tel. +34 94 413 9467
Spain
pablo.beneitone@deusto.es

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